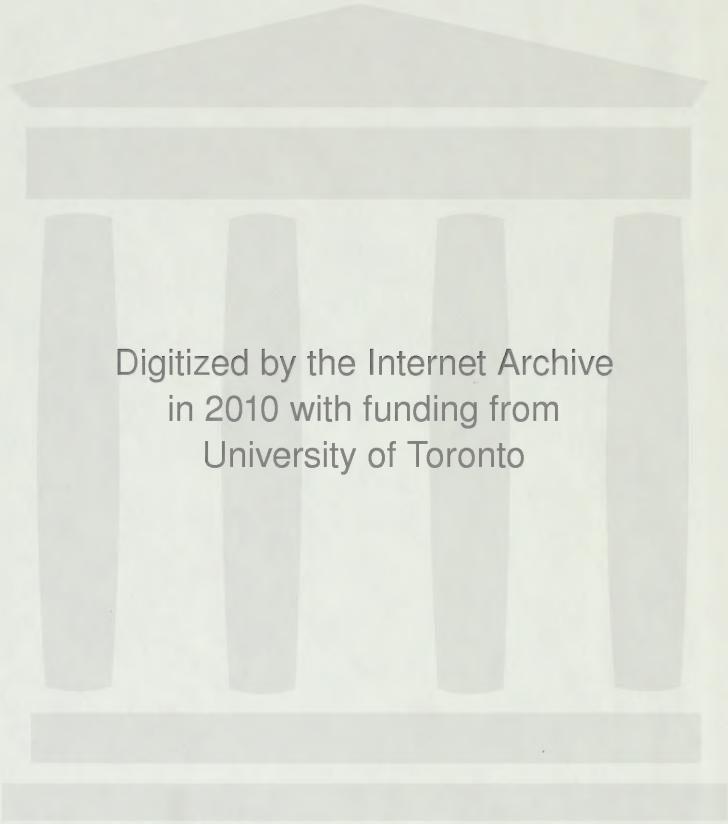

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# THE

# ELECTRICAL WORLD

A REVIEW OF CURRENT PROGRESS IN ELECTRICITY
AND ITS PRACTICAL APPLICATIONS

## VOLUME LXII

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## JULY 5 TO DECEMBER 27, 1913

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# Electrical World

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**Wiri Guaranteed by Contractors**

The proposal of the Electrical Contractors' Association of Great Britain to guarantee the work of its members ...ght well be emulated to advantage by the National Elec... Contractors' Association of this country. Although ... scheme has not been worked out to its finality, yet even ... embryonic stage it possesses features of merit. Brief... ...ed, every member of the association undertakes to ... out interior wiring contracts in strict conformity ... rules in force; the association stands back of this ...antee by agreeing to indemnify the employer of any ... members against bad workmanship or materials, and ... ember failing to remedy defective work after being ...d by the association to do so will be dropped from ... ganization. Such a scheme, if adopted by the 1200 ...ers of the National Electrical Contractors' Associa... would do more to raise the general standards of ... in this country than anything of which we can ...ve, and surely the industry will benefit by the change. ...ing aside entirely the question of the rights of the ...holder or owner to good work, which every reputable ...ctor will grant, the opportunity ought to be em...d by contractors if for no other motives than those ... are of selfish origin.

**American Society of Engineering**

A salient characteristic of the professions of medicine and engineering is their diversification. Law practice also ...ersified, so that practitioners in one branch rarely ex... their efforts into other branches. Nevertheless, the ...ng of students in the law schools is ordinarily the ... whatever branch they may intend to follow or chance ... come associated with. In the medical schools, until ... recent years, the training of students was the same, ... differentiation likewise became effective only in prac... Now, however, the range of medical study is becoming ...ge, in so many different departments, that differentia... becoming necessary in the school curriculum. In en...ring this differentiation is very marked. It has long ...n realized as impossible to train an engineering student, ...is Moses according to the biblical text, "in all the knowl...dge of the Egyptians." A division of engineering school ...ula into four branches—civil, mechanical, electrical ...ining—has been customary. So fast, however, do new ...alties in engineering arise and so hopeless is the task ...aining fully for each, or of knowing beforehand which ...ch the student will ultimately adopt, that the modern ...ency is rather toward unification than further differen... in the schools, with the purpose of teaching the ...amental principles thoroughly, in mathematics, mechanics, physics and chemisty, leaving the specialization to subsequent effort in practical life or for post-graduate study. Dr. William McClellan made a similar suggestion to the engineering profession, in a paper presented at the Cooperstown convention of the A. I. E. E. He pointed out very forcibly the loss of momentum which accompanies the segregation of engineers into separate societies, each devoted to a specialty. He desires to see a unification effected, whereby the social and intellectual momentum of the whole engineering body may be conserved and made effective. Although few will question the desirability of the objects Dr. McClellan wishes to accomplish, there may be some who will not agree with certain of the details of the method proposed by him for unifying the engineering societies in activities of a professional nature, and doubt may be expressed as to the timeliness of his suggestion. There may indeed be some objection to creating a new society when there are evidently too many now in existence. However, since membership in the new association is to be restricted to representatives from existing societies, there being no members as individuals, the increase in the number of societies is not likely to prove highly objectionable. Concerning the timeliness of the suggestion, it would seem that now, rather perhaps than at any time within the next five years, is the preferable moment for bringing forward the idea of concerted effort by the engineering societies to place the engineering profession on a high plane, in view of the forthcoming conventions of engineering societies in San Francisco during 1915. Now, as never before, the advantages of co-operation along purely professional engineering lines are being increasingly appreciated. The good seed should be sown now while the ground is in condition to bring forth abundantly.

**The Watt Versus the Horse-Power**

In its recent report the N. E. L. A. committee on measurements entered a plea for the more general use of the watt, and the more limited use of the horse-power, when specifying the power of boilers, turbines, engines, machinery or apparatus. Instead of keeping a single unit, the watt, for use in dealing with power, our technical literature swarms with half a dozen other units, all more or less unsatisfactory and brain-wearying. In view of the fact that there is no logical relation between the so-called "boiler-horse-power" and the horse-power developed by an engine receiving steam from the boiler, the desirability of abolishing the term "boiler-horse-power" has long been appreciated. The recent happy suggestion to substitute a proper multiple of the watt for the boiler-horse-power, which, as usually defined, is approximately equal

to ten kilowatts, has been enthusiastically indorsed by many engineers and opposed by many whom one would expect to welcome the improvement. It is indeed strange that, although the watt is primarily a mechanical unit of power and only secondarily an electrical unit, and also is named after a great mechanical engineer—James Watt—many mechanical engineers object to its use because to them it seems to be an electrical unit.

## The Institute Convention

The Cooperstown convention of the American Institute of Electrical Engineers was an important occasion from several points of view. It was well planned and successfully carried out. The meeting place was happily chosen, and combined with the excellent balance between the technical and the social programs there was a diversity of interests sufficient to satisfy in some degree the tastes of all, which is perhaps as much as one can expect of these events in general. In pleasing contrast with last year's crowded program of some sixty-five papers, with an allowance of only fourteen working hours for their consideration, there were only twenty-six papers here presented, with a working period of about seventeen hours. Printed copies of the papers were distributed well in advance, and as a whole there was plenty of time for discussion. Owing, however, to an unequal allotment of time for the papers on the program, some of them received rather scant consideration—a defect which can obviously be overcome by setting aside a fixed period for each paper and its discussion, and by prearrangement calling upon certain individuals to open the discussion from notes prepared in advance. In point of attendance the total registration of 239 certainly compares well with 178 at Jefferson, N. H., and 252 at Frontenac, N. Y., although the Atlantic City meeting, naturally enough, eclipsed them all. The large attendance secured at Boston and Chicago was, of course, drawn to a great extent from the local regions.

As a barometer indicating the trend of mind of many leaders in the profession, the remarks of both the president and the president-elect on the position which the electrical engineer, and all engineers for that matter, ought to occupy in relation to the affairs of industry, commerce and government are timely and important. A concrete suggestion toward the realization of this end was contributed in the paper by Dr. McClellan, and the hearty indorsement which it received shows clearly that the electrical profession will back the movement. A number of the papers presented will easily rank as classics, and others, while perhaps not in the same class, provoked such discussion as to indicate their present significance.

Notable among the high lights of the convention was the earnest attention given to the fundamental matter of framing a correct economic basis for the discussion and comparison of energy costs, and the evident determination shown to delve deeper into the mysteries of that evasive but important agent of the transmission engineer, the porcelain insulator. Considerable appreciation was expressed also of the somewhat unexpected interest displayed in the session held under the auspices of the electrophysics committee, which bespeaks an increasingly close relation between the physicist and the engineer.

As a closing commentary upon the Cooperstown convention it may not be amiss to point out that there are increasing signs of a general realization that these events serve a valuable purpose in bringing engineers together. It is one thing to know a subject profoundly, it is quite another to be able to discuss it forcefully before a gathering of one's contemporaries, sprinkled with men whose reputation is country-wide or even international. The engineer who would be broad, and who would enlarge his culture by contact with men of superior attainments, must obviously mingle with his fellow-kind at such gatherings as these. They hold the greatest potential advantage of all for the younger men, who may improve themselves by mutual fellowship and take away the inspiration which comes from meeting and listening to the leaders of the profession.

## The Computation of Energy Costs

The A. I. E. E. paper on the standardization of cost estimates by Messrs. H. G. Stott and W. S. Gorsuch represents what is emphatically a movement in the right direction. In the past it has been extremely difficult to find out, even from figures conscientiously made and presented in an honest effort to show the facts, just what real cost of energy must be reckoned with. Certain items in the cost of energy, such as the coal supply and the wages of the actual operating staff, are easily ascertained, but there has been no definite plan of action in charging against the cost of the energy produced the great group of somewhat indefinite items which hang undecided between power-house expense and the general expense, between repairs and renewals, between operating costs and fixed charges. For a long time it was a habit of plant managers to compare and promulgate costs on the basis of coal plus oil, waste and water plus power-house labor, with the result of obtaining beautifully low figures of a character to tempt public service commissions into pernicious activity. Anyone who looks over the carefully prepared list of items presented by Messrs. Stott and Gorsuch will come to a realizing sense that many more than the items just mentioned go into the actual costs of producing energy in a plant built and operated as a permanent investment. The authors explain and analyze just the meaning of the schedule and the items which should go into each group.

Perhaps the most illuminating portion of the paper is the consideration of the investment cost and the general charges appertaining to it. Carefully as the matter is studied out, some items of this kind are a bit puzzling. The division, for example, of franchise tax and casualty insurance between production and distribution is not altogether obvious even with the help of the explanations as regards general methods. The most ingenious feature of this particular account is the treatment of the amortization fund, which is intended to take care of depreciation involving renewals by the establishment of an actual sinking fund, unhappily far too rare in power-station accounts. The most important item of the expense that is to be

taken care of is what the authors call "functional depreciation," which is practically the thing frequently referred to as depreciation due to change in the art. Obsolescence and inadequacy are the usual causes for scrapping power-station equipment, and they are good and valid causes. One happy suggestion of the authors in this connection is that the lack of knowledge of the real amount of such depreciation makes it necessary to adjust periodically the rate of accumulation of the amortization fund so as to take account of experience in the life of apparatus and general equipment. It is fortunately true that much recent apparatus stands upon an entirely different plane with respect to endurance from the apparatus of earlier years. The physical depreciation, for example, of a big generator is very small indeed, and the functional depreciation, while considerably larger than the physical, tends to be much less than would have been indicated by the estimates of ten years ago. Hence the need of readjusting one's estimates of probable useful life in view of experience. If power-station operations would follow consistently the plan proposed by Messrs. Stott and Gorsuch, the actual practical costs of energy production would soon become much better known than at present. They would not seem quite so low as the loose experience of earlier practice would suggest, but the figures would be far more valuable as a guide to the central-station manager.

## Tungsten Lamps for Street Lighting

A recent issue of the *Electrotechnische Zeitschrift* contained data on the very interesting changes which the street lighting of the city of Dresden has undergone within the past few years. In Dresden, as in many other Continental cities, use is made of both gas and electricity for lighting, but the chief streets of late years have been lighted with electric arc lamps and some of the secondary streets with incandescent lamps. Ten years ago the important streets were illuminated with the ordinary carbon arc lamp, familiar at the time in most European cities. These lamps were run with fairly large currents and used high-grade carbon electrodes such as are common in Continental lighting. The arc lamps thus operated were much better than the contemporaneous American inclosed arc lamps, having a considerably higher efficiency, equally good steadiness and producing a beautiful white light very different from the bluish light of the inclosed arc lamp. A few years later the flaming-arc lamp made its appearance and the metallic-filament lamp also came into use. Five years ago the carbon arc lamp was being rapidly replaced by the yellow-flame arc lamp, and most of the carbon incandescent lamps had been replaced by tungsten lamps. Another year saw the complete replacement of both the older illuminants and the beginning of the use of tungsten lamps, no lamp in the first installation having a rating larger than 50 cp. This was a change sufficiently startling for a few years and admirable in its results.

Developments more recently have been somewhat revolutionary. Within the past two or three years the large tungsten lamps have come into considerable use and have been rapidly replacing the flaming-arc lamps. The lamps used are rated at 400, 600 and 1000 cp, the lamps being fitted with reflectors, and in some cases with inclosing globes as well, and hung at the height of 7 m instead of 8 m, which had been standard for the arc lamps. In the chief streets they are mounted on cross-suspensions, by far the most advantageous position for service. The reduction in cost of service by the substitution of the metallic-filament lamps has been very considerable. The Dresden flaming-arc lamps were of the alternating-current variety working at 8 amp, and consequently by no means at the top efficiency for the flaming type of lamp. Whether a similar change would have worked out as advantageously against direct-current flame lamps at a somewhat higher current may be regarded as dubious, since for the same illumination a considerable increase in the number of metallic-filament lamps would have been necessary. Nevertheless, the Dresden experience hints very strongly that the less powerful arc lamps, even modern flame lamps, can be very hard pushed by the large tungsten lamps now available and are extremely likely to be superseded.

## The Illinois Public Utility Law

During the present week Governor Dunne of Illinois signed the new public utility bill recently passed by the Legislature. The measure, an abstract of which appeared in our issue dated June 28, goes into effect on Jan. 1, 1914. In all important respects save one this seems to be an excellent law, but the provision exempting municipally owned utilities from jurisdiction is a serious defect. The discrimination against privately owned companies would seem to be the work of municipal-ownership enthusiasts who wish to ride their hobby unrestrained. This view of the matter is supported by the circumstance that the Legislature passed another bill authorizing cities to acquire, construct, own, lease or operate public utilities. Perhaps the quoted remarks of the Governor cover the situation as frankly as any: "With such rights given to cities, private corporations now furnishing gas, electric light, heat, power and other utilities will be compelled to give decent service at decent rates or face the alternative of public ownership." But is municipal ownership and operation without regulation the desirable alternative? We think not, nor can we discern any adequate defense of the injustice and discrimination of forcing private companies to submit both to regulation for themselves and unregulated municipal competition at one and the same time. All the arguments against the "home-rule" feature which became such a bone of contention in framing the law in the Legislature are equally potent against unregulated municipal ownership and operation. Experience elsewhere, in Wisconsin for example, establishes very clearly that municipally managed utilities as a whole are quite as much in need of regulation as are the private companies, if not more so. This defect in the Illinois law is merely the outcome of another scrimmage in the endless contest between selfish interests and the public welfare, this time with the leaders of the people in the wrong. The just course is both clear and simple, but it seems the pendulum has swung too far and a measure of patience is needed to await the return to equilibrium.

# The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

## Norwegian-American Radio-Telegraphy

Mention was made on page 1406 of our issue dated June 28 of the preliminary arrangements for a contract between the Marconi Wireless Telegraph Company and the Norwegian government for wireless service between Norway and America. The Norwegian Storthing has ratified a twenty-five-year contract for the joint operation of stations at Stavanger and in New England. Two locations, 20 miles apart, will be chosen at once somewhere in Massachusetts or Connecticut, and the Marconi Wireless Telegraph Company of America will build separate receiving and transmitting stations similar to those now being constructed at New Brunswick and Belmar, in New Jersey. They will form part of the world-encircling chain of stations, which includes San Francisco, Honolulu, Yokohama, Bangalore and Alexandria.

## Experts Selected for Chicago Terminal Plans

Dean W. F. M. Goss, of the University of Illinois, Urbana, has been appointed chief engineer to the committee on smoke abatement of the Chicago Association of Commerce, succeeding the late Horace G. Burt, of Chicago, whose death was recently announced in these columns. The university has agreed to grant Professor Goss a year's furlough from collegiate duties in order that he may carry on his work in Chicago. Dean Goss, who is at present touring Europe with the American Society of Mechanical Engineers, is one of the best-known railroad engineers of the country and before his appointment at Illinois was dean of the engineering schools of Purdue University, Lafayette, Ind.

The railway terminal committee of the Chicago City Council has also appointed Mr. John F. Wallace expert adviser to the committee in the formulation of its plan for terminal facilities for the steam railroads entering Chicago from the south. Mr. Wallace is to submit a report in ninety days. The terminal committee's new appointee is president of the Westinghouse, Church & Kerr Company, consulting and constructing engineers, New York, and was formerly chief engineer of the Panama Canal work

## Outages on Ontario System; Toronto Company to Rescue

Several serious outages have recently annoyed customers of the Ontario Hydro-Electric Commission's system, which is generally recognized as one of the best constructed transmission systems ever built. From 10 a. m. to 5:10 p. m. on June 16 service was off over the commission's Toronto system and in a large part of the Province and this would have caused serious inconvenience locally had not the Toronto Electric Company, which is a competitor of the municipal system, generously furnished 12,000-volt emergency service over an improvised connection from its terminal substation. Fortunately the break was repaired before dark, but the Toronto company offered to carry the city street lighting that evening if necessary. Credit is also deserved by the Toronto company for the rapid connection made, service having been available within one hour after Works Commissioner Harris applied for assistance.

To avert possibility of a water famine, the Toronto electrically driven water-works pumps were also transferred to the local central station company's system and thus continued operation uninterrupted.

On July 2 there occurred another interruption to the Hydro-Electric Commission's service at Toronto, the third serious one within three weeks. This time the "power" went off at 3 a. m. Wednesday and was not resumed again until 10 a. m. the same day. In view of the prevalence of transmission troubles during the last few weeks it has been suggested locally that some permanent basis for energy interchange be agreed upon between the two public-service organizations.

The merchants and manufacturers at London, Ont., who are customers of the provincial Hydro-Electric system, are also complaining of the poor service they have been receiving lately. From June 1 to June 26, inclusive, there were thirteen interruptions, totaling twenty-eight hours. The most recent trouble occurred on June 25, when the Hydro service was off for fifty-five minutes. The thirteen interruptions mentioned include two in which the whole 297 miles of Hydro lines in Ontario were out of commission, once for seven hours. The other outages were of local origin.

## Pennsylvania Utility Law

The public utilities bill in the State of Pennsylvania, mentioned on page 1204 of our issue for June 7, 1913, having been passed by both the House and Senate, is now before the Governor for his signature. The bill is believed to be in a form to protect the State, the municipalities, the consumers and the private utility companies.

## Illinois Utilities Law Signed by the Governor

Notwithstanding the vigorous opposition of the city administration of Chicago, which was insistent upon "home rule," Governor Dunne on June 30 signed the bill recently passed by the Legislature of Illinois creating a public utilities commission for that State. A summary of the new law was given in the *Electrical World* of June 28.

To explain his approval of the bill the Governor issued a public statement. He says that regulation by commission should have a reasonable trial in Illinois. If it fails, there is the alternative of public ownership under the "splendid public-ownership measure" recently passed by the Legislature and signed by the Governor. This is the Waage law authorizing cites to acquire, lease and operate public utilities and to sell the service to private consumers. The Governor says that the new Illinois utilities-commission law is better than the Wisconsin law, as it eliminates commission control of municipally owned utilities and does not give private corporations indeterminate franchises. Regret is expressed that the home-rule article was stricken from the bill, and the Governor says that this feature can be put in it at a future session of the Legislature. The executive promises to appoint as members of the state commission

"men of such character and ability as to place the cities of the State under no political disadvantage by reason of the failure to include the 'home-rule' amendment." The Governor also makes this statement: "Public ownership, in my judgment, must be the ultimate solution of the complex problems which forever are arising from the attempts of the people to exercise legitimate and lawful control over public-utility corporations, but realization of the benefits of public ownership may be deferred for a long time. Hence it is urgently essential that there shall be centralized control and authority now."

Mayor Harrison of Chicago and a large proportion of the City Council waited on the Governor in Springfield on June 25. They urged him by all arguments at their command to veto the bill and give "home rule" to Chicago. Included in the delegation were representatives of the city and county government in Chicago, the Municipal Voters' League and the Chicago Federation of Labor; also the United Societies for Local Self-Government and various civic organizations. The Mayor and a number of aldermen and others made speeches urging the Governor to veto the bill.

On June 24 the question was discussed before the City Club of Chicago at a meeting over which Mr. George C. Sikes presided. The first speaker was State Senator Dailey, of Peoria, who favors the bill as passed. Mr. Edward W. Bemis, of Chicago, public utility expert, opposed the bill as passed. One point he made was that one commission could not handle all the utilities of Chicago and the rest of Illinois, including the railroads. State Senator Walter Clyde Jones and Mr. James G. Skinner, assistant corporation counsel of Chicago, also spoke against the bill as passed. Mr. Skinner helped to draft the original bill, with the "home-rule" article in it.

Public sentiment has been expressed for as well as against the bill. The Illinois Mayors' Association, by a vote of fourteen to ten, defeated a resolution requesting the Governor to veto the bill. Representative Rapp, of Fairfield, who introduced the bill in the House with the original "home rule" feature, came out with a statement favoring the bill, even though amended.

## Refusal to Purchase Boston Municipal Gas-Lighting Equipment Sustained

The full bench of the Supreme Court of Massachusetts has sustained Commissioner of Public Works Louis K. Rourke, of Boston, in his refusal to expend $300,000 appropriated in May, 1911, by the City Council for some 11,000 gas lamps and fixtures for street lighting on a municipal ownership basis. On June 14 Commissioner Rourke signed a contract with the Boston Consolidated Gas Company for this lighting at a rate of $21.50 a lamp a year, on a ten-year basis, but before the agreement can become active it must be approved by each branch of the city government and the Mayor. For over a year past Commissioner Rourke has favored accepting the offers of the Boston Edison company at $18.33 per 60-watt tungsten lamp and $21.14 per 80-watt lamp annually. These offers mean a saving of from $27,000 to $60,000 a year compared with the Rising Sun contract. The court points out in its decision that under the circumstances the city ought not to be compelled to expend this large amount of money for a purpose which, according to the commissioner's belief, apparently supported by substantial reasons, would be unwise, and says: "There is no such compulsion to be found in the city charter of Boston or in the general laws of the commonwealth. The appropriation of money for a specific purpose by the legislative department of the city of Boston does not make its expenditure mandatory on the executive officers in a case like the present."

## Pittsburgh I. E. S. Convention

The Hotel Schenley has been selected as headquarters for the Illuminating Engineering Society convention, which will be held in Pittsburgh, Sept. 22 to 26. The choice is peculiarly fitting as the hotel is near the Carnegie Museum and Library, Carnegie Technical Schools, University of Pittsburgh, several prominent clubs and the Soldiers' Memorial Hall, the lighting effects of which are unique in this country. Among the entertainment features of the convention will be the annual banquet, golf, tennis, baseball games, automobile rides, theater and card parties, and inspection trips to local industrial plants. Subjects of convention papers already scheduled are the quartz and neon-tube lamps; church, factory, store, hospital and street-car lighting; the present commercial development in several forms of lighting; errors in photometric measurement, and the history of artificial lighting. Symposiums will also be held on various general subjects. A transportation committee, which includes the secretary in each city having a local section, will make arrangements for members and friends in obtaining transportation to and from Pittsburgh.

## How the Illinois Legislature Passed the Bill for a Utilities Commission

In the closing hours of the Forty-eighth General Assembly—to be exact, at 1:15 a.m. on June 21—the Illinois Legislature took the final steps to pass a bill creating a state public utilities commission. The bill provides for a single state-wide commission controlling all public utilities, abolishing the present Railroad and Warehouse Commission, and without the home-rule proviso so strenuously demanded by the city administration of Chicago.

The history of the agitation for a public-service commission or commissions in Illinois during recent years makes an interesting story. The Legislature of the State meets biennially, and public-utility-commission bills of varied purport have been introduced at preceding sessions. Two years ago the whole subject was referred to a joint legislative commission directed to report to the Legislature of 1913. The Republicans were in control of this commission, of which Senator Dailey, of Peoria, was chairman. This committee visited Wisconsin, Massachusetts, New York and other states and held a number of hearings in Illinois. It prepared an elaborate report, with draft of bill attached, modeled to some extent on the Wisconsin law.

But in the meantime the 1912 elections had taken place. A Democratic state administration was elected, and Senator Dailey escaped defeat for re-election by a narrow margin. Mr. Edward F. Dunne, of Chicago, was elected Governor. He is a man of the highest character and of conceded ability, but rather "advanced" in advocating municipal ownership and distrusting utility corporations, as he demonstrated when Mayor of Chicago. A remarkable Legislature was elected at the same time. In neither house has any political party a majority. Both houses are presided over by bright, ambitious young Democrats about thirty-one years of age, who had never before served in the Legislature or had legislative experience.

The Governor had made a state utility commission one feature of his platform. He wanted the Legislature to pass a bill on lines which he favored, giving "home rule" to the cities of the State; that is, giving direct control of local utilities to cities of 20,000 and over and permitting smaller cities to vote themselves under or out of control of the state commission. He had a bill drawn to express his ideas by members of the faculty of the University of Illinois in conjunction with lawyers from the office of the corporation counsel of Chicago. This bill was introduced by Representative Rapp, of Fairfield, and is the bill, materially amended, which finally passed. The Dailey bill and

everal others never had a chance, although, as adopted, he Rapp bill is similar in broad general features to the Dailey bill.

Article VI in the original Rapp bill gave cities the power o regulate their own utilities and to fix rates. It was he great bone of contention. The bill was referred to a ommittee in the House, reported back with minor changes, ut when it came up for debate this section was stricken ut by a close vote, and the bill was then passed by the House. Then the city administration of Chicago became larmed. Mayor Harrison, Corporation Counsel Sexton nd forty aldermen, including Alderman Merriam, hurried down to Springfield to labor with the Senate. A public earing was held at which Mayor Harrison made an earnst plea that Chicago be let alone in the management of its tilities. Governor Dunne also spoke, expressing his love or home rule, but rather intimating that if he couldn't get ll he wanted he would take what he could get, provided a airly satisfactory state commission was created.

The fight was now on in earnest. In the Senate the bill vas not referred to a committee but was discussed on the oor. Senator Glackin, of Chicago, a Democrat close to he city administration, led the home-rule forces. Senator Dailey, of Peoria, a Republican, championed the single tate-wide commission. On June 18, in the closing days adjournment being fixed for June 20), there was a great ebate on the bill in the Senate on second reading. Amendments were introduced reinstating Article VI and lso eliminating the power of the state commission to conrol the issue of stocks and bonds by public-utility comanies. Senator Dailey made an impassioned plea for the bandonment of Article VI. Senator Walter Clyde Jones, f Chicago, leader of the Progressives, cast his lot with the ome rulers. By a vote of thirty-one to sixteen the amendents were adopted by the Senate. Party lines were not trictly observed, but in general the Democrats and Proressives voted for the Senate amendments. Victory for ome rule!

On June 20, the closing day, the amended bill came up or third reading and passage in the Senate. Senator Dailey said that the bill as amended by the Senate was a onstrosity. Senator Manny, of Mount Sterling, Democratic floor leader, expressed himself as favoring one statevide commission; still, he held, some kind of a commission s better than none, and he voted for the bill with Article VI reinstated, but with reluctance. On roll call the bill assed the Senate as amended in that body by a vote of hirty-two to seven. Senate firm as a rock—almost—for ome rule!

Now back to the House. About 9:30 p.m. on June 20 he House took up the bill with Senate amendments. Mr. Rapp explained the amendments and moved that the House oncur in them. More oratory. Representative Holaday, f Danville, said that the home-rule commission as offered y the Senate would be a farce. The renowned Lee O'Neil Browne, of Ottawa, scored the Senate amendments severely. Many other representatives explained their votes on roll-all. At 11:30 the result of the voting is announced. The ayes," favoring concurrence, are seventy, the nays forty-hree. But, alas for home rule! Seventy-seven votes, or majority of all representatives elected, are needed to dopt the motion, and thus the House does not concur in he Senate amendments.

What next? Returning to the Senate, we shall see. It s now 12:30 a.m. on June 21, but still the legislative day f June 20, it appears. The Senate is debating whether it hall recede from its amendments. Dailey moves to recede. Home rule is limping badly, and Glackin is visibly anxious. More impassioned speech-making. Then announcement of he vote at 1:15 a.m. By a tally of twenty-seven to twenty he Senate has voted to recede from its amendments. Thus he Rapp bill as amended by the House has passed both ouses in the same form, and municipal regulation of public utilities—the home-rule argument—is a dead issue in the Forty-eighth General Assembly of the State of Illinois. What brought about the change in the Senate? Undoubtedly the action of the friends of the Governor. Several measures favored by the state administration, as initiative and referendum, a state tax commission and others, failed to pass, and at the last moment it was apparently decided to save something from the wreck in the shape of a state public-utility commission, not indeed with the desired home-rule features, but still a state commission, to which the Governor was pledged.

Senators Glackin and Keller, of Ava, filed a formal protest against the passage of the motion to recede at 1:15 a.m. on the day after the day set for adjournment by previous resolution. The protest was received as a constitutional right, but the Lieutenant-Governor remarked that it has been repeatedly held by the courts in Illinois that in the case of a continuous night session the legislative "day" does not expire until 10 o'clock in the morning of the next calendar day.

At its meeting of June 23 the Chicago City Council adopted resolutions requesting Governor Dunne to veto the bill, which was declared to be a "vicious measure subversive of the rights of the people of Chicago and other municipalities." A telegram signed by the Mayor and sixty-seven of the seventy aldermen was sent to the Governor, requesting a hearing and urging him to veto the bill in the interest of "home rule."

A synopsis of the bill as passed by the Legislature was given on page 1401 of our issue dated June 28. As noted elsewhere in the present issue, Governor Dunne signed the bill on June 30.

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## Contention Over Depreciation Fund in Attack on Cincinnati-Union Lease

A contest which threatens the legal existence of the Union Gas & Electric Company, of Cincinnati, as well as the life of the lease under which the Cincinnati utility property is operated by the lessee company, is now being waged to determine whether the underlying Cincinnati Gas & Electric Company or its tenant shall make the outlay for the new four-million-dollar power plant, which is badly needed for the local service. The underlying company, through a protective committee of its stockholders, claims that this new plant is a replacement of the existing Plum Street station, and that since by the terms of the lease the tenant company is required to maintain the property against depreciation, the Union company should build the new plant itself. The tenant company insists, however, that the proposed station represents simply a plant extension, and that therefore its cost should be defrayed, as in the case of recent additions to the Plum Street equipment, by the underlying concern.

The Cincinnati Gas & Electric Company, which is the owner of the central-station and gas properties in Cincinnati, now has outstanding $35,000,000 of 5 per cent securities out of an authorized issue of $36,000,000. Its property was leased for a term of ninety-nine years (beginning with 1906) to the Union Gas & Electric Company. Of this latter company's authorized allowance of $10,000,000 of 6 per cent stock, $5,000,000 has been issued, together with $10,000,000 of common stock. The Union company in turn is controlled by the Columbia Gas & Electric Company, a holding corporation which also controls the gas, electric-lighting and railway properties just across the Ohio River in Covington and Newport, Ky. The Columbia Gas & Electric Company has a capital stock of $50,000,000, and $13,000,000 outstanding in bonds out of a total of $20,000,000 authorized. It now plans to issue further $3,000,000 worth of 5 per cent debentures to acquire that

balance of the Union company's stock which it has not heretofore owned. The Columbia company's control of the Union company is at the present time effected, however, through the ownership of 60 per cent of the latter's preferred stock and 50 per cent of its common stock.

At the present time the principal generating plant of the Cincinnati property is the old Plum Street station, which contains about 30,000 kw in reciprocating and turbine units. Besides being inadequate, this plant will shortly be rendered useless by the draining of the canal from which it receives its condenser circulating supply, as the canal bed is to be converted into a city boulevard. It has therefore become imperative that a modern 50,000-kw turbine station be erected on the river front at a central point from which the surrounding community can be served.

From $3,000,000 to $4,000,000 will be needed for this new station, and it is the necessity for this additional capital investment which has precipitated the present contest. In this the initiative is being taken by a stockholders' protective committee of Cincinnati Gas & Electric Company shareholders. Mr. J. Evans Lippincott is chairman of the committee, the other members of which are Messrs. Jesse Lowman, Frederick A. Hilker and George W. Pohlman, Jr., secretary. Mr. Samuel Assur has been retained as counsel. The stock of the Cincinnati company is held by about 8000 shareholders, the average amount in each case being about forty shares. Nearly 7500 of the stockholders live in the vicinity of Cincinnati.

The stockholders' protective committee contends that the building of a new plant is an expense that should be paid entirely by the Union Gas & Electric Company by reason of the fact that it is a replacement of an inadequate and obsolete electric-light plant. The Union company, it is pointed out, may obtain payment from the Cincinnati Gas & Electric Company only for extensions and new additions which are agreed to by the latter underlying company, and which, under the lease, must be paid for by the Union Gas & Electric Company in the first instance, while the Cincinnati Gas & Electric Company may elect to pay for such new additions at the termination of the lease at the then value of such additions or improvements. In any event, however, the committee insists that the new plant required is a replacement, the entire expense of which is chargeable to the Union Gas & Electric Company and must be paid by that company without any possible hope of any future reimbursement from the Cincinnati Gas & Electric Company.

During the last fifteen years the Union company has been operated without setting aside any amount toward a depreciation fund to cover the elements of decrepitude, obsolescence or inadequacy of the plant it leases. Its books have meanwhile shown the accumulation of a surplus which, the committee maintains, should have gone back into the property for offsetting depreciation. For 1912 this surplus was $208,000, and for 1911 $329,000. Officials of the Union company declare, however, that the terms of the lease required no such establishment of any depreciation fund. The recently enacted public-service commission law of Ohio does, however, specify that such depreciation allowance be set aside for property renewals, although this applies only to the past two years of the lease's term.

The stockholders' committee in a letter to President W. J. Hauck, of the Cincinnati company, has urged cancellation of the lease to the Union company on the grounds that the latter has exploited the property without proper care of the owners' interests and that the lessee has been virtually returning capital investment to stockholders in the guise of dividends. Protest is also made against the plan to transfer the Union company's lease to the Columbia company by the latter's purchase of the balance of $3,000,000 remaining, and it is also pointed out that such transfer cannot in any case be consummated without the written consent of the Cincinnati company stockholders.

No estimate is available of the amount of stock represented by the protective committee. While the leasing interests are disposed to discount the seriousness of this protesting movement, the fact nevertheless remains that should the charges brought by even a single shareholder be proved, forfeiture of the lease might follow. It also seems that the temper of many of the Cincinnati underlying stockholders is such that should the present agreement be abrogated no lease would again be entered into with an operating company, for the Cincinnati Gas & Electric Company would doubtless under circumstances of that kind undertake to operate its own property.

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## Transportation Facilities in New York

Mr. Frank Hedley, vice-president and general manager of the Interborough Rapid Transit Company, of New York City, addressed the Electric Club of Chicago on June 26 on "Transportation Facilities in New York." He remarked that the daily newspapers probably had more to do with transportation problems in large cities than any other agency. The papers seem to be looking for sensational stories rather than honest recitals of fact. The only way to secure the rational development of transportation lines is for the owners and managers of the properties and the city authorities to get together and lay all their cards on the table, as the saying is, so that there may be a "square deal" for all. As a matter of fact neither the companies nor the public has had a square deal for many years, principally owing to the harmful activities of the newspapers and politicians.

In New York it is believed that the problem of furnishing adequate transportation at a minimum fare has been solved finally. Mr. Hedley reviewed the growth of transportation facilities in New York City. One interesting statement he made was that for a number of years the damages paid for accidents have been about 3 per cent of the gross receipts. Considering the congestion in New York streets, the operation is good. The records show about one collision with other vehicles for every 7000 car-miles operated. The speaker remarked that the subsurface contact system of electric railway operation, such as is used in New York, is very difficult to maintain, for a variety of reasons. The surface, elevated and subway railways in New York have 21,000 employees and about 4500 cars in daily service. On the elevated lines the minimum interval between trains is fifty-two seconds, and in the subways the minimum interval between ten-car trains is one minute and forty-eight seconds. The speaker referred in terms of approval to the automatic speed-control system used in the subway. The greatest number of passengers on the elevated and subway lines carried in one day was 2,431,000. The business of the elevated and subway lines has increased by more than 100 per cent in six years.

Mr. Hedley advocated the plan of the city pledging its credit for extending transportation facilities. The municipality receives ample return by the enhancement of real estate values in outlying districts, and the rapid growth of the Bronx was cited as an example of this. The speaker pleaded for fair treatment of transportation companies by the public and city authorities and said that the companies should be permitted to receive a fair return on the capital invested. It is unfortunate that the municipal officers as a rule do not make a deeper study of transportation questions. The Public Service Commission of New York, First District, has done a great deal to bring about real rapid transit in New York City. Mr. Hedley declared his belief in commission control as a result of his experience. He described in some detail the plan entered into for the purpose of financing recent subway extensions in New York.

## A. I. E. E. Convention at Cooperstown, N. Y.

An account of the first two days' sessions of the annual convention of the American Institute of Electrical Engineers held at Cooperstown, N. Y., June 23 to 27, was given in these columns last week. Following is a report of the remaining days of the convention, while on other pages of this issue will be found abstracts of convention papers and the discussions which they provoked.

The technical sessions of the convention followed closely the prearranged program. A meeting of the board of directors of the Institute was held at Cooperstown on Wednesday evening, but the business discussed related largely to routine affairs.

The executive committee of the committee on organization of the International Electrical Congress to be held at San Francisco in 1915 met Thursday afternoon, but took no formal action although general matters of organization were discussed.

### Presentation of Edison Medal

On Thursday evening in the grand ballroom of the Hotel Otesaga occurred the annual award of the Institute's Edison Medal "for meritorious achievement," conferred this year upon Mr. William Stanley, the fourth recipient of the honor. The presentation was made by President-elect Mailloux in the absence of Dr. Elihu Thomson, who was to have delivered the address of the evening. Mr. Mailloux sketched in a reminiscent vein the achievements of Mr. Stanley during thirty years of inventive activity in the electrical field, paying eloquent tribute to his work in direct-current and alternating-current generation, transmission and transformation.

Mr. Stanley responded with modesty, pointing out the debt of the commercial inventor to the discoveries of pure science, whose work has laid the foundations for the electrical industry. A note of warning was, however, sounded by Mr. Stanley, who questioned whether the present great commercial organizations accomplish the true purposes of our newer arts. Modern monopoly and brute control, he intimated, tend to misappropriate the great gifts which mankind has received from scientists, inventors and engineers.

### Conferences on Institute Affairs

On Tuesday, Wednesday and Thursday there were informal luncheons of the section delegates, with Chairman P. M. Lincoln presiding. After some lively discussion a number of resolutions were finally adopted, being in substance: First, that the directors be requested to hold annual conventions at more accessible places and nearer large centers of population; second, that the minutes of delegates' meetings be forwarded without delay to each attending delegate; third, that an executive committee of five delegates be appointed by the chairman; fourth, that the directors be urged to adopt the Baldwin committee report on participation of sections in Institute affairs.

### Reports of Section Delegates

On Thursday evening there was a general conference of officers and section delegates.

Dr. J. B. Whitehead, speaking of the experience of the Baltimore Section, referred to the problem of making the meetings attractive and stimulative to members. The Institute work can be brought before the men, but it is difficult to get creative work on the latter's own account.

Mr. N. J. Neall told of the peculiar conditions in Boston, where both joint meetings and college meetings are held. The general meetings are not so successful as might be wished, although the serving of refreshments has been found to increase the attendance.

Mr. R. H. Rice said that the chief difficulty in Chicago is to reach the Institute members and interest them. The local section co-operates with the electrical section of the Western Society of Engineers, and they have very satisfactory joint meetings, with 100 to 150 in attendance. The latter society has, however, a total of about 1100 members. Successful co-operation has also been obtained with the new Chicago branch of the A. S. M. E.

Mr. J. C. Lincoln said that at Cleveland successful meetings are held at different industrial plants.

Prof. A. R. Sawyer told of the meetings of the Detroit-Ann Arbor Section, held alternately in the two places, 30 miles apart.

Mr. P. H. Haselton, of Fort Wayne, Ind., said that practically all of their members are connected with the General Electric Works, which causes some difficulty in maintaining interest in the meetings.

Mr. J. L. Wayne, Indianapolis, described conditions in the Indianapolis-Lafayette Section, where one meeting is held in the latter city for each two in the former. As the cities are 75 miles apart, there is no large interchange of attendance, although the sessions are fairly well filled.

Dr. F. Bedell, of Ithaca, N. Y., described the student division of the local section and said that meetings are held alternately for the regular members and the students. The annual banquet is very popular and student debates have proved a good feature.

### Lynn Section the Best Attended

Mr. A. W. Hall reported that the Lynn (Mass.) Section has a total of 548 members, 443 being local. At thirteen meetings last year the average attendance was 269, a larger sustained attendance than that for any other section.

Prof. E. Bennett, of Madison, Wis., said that the local section hopes to do effective work on pending state legislation. Each incoming chairman is also to attend the annual convention.

Mr. A. L. Abbott, of St. Paul, said that the average attendance at the Minnesota Section meetings was thirty-five to forty, drawn from both St. Paul and Minneapolis, between which the meetings alternate. At first the program committee tried to interest members in papers read at the New York meetings, but failed, and now they have local papers. Dinner meetings are also popular.

Mr. H. A. Hornor, of the Philadelphia Section, told of the good attendance secured by having a dinner before the meeting and a smoker afterward. There is also an annual outing given at the end of the year, the necessary funds being obtained by economical methods. The most important thing, said Mr. Hornor, is to give every member something to do. Discussions are short and copies are distributed in advance.

### Joint Meetings at Pittsburgh

Mr. E. L. Farrar, of Pittsburgh, spoke of their successful joint meetings under the auspices of some of the Institute technical committees. An annual banquet is held in mid-winter.

Mr. W. C. Smith, of the Pittsfield (Mass.) Section, spoke of the usual lack of familiarity of the incoming chairman with his work, and emphasized the need of some plan of instructing him in handling section affairs.

Mr. H. M. Friendly, of Portland, Ore., said the attendance at the Portland Section meetings averages from forty to sixty. The Institute section has just affiliated with the local section of the N. E. L. A. Good fellowship is promoted by luncheons held at one of the hotels.

Mr. H. W. Crozier, speaking for the San Francisco Section, advocated set programs. During the past year both a dinner and a luncheon were given in honor of visiting Institute men, which were very successful. They also hold dinners, costing $1, at different places in advance of the meeting and have an attendance of fifteen to twenty. The effect of competition for local interest from the Jovian Order and the Electrical Development Society is felt, he said.

Mr. J. B. Taylor reported that the Schenectady Section has about 600 members, one-half of whom are local and contribute dues of $2 annually. Meetings are held monthly but there is no set program. The section is managed on a broad policy in the interests mainly of the younger men. Outside speakers are obtained from time to time.

Mr. M. T. Crawford spoke for the Seattle Section, which is governed by an executive committee. The chairman and secretary, who have succeeded themselves in recent years, alternate in attendance at the annual convention. The whole local membership is divided into committees parallel to the Institute technical committees, and to each committee there is given charge of one meeting.

Mr. F. J. Bullivant said that the St. Louis Section cooperates with local engineering societies. Funds are derived from dues from local members and from special assessments.

Mr. M. Neuber, of Toledo, said that the section in that city has about the same trouble as the others. The committees have programs of considerable variety and adopt all sorts of methods to hold the interest of the members.

### New Institute Section at Spokane

Mr. J. B. Fisken, of the recently organized Spokane Section, said that sixty-three local members have already been secured. The principal activity thus far has been the drafting of an electrical code for metalliferous mines. There are large sections of the civil and mechanical engineering societies in Spokane and the prospects for the electrical section are bright. A papers committee can sometimes be more active than is desirable and make the mistake of securing too many papers.

Prof. A. M. Buck, of Urbana, Ill., explained that his section is both one of the oldest and one of the smallest. This section depends, not upon the students, but upon the university faculty and staff. However, the students have a fine engineering society of their own, and he thought they ought to merge with the section in giving impetus to the latter's activities and usefulness.

Mr. F. D. Nims, of Vancouver, spoke of the success of the dinners and smokers. The section usually has a set program but departs from it as may seem expedient.

Chairman Lincoln announced appointment of the delegates' executive committee as follows: Messrs. P. M. Lincoln, N. J. Neall, J. L. Wayne, H. A. Hornor and F. D. Nims.

### Entertainment and Games

The entertainment committee, Mr. W. C. Smith, Pittsfield, Mass., chairman, and the games committee, Mr. F. Osgood, of Newark, N. J., chairman, made extensive arrangements for the entertainment of the ladies and for games and contests of various kinds. Launches and boats, golf links, tennis courts and bathing pier were all available to delegates and guests. Late Tuesday afternoon nearly the whole convention participated in a 20-mile boat-trip around Lake Otsego. The ladies were also entertained with automobile trips, golf tournaments, card parties, etc.

An illustrated lecture on the Panama-Pacific Exposition, San Francisco, Cal., 1915, was presented on Wednesday evening by Mr. H. W. Crozier. Afterward an impromptu "electrical show" was thrown open in the hotel, with a number of clever caricatures of leading electrical manufacturers.

Two silver cup trophies were offered for the golf tournament. Of these it was explained that the handsome silver cup presented by President Mershon must be won twice successively at Institute conventions before becoming the permanent property of the victor. Other prizes were offered for the tennis tournament, ball game, ladies' putting contest, whist and heart games, longest automobile trip to Cooperstown, largest fish caught during the convention, and a number of others.

Nineteen contestants entered the golf tournament and the finals were played off between Prof. C. A. Adams and Mr. A. M. Schoen, the latter winning. The same number entered the tennis tournament, and in the finals Mr. G. A. Sawin won from Mr. C. T. Mosman. On Thursday afternoon, despite unfavorable weather, the ball game was played. Captain F. Osgood and a nine composed of Messrs. Sawin, Farrar, Bentley, Mosman, Peck, Kelsay, Thurston and Creighton played against Captain Hall with a team composed of Messrs. Norris, Dewey, Craighead, Lloyd, Newbury, Upson, Hollins and Bocian. The latter won, 13 to 8.

In the ballroom on Thursday afternoon a lecture and recital on Chopin was given by Prof. V. Karapetoff, whose accomplishments in music have brought him no inconsiderable fame. Between the numbers on the program Professor Karapetoff discoursed in an interesting way on the life and character of Chopin and their influence on his compositions.

## Convention of Canadian Electrical Association

The twenty-third annual convention of the Canadian Electrical Association was held in the Chemistry and Mining Building of the Toronto University, Toronto, Ontario, June 25, 26 and 27. Owing to the fact that invitations had been extended to many persons interested in the electrical development of Canada to discuss the future of the association, especially with regard to a continuance of its affiliation with the National Electric Light Association, the attendance was quite large, 270 members and guests having registered. As pointed out below, the counsel of those best qualified to pass on the merits and demerits of affiliation with the National Electric Light Association prevailed, so that the Canadian Electrical Association will still remain a geographical section of the larger body.

### President Bird's Address

In his address President W. L. Bird, of the Kaministiquia Power Company of Fort William, Ont., called attention to the revolutionary character of the changes which have taken place in the electrical industry during the past few years, the enormous strides made in the transmission of energy with tensions as high as 150,000 volts, the rapid development of the electrical vehicle, and the great part electricity now plays in the life of the community. He exhorted the members of the association to exert every effort to keep up with and if possible in advance of the progress in electrical development, because apparatus which was considered the climax of inventive genius a few years ago is being rapidly discarded for better and more efficient devices, and competition is becoming so severe that only the fittest can survive. The increasing growth brings with it responsibility, and so close is the dependence of one part upon another, he said, that if anything fails, the whole system is tied up. In his opinion less attention can profitably be given to the question of rates and more to continuity of service. The latter should be the aim of every company in the business and should be secured at any cost.

### Growth of Association

The report of the secretary-treasurer, Mr. C. E. Bowden, of the Toronto Electric Light Company, Ltd., was presented in two sections, January to June, 1912, and June to June, 1913, covering a period of eighteen months. Gains in membership in all five classes were announced, the total membership of the association now being 619.

### Future of the Association

At the session on June 26 there was a very general discussion as to the future of the association. Mr. T. S. Young gave the results of a canvass made by the *Canadian Electrical News* at the suggestion of the association. Over 1000 letters were sent out to private plants, municipal

plants, contractors, electrical engineers and manufacturers requesting an opinion as to whether the association should continue as a geographical section of the National Electric Light Association or reorganize as a distinctly separate body. Of the replies received forty-one central stations were in favor of a change and fourteen were opposed; thirty-five municipal plants, sixty-nine manufacturers, thirteen consulting engineers and fifteen contractors also favored a change in the scope of the organization, while three municipal plants, eleven manufacturers, four consulting engineers and four contractors were against any change. Mr. A. A. Dion pointed out that the present organization does not differ from the old Canadian Electrical Association except that municipal plants which were formerly associate members and had no voice are now not admitted into membership at all. For purely business reasons, he said, an association such as the Canadian Electrical Association is necessary. At the meeting of the executive committee later in the day it was decided not to make any change.

### Election of Officers

The following officers were elected for the year 1913-1914 as announced at the closing session: President, Mr. D.



PRESIDENT-ELECT D. R. STREET

R. Street, of the Ottawa Electric Company; first vice-president, Mr. A. L. Mudge, of the Electric Power Company, Toronto; second vice-president, Mr. D. H. McDougall, of the Toronto Electric Light Company, Ltd.; third vice-president, Mr. Wills Maclachlan, of the Trenton Electric & Water Company, Belleville; honorary secretary, Mr. T. S. Young, of Toronto; secretary-treasurer, Mr. H. G. Martin, of the Toronto Electric Light Company, Ltd. The managing committee comprises Messrs. A. A. Dion, of the Ottawa Electric Company; J. S. Gould, of the Citizens' Electric Company, Smith Falls; F. G. Clark, of the Toronto Power Company; L. Pratt, of the Dominion Power & Transmission Company, Hamilton; R. S. McDunnough, of the North Shore Power Company, Three Rivers; H. G. Mathews, of the Quebec Railway Light & Power Company; E. L. Milliken, of the Cape Breton Electric Company, Sydney, N. S.; W. L. Bird, of the Kaministiquia Power Company, Fort William; W. L. Robertson, of the Electric Power Company, Toronto; A. E. Dunlop, of the Pembroke Electric Company, Toronto; R. M. Wilson, of the Montreal Light, Heat & Power Company; R. H. Sperling, of the British Columbia Electric Railway Company, Vancouver; R. J. Smith, of the Canadian Electric & Water Power Company, Perth, and W. G. Angus, of the Dominion Power & Transmission Company, Hamilton.

Lieutenant-Colonel D. R. Street, the president-elect of the Canadian Electrical Association, is secretary-treasurer of the Ottawa Light, Heat & Power Company, the Ottawa Electric Company and the Ottawa Gas Company. He has been connected with the electrical interests in Ottawa since 1893. In that year he accepted a commission in the Governor General's Foot Guards, and, by gradually accepting promotions in their due course, succeeded to the command of the regiment in April, 1908, which regiment he commanded at the tercentenary celebration in the city of Quebec, and he also commanded his regiment at the tercentenary celebration of the discovery of Lake Champlain, where he was the guest of the states of New York and Vermont. Colonel Street, although a busy man with his civic occupation and his military duties, has always taken a keen interest in matters pertaining to the Canadian Electrical Association, and was a strong advocate of the affiliation of the Canadian association with the National Electric Light Association. His election to the presidency of the Canadian association came as a surprise to him and was wholly unexpected, as he was not present at the convention, his absence being due to business causes.

### Entertainment Features

On the evening of June 25 there was a theater party at the Royal Alexandra Theater, to which all were invited. Thursday morning the ladies in attendance were taken for a ride about the city and entertained at luncheon at the Royal Canadian Yacht Club. In the afternoon there was a baseball match between the manufacturers and central-station men at the Aura Lee Club grounds, which resulted in a victory for the central-station men with a score of eleven to four. That evening a cabaret show was given at the Temple Building, followed by dancing.

One of the most interesting papers at the convention was that dealing with underground construction in small cities, an abstract of which is given below as well as an abstract of the paper on organization of an appliance department. Abstracts of other papers will appear in a later issue.

### Underground Distribution for Small Cities

In large cities the load density makes overhead construction in congested districts a difficult and expensive proposition, so that economic requirements and esthetic demands are very apt to become coincident factors and underground construction does not become a burden upon the operating company. In the case of smaller cities, however, the problem is vastly different, and in a paper prepared by Mr. S. B. Hood, of the Toronto Electric Light Company, Ltd., on "Underground Distribution for Small Cities" it is pointed out that in small cities the load density and corresponding income will not warrant expensive underground distribution, so that a yielding to the demand for this class of distribution must inevitably place an additional burden upon the community as a whole or at least that portion of it which patronizes the local distributing company. Where the cost is charged as a local improvement against the abutting property owners, the cry for all wires underground becomes very much subdued, and while it is possible for municipally operated systems to handle the proposition in this way, privately owned companies cannot do so. Mr. Hood in his paper outlined a type of underground distribution which has been tried successfully in Toronto for locations where the demand for underground has been such that no form of overhead construction would have been acceptable. Two lead-sheathed, paper-insulated cables are laid in the earth with a bare neutral between them. The combined cost of these and the bare neutral will not exceed the cost of a three-core armored cable, besides possessing all the advantages of two independent two-wire systems as to reliability and continuity of service. In laying these cables about 4 in. of earth should separate each conductor from the bare neutral and about 8 in. from the outers. The group of cables thus separated should then

be buried in from 4 in. to 6 in. of earth and covered with a board of 1-in. rough lumber, treated with carbolinium and the ditch then filled in. There is in Toronto to-day somewhat over 6000 ft. of this type of main which has been in use for over two years. This was laid in new residential streets where building construction was in process and with the certainty that three ditches would be dug over the company's main for every new dwelling erected. Under these conditions no interference or failures have occurred, and in opening up the street for new services from time to time no depreciation is visible on the cables. It was pointed out that the construction was in unfinished boulevards with sandy soil and that the outer cables were only of No. 00 cross-section. The cost was about 80 cents per ditch foot or $1.60 per foot of street with mains on both sides. The original supply for this street was by overhead lines at a cost of about 30 cents per foot of street, which means under the most favorable conditions that underground construction will cost five times more than overhead construction.

The alternating-current mains are fed from pole-type transformers erected on intersecting streets, and in order to provide against extensive outages due to trouble on any section of the mains, and also for sectionalizing of the main on either side of any block, each block is fed from each end, the transformers being located at the extreme ends of the system in order that no block may have its supply limited to one source. This arrangement permits the opening of any main for repairs or changes without interfering with the supply to any customer. The trouble with such a scheme is the difficulty of making a good job in bringing the eight cables (two pairs for the block on which the transformer is located and two pairs for the block beyond) up the terminal pole. To overcome this a pillar box is used. The latter is supported on two concrete piers going down below the frost line, and the box is secured by a pair of anchor bolts embedded in the concrete. In the standard box terminals are provided for ten outgoing leads on both positive and negative sides of the system. The polarity is separated by an intervening and removable asbestos board, which makes it easy to work without danger of short-circuit and provides a quick means of testing and sectionalizing without the necessity of going up the pole or opening manholes. The cost of this pillar box built with hot galvanized finish throughout is about $100. With a system of this kind, the author pointed out, industrial service must be carried on single-phase motors, and where objection to this type of motor is made because of the higher cost the supply company, in the opinion of the author, can afford to pay the difference rather than yield to the demand for a polyphase supply on which the excess investment for mains, services and meters will be considerably in excess of the difference in the cost of the two types of motors. In concluding, Mr. Hood called attention to the desirability of having the primary supply for the suggested underground system arranged as a ring main. The secondaries, to get full advantage of diversity factor and consequent low copper and transformer costs, must be interconnected.

Mr. Hood's paper, which contained valuable information for central stations, was discussed by Messrs. L. W. Pratt and W. G. Angus, of the Dominion Power & Transmission Company, Hamilton; A. A. Dion, of the Ottawa Electric Company; J. Croucher, of the Toronto Electric Light Company, Ltd.; W. H. Marsh, of the Standard Underground Cable Company, Ltd., of Hamilton, and A. L. Mudge, of the Electric Power Company, Ltd., of Toronto. The discussion was simply directed toward explaining more fully some of the details of the paper.

### Organization of an Appliance Department

Mr. B. E. Rowley, of the Hot Point Electric Heating Company, Ontario, Cal., in a paper entitled "Organization of an Appliance Department," said that the perpetual earning capacity of such a department is certainly sufficient to justify the personal attention of the manager of a lighting company at times, although the routine work may be placed in charge of an appliance department manager. The author discussed the subject of the organization of an appliance department under various heads and showed forms used by the appliance department of the Southern California Edison Company, of Los Angeles, Cal.

*Discussion*

Messrs. L. W. Pratt, of the Dominion Power & Transmission Company, Ltd., Hamilton; A. A. Dion, of the Ottawa Electric Company, and G. W. Magalhaes, of the Toronto Electric Light Company, Ltd., contributed to the discussion on Mr. Rowley's paper. It was brought out that a bulletin board in the main office of any central station on which the advertisement for the day can be placed would insure united effort on the part of solicitors, demonstrators, window trimmers and the advertising department.

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## Convention of the British Municipal Electrical Association

In his presidential address delivered before the eighteenth annual convention of the Incorporated Municipal Electrical Association at London, June 17, Mr. C. E. C. Shawfield, Wolverhampton, directed attention to the need for a cheap supply of electricity, which, he insisted, is as necessary to the welfare of the community as adequate water supply or drainage. The increasing use of central-station service by factories, he pointed out, has purified the air near cities, although at the same time obviating fogs which formerly contributed to improving the lighting load-factor. The speaker deplored the policy which, while permitting municipalities to expend large funds on generating and distributing systems, prevents them from entering the business of equipping customers for the use and consumption of energy. Urging furtherance of the central-station idea, Mr. Shawfield recommended lowered municipal rates as being ultimately productive of the greatest possible development.

### Prime Movers for Electric Power

In considering kinds of fuel for prime movers, Dr. S. Z. de Ferranti emphasized the importance of Great Britain as a coal-producing country, but declared that in the future all coal must be gasified to obtain the high efficiencies of from 20 to 22 per cent available with the internal-combustion engine. The oil engine offers still higher efficiencies, ranging from 28 to 30 per cent, with no stand-by losses at partial loads. From the labor standpoint, however, the rotary class of machines like the turbines will always have tremendous advantages over reciprocating units, due to the simplicity of the former. Internal-combustion engines, on the other hand, are handicapped in handling overloads, and also possess the disadvantages of occupying greater space and being more expensive. Looking to the future, Dr. Ferranti predicted the day when with turbines using the internal-combustion principle still better economies will be obtained.

### Air Filtration and Cooling of Electrical Machinery

In a paper by Mr. J. Christie, Brighton, were described methods of ventilating large generating machines, removal of dust from air, etc. Ordinarily cloth filters are employed for this purpose, allowing 0.2 sq. ft. per cubic foot of air per minute. The author described an improved water-spray filtering apparatus in use at Southwick, where the air for ventilating a large machine is passed first through a water screen from a bank of nozzles and is then freed of entrained water particles by baffle chambers. The advantages claimed are compactness, absence of fire risk, ease of cleaning, low resistance to air passage, and incidental cool-

ing of air. Owing to this cooling action the author believes that from 10 to 15 per cent additional output can be obtained from fully loaded machines. The degree of humidity incident to use of the water spray is about the same as that obtained with cloth filters.

### Electric Automobiles

A paper on "Electric Automobiles," by Messrs. A. H. Seabrook, W. H. L. Watson and R. J. Mitchell, was largely devoted to description of practice and construction methods in the United States which the authors recommended be followed by the British industry. Lead and nickel-iron storage batteries were described, charge and discharge curves being given. Details were presented of the principal forms of transmission and bearing mountings, and motors; systems of control, tires, etc., were discussed in detail. The paper closed with a compilation of electric-delivery costs for both trucks and light wagons. In an appendix was given a collection of illustrations showing typical American electric-automobile equipment.

The headquarters of the convention were at the Hotel Cecil, where also was held the annual dinner on the evening of June 18. All of the regular sessions were held at the Institution of Electrical Engineers, Victoria Embankment, with the exception of the June 19 meeting at Kingston-on-Thames. The entertainment features of the convention included inspection trips to the Deptford, West Ham and Chelsea stations, a boat trip on the Thames from Nuthalls to Weybridge, and several dinners and luncheons.

## Society for Promotion of Engineering Education

The twenty-first annual meeting of the Society for the Promotion of Engineering Education was held at the University of Minnesota, Minneapolis, June 24 to 26. The registered attendance numbered about 10 per cent of the membership, which was satisfactory in view of the fact that the meeting was this year held farther west than any previous one.

Among the conspicuous features of the program were (1) a series of papers on the design and construction of buildings for technical schools, (2) papers on hydraulic engineering education presented at a joint session with the American Water Works Association, (3) a symposium on highway engineering education, comprising a long series of papers by eminent highway engineers and teachers of the subject, (4) a paper by a representative of the Pennsylvania Railroad on co-operation between technical schools and the industries, and (5) a paper by a prominent manufacturer advocating a movement in the direction of standardization of technical terms. In addition there were other carefully planned papers dealing with details of administration of various courses and with the underlying principles of successful administration.

### Academic Efficiency

Last year at the Boston meeting of the society a number of experts on scientific management showed that there was a connection between this subject and education. This year Director H. S. Person, of the Tuck School of Administration and Finance, Dartmouth College, was requested to apply the principles of scientific management to college administration. In doing so he showed that by functionalizing college work greater efficiency can be obtained than by present methods. The functions involved in education are teaching, administration, advising, and guiding non-class-room educative influences. As teachers are not equally fitted for all functions, it is advisable to assign to each only those for which he is best adapted.

Professor Person does not agree with the statements sometimes made that because education deals with intangible material the principles of scientific management do not apply to it. Further he believes that, contrary to the usual view, the more functions the instructor is called upon to perform the less personal is his contact with the student. Finally he contends that teachers and administrators do not apply scientific methods of research in education and that this is an important cause of inefficiency.

### College Laboratory Construction

Three papers on building construction and laboratory arrangement took up different aspects of the problem. Professor C. R. Richards, of the University of Illinois, gave the results of studies made with a view to the enlargement of the laboratories of that university and including what he thinks to be an ideal arrangement for the conditions existing there. He finds that much more careful attention has been given to the details of office buildings than to the design of college buildings, if it can be called design at all. The demand for the largest space for the smallest expenditure has forced the erection of buildings which are architecturally unsatisfactory. He then outlined the requirements of good laboratory buildings and some of the features of the equipment which they are designed to house.

Profs. E. C. Schmidt and A. L. Williston described particular laboratory buildings at the University of Illinois and the Wentworth Institute respectively. The transportation buildings of the former were recently dedicated and were fully described in the technical press. The University has now a locomotive-testing plant to accommodate the usual types of steam and electric locomotives. When completed it will handle the heaviest Mallet compound engines, as the possible wheel-base is 90 ft. and the traction dynamometer capacity 125,000 lb. The new Wentworth Institute building, for which the ground is now being broken, will provide ample space for the mechanical and electrical laboratories and for administration purposes. The general building plan of the institute is on what is called the unit system, sections being three times as long as they are wide and with the supporting columns so placed as to permit the rearrangement of partitions with minimum expense. This institution, although in operation but two years, has already taken its place as an important factor in industrial education in the Boston district.

### Specialized Engineering Courses

There is a marked tendency away from a high degree of specialization in technical courses. Two sessions of the Minneapolis meeting were, however, devoted to the important civil-engineering branches of highway and hydraulic engineering education respectively, on account of the public interest in these subjects at the present time.

At a session held jointly with the American Water Works Association, Prof. S. D. Mead, of the University of Wisconsin, and O. L. Waller, of the State College of Washington, read papers covering the preparation of young men as hydraulic engineers. As might have been expected, the papers and the discussion following would apply almost equally well to any other branch of engineering instruction. In fact, the authors showed that the best preparation for a hydraulic engineer is that which will teach him to think. As Professor Mead stated, the value of any education is not so much in the acquirement of knowledge as in the ability to acquire it. The ability to analyze a problem, to investigate the conditions which surround it and to determine the fundamental principles on which a successful solution depends are among the aims of a true education. He pointed out that the tendency of educational methods is to discourage the development of judgment, for the students are apt to accept the dictum of their teacher as infallible and hence not subject to their critical inspection. This, if true, is unfortunate, as sound judgment is an attribute of the successful engineer.

Professor Mead contended for a place in the civil-engineering curriculum for hydrology, a subject so essential in all water-power, irrigation and drainage projects, but one which is overlooked in the average list of courses of instruction. Professor Waller covered somewhat the same ground from the educational side, but he also urged a closer union between theory and practice by sending students into the field for commercial work for which a limited amount of college credit should be given. Discussion of these papers brought out the value of a technical education to the hydraulic engineer, but emphasized the primary purpose to be a general preparation for life rather than a specific preparation for hydraulic engineering.

The titles of the papers composing a long symposium on highway engineering education would lead one to infer that the educational situation in this field is different from that in others. Among these titles are "Essential Qualifications for Highway Engineers," "Opportunities for Highway Engineers in State Departments," "Short Winter Courses in Highway Engineering," "The Humane Element in the Education of Highway Engineers" and "Financial Problems in Highway Engineering." The papers showed, however, that the art and science of road making should be understood by all civil engineers and, while the opportunities in this field are unusually attractive at present, this should not result in the giving of highly specialized undergraduate courses in the subject. The present activity in highway engineering is due to the action of state legislatures in appropriating large sums for roads. The call for men fitted to take immediate positions of responsibility is, for the time, greater than the supply. Hence there is a pressure on the schedule for practical instruction outside the natural field of the technical school. This must be resisted. The elements of success in highway engineering are not different from those required in hydraulic, mechanical, electrical and other branches of engineering.

### College Students and the Summer Vacation

There is no doubt that the summer vacation must be profitably employed if a technical education is to be efficient. In hydraulic engineering it may be spent in field work, in irrigation and other water-works, as Professor Waller pointed out. Professors Sherman and Schlafly, of the Ohio State University, explained how their students are encouraged to get into commercial work in the summer time. If this is impracticable, the instructors take commercial contracts and employ the students as assistants. These "practical" summer surveying camps take the places of "practice" camps and are giving excellent results. Under this plan the students feel and act more like engineers than under the old plan. Prof. F. P. McKibben, of Lehigh University, gave details of the experiences of his students in obtaining summer employment and of the excellent results obtained therefrom. The discussion brought out a general sentiment in favor of the use of the summer months in actual work and emphasized the duty of future employers of the men to provide such work for them.

### The Length of the Engineering Course

A marked tendency to lengthen the college course to five or even six years has been conspicuous of late. A number of schools have introduced longer courses, these being either required or optional. This tendency is opposed by some leading educators, and two of them, President A. C. Humphreys of the Stevens Institute of Technology and Prof. G. F. Swain, of Harvard University, vigorously voiced their opposition at the Minneapolis meeting. They claim that four years cover a period long enough for a boy to remain from actual work and that the expenditure of an extra year or two does not bring commensurate results. In championing the other side the advocates of the longer course pointed out that the extra time is not wanted for more technology but for studies selected to prepare for better citizenship, and that on this basis its use is justified. Obviously no agreement was reached or could be reached as to the proper length of a course, but the discussion served to keep the topic alive and to put the authorities in charge of technical schools in a defensive attitude toward their present practice whatever that may be.

### Grading Students

At the University of Missouri an unusual amount of attention has been given to the grading of students along psychological lines. All teachers know that a numerical grading is quite perfunctory, as it is the impression made by a student upon his instructor rather than the written work he turns in that eventually "passes" him in a given course. A study of the practice of a large number of teachers was recently made by Prof. Max Meyer, and on the basis of this a considerable modification of the system of grading was made at the University of Missouri some years ago. The results were described by Prof. A. L. Hyde as entirely satisfactory. There are five grades given—excellent, superior, medium, inferior and failure. It is assumed that each teacher knows intuitively to which grade a student should be assigned. That this assumption is correct is proved by the much greater uniformity of ranking under the new plan. In addition to the advantages accruing from the psychological correctness of the system the student is offered an incentive to do good work by rewarding him for obtaining high grades with increased credit, while he is penalized for receiving low grades even if he does not have to repeat the courses for which he receives them. In this way the good student can reduce the length of his college residence while the poor student must consume more than the standard time if his grades, although passing, are low.

### Engineering Nomenclature

A subject which affects all engineers, because it relates to the ease and understanding with which they can read technical literature, is the standardization of technical terms. Mr. D. M. Wright outlined the results of his experience in a paper in which he recommended the appointment of a committee to study the subject. He described the results of a recent investigation in which a picture of a machine was sent to a number of manufacturers with the request that they name its parts. The returns showed that there is absolutely no unity in nomenclature, each man having his own terms, which were in many cases crude. Mr. Wright's idea is that the Society for the Promotion of Engineering Education is a proper agency through which some reform can be brought about, as educators are in a position to promulgate a reform of this kind. The findings of a committee which will be appointed shortly to consider Mr. Wright's suggestions will be awaited with interest.

### Faults of Technical Graduates

At the request of the society a representative of the Pennsylvania Railroad, Mr. Ivy L. Lee, gave the results of the experience of that company with the many technical graduates who have entered the company's employ. The faults which they have noted are as follows:

(1) A lack of practical experience and judgment.

(2) An idea that they are far superior to the rest of mankind.

(3) A certain narrowness of mind, inculcated through a too exclusive attention in college to mathematics and theoretical science and to a too great neglect of those broader subjects such as political economy, history and general literature.

Mr. Lee believes that these faults can be overcome and that, by directing attention to the shortcomings and limitations as well as the strong points of the students, teachers

can do much to assist them in eliminating their weaknesses. This is a time for social service in public utility commissions, in colleges, in university settlements, in municipal health boards, in city governments, in all capacities in which men can serve their fellows. The demand in all lines is, in Kipling's words:

"From forge and farm and mine and bench,
Deck, altar, outpost line—
Mill, school, battalion, counter, trench,
Rail, senate, sheepfield, throne—

"Creation's cry goes up on high
From age to cheated age;
Send us the men who do the work
For which they draw the wage."

### Manual Work for Students

Two important features of all technical courses are shopwork and drawing. That these subjects are being taught upon a high plane was indicated by the papers of Prof. J. V. Martenis and Mr. W. H. Richards, of the University of Minnesota, and Prof. T. E. French, of the Ohio State University. While shopwork and drawing are different in kind, they are alike in principle. They are tangible expressions of ideas. If taught in a routine, mechanical manner, they lose their vital interest; if related to engineering life, they become efficient parts of the curriculum. Messrs. Martenis and Richards have made shopwork interesting by allowing the students to make things worth while and, as nearly as may be, under commercial conditions. Professor French has related elementary drawing to the needs of the students so that they may be impelled to the desire for expression in this form. If all engineering subjects can be taught in this way, combining thoroughness with interest, the student will be happier and hence more efficient.

### Teaching Elementary Dynamics.

Of all the difficult concepts which students have to grasp, that of the relation of force, mass, weight and acceleration is one requiring possibly the greatest mental effort. Teachers of mathematics, physics, mechanics and engineering struggle with it. The situation is aggravated by the use of many different units for these quantities. Prof. E. V. Huntington, of Harvard University, proposed a simplification of these by eliminating most of these units and substituting what he calls the "standard" weight and the "local" weight for the usual "mass" and "weight." These names are self-defining. Then if the standard weight of a body be known (say by applying a correction to the local weight) the effect of any force on that body will be an acceleration proportioned to the quotient of that force and the standard weight multipled by the gravitational acceleration in the standard locality. Or

$$A = \frac{F}{W_s} g$$

Naturally a proposition like this stirred up much discussion and the whole subject was referred to a special committee on the teaching of mechanics to engineering students, which was appointed forthwith, with Prof. E. R. Maurer, of the University of Wisconsin, as chairman.

### Thesis Work for Undergraduates

The cause of the much-discussed thesis, once an essential part of the engineering curriculum, was championed by Prof. H. Wade Hibbard, of the University of Missouri, and many other teachers who believe that a limited amount of time may be profitably devoted to a research problem of some sort, provided that it be not too comprehensive. The satisfactory solution of such a problem demands careful preparation and systematic solution. Professor Hibbard has collected a list of 1500 or more topics for thesis study, which will be published in an early number of the *Bulletin* of the society.

### What an Instructor Should Be

In his presidential address Prof. William T. Magruder, of the Ohio State University, painted a picture of an ideal instructor which showed that a man who occupies a position of such moral responsibility should be possessed of high character and attainments. He must, of course, be familiar with his subjects in both a theoretical and a practical way, but his knowledge must be within reach of his students. If they cannot understand him, he might better know less for their purpose. If possible, he should have earned his living in the line which he tries to teach so that he may be sufficiently practical in his instruction. He must be able to express himself clearly and forcibly, requiring for this purpose not only ability but health, adequate recreation and endurance. He must be a model to his students in character, involving honesty, right living and patience. He must have unbounded enthusiasm for engineering and for teaching, with conviction as to their dignity and importance. The good teacher is he who has felt the thrill of having been called to the upbuilding of character in others, who day by day sees the unfolding of the innermost life of service to live and enjoy, and who deals with human minds in the laboratory of life; for, after all, is not education only scientific research applied to character?

### Activities for Next Year

In addition to the plans for new work already mentioned, a number of committees appointed last year to study the improvement of instruction in the several branches of engineering reported progress and were continued for another year with instructions to carry out their own suggestions. The chairmen of these are Profs. F. P. McKibben, of Lehigh University; C. F. Scott, of Yale University; A. M. Greene, Jr., of Rensselaer Polytechnic Institute, and F. W. Sperr, of the Michigan College of Mines. The committee on college administration, which made a report covering such matters as the salaries of professors, falling off in the number of technical students, leaves of absence, etc., was continued. A new committee on the teaching of physics to engineering students, with Prof. G. V. Wendell, of Columbia University, as chairman, was also appointed. Altogether the society has a large amount of committee work in progress, greater than at any other time in its history.

### Business Session and Election of Officers

The governing body of the society comprises the usual complement of officers and a council. The latter includes the past-presidents in addition to twenty-one members, one-third of whom are elected annually. The following elections occurred this year: President, G. C. Anthony, Tufts College, Mass.; vice-presidents, H. S. Jacoby, Ithaca, N. Y., and D. C. Humphreys, Lexington, Va.; secretary, H. H. Norris, Ithaca, N. Y.; treasurer, W. O. Wiley, New York, N. Y.; councilors, H. W. Tyler, Boston, Mass.; J. F. Hayford, Evanston, Ill.; A. S. Langsdorf, St. Louis, Mo.; S. M. Woodward, Iowa City, Ia.; M. S. Ketchum, Boulder, Col.; F. P. Spalding, Columbia, Mo., and P. F. Walker, Lawrence, Kan.

Several important actions were taken at the meeting. The council voted to take the steps necessary to bring before the membership a plan to make the secretaryship permanent. Princeton was recommended for the 1914 meeting and California for the year following. The secretary was instructed to confer with the officers of other societies with a view of reducing the conflict between convention dates. The wisdom of this action is seen when one considers that this year during the same week as the Minneapolis meeting the American Institute of Electrical Engineers met in Cooperstown and the American Society for Testing Materials in Atlantic City. At the same time many members were abroad on account of the tour of

the American Society of Mechanical Engineers and of the Highway Congress in London. As the educational society draws its membership from all engineering societies, attendance at its convention is seriously affected by such conflicts.

The social side of the Minneapolis convention was, as usual, made a feature, and excursions, receptions and luncheons enabled the delegates to renew old acquaintanceship and the younger teachers to meet the veterans in the teaching profession.

A novel element of the meeting was the presence of representatives of instrument manufacturers and publishers, with excellent exhibits of their products. The teachers were thus able to examine at leisure the latest books and apparatus with experts to explain them.

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## A. I. E. E. Convention Papers and Discussions

Herewith are presented abstracts and discussions of the papers read before the annual convention of the American Institute of Electrical Engineers at Cooperstown, N. Y., June 23 to 27, omitting, however, for lack of space, papers on the subjects of high-tension transmission, corona, and synchronous motors. An account of the news features of the first two days' sessions was given in these columns last week, and on a preceding page of this issue will be found a report of the closing days of the convention.

### An American General Engineering Society

Deploring the lack of a united engineering profession, Dr. William McCellan presented a paper in which he proposed the formation of a general engineering society, to be known as the American Engineering Association, which would include no personal memberships, but in which the present national engineering societies would participate by electing representatives annually. No business or trade organizations would be included. The present lack of unity, according to the author, has prevented the engineering profession from exerting its proper influence in the solution of economic problems and has also prevented the profession from having the standing it deserves among the learned professions. Among the functions of such a general engineering society as that proposed would be arrangement of an annual convention for the discussion of engineering in general, the holding of semi-annual meetings, investigation of various subjects, appearance in national and civic matters, etc. To carry such a scheme into effect, it should have the support of at least three of the four national engineering societies.

*Discussion*

Mr. C. O. Mailloux characterized the paper as one of the most interesting contributions presented in a long time. This, he said, is one of the means of raising the status of the engineering profession. Evolution in engineering has been largely a process of segregation, with many resultant different attitudes and opinions as to professional ethics, the relation of the engineer to public questions, etc. The American Institute of Consulting Engineers has given considerable attention to this question, but has considered only the interests of consulting engineers. The proposal in the paper, declared the speaker, should be fostered and promoted by the Institute, and to that end he offered a motion that it be referred to the board of directors for consideration.

Strong indorsement of the paper was next given by Mr. Oberlin Smith, of Bridgeton, N. J., a member of the four national engineering societies. He felt, however, that too much clannishness among members of different national engineering organizations exists to make the project feasible just yet. It was hoped, he said, that when Mr. Andrew Carnegie donated the Engineering Societies Building in New York the four great societies would come together under one roof, and he declared that the American Society of Civil Engineers has since regretted its action in staying out. The civil engineers, he said, still consider that their society represents all the domain of engineering except military engineering, although there is a growing sentiment among many of them for a united national society. Such a society, said Mr. Smith, should not be organized unless it embraces all of the present national societies.

He closed by seconding Mr. Mailloux's motion, which was then voted upon and carried.

Mr. C. L. Clarke, of New York, N. Y., who indorsed the plan of Dr. McClellan, urged that clannishness would be no obstacle to its accomplishment, because none of the functions of any of the constituent societies would be disturbed. He proposed the name of "American League of National Engineering Societies," as being both descriptive and sonorous.

Mr. D. B. Rushmore, of Schenectady, N. Y., deprecated the existence of too many professional and commercial organizations, many of which he regarded as superfluous and imposing an unnecessary financial drain. He also spoke of the proposal which has been made repeatedly for licensing engineers and believed that such a plan, if ever carried out, should be supervised by a unified national organization of engineers of every kind.

Prof. C. L. de Muralt, of Ann Arbor, Mich., indorsed the paper. He thought, however, the best plan would be to apply for representation in the American Society of Civil Engineers, making that organization ex officio the national body. This proposal met with objection at once from Mr. Mailloux, who took the floor and characterized such a plan as preposterous and ridiculous. The civil engineers, he declared, had lost their opportunity forty years ago and were both clannish and unprogressive in this respect. Prof. Muralt then defended his proposal, saying that the civil engineers would welcome such a plan, and that it would be entirely feasible.

Mr. Oberlin Smith declared that the civil engineers would be delighted, of course, to take everybody in on such terms, but agreed with Mr. Mailloux that the proposal was impossible.

Prof. D. C. Jackson, of Boston, Mass., indorsed the general plan. Speaking of Tredgold's well-known definition of engineering, he said he preferred to amplify it to the extent of defining engineers as those competent to conceive, organize and direct engineering work. And under such a definition it seems obvious that scientists should be included since they fall under the head of those who conceive.

### Tests of Artificial Telephone Line

Tests described by Dr. A. E. Kennelly and Mr. F. W. Lieberknecht were made on the 500-mile artificial line at Harvard University which had been converted to the characteristics of an aerial telephone line by the addition of non-inductive 100-ohm resistors at intervals of 80 km, increasing its resistance to about 2.5 ohm per wire-mile. The experiments included three sets of terminal conditions at the receiving end, the signals being sent by alternating current at 1.7 volts and 760 cycles per second. In the first set of tests the distant end was freed or open, in the second grounded, and in the third connected to ground through a standard subscriber's set. The results of the experiments, set down by the authors in tabular and polar-co-ordinate curve-forms, evince the close agreement with the theoretical conditions computed with the aid of the hyperbolic-function method.

*Discussion*

The paper was discussed briefly by Prof. D. C. Jackson, Boston, and by Mr. F. K. Vreeland, New York, N. Y. Prof. Jackson brought out the distinguishing characteristics

of telephone transmission and energy transmission, commenting upon their several points of general similarity and emphasizing the importance of the paper to energy-transmission engineers. The applicability of the hyperbolic-function theory, he said, is very clearly established by the experimental data presented.

Mr. Vreeland raised some questions in relation to the constants of the artificial line used in the tests described, and commented upon the very notable agreement between theory and practice. Mr. E. H. Colpitts, who presented the paper for the author, gave the results of some of his calculations from the observed results exhibiting discrepancies between the computed constants of the line and the

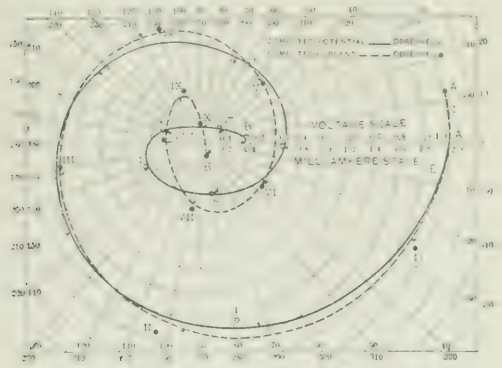



FIG. 1—VECTOR DIAGRAM OF VOLTAGE AND CURRENT

measured constants. In part the differences, he said, were attributable to the comparatively small number of artificial-line sections per wave-length. The line constants, so-called, are not constant but depend to some extent upon the frequency of the impressed emf.

### Automatic Long-Distance Telephony

Since "line time" is the commodity of principal value in the operation of a long-distance telephone system, it is poor economy, as pointed out by Messrs. H. M. Friendly and A. E. Burns, to limit the expenditure for office switching equipment where proper investment of this kind will facilitate transmission efficiency to even a small degree. The human factor represented by the operator often determines the efficiency of operation to such an extent that any dependable equipment which will reduce this indeterminate element is well warranted, however complicated it may be.

The authors described with the aid of circuit diagrams equipment for eliminating the through operator at intermediate offices heretofore used in establishing connections where the service cannot be made over direct lines or where the traffic offered does not warrant direct-line service being provided. The function of the through operator is performed by apparatus in semi-automatic control of the terminal operators.

Equipment was also described for enabling a toll operator to call subscribers directly in a distant manual local exchange via the "B" board, without disturbing the toll operator at the called exchange, though such service is subject to the latter's supervision. This does not, however, restrict or modify the normal uses and operation of the toll line.

#### *Discussion*

In discussing the paper briefly Mr. J. B. Taylor, Schenectady, N. Y., remarked that the use of such elaborate and complicated equipment in telephone service seems sometimes justified, but, on the other hand, is questionable in certain instances. He commented on the disagreeable and occasionally painful mechanical shocks received by the ear when using an instrument operated by the common-battery system, and the desirability of preventing such shocks in any successful commercial system, manual or automatic. Mr. Oberlin Smith, Bridgetown, N. J., said that the advent of automatic systems is to be welcomed, and expresssed the hope that all telephone service would in due time be upon such a basis.

In closing the discussion, Mr. H. M. Friendly said that

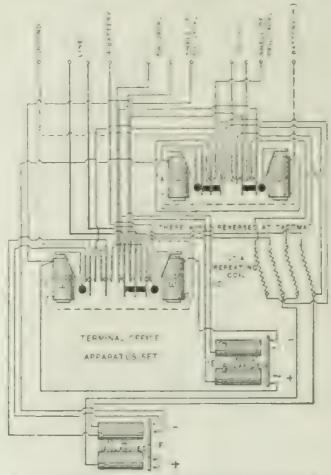



FIG. 2—THROUGH SWITCHING CIRCUIT

the application of automatic equipment to toll switching has been effected in such a manner as to make it click-less. He also reported that the maintenance charges upon such equipment were extremely low.

### Electrolytic Corrosion of Iron in Soils

In a paper by Messrs. Burton McCollum and K. H. Logan was discussed generally the subject of electrolytic corrosion of buried iron from outside current sources as well as from self-corrosion within the piece itself. The two actions are to a large extent interdependent, the existence of one affecting largely the occurrence or severity of the other. In the tables of experimental data compiled by the authors the factors are given which are most likely to effect electrolytic corrosion of buried pipes under practical conditions. Among these elements are current density of discharge, moisture content of the soil, presence of oxygen, temperature, voltage, etc. In the laboratory tests carefully cleaned iron anodes were tested in cans of sifted earth moistened with distilled water. Meanwhile check specimens of iron were also embedded in protected sections to investigate simple self-corrosion. Detailed precautions were necessary in the preparation and cleaning of the specimens. To afford a variety of practical conditions soils from various localities were used in the tests. The authors discussed briefly earth resistance, polarization and surface-film resistance, presenting tables of results of specific resistance and corrosion tests, etc. A number of practical conclusions were drawn from the experiments, it being found, among other facts, that corrosion is most efficient at low current densities and is independent of temperature, of depth of burial and of the oxygen present in electrolytes. Soil resistance varies with moisture content up to the point of saturation.

#### *Discussion*

Mr. J. L. R. Hayden commended the paper as a very valuable one, but expressed some disagreement respecting the [illegible] of iron.

Prof. D. C. Jackson remarked that the authors presented

only in part the results of the researches carried on at the Bureau of Standards. In his own experience he found that soil resistivity is a more important factor than moisture content. Thus corrosion differs greatly for the same voltages with different soil conditions, as found in different localities. Concrete road-bed construction usually holds much moisture and is thus conducting to a considerable degree. The effect of temperature is important, and frozen earth lessens the stray current flowing in metal structures beneath. In experiments made in 1894 he found corrosion in the presence of a single acid radical to be much less than that predicted by Faraday's law. Cast iron corrodes less rapidly than does wrought iron, perhaps due to the impeding action of the carbon and manganese present. When the earth around a pipe is frozen the conductivity is greatly reduced, which he found to be the case from the close agreement between actual and calculated current values required to thaw ice in water pipes. It is not the peak current in electrolysis which is important, but the average. The real problem now pressing for solution is how far to go to strike a cost balance between the damage done and the cost of preventing it.

Mr. H. T. Wreaks, of New York, N. Y., spoke of the efficacy of pipe coatings and asked what results had been obtained with them at the Bureau of Standards. Mr. H. V. Bozell, of Norman, Okla., referred to the expedient of laying water and gas mains on each side of the street, to avoid or reduce corrosion of the service pipes. Prof. F. C. Caldwell doubted the wisdom of placing a limit on track drop as some city authorities do, because of the implied acceptance of liability for damage by so doing.

Past-president H. G. Stott, of New York, spoke of the responsibility of railway companies, and mentioned the paper presented by Mr. G. I. Rhodes a few years ago on negative return feeder systems, which he characterized as a classic. The roads under his direction are using such means to reduce the damage to a minimum. Voltage is not so important a criterion as the points in the track return where the current is collected and returned to the power house.

Mr. A. Maxwell, of New York, commended the value of the paper. At very low current densities, of 0.0005 to 0.04 milliampere per sq. cm, the corrosion seems to exceed the theoretical amount.

Prof. A. F. Ganz said that the paper proves the practical value of Faraday's law, which gives about 20 lb. of iron lost per ampere-year. Very excessive apparent efficiencies of corrosion, as high as 500 per cent, were obtained by him only where the surface skin of the pipe had not been removed. Where the pipe had been turned off he found corrosion efficiencies of from about 100 to 120 per cent. There is unquestionably a variation of efficiency with the current density. But the damage increases where corrosive action is non-uniform and pitting occurs, and the pipe shell will be pierced much sooner than otherwise.

In closing the discussion Mr. Burton McCollum said that the passivity of iron is due to a number of different causes. For instance, it is passive in fuming nitric acid. He agreed that high earth resistance is an important point, but said that high resistance and low moisture content generally go together. Faraday's rule as originally stated is applicable only to the electrolyte, but it still holds also for the anode reaction. There is undoubtedly less leakage, he said, when the earth is frozen. It is not necessary to eliminate corrosion entirely, but only to reduce it to the economic maximum limit. Pipe coatings he did not in general approve of, as they are very likely through defects to augment corrosion at local points. Pitch, although expensive, he said, is an effective coating. Alternating-current electrolysis even at very low frequencies amounts to only a fraction of 1 per cent of the amount that occurs with direct current. He commended the use of return or negative feeders and said that insulated pipe joints are useful only as an adjunct remedy. In the matter of current densities he thought the range given in the paper covers average conditions, although possibly the lower limit ought to be depressed slightly.

### INDUSTRIAL EDUCATION

The report of the committee on education was prefaced with an introduction by Prof. H. H. Norris in which special reference was made to the work of the National Association of Corporation Schools, recently organized at New York. A detailed description of the purposes and plans of this association, prepared by Mr. F. C. Henderschott, followed as Part 2 of the report. "Vocational Education in Philadelphia and Vicinity," the section prepared by Mr. A. J. Rowland, described the work being done in the night and day schools of Drexel Institute, Franklin Institute, the Y. M. C. A., Temple University, Spring Garden Institute, the Philadelphia Trades School, the Pennsylvania Railroad Company's school of telegraphy, the Bell Telephone Company's plant schools, the electrical department of the Underwriters' Association, the School of Industrial Arts, etc. Western educational topics were taken up in the section by Mr. Robert Sibley, who gave an account of the work in A. I. E. E. sections and branches in the West and described the aims of some of the large utility companies of the Pacific slope. The Pennsylvania Railroad Company's apprentice schools were described in the closing section, prepared by Prof. J. P. Jackson and Mr. J. W. L. Hale.

#### *Discussion*

A prolonged and interesting discussion was contributed by Messrs. C. L. Clarke, New York; H. G. Stott, New York; M. T. Crawford, Seattle, Wash.; W. I. Slichter, New York; C. R. Dooley, East Pittsburgh; N. J. Neall, Boston; J. L. Wayne, Indianapolis; A. M. Buck, Urbana, Ill.; F. C. Caldwell, Columbus, Ohio; H. M. Friendly, Portland, Ore.; G. C. Shaad, Lawrence, Kan.; O. J. Ferguson, Lincoln, Neb.; C. A. Adams, Cambridge, Mass.; H. Barker, New York, and J. W. L. Hale, Altoona, Pa. The points brought out by these speakers are briefly summarized in the following paragraphs:

Ability to compose good English is one of the important things to impart in vocational training, and even college graduates are often sadly deficient in this respect. The keynote in industrial schools is not to develop ambition in the individual beyond his capabilities, which is sure to result in unhappiness, but to discover the occasional or perhaps rare man of unusual ability and promote him when fitted. The percentage of such men is very small. Another valuable feature of such training is equipping the industrial worker to do his work more efficiently and effectively, commencing with men in the lowest grade. Some apprenticeship courses, however, are open to the probable objection that their courses are too long and tend to wear out youthful material instead of developing it. There is need for stimulating and developing the worker's interest in his occupation. In selecting employees attention should be given to the local sentiment of the community toward education in general. Occasionally those workers who profess an interest in vocational training do so merely with the object of currying favor with their superiors. Vocational instructors should be men who can inspire their men; success in college work by no means forecasts success in this field. The real engineering must be done by college men, all of whom are needed because the supply is decreasing in the face of greater demand for them, ascribed in part to the competition of the agricultural college. There is great need of discovering the potential engineer of real ability before he makes a decision as to the work in life he thinks he is best fitted for. More attention should be paid to the reading of technical journals on the part of men who can be greatly helped in such a way. Many study engineering in college

who are not fitted for such work, perhaps one-half or two-thirds of all who now select such courses are unfitted for them. Too many men go to college for purely social reasons, and are inspired with false ambitions in directions which can never be realized.

### Non-elastic and Elastic Catenaries

In a paper by Messrs. C. A. Pierce, F. J. Adams and G. I. Gilchrest equations were derived for length of conductor, span, tension and sag based upon the assumption of a flexible elastic conductor. These equations contain functions of the angle of bending of the curve in which the conductor hangs, and a constant. The latter can be eliminated in two ways. The first leads to expressions for the characteristic ratios of elastic and non-elastic catenaries. The second method develops equations for the value of tension, conductor length and sag in terms of each other.

Numerical values of the characteristic ratios of the simple catenary are tabulated for angles less than 60 deg. These ratios are reduced to simple forms involving the non-elastic catenary, since the exact equations are too complicated to use. The results of tests on an experimental span approximately 200 ft. long are compared with the theoretical values based on the non-elastic catenary. Further experiments with wires of different sizes are now being carried on, and during the coming season it is planned to make tests of change of sag and tension with temperature.

### Commutating-Pole Saturation

Mr. Harold Stokes presented a paper in which was discussed the importance of obtaining the characteristic curve of the commutating-pole useful flux, especially with regard to machines designed to withstand heavy overloads. This curve must not depart from that of the flux required to neutralize the reactance volts of the machine by an amount greater than that which can be handled by the brush resistance. In addition to descriptions of methods for measuring the total and useful commutating-pole flux, results of tests on two machines are given. The author pointed out the importance of the ratio of leakage to useful flux at low saturations. Analysis was made of the magnetic leakages due to the main and commutating-pole ampere-turns, showing that the paths taken by the flux are to a degree dependent on the relative values of the pole ampere-turns. While the formula developed is subject to some discrepancies, the author's experience nevertheless has indicated sufficiently close agreement between calculated and test results to justify the approximate method.

#### *Discussion*

The commutating pole, said Mr. H. M. Hobart, has been of the greatest advantage in direct-current design. But when it was introduced designers rather overdid the matter. If there is any carelessness in the design there may be as much as from 200 to 300 per cent magnetic leakage. It is always best, the speaker said, to design the best possible machine of the ordinary type and then add enough commutating poles to neutralize the reactance voltage in the coils undergoing commutation. As a rule, such poles should not be as long as the full armature length. This device really serves best as the finishing touch in design.

Mr. F. D. Newbury said that the paper indicated a tendency among designers of direct-current machines to get down to fundamental considerations, following the lead of designers of alternating-current machines. The overload capacity is greatly improved by commutating poles, but even a compensated machine will flash with from fifteen to twenty times full-load current, or short-circuit. Mr. J. M. Hipple remarked that in the old style of design under-voltage and overload conditions are taken care of by stiffening the fields or saturating the pole tip. The commutating pole now provides a means of much improved operation under both of these conditions, limited only by saturation.

Mr. H. M. Hobart contended that the commutating pole is really an antidote in design, so to speak, and added that the cure may in some cases be worse than the disease. Against this view Mr. J. M. Hipple argued that the commutating pole is a prime condition in design, just as the use of a saturated pole-tip in the non-commutating-pole type is regarded. Mr. Harold Stokes in closing the discussion said that it is customary to limit the length of commutating poles to from 60 to 70 per cent of the armature length. Flashing over is due mainly to the fact that the flux in the commutating poles lags appreciably when very rapid changes occur.

### Motor Drive in the Rubber Industry

Information of interest to the industrial power engineer was given in a paper by Mr. C. A. Kelsey outlining the principal operations in the process of working up raw rubber. This material has a large capacity for absorbing power and is greatly improved by such working. Motor drive of sheet rolls involves an irregular load with abrupt peaks. Mixing, masticating, tubing, calendering, etc., are some of the other operations involving special applications of motors. Certain operations of "working" and mixing also have heavy overloads of short duration, but these diverse demands, by grouping under a single motor, result in reduced peaks. For individual drive squirrel-cage induction motors are preferable. In the calendering processes where close speed control over ranges of four to one is required direct-current motors may be used to advantage, speed adjustments being effected by the multi-voltage and adjustable-voltage methods. The tubers also require direct-current operation. As the power required to drive the mills is by far the greatest part of the total requirements, alternating-current service is generally selected. The motor-generator set or synchronous converter used to supply direct current can then be used for power-factor correction of the main circuit. In conclusion there was given a comparison of methods for obtaining adjustable-speed operation, with emphasis on the features to be embodied in the control.

### Operating Costs in Steam Plants

To avoid the variation in results which follows from lack of uniform accounting principles in power-plant determinations, Messrs. H. G. Stott and W. S. Gorsuch, in a paper entitled "Standardization of Method for Determining and Comparing Power Costs in Steam Plants," recommended the kilowatt-hour of net output as the fundamental basis for determining and comparing the cost of energy. Groups are suggested for assembling items of expense, and a method is proposed for providing an amortization fund from life-expectancy tables for replacing and renewing buildings and equipment. Administration expenses which are clearly departmental charges should be apportioned under the proper headings, the remainder being similarly divided on the basis of departmental costs. The relation between load-factor and cost of energy must be determined in order to permit the comparison of costs per kilowatt-hour under varying conditions. A method is also suggested for comparing the relative values of coals where the chemical analysis and price are different, and for correcting the cost of labor where the average daily wages per man are materially different.

#### *Discussion*

The discussion was opened by Mr. Henry Floy, New York City, who read a somewhat extended comment in which he characterized the paper as exceedingly important. On some of the points on the economics he differed from the authors. He said that some of the formulas did not include all of the cost and pointed out that some items of a general character, such as the salary of the president and other executive officers and the cost of the auditor's department, are very hard to distribute equitably to the dif-

ferent items in the detailed operating accounts. There is in the paper, declared the speaker, a deviation from standard accounting classifications, which would result in certain inconsistencies. The table of life expectancy for different kinds of plant equipment is not in accord with values generally accepted, in Mr. Floy's opinion. The exact dividing line between depreciation and maintenance is also very difficult to establish, he said, and likely to be arbitrary. In a very large system the speaker claimed that renewals can be treated as repairs, with no difficulty, but an annual check on depreciation is very desirable nevertheless. Mr. Floy also criticised the use of 5 per cent as an interest rate in computing the cost of capital, as being too low and not equal to the customary rate of return allowed on public-utility properties.

Mr. C. Schwartz, New York, read an extended discussion giving many figures and illustrations of the points involved in comparing operating costs in different plants and with dissimilar equipment. For several years past, he said, a number of large generating plants had been exchanging their cost data and found it very advantageous to do so. In one of these plants, having a rating of about 20,000 kw, the energy costs in several years had fallen from 0.67 cent to 0.45 cent per kw-hr., and if the turbine water rate had been down to 13 lb. the cost would have been reduced still further to 0.38 cent per kw-hr. It is needless, he thought, to go to the extreme of computing the cost per kw-hr. of each detailed item in the classification, but rather to do so only for the sub-totals. He also thought the wages per man per day do not give a useful figure for comparisons between plants using stokers and hand firing. Volatile matter, sulphur and other ingredients, said the speaker, are important factors in determining the true economic value of coal and should not be ignored as the authors had done. He also urged that the classification of costs given in the paper be simplified.

Dr. William McClellan, New York, said that while he first had many comments to offer, subsequent reflection reversed his intention and he was convinced that the paper was a masterpiece. He urged that the great importance of the subject warranted its reference to a special committee to consider it in detail, putting this in the form of a motion which was later seconded and carried. All companies, he said, ought to make such cost analyses, if only for their own information and advantage, but in any case the public service commissions will ultimately require them to do it. However, since there is considerable work involved in preparing the data, the companies will probably be divided into appropriate classes.

Mr. C. O. Mailloux then spoke briefly and, after highly commending the paper, seconded Dr. McClellan's formal motion that it be referred to the board of directors for subsequent reference at once to the proper Institute committee. Mr. P. Junkersfeld, Chicago, voiced his appreciation of the paper, but added that possibly it attempted too much. He said that the N. E. L. A. and the A. E. R. A. both have adopted accounting classifications, and compared their eight or nine principal sub-classes with the authors' classification.

The standardization of such a major classification, said the speaker, is almost imperative. Cost should be based always on net rather than gross output. He also thought it would be a very large undertaking to standardize all energy cost data over the entire country at one operation and recommended dividing the task in half, taking up operating costs first and capital or investment costs later, also condensing the classification into the simplest acceptable form at the outset. Load-factor, said Mr. Junkersfeld, ought always to be carefully defined, as the mere use of the term itself without qualification leads to misunderstanding. Spare plant equipment is another item, he said, which should be included; in some cases 10 per cent may suffice, while 20 per cent is hardly enough in others. Neither do maintenance and depreciation items always tell the whole story, because low maintenance costs may be reflected in poor physical condition of the plant, as in cases where the physical condition as a whole is on the decline instead of being kept up to normal.

Mr. D. B. Rushmore, Schenectady, N. Y., commended the paper highly and emphasized the growing importance of engineering economics in general. He also spoke of the importance of thoroughly investigating what the elements of cost really are and including them all in comparisons. Mr. A. H. Kruesi added his appreciation of the paper and recommended an extension of its classification to include plants selling steam for heating purposes. He also remarked that the load-factor does not completely define the load conditions, but there is needed in addition a plant-capacity factor. The use of curves instead of formulas, which he illustrated on the blackboard, he said would be a simpler method of analysis.

Prof. W. I. Slichter, New York, remarked that the terms power and energy were being confused and improperly used in an interchangeable sense. Mr. C. O. Mailloux remarked that abroad the term "energy transmission" is in general use, while in this country it is common practice to use the term "power transmission," with the same meaning. Prof. D. C. Jackson discussed the point at some length and said that even some textboooks on physics confound the terms power and energy. He then commended the paper as a classic, commenting upon the accuracy of the fourth-root rule in relation to the load-factor, as he had found from some analyses of his own. The cost of energy, he said, goes beyond the walls of the generating station and embraces the distribution, and hence the inspiring motive of the paper should be properly expanded to cover also the transportation and delivery of energy. He also made the point that insurance and depreciation have no relation, being quite apart and distinct. When a company has a sufficiently great number of property units, said the speaker, it can better afford to carry its own insurance.

Mr. R. D. Mershon said that power is a term in general use in referring to that which a central-station company sells to its customers, but in reality it is neither power nor energy, but service.

Mr. P. W. Sothman, New York, spoke very highly of the paper and emphasized again the need of properly defining and qualifying the term load-factor.

Mr. H. M. Hobart dwelt upon the effect of the load-factor and called attention to the difference between alternating-current and direct-current generating systems, where such questions come in with the former as power-factor and the number of phases in the electrical system. He also said that the difference between summer and winter temperatures gives rise to a large difference in maximum generator rating, amounting sometimes to one-half.

Mr. P. M. Lincoln stated that load factor is a generic term, but nevertheless agreed that in using it there is need for qualification.

In closing the discussion Mr. W. S. Gorsuch argued that investment costs, as well as operating expenses, must be included in a cost comparison in order to determine whether a plant is overloaded. The rule of the inverse fourth-root of the load-factor, he said, is applicable to small plants as well as large ones. The speaker then explained various points that had been raised in connection with the paper, offering the authors' justification for their position in the matter.

### AUTOMATIC SUBSTATIONS

In a paper by Mr. W. R. Summerhayes particular attention was devoted to the attendantless automatic rotary-converter substation of the Edison Electric Illuminating Company of Detroit, Mich., a more detailed account of which, with scheme of operation, etc., was given in these

columns last week. Various other automatic installations were also discussed, including train-lighting sets, motor drives, substations, etc., and a preliminary outline was given of the plans for installing a 1400-kw induction generator in a Western hydroelectric plant, to be operated at full gate-opening without a governor, while running in parallel with another station on the same stream. Elimination of the exciter greatly simplifies operation. An attendant's services will be required to shut down and start the machine, but in ordinary load-dispatching the unit will run idle during "valley" periods, at double rated speed, a condition for which its parts have been specially designed.

### Converter Substations in Basement

Within an area of less than a square mile of the business section of Chicago, ten substations aggregating 42,000 kw

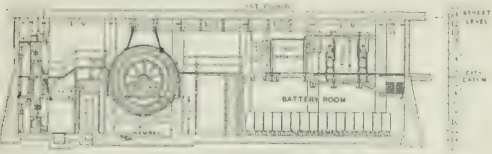



FIG. 3—SECTIONAL ELEVATION OF SUBSTATION

are in operation feeding energy into the direct-current three-wire system whose connected load is nearly 2,000,000 lamps. In a paper by Mr. B. G. Jamieson these substations were divided into two classes, the basement and sub-basement types. Methods and provisions for bringing in machinery were described. Air supply is a special problem in such plants, special air-cleaning and ventilating equipment being required. Stationary apparatus, such as transformers and regulators, is preferably cooled by water circulation. Other difficulties are introduced by the nature of the

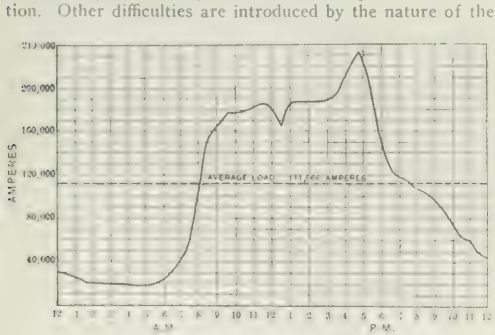



FIG. 4—DAILY LOAD CURVE

floor construction, which often interferes with foundationing, etc. The floor space needed for units of 500-kw capacity is 0.95 sq. ft. per kw and for 3500-kw units 0.54 sq. ft. per kw. With increasing values of real estate in large cities the basement type of substation, the author predicted, will become of increasing interest to electrical men.

### Operation of Frequency Changers

In a paper by Mr. N. E. Funk were discussed the general conditions governing parallel operation, including the theory, practical operation and methods of synchronizing two or more frequency changers tying together systems of different frequencies. After developing the theory of parallel operation, the results were applied to practical operating conditions, the aim being to aid the non-technical operator in automatically obtaining the correct conditions of synchronizing for all conditions of load. This is accomplished with the aid of synchroscope dial disks which have the machine-load markings entered on their scales at the proper angles. Great care is required in the design of frequency changers which are to transfer loads alternately from one frequency to another, for while it is possible that the load may be correctly divided at a given point when transferring load in one direction, the sets will not operate satisfactorily when the direction of load is reversed. Where, however, the sets are in different stations the line inductance controls to a large degree the division of the load.

### *Discussion*

Mr. D. B. Rushmore opened the discussion with comments upon the economic importance of substations in general and referred briefly to a small automatic substation designed by Mr. W. S. Moody and now in constant operation.

Mr. F. D. Newbury commented upon the ingenious solution of the problems in automatic substations described by the author, and said that it remains now to hear from operating men as to how the automatic substation holds up in service. There might be some difficulty, he thought, in bringing the converter up to synchronism with the proper polarity when supplied with excitation from a separate source. Possibly, said the speaker, it would be desirable to use only one starting voltage, instead of two or more. The need of a supply of clean air for cooling purposes is quite imperative. The speaker also asked whether oil pumps were in use anywhere to inject an oil film under the shaft bearings prior to starting, so as to reduce the initial torque required to overcome the friction of rest.

Prof. F. C. Caldwell, Columbus, Ohio, spoke briefly of a new automatic-resetting circuit-breaker which he said would soon be on the market. This device will automatically close after the load goes off.

Mr. P. M. Lincoln stated that the crux of the matter is how these substations behave in actual service.

Mr. H. M. Hobart spoke of the advantages of air-washing by means of water sprays instead of screens or filters. The largest installation of the former type, he said, is in the Deptford generating station in London. The spray both cools and washes the air, and, unlike filters, does not clog with accumulations of dirt and thus impair the quantity of supply and permit the machines to reach a higher temperature.

Mr. H. W. Peck declared he would not hesitate to apply automatic substations in central-station distribution. He also expressed the hope that Mr. Summerhayes would now turn his attention to the development of automatic stations for the operation of synchronous condensers and saw no reason to doubt the feasibility of the plan. It is now the best practice to have at least two attendants in substations where there is high-tension equipment, although one man could easily do the work. The introduction of automatic features will therefore be of great economic advantage.

In closing the discussion of his paper, Mr. Summerhayes said that although large converters are more reliable in operation than small ones, there will perhaps be some hesitation in adopting large automatic substations because of the investment risks involved. As regards the polarity of the converter when brought up to synchronism, he said that Mr. J. B. Taylor has devised a polarized relay for connection to the brushes which reverse the field circuit in case of wrong polarity. Replying to one of Mr. Newbury's comments, he thought it preferable to employ two starting voltages instead of one. The speaker also said that in his opinion synchronous condensers can be made automatic by means of Tirrill regulators. There is an instance, he said, where it is now planned to install an automatic restarter for a synchronous motor, to avoid shut-downs in the absence of the attendant who has other duties. Mr. Summerhayes reported that the operation of the Detroit installation thus far has been very satisfactory. The substation building in this case is not heated.

Mr. D. W. Roper, in closing the discussion on Mr. Jamieson's paper, said that air filters require less space than air washers, an important consideration where space economy is necessary.

In closing the remarks on his paper, Mr. Funk stated that on large machines an oil pressure in the bearings of about 300 lb. per sq. in. is required for a period of from three to five minutes in order to inject an oil film before starting. The sufficiency of the film is attested when the shaft lifts, giving as it does so an audible noise or sharp crack.

Owing to lack of space, as above noted, it has been necessary to omit from the foregoing abstracts and discussions of papers on the subjects of high-tension transmission, corona, and synchronous motors, which will appear in a later issue.

## Louisville Merger Company to Operate One Plant

General George H. Harries, president of the Louisville Lighting Company and of the newly organized Louisville Gas & Electric Company, formed by merging the Kentucky Electric Company with the Louisville companies, has announced that all of the various Louisville power plants will be operated for a time in order to determine which are the most efficient, while it will be some time before any concentration of production or distribution is determined upon. It is probable that the Kentucky Electric Company's plant, at Second and Washington Streets, will be the central distributing station for electricity, on account of its favorable location. Machinery now in use at the other plants will be moved to this plant, if the plan indicated is followed, and the generating units of the company's system will be concentrated there.

## Assessed Valuation and Rate-Making

Although the recent Supreme Court decisions in the Minnesota and Missouri rate cases, applying to transportation rates, are not of direct technical interest to the electrical industry, the comments of the court in the matter of correct methods of valuation of railway property for rate-making purposes are important. As will be remembered, the rates in question were upheld in a majority of the instances, but in certain exceptions were found confiscatory and therefore illegal under the Fourteenth Amendment to the United States Constitution. The ground upon which they were so found, however, was substantially that the roads were already so unprofitable, regardless of their value, that any further reduction of their revenues would constitute evident confiscation.

On the question of valuation in general the court held that the arbitrary method of applying some multiplier, such as two or three, to the assessed valuation for taxation purposes was wholly inadequate and inconclusive, even though it was the accepted practice in certain localities. The language of the court on this point was quoted as next given:

"Manifestly, a finding of confiscation could not be based on such a valuation in the absence of clear and convincing proof that the value actually existed and that the different items of property were estimated respectively by correct methods and in accordance with proper criteria of value. This proof was lacking.

"In the case of the other roads, although the special considerations which have been mentioned with respect to the Burlington property may not be applicable, still we are left in uncertainty as to the correctness of specific valuations which have been made. It cannot be regarded as sufficient to introduce assessments or valuations made for the purposes of taxation; and this is particularly true when the principles governing the assessments are not properly shown, and, for all that appears, they may have rested upon methods of appraisement which would be inadmissible in ascertaining the reasonable value of the property as a basis for charges to the public."

From this it would seem that, except in those cases where confiscation is self-evident, nothing short of a complete and thorough physical valuation would be admissible. These observations, although directly applicable to railroad transportation, doubtless apply also to any other public utility where the reasonableness of rates is in question. It is worthy of note that these decisions were delivered by Mr. Justice Hughes, who, when Governor of New York, was successful in his efforts to secure for the State a law regulating public utilities which has frequently been referred to as a most effective and efficient statute.

## Various Phases of Municipal Rate-Making Frankly Discussed

A meeting of the committee on gas, oil and electric light of the City Council of Chicago was held on June 26, primarily to discuss the report of City Electrician Palmer on the rate investigation of the Commonwealth Edison Company. Before adjournment, however, the discussion took a wider range and embraced a more general consideration of some aspects of municipal rate-making, brought out by vigorous colloquy between Alderman C. E. Merriam, a member of the committee, and Mr. William G. Beale, counsel for the Commonwealth Edison Company.

Early in the meeting Alderman Merriam questioned Mr. C. B. Willard, an expert accountant in the city comptroller's department, who assisted in the preparation of the report, about the alleged ownership of the Cosmopolitan Electric Company of Chicago by the Commonwealth Edison Company. Mr. Willard could give no definite information on this point, and Mr. William Arthur, of counsel for the Commonwealth Edison Company, said that he believed the Cosmopolitan Electric Company was an independent corporation. The relation of the Illinois Maintenance Company with the Commonwealth Edison Company was also discussed. It was shown that the former is an adjunct to the electric-service company, doing a steam-heating business.

The reading of Mr. Palmer's report was then resumed. The author explained that he found a surplus of $636,000 which might be applied to a reduction in rates. Mr. Palmer doubts if it is wise at this time to make a new appraisal. It would take four months, he said, merely to check the Byllesby appraisal of 1908.

### Mr. Beale Discusses the Palmer Report

Mr. Beale came in during the meeting. He told the committee very plainly that in his judgment as a lawyer the statute under which the city seeks to regulate the rates of the Commonwealth Edison Company is not valid. However, the company has voluntarily reduced its rates and will do so in the future when conditions warrant, despite the legal aspects of the case. The company is willing to discuss the subject with the committee.

Mr. Beale said that he recognized the spirit of fairness in which Mr. Palmer's report was made, but he objected to some features of it. In relation to the cost of street paving over conduits, which was excluded by Mr. Palmer, Mr. Beale pointed out that the Appellate Division of the Supreme Court of the State of New York has overruled Commissioner Maltbie of that State, who was quoted by Mr. Palmer as an authority sanctioning exclusion of paving costs in rate-making. No franchise value is allowed in the Palmer report, and Mr. Beale objected to this also. There should be, he said, an allowance for the value of the franchise. The company makes an annual payment to the city of 3 per cent of its gross receipts, and this indicates that the franchise has a value. The company in effect pays a rental for the use of the streets.

The practice of the Commonwealth Edison Company is extraordinarily conservative, according to its counsel. The cost of paving over conduits has been charged to operating expenses in pursuance of this policy. In any event the city has power to regulate maximum rates only. Inasmuch as about 25,000 customers produce no profit to the company, it is manifestly unjust to reduce the maximum rates. The company makes its profit from the larger users of electricity.

Mr. Beale declared that Mr. Palmer in his report virtually admitted that it would be unfair to require the company to reduce its maximum rates, and to prove this assertion quoted the following paragraph from page 105 of the Palmer printed report:

"It will be observed that the direct-current service is more costly than the alternating-current service, on account of greater investment and operating costs, due principally to conversion. For either class of service the present rate of 10 cents per kw-hr. for the first hour's daily use of the maximum demand, and 5 cents for the excess use, is greater than the cost, including an allowance of 7 per cent on the investment, when the maximum demand is used longer than about one and three-fourths hours per day. It is also evident that when the maximum is used less than about one and one-half hours per day, as an average, the company fails to realize 7 per cent on the required investment. Table No. 16 shows that about one-third of all retail lighting customers make use of their maximum not to exceed one hour per day, indicating that a large proportion are not profitable to the company when considered from their individual standpoint; yet if they did not employ the service, the cost of supply to those remaining would be increased."

### As to State Regulation

The subject of state regulation of public utilities in Illinois having been brought up, Mr. Beale said that so far as he knew no lawyer for a public-utility corporation had been asked to make a suggestion in relation to the bill providing for a state public utilities commission which passed the recent session of the Illinois Legislature. This bill, he said, has unsatisfactory features. If Mr. Beale had been asked, he could have pointed out some things that were unfair to the companies. The lawyer expressed himself as a firm believer in the city having the right to regulate local utilities, within limits.

Alderman Merriam made a speech in answer to Mr. Beale in which he said that the courts have not allowed franchise value to be capitalized for rate-making purposes. The alderman requested Mr. Beale to tell the committee why the Commonwealth Edison Company caused all its old books of account to be destroyed in 1911. This is a point brought up in Mr. Palmer's report, and one to which the daily newspapers of Chicago have devoted some attention.

[illegible]

Answering Alderman Merriam, Mr. Beale said that the committee had no power to inquire into the disposal of the old books of the Commonwealth Edison Company. Ordinarily, he declared, when a man is exceedingly suspicious it may be taken as an indication that he is crooked himself. The directors of the Commonwealth Edison Company are men of high character, who will be acquitted of any improper action. The fact was that the Commonwealth Edison Company and its predecessors had bought up a large number of electric-service companies in the period from 1887 to 1911. These proceedings produced a great mass of books and papers of all kinds. After the consolidation of the Chicago Edison Company and the Commonwealth Electric Company the question arose whether there was any reason to preserve all these old books and papers. Mr. [illegible] after consideration, the lawyer advised the company that it had a perfect right to dispose of its old books. This course was taken, probably to save storage room, and that is all there is to the matter.

Alderman Merriam declared that Mr. Beale's remark about crookedness was a personal insult to himself, but nevertheless he would not be influenced by it in his course as a member of the committee. He said, however, that he thought Mr. Beale had shown discourtesy to the committee and he wanted the lawyer to know that he could not bulldoze the committee.

Mr. Beale disavowed any intention of browbeating the committee.

As to the ownership of the Cosmopolitan Electric Company, Mr. Beale said he thought that the Commonwealth Edison Company did not own that company, but that he was not sure. In any event he had no authority to give out information on the subject.

### Relation with Elevated-Railway Companies

In answer to another question of Alderman Merriam, Mr. Beale gave a frank exposition of the relation of the Commonwealth Edison Company to the trust or association which controls the elevated-railway properties of Chicago. He said that Mr. Insull, president of the Commonwealth Edison Company, was induced to take up the subject of consolidating the elevated properties in view of his company's relation to the transportation lines in supplying electrical energy to nearly all of them. However, the original effort failed. Some other gentlemen then took hold of the matter and asked Mr. Insull's company to come in with them. That proposition also came to naught. During the negotiations, and indeed up to the present time, there has never been the slightest idea of including the Commonwealth Edison Company in consolidation with the elevated railway companies. Finally, Mr. Henry A. Blair, of Chicago, took the matter up. He secured options from the principal stockholders to buy the elevated-railway properties of Chicago, after two or three years of effort. He then went to New York to get the money to finance the deal. Great difficulty was experienced in doing this. Finally the New York financiers asked the Commonwealth Edison Company to make a guaranty that the financiers would not lose anything if there was not a consolidation of the elevated and surface lines within a limited time. The amount of money required was $46,000,000 and the Commonwealth Edison Company was required to give its guaranty to the extent of $6,000,000. The guaranty was in the form of a stipulation that certain preferred stock should be repurchased by the Chicago trustees at a certain time and at a fixed price. When the Commonwealth Edison Company was asked to make this guaranty a threat was made that if it did not comply a large competing electric-service system would be built in Chicago. The required guaranty was made, and contracts for electric service were made or renewed with all the surface and elevated-railway companies of Chicago. Under these contracts the Commonwealth Edison Company expects to get a gross business of $100,000,000 within the next twenty-five years. This guaranty is the only relation which the Commonwealth Edison Company has to the consolidation of the elevated-railway companies of Chicago. To secure itself the Commonwealth Edison Company holds the stock of the trust or association which controls the elevated-railway companies. No doubt a reorganization of the elevated-railway companies will be brought about before long. The contract by which the Chicago trustees must buy back the preferred stock of the elevated railway companies, which contract has been guaranteed by the Commonwealth Edison Company, must be executed next year.

[illegible] Commonwealth Edison Company

At the close of a rather stormy session Alderman Sitts, chairman of the committee, remarked that the Commonwealth Edison Company was one of the fairest corpora-

is to do business with in the city of Chicago. It has set example that other public-utility companies might well ow. Illustrating this, Alderman Sitts mentioned the otiations which resulted in the Edison company obtain- the right-of-way for its elevated railway connecting the cago & Northwestern tracks with the Northwest gener- g station. The chairman hoped that no unpleasantness ld result from the charges and counter-charges made ing the meeting.

Ir. Beale declared smilingly that the committee took lf too seriously, but that the company was willing to uss rate matters with its members as a matter of rtesy.

ity Electrician Palmer defended his report in a few ds. He said that Mr. Beale had not given the proper it of it in the extracts he had quoted.

## Massachusetts Legislation in 1913

he Massachusetts Legislature was prorogued on June having passed 841 acts and resolves and considered e than 3000 matters in a session of about five and one- months. Comparatively little direct legislation of ediate concern to electric or gas service companies was cted, although many injurious and burdensome measures e presented to meet a timely death in committee or on floor. A bill was passed rendering it unlawful for person or company furnishing gas to consumers to rge a consumer for the use of a meter for any part of fiscal year if the consumer during that period uses gas he value of $7 or over. An act was passed requiring ers for electric-lighting service to indicate clearly the rgy consumption in kw-hr., with a provision that no rge shall be made for the use of a lighting meter during portion of twelve consecutive months if the consumer ng that time uses electricity to the value of $9. The islature also enacted a law which provides that upon uest of any member of the inspection department of the rict police or of five employees of a factory or work- , the state board of labor and industries shall investi- e the adequacy of the shop lighting, with power to ommend changes, subject to a penalty of $500 for each ure to carry out an order of the board. This act is outcome of serious neglect of the proper standards of ustrial lighting in many installations and is generally arded as a salutary measure.

he passage of the Washburn railroad bill, by which the ner Board of Railroad Commissioners is to be increased a total membership of five, with mandatory powers, er the title of the Massachusetts Public Service Com- sion, has already been noted in these columns. The transfers the jurisdiction of the Highway Commission r telephone and telegraph companies to the new board, leaves the present Gas and Electric Light Commission ouched in its duties and responsibilities. Easier facili- for raising capital for transportation companies' im- vements are a feature of the act. Nothing was accom- hed in the present session toward the electrification of roads in the Boston district, but each year public sen- ent grows stronger in favor of the abolition of the steam motive, and from all indications this radical change in ive power cannot long be delayed.

n important measure passed over the veto of Governor s late in the session authorizes the purchase by the v York, New Haven & Hartford Railroad through the kshire Street Railway of the trolley systems centering Worcester and Springfield. With this purchase goes a vision that the railroad company shall make an early enditure of $5,000,000 for new lines and facilities. ably in the hill-town district of western Massachusetts, ch has been going backward industrially for many rs through the absence of railroad or electric railway service. Another bill passed after a long struggle over the Governor's veto gives street railway motormen and conductors a nine-hour working day to be performed within eleven consecutive hours. A more socialistic measure has not been passed in Massachusetts within recent years, and it is anticipated that the constitutionality of the act will be tested in the courts in the near future, when many of its opponents think it will be declared illegal.

A number of important measures affecting the rapid-transit problem in the Greater Boston district also became law, among these being an act authorizing the construction by the Boston Transit Commission of a double-tracked subway between the North Station district in Boston and the Sullivan Square terminal in Charlestown, with the removal of the existing elevated structure on the route; an act providing for the construction of a subway for train service in the cities of Malden and Everett, in place of an elevated railway authorized by statute but not as yet constructed, and various investigations and reports to the next General Court by the commission. The jurisdiction of the Gas and Electric Light Commission has been extended to cover the complete and detailed investigation of the books and papers of all holding companies in control of stock of public utilities under the supervision of the board, and a special act provides that no holding company shall assume a title which will lead the public to consider it as a public-service corporation. An act was also passed providing for the publication through the secretary of state of the agreements of holding companies controlling public-service corporations. Another law forbids any corporation organized under the general law of the State to acquire more than 10 per cent of the stock of a public-service corporation, without special legislative authority.

## Public Service Commission News

### Massachusetts Commission

Plans are being made for the reorganization of the Railroad Commission in accordance with the new Public Service Commission act. At the outset the board will take over all employees of the Highway Commission who have been engaged in the work of telephone supervision, and other enlargements of the organization will soon be made, with the formation of new departments headed by chiefs who have specialized in different branches. Chairman McLeod and Commissioner Bishop visited the New York commissions recently and studied the organization of both boards, the latter also making an inspection of the terminal facilities of the New York Central system at New York City. New quarters are being sought by the board for its offices.

### New York Commissions

The Public Service Commission of the First District will begin an inquiry July 7 to determine whether the New York Edison Company has violated an order made by the commission in December, 1908, prohibiting discrimination in rates and contracts by electrical corporations. The commission recently dismissed the complaint of Frankel Brothers alleging that the company refused to supply them with break-down service because they supplied energy from their private plant to another building which formerly was supplied by the Edison company. Frankel Brothers asked for a rehearing, but the commission denied the application. In it, however, the complainants alleged that the Edison company is supplying break-down service to the St. Nicholas Rink and Healey's Restaurant, where practically the same conditions exist as with Frankel Brothers and the building which they supplied. To ascertain whether the company is violating the commission's order in providing such service for the St. Nicholas Rink and Healy's Restaurant the commission ordered the inquiry.

# Current News Notes

Large Municipal Compensation.—The Commonwealth Edison Company of Chicago paid into the city treasury on June 27 the sum of $473,000.93. This amount represents 2 per cent of the gross receipts for the fiscal year ended May 31, 1913. The corresponding payment of last year was about $434,000. This percentage is required by the contract ordinance under which the company operates.

* * *

Field Day of Commonwealth Edison Section.—The fourth annual field day of the Commonwealth Edison Company Section of the N. E. L. A. in Chicago was held at the grounds of the Northwest station, Elston Avenue and Roscoe Street, on the afternoon of June 28. There was a pole-setting contest as well as a baseball game, tennis, trapshooting and various running races. Prizes were given to the successful contestants.

* * *

Harnessing the Ohio with a Floating Power House.—The falls of the Ohio River at Louisville furnish perennial possibilities for the promoter. The latest scheme, which is broached by the National Power Company, of Birmingham, Ala., contemplates the location of a stationary barge or dock in midstream. Here energy would be developed by turbines mounted on the barge and connected to the shore to operate the generating equipment. Mr. S. F. Crecilius, a well-known engineer of Louisville; Mr. D. Edgar Macasco, and other business men of Birmingham are interested in the device, which has been tested at Joliet, Ill. The company is capitalized at $1,000,000, and it is said that $200,000 of the stock has been subscribed for. The proposed plant is to be located on the Indiana shore of the river, opposite Louisville.

* * *

Subway Situation in Chicago.—Negotiations continue between a sub-committee of the local transportation committee of the Chicago City Council and representatives of the elevated-railway companies of that city in relation to the building and operating of a subway. The plan now under consideration is for the city to build subways under the central business district, to cost about $17,000,000, out of the traction fund in the city treasury. It is reported that the railways have offered 4 per cent of the cost of construction for the privilege of using the subways. In making this offer Mr. W. G. Beale, counsel for the elevated railways, is reported to have said that a larger percentage could not be offered because the railway companies are contemplating the expenditure of $24,000,000 within the next ten years. The aldermen think that 4 per cent is an insufficient return for the city, inasmuch as the net return desired by the railway companies is 7 per cent.

* * *

Building Trades Strike in Chicago.—A strike, or "lockout," as it is variously termed, in Chicago has resulted in throwing about 20,000 men out of employment and bringing nearly all large building operations to a standstill throughout Cook County. The Building Construction Employers' Association seems to blame the International Brotherhood of Electrical Workers principally for the situation. It is said that this union insists that contractors employ "maintenance men," who are said to do no actual work but to receive $72 a week for being on duty eight hours a night. The maintenance men are supposed to be on hand in case something should go wrong with the electric hoists or with the electric lighting used in connection with the excavation of caissons. The regular pay of an electrical worker is $6 a day, and one set of maintenance men—those employed on the first shift—receive that pay. The work on the second shift is classed as overtime, for which double pay, or $12 a day, is required. The union is said to require maintenance men for every two electric hoists. The employers assert that the so-called "maintenance men" do no actual work, but receive enormous wages. They declare that the labor situation in Chicago has been for years conducted in an outrageously high-handed manner by the representatives of the unions. It is said that there probably has been no single day within the last three years when there was not some sort of a building strike in Chicago. On June 10 the maintenance men on the new building of the Continental and Commercial National Bank were laid off by the employers. The electricians struck on the following day and on June 12 all other building trades employed on the building struck in sympathy. Thereafter the strike spread to other buildings under construction. The contractors assert that they employ none but union men and pay the highest wages of any city in the country.

* * *

## SOCIETY MEETINGS

Boston Section, A. I. E. E.—At the recent business meeting of the Boston Section, American Institute of Electrical Engineers, the following officers were elected for the ensuing year: Chairman, Mr. N. J. Neall; vice-chairman, Dr. Harold Pender; secretary, Mr. L. L. Edgar; executive committee, Messrs. F. M. Gunby, G. K. Manson and T. L. Moreland.

* * *

Minnesota Electrical Contractors' Association.—At the fourteenth annual convention of the Minnesota Electrical Contractors' Association, held in Richfield, Minn., on June 16, officers were elected as follows: President, Mr. A. W. Zahm, Minneapolis; first vice-president, Mr. G. B. Burgess, Duluth; second vice-president, Mr. O. S. Bakke, Minneapolis; treasurer, Mr. C. T. Nimis, St. Paul; secretary and national director, Mr. G. M. Jones, Minneapolis. A banquet was given to the association in the evening at the Commercial Club in Minneapolis by the electrical supply dealers of St. Paul and Minneapolis.

* * *

Chicago Section of Illuminating Engineering Society.—The last meeting for the season of the Chicago Section of the Illuminating Engineering Society was held on June 27, with Mr. F. A. Vaughn, of Milwaukee, presiding. Officers were elected as follows: Chairman, Dr. M. G. Lloyd; secretary, Mr. J. B. Jackson; managers, Messrs. Nelson M. Black, J. W. Pfeifer, C. C. Schiller, M. J. Sturm and H. B. Wheeler. Mr. A. J. Sweet, of Milwaukee, discussed the subject of "Postal Car Illumination." Having been prominently connected with the tests on this subject under the auspices of the Baltimore & Ohio Railroad several months ago in Washington, D. C., Mr. Sweet is well qualified to speak with authority on the subject. Messrs. F. H. Bernhard, J. R. Cravath, F. A. Vaughn and A. J. Sweet took part in the general discussion which followed.

* * *

Electric Club of Chicago.—At the meeting of the Electric Club of Chicago on June 26 resolutions were adopted urging Congress to provide for a non-partisan patent commission made up of men of national reputation chosen from various walks of life. The resolutions also favor the creation of a court of patent appeals and strongly disapproved of House bill No. 23,417, commonly known as the "Oldfield bill." The resolutions were prepared by a committee consisting of Dr. M. G. Lloyd and Messrs. Donald M. Carter, H. M. Frantz, T. P. Gaylord, W. P. Hoagland, Eugene A. Rummler and Max W. Zabel. The club decided to have an outing some time during the summer. Mr. Frank Hedley, vice-president and general manager of the Interborough Rapid Transit Company, of New York, read a paper on "Transportation Facilities in New York." There will be no further meetings of the club until September.

# Electrical Equipment in Lytton Building

**Engine-room apparatus, refrigerating system, lighting installation and telephone and signal systems in an eighteen-story structure in Chicago**

E new Lytton Building, at the northeast corner of South State Street and East Jackson Boulevard, Chicago, is an eighteen-story structure, with a t and two sub-basements. The lower eight floors basements are occupied by The Hub department id the remaining floors are divided into offices, ill later be leased. Among the conveniences which y makes possible in this building are elevators, municating telephones between departments, auto-ash register system, dismissal, fire and burglar-id auto-call bells, general illumination and emer-ghting, ventilation and tailor-shop equipment.

e portion of the building occupied by The Hub 5 kw is required for display lighting, 276 kw for illumination, 26 kw for emergency lighting and or miscellaneous illumination. In addition to the required for indirect lighting in the offices above th floor, wall plugs for about 17 kw have been . About 27 kw is required for exterior illumina-he total motor load is about 570 kw and the light-about 805 kw.

### Engine-Room Equipment

ugh the building is already occupied, the engine hich is located in the first sub-basement, was not d at the time this was written, and electricity was pplied by the Commonwealth Edison Company. erating equipment which will eventually furnish y for the building consists of two 400-kw, 220-erators driven by two cross-compound Corliss and one 150-kw generator driven by a Ball auto-ngine. All of the generators were manufactured Crocker-Wheeler Company. As a three-wire dis-is used, two duplicate balancer sets are installed. hbert switchboard, 96 in. high, consisting of black nels, 2 in. thick, is mounted on channel irons em-n the concrete floor. No bracing from the walls or columns is required with this construction. The switchboard is subdivided into power, lighting, emergency, machine, feeder and balancer panels. Electrical energy supplied to The Hub and to the offices above the eighth floor is measured by four watt-hour meters which record total lamp, total motor, Hub lamp and Hub motor consumption. Weston ammeters of the flush type with illuminated dials are installed on the board. The feeder circuit-breakers are equipped with inverse-time-element, no-voltage and overload relays. In addition to these relays the machine circuit-breakers have reverse-power relays. Each generator panel is equipped with a pilot lamp placed behind a lens set flush with the switchboard. An additional machine panel was erected to take care of a generator which will be installed in the future. Ample space has been left in the generating room for the addition of 600 kw in generators. The balancer panels are equipped with motor-starting switches. The emergency lamps which light the hallways and fire exits and all lamps in the engine and boiler room are supplied with electricity from special feeders, which are tapped off from the machine buses before they reach the switches. This arrangement avoids almost any possible failure of the emergency lamps. A flat-ribbon grille incloses the back of the switchboard, entrance to which may be obtained at either end through doors having barrel locks. All of the connections between the generators and the switchboard are carried through iron conduit laid in the concrete floor.

### Refrigerating System

In addition to the generating equipment, there is an electrically driven 6-ton carbon-dioxide compression-type refrigerating plant in the first sub-basement which is used for cooling the drinking water. The compressor, which is a double-acting horizontal machine, was manufactured by Kroeschell Brothers Ice Machine Company. A 12.5-hp. 220-volt compound-wound direct-current Crocker-Wheeler



FIG. 1—LUMINOUS BOWL FIXTURES IN DEPARTMENT STORE

motor operating at 600 r.p.m. is belted to the compressor. The motor is equipped with a Cutler Hammer motor-starter and regulator.

The water cooling tank, 4 ft. in diameter and 5 ft. high, contains direct-expansion cooling coils, which consist of 1-in. extra-heavy iron pipes. The water is automatically maintained at a uniform level. The tank is insulated with

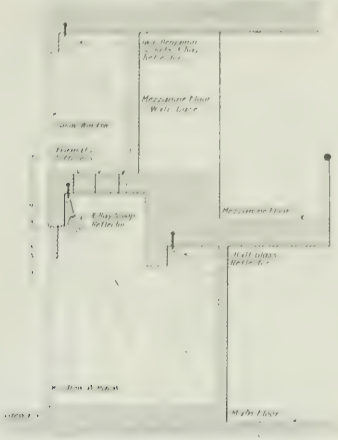


FIG. 2—DIAGRAM OF WINDOW LIGHTING SCHEME

2 in. of cork board impregnated with hot asphalt, coated with cement and covered with canvas. Circulation of the drinking water through the system is maintained by a steam-operated duplex pump capable of delivering 15 gal. per minute.

### Boiler Room

The boiler room is conveniently located with relation to one of the Illinois Tunnel Company's tracks, so that coal may be brought in by tunnel cars or unloaded from the street above into manholes opening into the coal bunkers. Steam for heating the building and driving the engines is generated in three 500-hp boilers which are equipped with automatic stokers. The McKenzie chain grates installed are arranged to be driven by a single steam engine or by individual electric motors, the latter being preferable.

An overlapping bucket conveyor capable of delivering 25 tons of coal per hour carries the fuel from the bunkers located under the tunnel tracks to overhead bunkers which run parallel to the firing aisle. The same conveyor on its return route receives the ashes from under the grates and delivers them to an ash hopper. A 220-volt direct-current constant-speed motor equipped with a Cutler-Hammer motor starter operates the conveyor through a chain belt. Sheraduct conduit incloses the circuits connecting the motor with the switchboard.

Coal is fed to the stokers by an electrically operated overhead traveling discharger, which receives its supply of coal from the overhead bunkers. With this arrangement any [illegible] shows indications of heating. A hot-water meter records all of the water supplied for boiler-feed purposes and the coal is weighed and recorded as it is supplied to the hoppers.

### Distributing Switchboard Room

From the switchboard feeder cables are carried through iron conduit laid in the floor to vertical shafts in diagonally opposite corners of the building. Communicating with these shafts on each floor are switch and fuse cabinets for general illumination. On the floors occupied by The Hub there are additional fuse cabinets for display lamps. With two exceptions the fuses and switches are installed in separate cabinets equipped with locks. The fuse cabinet, which is the larger in each case, is placed in the corridor, while the switch cabinet, which is much smaller because gang switches are used, is placed on the opposite side of the wall in the room containing the lamps which it controls.

### Tailor Shop

A special 110-volt riser is brought through one of the shafts to a fuse and switch cabinet in the tailor shop on the seventh floor. From this cabinet smaller feeders branch out to distributing centers located on columns and thence to the table switches. There are fifty-four tables in the tailor shop, some of which are used by tailors and some by pressers. Each table is lighted by two 60-watt tungsten lamps equipped with cone reflectors. No overhead wires are used, as all connections are brought up through the floor in conduit. Each of the pressers' tables is equipped with two and the tailors' tables with one 500-watt flatiron. The cord from each iron is supported by a ring which slides on a wire above the table. The switches for operating the irons are placed on the table. When they are turned on a pilot lamp over the table is lighted.

Several electric sewing machines are installed at present and it is asserted that twenty-four will eventually be employed. On the same floor are nine fitting rooms, the lamps in which are operated by gang switches.

### Credit Telephones

The automatic National cash register system operated in conjunction with forty-eight credit telephones is used in this store. When purchasers desire credit the cashier in the department in which the sale is made calls up the credit department, which is located on the eighth floor, and at the same time inserts the bill of sale in an electrically operated stamping machine at the side of the telephone. Two telephone operators located in the credit department are supplied with a card-index system which enables them to quickly ascertain the status of the person desiring credit. If the purchaser is in good standing, the credit operator moves a lever which stamps the bill and its duplicate "O. K." The cash registers are operated by electricity.

### Signal and Call-Bell Systems

In the same room with the telephone operators is a device for ringing bells on all floors occupied by The Hub. As



FIG. 3—ELECTRICALLY LIGHTED TAILOR SHOP

store officials have given call numbers, and when they cannot be reached by telephone the call bell is used to summon them. The ringing apparatus consists of a cylindrical contactor which is rotated by a motor and is designed to give thirty different ringing combinations. This contactor operates a relay by storage-battery energy, which in turn rings the 110-volt bell.

On every floor of the building there is a fire-alarm bell. A sprinkler system is installed throughout the building, and whenever a sprinkler head opens a fire alarm is turned in to the station and the bells ring on the floor where the trouble is located. A master switch rings the bells on all floors.

Dismissal bells are operated simultaneously from a master clock on the eighth floor. All possible entrances on the main floor and those near fire escapes on the upper floors are protected by burglar alarms. These send in alarms to police headquarters and indicate the point at which an attempt has been made to enter the building.

Chicago automatic intercommunicating telephones are used between departments and several outgoing lines are installed. The building is supplied with ten trunk lines on the Bell telephone system. Independent and Bell telephone booths are placed on each floor for the use of the patrons.

### Dumbwaiter Elevators

To convey merchandise from the storerooms in the basement to floors on which the goods are retailed four electrically operated dumbwaiter elevators are installed. Two of these operate in one bank between the second sub-basement and the eighth floor. On each floor near the elevator shaft are a telephone and a push-button which connect with a switchboard located near the shaft on the seventh floor. This switchboard is operated by an attendant who has other duties which occupy his spare moments. On the switchboard are pilot lamps which indicate when the elevator is in motion and also when a door opening on to the shaft is not closed. An annunciator indicates the floors at which the elevator is desired and the one to which it is to be sent. A master controller causes the elevator to be sent to any predetermined floor. The apparatus is interlocked so that the elevator cannot be operated when any doors on the elevator shaft are open. The number of the floor to which the dumbwaiter is to be sent is conveyed to the elevator operator by pushing one of a group of push-buttons in the base of the elevator. The elevators are operated by two 10-hp compound-wound reversible motors. Slack cable attachments cause the elevator mechanism to stop when there is any obstruction in the shaft. Each elevator is capable of carrying 250 lb. and is automatically brought to a gradual stop.

Two additional dumbwaiters operate between the second sub-basement and the shoe department on the mezzanine

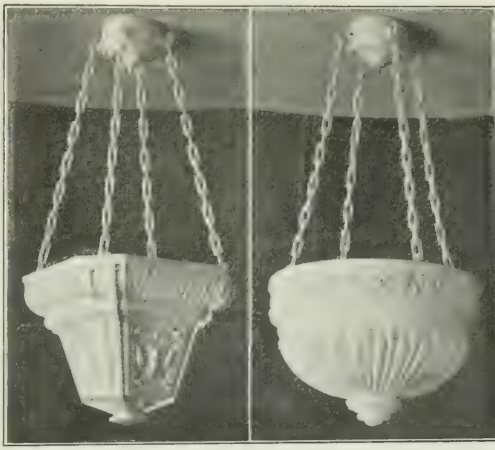


FIG. 4—COLLEGE ROOM IN LYTTON BUILDING

floor. These are automatic and no attendant is required to operate them. They are capable of carrying 150 lb. each. An electrically operated gearless-traction package elevator runs between the second sub-basement storeroom and the shipping room. In the shipping and delivery room are loud-speaking telephones, by means of which orders can be given out to the employees without their coming to the telephone.

### Passenger Elevators

Two banks of electric passenger elevators are installed in the building. One bank of five elevators runs up to the eighth floor and is exclusively for patrons of The Hub. Another bank of six elevators is used for office service above the eighth floor. Each elevator is equipped with a loud-speaking receiver and a telephone, both of which con-



FIGS. 5 AND 6—INDIRECT LIGHTING FIXTURES

nect with the starter on the main floor. With this equipment orders can be sent to the operator, and in case the elevator is stalled between floors the operator can notify the starter. Ricketts illuminated thresholds are used. The up-and-down flash signal system is employed for indicating elevator stops. An indicator showing the position of the elevator is located on the main floor only. The electric motors which operate the elevators are directly connected to driving drums and are of the overhead, commutating-pole type. A magnetic control switch in each car operates the 220-volt motors. Magnetic spring-actuated brakes are used to bring the car to a stop.

### Lighting

Before the scheme of illumination was finally decided upon experiments were conducted under actual service conditions to determine what form of lighting would give the most satisfactory results. Tests were run on direct, semi-direct and indirect fixtures with reflectors of eleven different types, special attention being paid to the color, shadows and distribution of the light. An experimental station was located on the third floor of the building, in a section 32 ft. long and 24 ft. wide, which was curtained off to give equal advantages to all systems. The tests were conducted by the Bryan-Marsh Electric Works of the General Electric Company. Data were obtained from six units of each system identically located and were submitted to Mr. Walter Lytton, general manager of the store, who passed upon the type of reflector to be used.

The fixtures on the first floor were designed by the Acme Chandelier Company, of Chicago, and those on the remaining floors were furnished by the Decorators' Supply Company, of the same city. All of the fixtures were designed to agree with the woodwork and showcases. Sixteen luminous-bowl semi-indirect fixtures equipped with eight 150-watt tungsten lamps with X-ray reflectors furnish the lighting for the main floor. These are supported by chains arranged so as to cast no shadows on the ceiling. Around the balcony on the mezzanine floor are pedestal indirect fixtures containing 150-watt lamps.

Most of the showcases have general illumination, and

when special emphasis is to be laid on any particular article a spotlight is so placed as to illuminate it. The show-case lamps are not controlled from a common switch cabinet, but each case has its individual switch.

The show windows are lighted by three rows of lamps, all of which are concealed from view. These are arranged to give cross lighting and thus to avoid any sharp contrasts. On the exterior of the fourth floor of the building are seventy-seven 100-watt border lamps, and on the sixteenth floor is an outside balcony on which thirty-two ornamental torches are erected having a total demand for 19,200 watts. Altogether about 15,000 tungsten lamps are used in the building.

### Ventilation

Seventeen electrically driven fans circulate fresh air through the entire building. The air is drawn in through screens and is passed through air washers, temperers and retemperers. The screens and washers remove the dust and impurities, and the temperers and retemperers heat the air and automatically maintain a uniform humidity. The air is

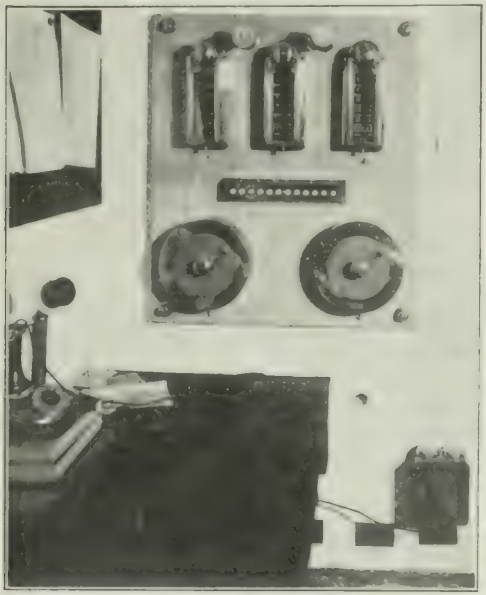


FIG. 7 SWITCHBOARD FOR OPERATING PUMP & AIR FANS

delivered to two vertical air shafts and is distributed at each floor through ducts above show windows and wall show-cases to registers.

Seven of the circulating fans are used for exhausting the foul air. They range in rating from 33,000 cu. ft. to 2000 cu. ft. per minute and are driven by 220-volt direct-current, variable-speed electric motors rated from 28 hp to 1.5 hp. The motors are directly connected in most cases, but chain drives are used in one or two cases. Cutler-Hammer starter and controllers mounted in locked cabinets are used with each fan and circulating pump. Air is delivered at about 75 deg. Fahr., and the humidity is maintained at about 55 per cent. Practically all of the motors in the building were furnished by the Crocker-Wheeler Company.

The Lytton Building was designed by Marshall & Fox, architects. Mr. A. B. Borden, representing Mr. Martin C. Schwab, the consulting engineer for The Hub, was the superintendent of construction. Mr. I. Graham Smith is the chief engineer of The Hub

## Phase Compensation

By Carl A. Fyss

Phase compensation is the art of controlling the time-phase relation between two harmonic motions of same frequency, and more particularly between an alternating emf and an alternating current. One of the most useful purposes to which this art can be applied is to improve the power-factor of alternating-current motors.

For the purpose of gaining an insight into this art, it appears advisable first to review briefly the nature of a phase difference; then to ascertain some of its principal effects on the apparatus wherein it appears and on the source from which that apparatus is fed; to indicate how a phase difference is produced, and, finally, to show how a phase difference can be controlled in alternating-current motors and, more specifically, how the power-factor of a single-phase motor can be controlled.

A great many alternators, especially those with distributed armature windings, generate emfs which are very nearly harmonic, and the currents due to such emfs naturally tend to follow the same wave-shape. Discussions of alternating-current phenomena become sufficiently simple for practical purposes only when all emfs and currents are assumed to be truly harmonic. The conclusions derived on the basis of this assumption as a rule do not differ materially from the actual facts. This assumption is generally made, and it will be adopted throughout this paper.

A simple harmonic motion may be defined as the projection on any fixed straight line of a uniform circular motion. Uniform circular motion may be expressed by a vector of constant length, such as the radius of a circle revolving with constant speed about one of its extremities. Simple harmonic motion may be represented by another vector, which is the projection of the first vector on a fixed straight line. The first vector is referred to as a rotating vector, the second as an alternating vector. A rotating vector is constant in length but variable in direction; an alternating vector is variable in length but its direction is always along the same straight line.

If a vector such as $OE$ of Fig. 1 rotates at a uniform rate of $n$ revolutions per second about point $O$, say in the direction of the arrow $D$, then the projection $Oa$ of $OE$ on the fixed axis $Y$ is said to oscillate or alternate harmonically. An emf or a current is said to be harmonic when its instantaneous value is at each instant proportional to the vector $Oa$.

If the two harmonic motions of same period, depicted in Fig. 2 by the curves $e$ and $i$ respectively, represent the alternating emf impressed on a given apparatus and the alternating current taken by the same, then it is of interest to determine how much power can be developed by $e$ and $i$. This power, in watts, must, similarly to what obtains in the case of direct current, be equal at any instant to the product of the value of $e$ at that instant and the value of $i$ at the same instant. This product determines the instantaneous power absorbed by the apparatus in question and is shown in Fig. 2 by the curve marked "instantaneous power." It is seen that this instantaneous power varies greatly, being sometimes positive (full-line) and sometimes negative (dotted-line). The power developed by an alternating emf pulsates.

In practice it is seldom of interest to know the value of this instantaneous power, the important consideration generally being the average power during one complete cycle, that is, that which represents irrecoverable energy.

A cursory examination of Fig. 2 must show at once that the negative values of the instantaneous power must become smaller and smaller as the phase difference between the two factors $e$ and $i$ diminishes. When these two coincide in phase the instantaneous power curve will show no negative values at all and the average power will reach its maximum. Similarly, the negative values of the instantaneous

power will become greater and greater as the phase difference between the two factors $e$ and $i$ increases, reaching their maxima for a phase difference of 90 deg. between $e$ and $i$, as a simple graphical experiment will convince anyone sufficiently interested to try. With a phase difference of 90 deg. between $e$ and $i$ ($\theta = 90$ deg. in Fig. 1), it will be found that the instantaneous power $ei$ passes through identical sets of positive and negative values, and the average power is zero.

The same thing may be stated in a more definite manner, algebraically. In order to find an expression for the average value of $ei$, one may proceed as follows: The instantaneous values of emf and current, in terms of their maximum values, can be written as

$$ei = E.I. \sin \omega t. \sin (\omega t - \theta), \quad (1)$$

and since $\sin (\omega t - \theta) = \sin \omega t. \cos \theta - \cos \omega t. \sin \theta$

$$ei = E.I. (\sin^2 \omega t. \cos \theta - \sin \omega t. \cos \omega t. \sin \theta), \quad (2)$$

or average $ei = E.I. (\cos \theta.$ Average $\sin^2 \omega t - \sin \theta.$

Average $\sin \omega t. \cos \omega t.)$ (3)

But the average value of $(\sin \omega t. \cos \omega t)$ is zero, since it passes through identical sets of positive and negative values, while the average value of $(\sin^2 \omega t)$ is known to be one-half. Therefore, the last equation is reduced to:

$$\text{Average } e.i = \text{power} = \tfrac{1}{2} E.I. \cos \theta \quad (4)$$

or, substituting effective values, as measured by commercial instruments, for maximum values.

$$\text{Power} = \tfrac{1}{2}. \sqrt{2}. E. \sqrt{2}. I. \cos \theta$$

$$\text{Power} = E.I. \cos \theta \quad (5)$$

It is easily seen that this expression confirms the conclusions already reached to the effect that the average power is a maximum for phase coincidence between $e$ and $i$ and zero when there is a phase difference of 90 deg. between the two. The angle $\theta$ in equation (5) is the phase angle between $e$ and $i$, and, of course, between $E$ and $I$ of Figs. 1 and 2.

When there is a phase coincidence between the two, then $\theta$ is zero, and since the cosine of zero is unity, the power is equal to $(E \times I)$ just as is the case in direct-current practice.

When there is a phase difference of 90 deg. between $e$ and $i$—that is, when $\theta$ is 90 deg.—then the power is nil, irrespective of the magnitude of $E$ and $I$, because the cosine of 90 deg. is zero.

In Fig. 3 the percentage of power which can be developed by a given effective alternating emf and a given effective alternating current is plotted against the phase difference between the two, expressed in degrees. The power that can be developed by a constant emf equal in value to the above effective alternating emf, and by a constant current equal in value to the above effective alternating current, is taken as unity.

The factor (cos $\theta$), graphically shown in Fig. 3, depends on the resultant impedance of the circuit which is receiving the power, and this factor is known as the power-factor of the circuit.

A current may either lead the emf with which it is co-operating or it may lag behind the same. In either case the phase difference may amount to 90 deg. When the current leads the emf, one speaks of the circuit receiving the two as having a leading power-factor. When the current lags behind the emf, the circuit is referred to as having a lagging power-factor. When the current coincides in phase with the emf, the circuit is spoken of as one having a unity power-factor.

It is only in a circuit having unity power-factor that a given alternating emf and a given alternating current can perform the maximum amount of work.

A leading current in a transmission line, a cable or the like occasions just as much loss as a corresponding lagging current, but all the ill effects of a lagging current in a conductor can be absolutely avoided or compensated for by sending through that same conductor an equal but leading current, and vice versa.

Since a great proportion of alternating-current apparatus already in operation takes lagging currents, it is obviously of great commercial importance to employ means by which at least some of this apparatus may be so constituted as to operate with leading power-factor over at least part of its working range. Leading power-factor as compared with unity power-factor apparatus will, however, require a greater real as well as apparent input for the same useful work done. It follows that such apparatus must be either larger or less efficient than unity power-factor apparatus.

A circuit in which the current leads the emf by $a$ degrees generally utilizes a given alternating emf and a given alternating current almost as inefficiently, in producing work, as a circuit in which the current lags behind the emf by the same angle $a$.

A lagging alternating current drawn from a generator affects the latter in three ways: It decreases the efficiency of the generator because of the greater excitation required to maintain a constant terminal voltage for a given current output, and also because of the decreased real output for a given current at a given terminal voltage. It furthermore increases the terminal voltage drop for a given current at constant excitation; in other words, makes the self-regulating properties of the generator worse.

A leading current also decreases the real output of an alternator, but decreases instead of increasing the amount of excitation required by the latter with diminishing power-factor, with the result that the efficiency is not decreased to quite the same extent as by a lagging current. Since a leading current decreases the amount of excitation required by a generator, it tends to improve the self-regulating properties of the latter, instead of making them worse, but is, of course, liable to overshoot the mark if the lead becomes very marked.

A lagging current withdrawn from a generator proportioned for a maximum output of 100 kw precludes the full utilization of the prime mover, for the reason that an apparent output of 100 kva will always heat the machine more than a real output of 100 kw. The heating of the generator will be the greater the smaller the power-factor of the circuit to which it feeds energy, because the excitation losses increase with decreasing power-factor, while the armature copper losses remain the same so long as the current is the same, the heating effect of a current being independent of the phase relation it bears to its emf. But the poorer the power-factor the smaller the real or kilowatt output and therefore the smaller the load on the prime mover. To increase the load on the prime mover to the value at which it will operate most economically is out of the question, because the heating of the generator will not allow one to do so. Nothing can be done but to use an alternator which operates below its full rated output on a unity power-factor load, its output being then limited by the prime mover, or to use a prime mover operating below its full rated output on loads with a power-factor differing from unity, its output being then limited by the heating of the generator.

A leading current withdrawn from a generator also precludes the full utilization of the prime mover, but not quite to such an extent as in the case of a lagging current, for the reason that a leading current does not require an increase but a decrease of excitation with increasing lead.

The best results are obtained from a given generator and prime mover of equal rating when the current withdrawn from the former leads the terminal emf by a few degrees. To achieve this most desirable object it is necessary to utilize alternating-current apparatus capable of being so adjusted as to absorb leading currents.

It has been shown that lagging or leading currents are detrimental to the line, to the generators and to the prime movers, and it has been suggested that current-consuming devices are desirable which operate with leading power-

factor for the purpose [illegible] as much as possible for the lagging currents which are present in all existing alternating-current distribution systems. It thus becomes specially interesting to form a clear idea as to the ability of such apparatus to perform simultaneously useful work besides that of compensating for the deficiencies of other apparatus fed from the same distributing system.

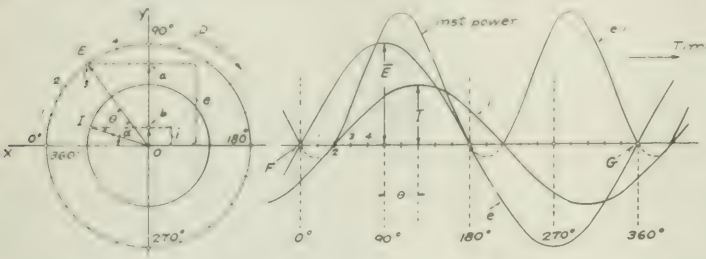



Fig. 1 Fig. 2

FIGS. 1 AND 2. GRAPHIC REPRESENTATION OF TWO HARMONIC MOTIONS AND OF THEIR PRODUCT AT EACH INSTANT

To this end consider, say, a unity-power-factor single-phase motor designed for a normal input of 1000 watts, or, say, 20 effective amperes at 50 effective volts, disregard all losses except those due to ohmic resistance, and assume that with 1000 watts input at power-factor unity (see Fig. 4) these ohmic losses amount to 50 watts, or 5 per cent. For a power-factor of unity the machine will, therefore, absorb 1000 watts; 50 watts of that power will be wasted in heating the copper in the machine, while 950 watts will be available for translation or conversion into mechanical power.

Now change the constitution of the machine so as to cause it to operate with a phase difference $\theta$ differing from zero, but do not alter its ohmic resistance. In order to secure the same output—that is, to make the same amount of mechanical power available at the motor shaft—the input will have to be considerably increased, for a reason clearly apparent from a comparison of Figs. 4 and 5. In Fig. 4, which depicts the unity power factor condition, the total current $I$ is in phase with the emf $E$, and all of it is useful. If the machine is to operate with a phase difference $\theta$ between $E$ and $I$ and yield the same output as before, then the useful component of $I$, or its projection $I_1$ on $E$, must have the same magnitude as had the total current $I$ for the case of unity power-factor, when $\theta$ was zero. Fig. 5 clearly shows that for constant output the total current $I$ must increase rapidly with increasing $\theta$; that is, with decreasing power-factor.

Whenever the total current taken by a translating device does not coincide with the terminal emf, that current can be conveniently resolved into two components, one of which coincides with the emf while the other is in time quadrature to it. The former, $I_1$, is that which is proportional to the power available and is known as the watt or useful current component, while the latter $I_2$ only wastes energy and is referred to as the wattless or idle component. In Fig. 6 the resultant $I$ and its two components $I_1$ and $I_2$ are plotted against cos $\theta$ and the corresponding angle $\theta$ for the case of constant motor output. While $I_1$ remains constant, both $I_2$ and $I$ increase at a rapid rate, particularly for the smaller values of cos $\theta$. In view of this very rapid increase of the idle component $I$, the ohmic losses $(I_1^2 + I_2^2)\,R$ increase [illegible] when it operates at unity power-factor. The larger total current required by the motor with decreasing power factor of course necessitates a higher [illegible] while the output remains constant [illegible] apparent input increase very rapidly.

Fig. 6 shows conclusively that the highest efficiency of an apparatus of any kind is attained for unity power-factor, but that the efficiency does not vary greatly in the neighborhood of $\theta = 0$. Since Fig. 6 holds equally true for lagging and leading power-factor, it will be clear that a motor designed to operate with a leading power-factor at full-load will have a lower efficiency than one designed to operate at unity power-factor, unless the leading power-factor machine is made sufficiently larger to take care of the increased losses. A larger machine must of course be a more expensive one. From the economical point of view, a motor operating under anything like full load should not be called upon to supply a leading current component to the mains, but it can reasonably be expected to do so, to a limited extent, at light loads. Any exaggeration of this leading power-factor feature inevitably leads to a decreased efficiency, unless the active material of the machine is increased beyond the normal.

The one rational thing for a central station to do is to use unity-power-factor motors only—that is, machines which operate under all loads with a power-factor in the immediate neighborhood of unity. Existing undertakings already supplying energy to many motors of the non-compensated type, must help themselves by insisting that all new motors connected to their mains shall operate with an appreciably leading power-factor, at least over part of their range of operation. The leading current taken by these over-compensated motors will then compensate for the lagging current taken by the existing non-compensated machines. Since the compensating capacity of any one leading power-factor motor is necessarily limited, the average power-factor of a central station can only be materially improved by the addition of many such motors. These over-compensated motors will be called upon to perform two duties, namely, to compensate for the shortcomings of

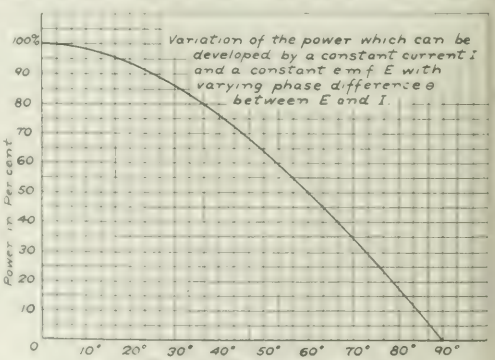



FIG. 3. RELATION OF KILOWATTS TO KILOVOLT-AMPERES WITH VARYING POWER-FACTOR

the existing machines by acting as condensers and to convert electrical energy into mechanical work. Besides serving their owner in the usual way, they will be greatly benefiting the station engineer by raising his average power-factor. The introduction of these machines in the greatest possible number should therefore be facilitated in every way by all station engineers. Machines designed to operate

with a leading no-load and a nearly unity full-load power-factor are ideal from the point of view of the station engineer and the consumer and acceptable to the manufacturer.

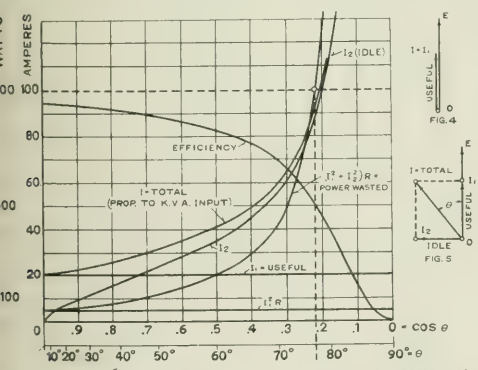
In practice, polyphase as well as single-phase induction motors of ordinary construction are the chief offenders in lowering the average power-factor of a station. The power-factor of ordinary single-phase induction motors, for instance, varies from about 0.1 at no-load to 0.6 at full load in the smaller sizes, the full-load power-factor rising to about 0.85 in the larger motors. A station supplying energy to many small motors may easily have to deal with an average power-factor of about 50 per cent, while one serving a greater proportion of large motors may, under favorable circumstances, have an average power-factor which is as high as 70 per cent.

A reference to Fig. 6 will show that the first of the above stations is called upon to supply 175 amp of idle current for every 100 amp of useful current, while the second must generate 110 idle amp for every 100 useful amp. All copper losses in the first station are four times as great as if its average power-factor were unity, while the copper losses in the second station exceed the unity-power-factor losses by 110 per cent.

All these considerations show that the station engineer directing a long-established undertaking has every inducement to favor reasonably overcompensated motors. But even if he makes it a rule not to countenance the use on his mains of any motor showing a no-load lagging power-factor inferior to 85 per cent, all his troubles will very soon assume unimportant proportions. New electric service companies should avoid trouble from the start by allowing nothing but unity power-factor motors on their mains.

## SECTION II

In order to maintain a certain current through a non-inductive or ohmic circuit, an emf is required which is of the same phase as the current. This statement is strictly true for direct as well as for alternating current. The reason why larger and phase-displaced emfs are necessary to maintain the same current in an inductive or in a capacity circuit is found in the fact that the rapidly varying currents produce phenomena which are not produced by steady continuous currents. Alternating currents are responsible, within the circuit in which they flow, for emfs other than




FIGS. 4, 5 AND 6—INCREASE OF IDLE CURRENT FOR CONSTANT OUTPUT WITH DECREASING POWER-FACTOR AND ITS EFFECT ON EFFICIENCY

those due to ohmic resistance. The phase relation between these additional emfs and the current in the circuit determines the phase relation between the terminal emf and the current, but that emf which actually forces the current through the ohmic resistance of the circuit, and which is, at least, a component of the terminal emf, always remains co-phasal with the current.

As is well known, inductance or capacity contained in a circuit on which an alternating emf is impressed can produce a phase difference between said emf and the current through the circuit. There are other causes which lead to phase differences, and one of the most important of these may best be studied by analyzing the mode of operation of an ordinary synchronous single-phase or polyphase motor.

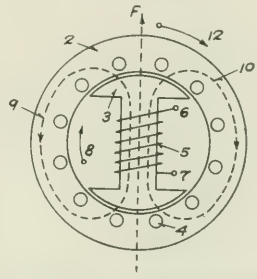



FIG. 7—ALTERNATING-CURRENT GENERATOR

The study of this machine also reveals the principle on which rests the method of phase compensation employed by the Wagner Electric Manufacturing Company.

Consider first an alternate-current generator of ordinary construction such as is diagrammatically shown in Fig. 7. This machine comprises a stator, 2, provided with a number of slots, 4, wherein are located the armature coils. These coils are not shown in Fig. 7, their arrangement for single-phase as well as polyphase alternators being well understood and having no influence on the conclusions about to be drawn. Arranged to rotate within the armature, 2, is a field magnet, 3, provided with an exciting winding, 5, adapted to receive a unidirectional exciting current which may be introduced by means of slip-rings at the points 6 and 7. As long as the field magnet, 3, is stationary, the magnetic flux produced by the exciting winding, 5, will be mainly distributed along the dotted lines 9 and 10. It is usual and convenient to represent a flux distributed as shown by these lines simply by means of a straight line, such as *F*, indicating the general direction of that flux. This method of representation will be used hereafter and a line such as *F* will be understood to represent the flux distribution shown in Fig. 7, or an equivalent flux distribution As long as the field magnet, 3, is stationary and the exciting current sent into 5 is constant, no emfs will be produced in the armature windings located in the slots 4; the flux picture shown in Fig. 7 will be stationary in space and the magnitude of this flux will be constant. If the field magnet is revolved, say in a clockwise direction, as indicated by the arrow, 8, then the flux picture will not materially change its shape or its magnitude, but will revolve with the field magnet, 3, in the direction 12, which, of course, must coincide with the direction 8 in which the field magnet revolves. Under these conditions, the flux will cut the armature conductors and one or more emfs will be generated in the latter. The alternator is now in a position to convert mechanical into electrical energy.

In order to produce an alternator it is therefore necessary to dispose of an armature provided with the necessary windings, of a unidirectional magnetic flux (of adjustable magnitude), and to arrange for a relative motion between the armature windings and the magnetic flux. It is, of course, immaterial whether the armature conductors are kept stationary and the flux is revolved or vice versa.

Assume now that a three-phase alternator of the type shown in Fig. 7 is driven at a constant speed and is feeding a unity power-factor circuit. Polyphase currents circulating in the armature will produce, in a manner well understood, a unidirectional, synchronously revolving field

the magnitude of [illegible] the magnitude of the polyphase currents and the direction of rotation of which is the same as the direction of rotation of the unidirectional exciting [illegible] field magnet, 5, and responsible for the polyphase currents in the armature. This revolving field produced by the armature currents is termed "armature reaction," and, for unity power-factor, corresponds exactly to the armature reaction of an ordinary direct-current generator. In a direct-current generator of ordinary construction this armature reaction is stationary in space and displaced by 90 deg. with respect to the field or exciting flux. If a direct-current generator were built with a stationary instead of a revolving armature, and with a revolving exciting field instead of a stationary one, then it would require revolving armature brushes instead of stationary brushes, and while the armature reaction flux would still maintain its angular displacement of 90 deg. with respect to the exciting flux, it would now revolve at the same speed as the latter.

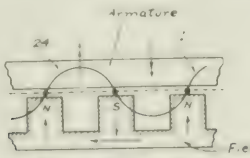



FIG. 8—GENERATOR FEEDING UNITY POWER-FACTOR CIRCUIT—SPACE RELATION OF ARMATURE REACTION FLUX TO EXCITING FLUX

Returning to the case of a polyphase alternator feeding energy to a unity power-factor circuit, it is seen at once that the flux produced by the armature reaction of such an alternator, under the conditions named, must be displaced in space by 90 deg. with respect to the exciting flux. If the armature windings of a multipolar alternator are well distributed over the air-gap periphery, then the armature reaction of such a machine can clearly be represented by a synchronously rotating wave of magnetic flux, such as is diagrammatically indicated by the curve 24 of Fig. 8. Remembering that the armature reaction and the exciting flux always revolve at the same speed and in the same direction, it is at once seen that the influence of the one on the other may just as well be ascertained from their stationary images. Now, since for unity power-factor the armature reaction flux is displaced by 90 deg. with respect to the exciting flux, then the maxima of the former will coincide with the minima of the latter; in other words, the maxima of the armature reaction flux will appear between adjacent poles of the field magnet, as shown in Fig. 8. For a direction of rotation of the field magnet from right to left, the positive maximum of the armature reaction flux will fall ahead of the negative maximum of the field magnet; in other words, a north pole of the armature reaction flux will precede a south pole of the exciting flux. In all the figures the direction of the exciting flux is indicated by single-head arrows, while the direction of the armature reaction flux is shown by double-head arrows, and it appears that for the case of unity power-factor the armature reaction flux can only distort the exciting flux, but cannot (for the case of an ideal machine) alter the magnitude of this flux, because the north and south polarities overlap to the extent of half a pole pitch. The magnitude of the armature reaction flux, of course, depends on the ampere load and increases as the load increases, while the exciting flux depends on the unidirectional exciting current sent into the field winding, 5, and remains constant as long as that current is constant. A change in the magnitude of either flux is without effect on the above conclusions.

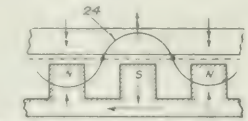



FIG. 9—GENERATOR FEEDING INDUCTIVE CIRCUIT, 90-DEG. LAG—SPACE RELATION OF ARMATURE REACTION FLUX TO EXCITING FLUX

Next consider the alternator in question operating on a circuit containing pure inductance and therefore possessed of what is called a "lagging" power-factor. In this case the alternating current will lag behind the alternating emf by 90 deg. in time, with the result that the armature reaction flux, which revolves at the same speed as the exciting flux, will be permanently retarded by 90 space-degrees relatively to this exciting flux. The reason for this displacement arises from the fact that the time-phase of the emf generated in any given armature conductor is at any instant dependent on the space position of this conductor at that instant relatively to a given field pole. From this it follows that if the current conveyed by the conductor in question is in time-phase with the emf generated therein, then the maximum value of that current, of the emf to which it is due and of the reaction flux set up by the current will all coincide in time and will all bear, at any given instant, the same space relation to a given field pole. But it also follows that when the current and the reaction flux differ in time-phase from the generated emf, then the space position of the maximum value of the reaction flux relatively to a given field pole will differ correspondingly from the space position of the maximum value of the generated emf relatively to the same field pole. This being true for the reaction flux due to any one conductor must also be true for the reaction flux set up by all the conductors and indicated by curve 24 or *I* of Figs. 8, 9 and 10. The space position of the reaction flux relatively to the exciting flux, which corresponds to a lagging current of 90 deg., is shown in Fig. 9, from which it is apparent that the positive maximum of the armature reaction flux has been shifted back through 90 deg.—that is, against the mutual direction of rotation of the armature reaction flux and of the exciting flux. A glance at this figure discloses the fact that the armature reaction flux now opposes the exciting flux at every point, with the result that the resultant flux of the machine—that is, that on which the terminal emf depends—is considerably weakened. It is seen that a lagging current delivered by an alternator produces an armature reaction which demagnetizes the exciting field of that machine.

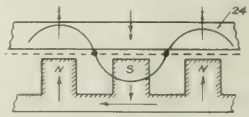
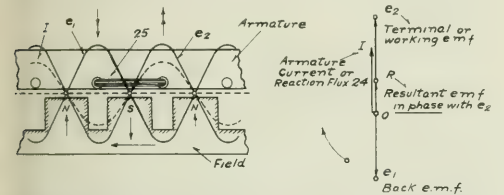



FIG. 10—GENERATOR FEEDING CAPACITY CIRCUIT, 90-DEG. LEAD—SPACE RELATION OF ARMATURE FLUX TO EXCITING FLUX

In case the alternator operates on a circuit having a so-called "leading" power-factor, the armature reaction flux will be moved out of its neutral position corresponding to unity power-factor and propelled in a forward direction to an extent depending on the power-factor of the circuit. If the current delivered by the alternator leads the alternating emf by 90 time deg., then the armature reaction flux will be moved forward through 90 space deg. and will occupy, relatively to the exciting flux, the position shown by the curve 24 in Fig. 10. This figure shows that the armature reaction flux produced by a leading current helps, or adds to, the magnetization produced by the exciting flux.

It is easy to show that exactly the same conditions prevail in the case of a single-phase alternator. It is true that the armature reaction of a single-phase alternator does not produce a revolving field of constant magnitude, in the sense in which this term was used in connection with the polyphase machine. In fact, the total armature reaction of a single-phase machine gives rise to a simple alternating or oscillating flux wave; an alternating flux can always be decomposed into two unidirectional component revolving fields of one-half the amplitude of the alternating field, on condition that it be assumed that one of these fields revolves synchronously in one direction while the other revolves with equal speed in the opposite direction. In the case of an alternator, the speed of revolution of each of these components is the same as that of the exciting field, and since these components revolve in opposite directions, it is clear that the direction in which one of them revolves will coincide with the direction of rotation of the exciting field while the other will be opposed to that direction. That unidirectional armature reaction flux component which revolves in the same direction as the exciting field will react on the latter in exactly the same manner as the unidirectional revolving armature flux of a polyphase machine. Since the other unidirectional revolving component of that single-phase armature reaction flux revolves at the same speed as the exciting flux, but in a direction opposed to it, then the relative speed of these two fluxes must be double the synchronous, and the effect of this second component on the exciting flux is nil, since it alternates from a magnetizing to a demagnetizing action as it sweeps past each pole.




FIGS. 11 AND 12—SYNCHRONOUS MOTOR EXCITED TO TAKE CURRENT IN PHASE WITH TERMINAL EMF—SPACE AND PHASE RELATION OF EXCITING FLUX TO WORKING EMF, BACK EMF AND ARMATURE REACTION FLUX

This component merely increases the losses in the machine.

Reviewing the results arrived at so far we find:

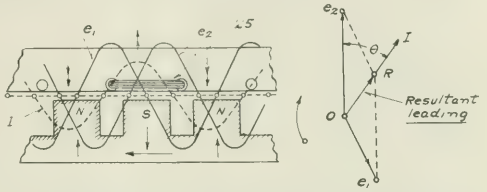
(1) That in order to produce an alternator there must be provided, in one way or another, a unidirectional exciting flux (of adjustable magnitude) revolving relatively to a fixed armature, or vice versa.

(2) If an alternator delivers current which is in time-phase with the terminal emf, then the armature reaction does not affect the magnitude of the exciting flux nor that of the generated voltage, but merely distorts the exciting flux.

(3) In case the armature delivers current lagging behind the terminal emf, the armature reaction weakens the exciting flux and tends to lower the generated voltage.

(4) In case the armature delivers current leading the terminal emf, the armature reaction strengthens the exciting flux and tends to raise the generated voltage.

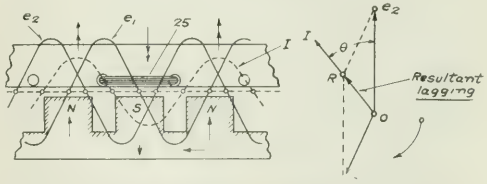
Now suppose the alternator to be running as a motor, its armature being connected to an alternating-current supply and its shaft driving any desired power-consuming device, such as a pump, which cannot possibly drive the motor and thus convert it back into a generator. If the unidirectional excitation of this motor be altered, it will be found that the machine, while performing a constant amount of work, will absorb a current the magnitude of which will vary with varying magnitude of the unidirectional excitation. It will also be noticed that the phase of the current will vary relatively to the phase of the emf impressed on the terminals of the motor as the magnitude of the excitation is altered. It is known that a synchronous motor of this kind can be made to operate at unity power-factor at any desired load simply by adjusting the magnitude of the unidirectional excitation. Let, then, the load be kept constant and let this excitation be adjusted to what may be termed its "normal" value and for which the current taken




FIGS. 13 AND 14—SYNCHRONOUS MOTOR EXCITED TO TAKE LEADING CURRENT—SPACE AND PHASE RELATION OF EXCITING FLUX TO WORKING EMF, BACK EMF AND ARMATURE REACTION FLUX

by the motor exactly coincides in time-phase with the emf at the terminals thereof. Then, as was the case when the machine was operating as a generator, the conditions depicted in Fig. 8 will obtain, except that the armature reaction curve shown in that figure will be inverted; but the relative position of its maxima with respect to those of the exciting flux will be the same, as is clearly indicated in Fig. 11. This inversion of the armature reaction curve 24 of Fig. 8, when the machine operates as a motor and not as a generator, is due to the fact that curve 24 represents in Fig. 8 a current $I$ in time-phase with the emf generated in the machine. Now, when the machine operates as a motor, this generated emf becomes the back emf $e_1$ of such motor and opposes the working emf $e_2$ impressed on the terminals of the machine, while the motor current $I$, for unity power-factor, coincides in time-phase with the impressed working emf, and is therefore opposed by the generated or back emf. In other words, and other things being equal, the current taken by a machine operating as a motor is of opposite direction to the current delivered by this machine when working as a generator.

Now assume that the unidirectional excitation is increased. In an ordinary motor the natural consequence of such an increase of excitation would be a permanent reduction in the speed of the machine, for if that speed is not reduced, the back emf of the motor must rise, thus reducing the current taken by the machine and cutting down the power delivered by it. However, with a synchronous motor the speed cannot be permanently altered with-




FIGS. 15 AND 16—SYNCHRONOUS MOTOR EXCITED TO TAKE LAGGING CURRENT—SPACE AND PHASE RELATION OF EXCITING FLUX TO WORKING EMF, BACK EMF AND ARMATURE REACTION FLUX

out causing the machine to drop out of step and come to a standstill. It is, therefore, necessary for some other change to take place in order to enable this motor to cope with its constant load, notwithstanding the fact that the increased excitation tends to increase the back emf and thus reduce the power of the motor, or even turn it into a generator. The necessary change which actually does take place in the

machine results in a phase difference—that is, in an adjustment of the phase of the current taken by the motor relatively to the phase of the terminal emf and involves only a momentary change in speed. This adjustment is brought about by a momentary acceleration or retardation of the field poles relatively to the phase of the impressed or working emf, resulting in a different permanent set between the two.

Thus, in an ideal motor and with "normal" excitation, the permanent set of the two will be such that each pole will stand exactly opposite an armature coil every time the terminal or working emf $e_2$ reaches a zero value. This condition is shown in Fig. 11, where $e_2$ represents the impressed emf wave, 25 one of the armature coils, $e_1$ the generated or back emf wave, and where the dotted curve (24 of Figs. 8, 9, 10) represents the armature reaction flux which is co-phasal with the armature current $I$. The armature current $I$ depends on the resultant of, or on the vectorial difference between, the impressed and the back emfs. In an ideal motor the armature current will always be co-phasal with this resultant. Now, since for "normal" excitation the phase of the back emf $e_1$ exactly opposes the phase of the impressed or working emf $e_2$ and since the latter must be the larger, their resultant will coincide in phase and direction with $e_2$, as shown in Fig. 11, from which it appears that the armature reaction flux, for normal excitation of a synchronous motor, neither strengthens nor weakens the exciting flux.

The phase relations of working, back and resultant armature emfs and of armature current are also shown in Fig. 12, by means of an ordinary phase diagram.

Should the excitation be increased above the normal, then the speed of the revolving exciting field will be momentarily checked, and when equilibrium and synchronism are re-established it will be found that the permanent set between the phase of the impressed emf $e_2$ and the field poles is such that each of the latter comes to stand exactly opposite an armature coil, not every time $e_2$ reaches a zero value, but every time $e_2$ has passed its zero value and has reached a certain value greater than zero. This is clearly shown in Fig. 13, while from the corresponding phase diagram (Fig. 14) we gather the very important fact that when the phase of the back emf is not exactly opposed to the phase of the working emf then the phase of their resultant does not coincide with that of either of the components. This resultant is represented by the vector $R$ of the phase diagram shown in Fig. 14, and the resultant co-phasal current $I$, or the co-phasal reaction flux, by the correspondingly located wave $I$ in Fig. 13. It is seen that the leading current ($I$) taken by an over-excited synchronous motor produces an armature reaction flux wave $I$ which opposes the exciting flux at almost every point, thus reducing the effective exciting flux and consequently lowering the magnitude of the back emf, notwithstanding the fact that the exciting current has been increased and that synchronism—that is, a constant speed—has been maintained except for a momentary irregularity.

The angle by which the synchronously rotating field poles are permanently retarded when the machine is over-excited, automatically assumes just that magnitude which will cause the armature reaction to demagnetize the machine to an extent sufficient for the latter to take all the current necessary for dealing with the load intrusted to it. It will at once be evident that under-excitation must bring about exactly opposite effects, as is clearly shown by Fig. 15 and phase diagram 16.

From the above remarks it is seen:

(1) That in order to produce an alternating-current motor one must provide, in one way or another, a unidirectional exciting flux (of adjustable magnitude), must cause this flux to revolve relatively to a fixed armature, or vice versa, and must insure that this flux shall revolve in synchronism with the alternating emf impressed on the motor terminals. (Since the impressed emf is an alternating one, the back emf generated in the motor must also be alternating and must have the same frequency as the terminal emf if it is to oppose the latter successfully. Such a back emf can obviously only be produced by a synchronously revolving unidirectional exciting flux.)

(2) If an alternating-current motor constituted in the manner described is "normally" excited, the current taken by it will be co-phasal with the terminal emf, the armature reaction flux will not affect the magnitude of the exciting flux and will only tend to distort it.

(3) In case such a motor is over-excited the current taken by it will lead the impressed emf, and the armature reaction flux will oppose, or take from, the exciting flux.

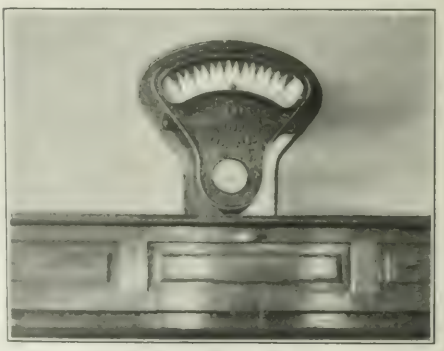
(4) In case such a motor is under-excited the current taken by it will lag behind the impressed emf, and the armature reaction flux will help, or add to, the exciting flux.

Attention is particularly directed to the fact that a variation of the phase of the back emf $e_1$ of a motor relatively to the phase of the working emf $e_2$ impressed on its terminals results in a change in the phase relation between the terminal emf $e_2$ and the current $I$ taken by the machine. A reference to Figs. 12, 14 and 16 shows that this is the very fact which enables a synchronous motor to operate either with power-factor of unity (Fig. 12, "normal excitation"), or with "leading" power-factor (Fig. 14, over-excitation), or with "lagging" power-factor (Fig. 16, under-excitation).

A further discussion of the subject of phase compensation will appear in these columns in subsequent issues.

## An Electrical Weather Vane

To enable the direction of the wind to be observed under all weather conditions and at all hours a New Bedford (Mass.) street-railway man has designed the electrical weather vane shown in the accompanying photograph. The apparatus is operated by a dry battery which may be connected into the circuit by a push-button on the face of the indicator. The position of the pointer is determined by contact strips on the usual aerial weather vane, which is mounted on the roof of the carhouse. As the wind changes the contact strips are automatically changed to correspond, and the introduction of resistances in the different con-



ELECTRICAL WEATHER VANE

tact circuits enables the device, working on the principle of a voltmeter, to indicate the points on the scale calibrated to each of the eight principal points of the compass. This arrangement is of much value in assisting the transportation department to forecast changes in the weather which lead to changes in the car schedule or in the type of cars to be operated.

# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Electric Cooking in a Town of 2000

Mr. K. A. Steinhauser, secretary and manager of the Nashville Electric Light Company, Nashville, Ill., a town of 2000 population, reports gratifying success with an electric-cooking campaign, in the course of which eighteen electric ranges of the Hughes type have been added to its lines. This cooking business is found to be a good day-load and revenue producer. Most of the ranges are used for domestic purposes and at 3 cents per kw-hr. earn monthly incomes averaging $3.30. Others which are installed in hotels and restaurants bring in average revenues of $9 per month.

## Advertising Electric Cooking by Central-Station Energy

The accompanying photograph taken at Newton, Mass., on the system of the Edison Electric Illuminating Com-




ADVERTISING ELECTRIC COOKING

pany of Boston illustrates an effective electric flasher sign maintained at one of the best strategic points of the city for the present purpose of advertising the low cost of electric cooking upon the company's miscellaneous energy rates. The sign faces the principal railroad and trolley lines passing through Newton proper and can easily be read in Norantum Square, about 500 ft. distant. It is about 35 ft. long and 22 ft. wide and contains about 600 10-watt metallized-filament lamps. The menu of three items set forth can be cooked in the minimum time with an energy consumption of about 1 kw-hr. In the fewest words the sign hints at the low cost, speed and attractiveness of electric cooking. The brevity of the message carried enables the commuters between Newton and Boston and passengers on through expresses going past the Newton station to read the inscription understandingly.

## Illuminated Sign Exchange Plan at Kansas City

A little more than a year ago the Kansas City Electric Light Company perfected an agreement with the Thomas Cusack Sign Company whereby the former agreed to furnish energy for the illumination of 250 linear feet of bulletin board and the latter agreed to paint the advertisements




FIG. 1—CENTRAL-STATION DISPLAY ON SIGN COMPANY'S BOARD

and equip the boards with lamps and reflectors. It was further agreed that when any customer of the sign company desired a lighted board the electric-light company was to vacate, its own display being taken elsewhere. The sign company's contract with the customer for lighting the signboard included the equipment and maintenance of the lamps. This arrangement served a double purpose as it not only gave the central station the benefit of the advertising but by attracting attention induced other advertisers to follow the example, so that within one year 2700 additional linear feet of lighted signboard have been installed.




FIG. 2—ELECTRICALLY LIGHTED BULLETIN BOARD AT KANSAS CITY

One sign is installed on the roof of a two-story building at an important corner of the city. By the use of colored lamps and a flasher, changes in color are obtained on the face of the sign, tending to make it more attractive and efficient. Before the lighting company started its own signboard lighting there was not a board in the city working at night.

## Large Factory Sign on Central-Station Service

The accompanying photograph illustrates a large electric sign on the roof of the factory of the Library Bureau, at Cambridge, Mass., on the circuits of the Cambridge Electric Light Company. The sign, one of the longest in Greater Boston, measures 100 ft. by 20 ft. and is mounted




FACTORY SIGN

at a height of about 60 ft. above the ground. It is formed by 312 2-cp, 110-volt carbon incandescent lamps set against a backing of dark-colored galvanized iron and is supplied with energy through a small transformer on the roof which is connected with the local 550-volt motor-service feeders in the factory. The sign is of the fixed type, faces the Charles River Basin and is run on weekdays from dusk until 11:30 p. m. It is easily legible for more than a mile and can be seen by passengers on the principal streets and steam railroad lines entering Boston proper on the west side of the city.

## Disinfecting Books with an Electric Blower

Every public library faces the problem of disinfecting its books so as to prevent the spreading of contagious diseases, which in some localities has become a serious problem. From Los Angeles, Cal., comes the suggestion that the books be placed on a revolving rack against which small motor-driven blowers force jets of air. The breeze not only rotates the whole rack but also spreads out and flutters the leaves so that the air can readily pervade them. By dropping some disinfectant into the chamber from which the blowers get their supply of air, the fluid can be finely distributed through the books.

## Forty-two Household Uses of Electricity

In the June number of its monthly publication, *The Silk Cord*, the Electric Development Association of New England, Boston, Mass., presents a list of forty-two household uses of electricity, making up an array of domestic applications well worth a little serious consideration. Following are the uses suggested: Heat water for shaving or the bath; percolate the breakfast coffee; toast bread; fry eggs or anything that will fry; poach eggs, cook the cereal or heat milk; operate the washing machine and clothes wringer; iron the clothes; run the vacuum cleaner; operate the sewing machine; cool rooms with an electric fan; knead the bread and bake the bread; with a motor, grind, mix, churn, whip cream, make ice-cream, polish silver, etc.; heat a fireless cooker; heat the electric range; make the tea in a samovar; cook food in a chafing dish; curl a woman's hair; dry a woman's hair; ignite cigars; furnish illumination for the house; heat the bathroom and other rooms on cool mornings; keep hot the heating pad (used in place of hot-water bottle); warm the milk for baby day or night; pop corn; protect houses from burglars; amuse the children by running electric toys; give electric baths in bath cabinets; carry the family in the electric automobile; warm an electric blanket for out-door sleeping; purify the drinking water; polish the floors—electric floor polisher; dry the wash—electric drier; sterilize water or utensils; make ice—furnish refrigeration; play the piano; mix family beverages; lift or lower dumb waiters; supply electric treatment; vibrate the massage vibrator; ozonize (purify) the air; thaw frozen pipes; wash dishes.

## 400 hp to Ventilate Appalachian Tunnel

The Appalachian Power Company, of Bluefields, W. Va., recently closed a contract with the Virginia Railway & Power Company for furnishing electrical energy to operate ventilating fans in the Allegheny Tunnel of the railway company. The total rating of the motors will be 400 hp. During the construction of this tunnel it is also probable that the electric service company will secure temporary business from the contractor who has the work in charge.

The work of securing additional contracts for electrical energy used in mining continues, and it is expected that several contracts for such business will be closed shortly. The weekly energy output of the company is now approximately 700,000 kw-hr. and is increasing steadily. Last April the Appalachian company had a connected load of more than 26,000 hp, and there remains a large field for securing new business. An illustrated twenty-four-page booklet entitled "Hydroelectric Power in Southwest Virginia" has been prepared by the company and will be ready for distribution about July 1. The booklet describes the Appalachian Power Company and the territory served and gives the history of the construction of the two hydroelectric developments which have been in full operation for some months.

## Agricultural Service in California Delta Lands

By R. B. Mateer

At the junction of the Sacramento and San Joaquin Rivers in California are the delta lands, reclaimed from a valueless swamp and comprising some 750,000 acres. This land, now protected by strong levees and equipped with great motor-operated reclamation pumps, is of unsurpassed



LEVEE HOUSE FOR MOTOR DRIVEN PUMP

fertility and possesses wonderful possibilities for ranching, dairying, truck-gardening and diversified farming.

In this territory the Great Western Power Company of California has extended its 22,000-volt feeders and is now supplying energy for irrigation and general agricultural purposes. The connected load of some 4644 hp was obtained as a result of an aggressive sales campaign in the

fall of 1912 and the spring of 1913. The motors, in the majority of cases belted to pumps ranging from 4 in. to 16 in. in size, vary from 7.5 hp to 75 hp in rating and are operated from 220-volt, 60-cycle, three-phase secondary circuits.

All energy necessary for irrigation, lighting, heating and



FIG. 2—BELTED CENTRIFUGAL PUMP ON LEVEL BANK

general agricultural purposes is metered at one point at one voltage and is charged for according to the accompanying schedule. Where the energy consumption per hp of motor

RATES FOR ENERGY USED IN AGRICULTURAL SERVICE

| Kw-hr per Hp | Price, Cents | Kw-hr. per Hp | Price, Cents |
|---|---|---|---|
| 31 to 42 | 2.9 | 221 to 250 | 1.9 |
| 42 to 55 | 2.8 | 250 to 280 | 1.8 |
| 55 to 70 | 2.7 | 280 to 312 | 1.7 |
| 70 to 86 | 2.6 | 312 to 346 | 1.6 |
| 86 to 105 | 2.5 | 346 to 381 | 1.5 |
| 105 to 124 | 2.4 | 381 to 418 | 1.4 |
| 124 to 146 | 2.3 | 418 to 457 | 1.3 |
| 146 to 169 | 2.2 | 457 to 498 | 1.2 |
| 169 to 194 | 2.1 | 498 to 540 | 1.1 |
| 194 to 221 | 2.0 | Over 540 | 1.0 |

rating is less than 31 kw-hr., the rate of 3 cents per kw-hr. applies. For other consumption per hp of motor rating, the rates are as given in the table.

## Operation of a Complaint Department

Several outside central-station men who have studied the complaint department of the Western States Gas & Electric Company, Stockton, Cal., declare that this division is one of the best organized and equipped among public utility companies in the West.

The policy of the Western States complaint department, declares Mr. A. G. Halloway, who is in charge, is to shape its attitude toward the public so that the consumer is bound to feel that by simply calling attention to a real or imaginary wrong it will receive prompt attention. A patron of the company is made to feel that in making a complaint he is honest in his belief that a wrong exists, and no matter how trivial the complaint may appear to be it is gone into thoroughly.

When a complaint is entered it is carefully recorded, and the correct name and street number are taken. The department at once tries to find out the cause of the trouble, in order to enable it to determine to whom the order should be sent for prompt execution. The head of this department follows each order carefully and sees that it is executed promptly and satisfactorily. The company believes that a satisfied customer is the best kind of an advertisement.

The complaint department is fully equipped with electrical appliances such as recording voltmeters, banks of lamps, both carbon and tungsten, etc. Connected to each lamp bank is a wattmeter, its dial graduated directly at the rate at which energy is sold and so arranged that by turning on any one of the lamps the consumer can be shown how much that unit costs to operate in cents per hour. This graphic-comparison method has enabled the Western States company to settle many disputed bills to the entire satisfaction of the complainant.

In all cases of complaint other than tests and "re-reads" return post cards are sent out. On tests and "re-reads" an individual letter is sent to the complainant. The originals are filed alphabetically and the duplicates numerically during the current month, at the end of which they are removed and bound and placed in the company's vault, but a book entry is also made of all complaints.

A trouble man is on duty during the day and another during the night, the latter's report indicating what has occurred during his hours of service. Mr. Halloway lays great stress on the importance of this subject of handling complaints, the manner in which the customer is received, and the interest manifested in the complaint.

The success of such a department often depends largely on the man at its head. He should be a man who understands the business thoroughly, for necessarily he must deal with a wide variety of complaints—high bills, poor service, setting of or removing meters, adjusting overcharges, re-reading meters, opening and closing meters and testing meters—as well as settling any and all disputes and adjusting all claims against the company in such a way as not to offend the customer.

## A Hot-Weather Window Display

A window display installed by the Kentucky Electric Company in its spacious display room on the principal business street of Louisville has done much to stimulate the sale of electric fans. The central figure is a healthy-looking snow man about the size that would be made by an expert boy with plenty of snow at his command. The body of the figure was constructed of excelsior wrapped over a wooden frame and covered with white cotton and mica dust, and the figure is complete even to the bits of coal used for eyes and nose. A bit of realism is added by the presence of a boy's sled, lying just as the urchin is supposed to have left it in the snow



A "SNOWBOUND" ELECTRIC FAN DISPLAY AT LOUISVILLE, KY.

Conspicuous in the group of electric fans in the window is the one in front, the guards of which are covered with cotton. This fan is kept constantly in motion and produces the effect of snow driven by the wind. The timeliness of the display may be understood when it is explained that it was put on exhibit on a day when the thermometer registered 98 deg. Fahr.

# Illumination and Wiring

## Intensities of Natural and Artificial Light Required for Reading

By J. R. Cravath

The statement has been made frequently that with natural lighting outdoors a higher intensity of illumination in foot-candles is required for reading and similar work than with artificial light indoors. Various theories have been advanced to account for this. The tests here described, made by the writer, indicate that this old idea is fallacious and that the difference, if any, is in the opposite direction.

The intensity of artificial illumination required for comfortable reading of ordinary newspapers and magazines has been tested at various times by Messrs. Preston S. Millar, A. J. Sweet, the writer and others. The amount required has been found to vary considerably, depending on the person, the surrounding conditions and the direction from which the light is received on the page. Glare from the paper (which is the popular term for specular reflection from the paper) has considerable influence on the amount of light any given individual will require for reading. The less glare received from the paper the lower the illumination required. Taking the general run of results obtained from artificial lighting, it may be said that most individuals will ask for an intensity of from 1 to 2 ft.-candles for ordinary reading. Many can read comfortably under favorable conditions with intensities from 1.0 to 0.5 ft.-candles, or lower. These tests on the intensity of artificial illumination required have usually been carried on by increasing or decreasing the light by means of a rheostat inserted in the circuit supplying energy to the lamps.

The writer has made a few rough tests outdoors at sunset and sunrise on the illumination required for comfortable reading. These tests, while not very extensive, are sufficient to indicate that no extra large quantity of natural light is required, as has sometimes been stated.

One test made during a clear sunset with the subjects on an open lawn facing south showed that about 1 ft.-candle was considered comfortable for reading both by the writer and one other subject. For the writer this was ample, but his companion would choose more if given free choice. When the illumination on the page had decreased to 0.22 ft.-candle the writer could still read without much strain, although his companion could not do so.

A test made during a heavily clouded sunrise with the writer as a subject on the east side of a building facing east showed that he could read easily with an illumination of 0.15 ft.-candle. At 0.42 ft.-candle he could read very comfortably and at 1.26 ft.-candle the illumination seemed ample for ordinary purposes. It should be explained here that the illumination intensities considered ample by the writer on a number of previous tests with artificial illumination were from 1.3 to 3.3 ft.-candles, depending on the direction of the light and the surroundings. This is considerably higher than required outdoors in the tests herewith recorded.

In another test made at sunset on the east side of the house with the writer seated facing east, reading was very comfortable with 1.15 ft.-candles. With an intensity of from 0.98 to 0.69 ft.-candle the illumination seemed a little lower than one would want steadily. At 0.63 ft.-candle the illumination was insufficient for steady work, although entirely comfortable for temporary work. From 0.45 to 0.34 ft.-candle the illumination was still sufficient to make brief reading easy. Reading began to be difficult at 0.25 ft.-candle, and at 0.16 it was decidedly difficult.

In all of the above daylight tests the writer was impressed with the comfort with which reading was done as compared to similar tests made under artificial light for which the writer has frequently been a subject. This result is attributable to the diffused character of the illumination, which gave a minimum of reflected glare from the paper.

The low illumination required in the sunrise test as compared to the sunset was to be expected because the eye had become accustomed to darkness before the sunrise test and the illumination was gradually increasing rather than diminishing.

These results, as far as they go, indicate that daylight illumination in the open is satisfactory for reading at intensities as low as with artificial light and probably lower.

## Electric-Lighted Showcase for the Plate-Glass Storeroom Door

The plate-glass door of the average storeroom occupies valuable display space, of which, however, little use is ordinarily made. Realizing this, an astute shoe merchant in a southern Ohio city had an electric-lighted showcase built, as shown in the sketch, to be hung behind the glass




ELECTRIC-LIGHTED SHOWCASE FOR DOOR

door after business hours. Connection to the lamps inside is made by a flexible cord which can be plugged into an outlet at the side of the door. A couple of 60-watt tungsten lamps light the little box profusely, and the unique display draws more than its share of attention from the passing public.

## Cost of Chicago's New Street Lighting

Several committees of the City Club of Chicago on June 18 made an inspection trip over some of the recent new electric street-lighting work being carried out in Chicago. At the luncheon preceding the trip Mr. Ray Palmer, city electrician, explained the systems adopted and gave some interesting figures on cost of construction and operation. The two systems used were described and illustrated in the *Electrical World* of Oct. 12, 1912.

### Flame-Arc System

The system most generally used over the city employs flame-arc lamps which operate about 100 hours between trimmings. These lamps are on 10-amp, 60-cycle circuits and take from 55 to 65 volts per lamp. They are spaced about twenty-three to the mile or an average of one to every 230 ft. of street, and with the exception of a certain central underground district, the line work is carried overhead on tubular steel poles. The lamps are mounted 25 ft. above the pavement. The total first cost per mile of this system was $3,700, not including generating plant but including the substations. The cost of operation per mile is $1.200 per year, or $52.30 per lamp. Public by-product water-power furnishes the energy.

### TUNGSTEN SERIES UNDERGROUND SYSTEM

Another system is being used on some residence streets where there are many low trees and where the property owners prefer smaller lamps more closely spaced. This system consists of 80-cp series tungsten lamps spaced seventy-five per mile of street. These are mounted on very neat iron poles formerly used for gas lamps, the gas lantern being removed and a light opal ball substituted therefor. The lamps are operated on 4-amp series circuits laid underground in No. 6 lead-covered and double-steel-taped single-conductor cable buried about 13 in. below the surface in the parkway just inside the curb. This is very much cheaper construction than any kind of underground conduit and involves very little disturbance of the street. The first cost per mile of this system was $8,800, not including generating plant but including the substations. The cost per mile of operation is $1,800 per year, or $24 per lamp. The cost of furnishing and laying the steel-taped cable is estimated at 50 cents per foot. This would make the labor cost about 30 cents per foot. In this connection it should be stated that repair work has been very carefully done so as to leave the street in as good shape as it was found.

## New Rules Governing Overhead Wire Crossings in Illinois

The Illinois Railroad and Warehouse Commission, in its Synopsis of Proceedings, issue No. 12, recently distributed, gives a set of thirteen rules adopted for the regulation of overhead-wire crossings with steam railroads, abstracted herewith.

All wire crossings are divided into two classes, those of 700 volts or more and those of less than 700 volts. No wires of the former class shall be permitted to cross the tracks of any railroad, or the wires on the railroad right-of-way, until complete plans, including maps and profiles, shall first have been submitted to the commission and approved by formal order. At all crossings of this class suitable danger signs stating the voltage of the circuits must be attached to each pole upon or adjacent to the right-of-way. If the wires of any telegraph, telephone or electric railway company are crossed at the same location, the minimum vertical clearances between wires shall be 7 ft.

All wires of this class (except trolley wires) shall in general have a total vertieal clearance of not less than 35 ft. when not suspended from messenger wires. If suspended as last mentioned, at intervals not greater than 15 ft., the clearance shall be not less than 30 ft.

Trolley-wire crossings must be equipped with an approved trolley guard, and the minimum clearance above the rail top shall be 22 ft.

All wires carrying less than 700 volts (except trolley wires) shall in general have a clearance of not less than 25 ft. if suspended from messengers at intervals not exceeding 15 ft., or if not so suspended, the clearance must be at least 30 ft. But where the wires of other companies are crossed at the same location the smallest vertical clearance between wires must be 5 ft.

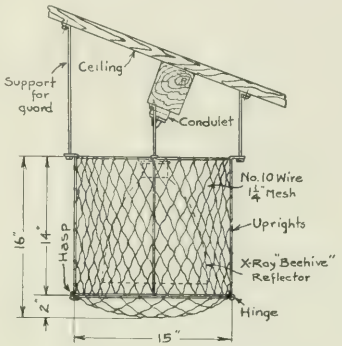
In every case the wire crossing, where wires of other companies are also crossed as mentioned, must be equipped with a slatted platform or some other approved type of protection, to prevent wire contacts in case any of the upper wires fail.

The clearances prescribed must exist under the most unfavorable conditions with respect to loading and temperature. If smaller clearances than those here mentioned appear to be desirable, application must be made to the commission for special permission by order to depart from the rules, giving full data, maps, profiles, etc.

These rules were approved Nov. 21, 1912.

## Mounting of Lamp Guards in Gymnasium

In gymnasiums, hand-ball courts, indoor-tennis courts, etc., tungsten lamps should be protected against the chance impact of balls thrown by players by installing a wire screen or guard of some kind around the lighting units. Frequently the mistake has been made of attaching these guards to the lamp-holders themselves, with the result that when a ball struck the screen the jar and vibration transmitted to the whole fixture was sufficient to break the filaments, especially if the lamps happened to be cold. The accompanying sketch shows the improved method of supporting the guard screen used in the case of a recently completed gymnasium in which the protector is separately mounted entirely clear of the lamp fixture and reflector. The bottom of the wire basket is hinged and held closed with a hasp, so that access is made easy for renewing lamps and cleaning globes and reflectors.




GYMNASIUM LAMP GUARD

## Recent Telephone Patents

### EXCHANGE SYSTEMS AND APPARATUS

With the introduction of automatically applied ringing at central offices, especially in connection with trunking, the necessity for an intermittent current supply became at once apparent. In the ordinary system of automatic ringing the response of the called station disconnects the source of ringing energy. The usual periods used are two seconds of ring followed by four seconds of silence. It will thus be seen that a possible delay of four seconds may occur after connection, before ringing begins, while there is a probable delay of at least two seconds.

It is to obviate this difficulty that Mr. W. G. Blauvelt, of New York City, has introduced an auxiliary switching device by means of which ringing is immediately applied irrespective of the particular position of the controlling interrupter. After a preliminary ring the regular interrupter is applied for any further ringing that may be necessary. Mr. Blauvelt provides a rotating shaft upon which is secured a set of cams each controlling contact springs. The whole set is caused to rotate by means of a ratchet wheel and stepping pawl. This pawl is controlled by an interrupter, the circuit of which may be closed and opened not only through the contacts associated with the cams but also through those of various relays and of a rotating commutator, the segments of which pass its brushes at half-second intervals. When a calling plug reaches a line, energy for ringing is immediately applied for a half second. Simultaneously the switch is advanced, cutting off this ringing supply and switching in the regular supply. The patents for this system have been assigned to the American Telephone & Telegraph Company.

A patent granted to Mr. H. [illegible] of Chicago and assigned by him to the [illegible] Manufacturing Company, describes a method for preventing listening or by operators. A [illegible] is associated through [illegible] relays, one of which is [illegible] with the calling cord and one with the answering cord of each cord pair. Both of these relays are in operation as long as both parties to a connection have their receivers down. Under this condition should the operator throw the listening key of the connecting cord pair a relay associated therewith will short-circuit the operator's set and ring a buzzer to call attention to the attempted infraction of the rules.

Another patent granted to the same inventor and similarly assigned refers to systems of cash service where prepayment is required. According to this proposed system the subscriber may signal in the usual way by removing his receiver and may hear the response of the operator and give the desired number. When connection is made to the desired line the calling party loses his transmitter connection but can hear the response of the called party. A phonograph is arranged to ask the called party his number and to instruct the caller to drop a nickel. This being done, the restraint is lifted and conversation may then begin.

Mr. P. C. Burns, of Chicago, recently obtained a patent for a special type of small switchboard, described in the *Electrical World* of June 21, 1913, in which the apparatus was especially designed for removal without disturbing the permanent wiring. The jacks and drops were individually combined and all contacts were maintained mechanically. A patent has now been granted to him for a similar board wherein lamp signals have replaced the drops.

Mr. F. Wöhler, of Hanover-Linden, Germany, has obtained a patent for an automatic telephone system, which he has assigned to the Western Electric Company. This system provides for so-called restricted service; that is, some stations of a group have universal service and others are restricted to calls within the groups. The system of Mr. Wöhler provides for this feature and in addition contemplates that a call from a universal service station to another of the same class shall serve to intercept any existing call between the desired station and any restricted station.

A complete automatic system is described in the patent granted to Mr. J. Peticky, of Austria-Hungary. This system provides the usual features, comprising sending apparatus and the various selectors and connection apparatus for a four-digit system.

### Subscriber's Station Devices

Many receivers have been produced to operate without a permanent magnet, depending upon a steady current in the windings for the initial magnetization. Such a receiver has been patented by Mr. E. R. Corwin, of Chicago, and has been assigned to the Corwin Telephone Manufacturing Company. The diaphragm is placed upon a shallow circular pan and held between the shell and the ear cap. The pan has two slits to receive the ends of the pole pieces. Another patent granted to the same inventor describes the method of use of this receiver with its two coils in parallel and in series with the transmitter.

A transmitter for picking up and concentrating sound vibrations is the subject of a patent issued to Mr. W. J. Marchant, of London, England. The mouthpiece is of parabolic section, truncated at the focal point, the diaphragm being carried so as to be in this plane. For adjustments a series of screens are provided, one or more of which may be placed over the mouthpiece.

Mr. Felix Gothschalk, of Stirling, N. J., has invented a transmitter in which a strained diaphragm is used. The diaphragm is stretched radially by a clamping ring. The connection between the diaphragm and front or movable electrode is effected through a symmetrical spider the legs of which make contact with the rear of the diaphragm some distance from its center and concentric with its periphery.

An antiseptic device invented by Mr. C. R. Phillips, of Richmond, Va., which consists of a diaphragm somewhat larger than the face of a transmitter, has a concentric channel formed in it about a central perforation. A fiber ring soaked in antiseptic material is pressed into the channel and the diaphragm is clamped against the mouthpiece with the open face of the channel inward. The whole device is held in place by a wire ring engaging ears which clamp over the lip of the mouthpiece.

## Letter to the Editors

### Fuse Economy

*To the Editors of the Electrical World:*

Sirs:—An article appeared in the *Electrical World* of May 17 by Mr. Harvey S. Pardee on "Fuse Economy," in which he discussed several phases of the situation of vital importance to the fuse-buying public. The writer wishes to take exception to the conclusion of the author, which may be true in an academic sense but is entirely irrelevant and misleading as regards the present refillable-fuse situation.

He states that "an economic demand cannot be resisted indefinitely, and there exists at present a real demand for a refillable fuse which shall be reliable as to rating, cheaply refillable and reasonably fool-proof; that is, one that cannot be improperly refilled by anyone who may undertake to do so." It is readily granted that some demand always exists in every line of business for a supposedly cheaper product that is "just as good," but we must deal with conditions as they now are and not with mere theories of this kind.

The agitation at present on foot to have the insurance underwriters approve certain makes of refillable fuses now on the market does not aim to standardize refillable fuses "that cannot be improperly refilled by anyone who may undertake to do so," but rather to permit the use of fuses that anyone can reload in any manner, either good or bad.

The existing reloadable fuses are refilled by replacing their blown fusible element with new ones. Mechanical limitations as to the size of the new element can be built into such fuses, but no limitation can be put on the character of the material of which the new fusible links are made.

The ease with which any existing make of refillable fuse can be reloaded improperly gives rise to a sufficiently serious fire hazard to warrant the underwriters in refusing to approve them. Instances have come under the writer's observation in which refillable fuses of normal appearance were found to be fused at double their rated capacity in ordinary service.

Mr. Pardee's letter gives the idea that a great demand exists for refillable fuses which are as reliable as approved cartridge fuses. It may throw some light on this matter to point out that manufacturers of approved fuses have made a regular business of reloading blown fuses in an approved manner for years, at prices which effect a saving of about 60 per cent of the cost of new fuses. In spite of this, the number of fuses returned to the manufacturers for reloading is only a few per cent of the number of new fuses made.

We may agree with Mr. Pardee that some demand exists for a refillable fuse as good as the present approved inclosed fuse, but we have not yet seen the device which satisfies this desirable but unattained end.

R. C. Patton,
[illegible] Electrical [illegible] Company.

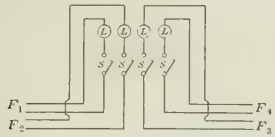
*Providence, R. I.*

# Field of the Operating Engineer

**A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers**

## Field Excitation Test Lamps

A useful adjunct to the operating equipment of a large Western turbine station is a bank of lamps and switches by means of which the floor attendant can determine at any time which machines have their fields excited. The small lamps of the bank, which is mounted on a pedestal at




FIELD EXCITATION TEST LAMPS

the center of the turbine room, are each connected in parallel with one of the turbine fields, and by closing its corresponding switch momentarily the operator can test to find on which units the excitation switches are closed.

## Methods of Charging Storage Batteries

A detailed discussion of the various methods of charging storage batteries for use with straight-storage, head-end and axle-generator systems of train lighting was presented before the recent Atlantic City convention of the Association of Railway Electrical Engineers by its committee on battery-charging methods, of which Mr. J. R. Sloan, of the Pennsylvania Railroad, is chairman. Of general interest will be the account of the methods for straight-storage operation which have applications in other fields. Six schemes were outlined, as follows, the committee by a majority vote recommending the method of constant-potential charging with ballast resistance, using ampere-hour meters and shunt-trip circuit-breaker on each car.

*A. Rate of charge and ampere-hour input determined by operator based on voltage test on arrival and time available, the charging current being regulated by manipulation of rheostat.*

This method of charging, while probably used to a greater extent than any other method, cannot be considered satisfactory. To obtain the best results the following elements must be considered and proper allowance made for each:

Make and type of battery.

Actual capacity of battery.

Physical condition of battery, with respect to sulphate, density and level of electrolyte, temperature, short-circuits, condition of connections, etc.

Rate at which the battery is discharged when determining arrival voltage test and the length of time this discharge continues before making test.

Time that has elapsed between the termination of discharge in service and the time of test for voltage.

Drop in voltage in the battery connectors and in the car wiring.

Time available for charging.

Accuracy of the voltmeter itself and the accuracy with which it is read.

It is obvious that many of these factors are unknown quantities to the operator, and, therefore, he cannot give them all proper weight. Furthermore, when there are a great number of cars to be charged the charging rate to the battery on each car cannot be followed closely.

At the smaller terminals better results could probably be obtained, especially if battery voltage readings are frequently taken during the charge to determine when the voltage has reached a maximum, but the method as a whole is considered unsatisfactory.

*B. Charging current held approximately constant by manipulation of rheostat and state of charge of battery determined by constancy of voltage pilot cell, readings being taken at intervals during charge.*

This method of charging is dependent upon the accuracy with which the voltmeter is read and the assumption that the remainder of the cells are exactly similar in all respects to the pilot cell. It is essential that when obtaining the voltage readings the charging current be maintained at the same rate and that identical values be obtained with successive readings at least a half hour apart.

It is known that the assumption made above is erroneous, but nevertheless, if properly handled, this method will undoubtedly result in prolonging the life of the battery over that obtained with the first method mentioned, but it is believed the cost of operation will be excessive on account of the amount of labor involved in holding the current constant and in obtaining the successive voltage readings.

*C. Charging current held approximately constant by manipulation of rheostat and state of charge determined by constancy of specific gravity of electrolyte of pilot cell, readings being taken at intervals during charge.*

This method is dependent upon:

Class of battery.

Temperature of electrolyte, variations of which must be corrected for.

Accuracy with which the hydrometer is read and the care taken to get a representative sample and the assumption that the remainder of the cells are exactly similar in all respects to the pilot cell.

When taking the specific gravity readings it is essential that identical values be obtained with successive readings at least a half hour apart.

Like method B, it is known that the assumption that all cells in the battery are exactly similar to the pilot cell is in error, but nevertheless, if properly handled, this method will undoubtedly cause less depreciation of a battery in a given time than method A. However, it is believed that the cost of operation on account of the amount of labor involved in obtaining the successive specific-gravity readings would be even greater than with method B.

*D. Charging current maintained approximately constant by automatic resistance, the resistance being controlled by a thermostat governed by the charging current.*

This method of charging is satisfactory in theory (if proper means are provided for terminating the charge), inasmuch as the charging rate can be set at a value which does not tend to produce undue depreciation of the plates. In practice, however, it is not flexible, as in case of cars with short layovers the rate of charge cannot be increased without adjusting the apparatus to permit higher currents. It has also been found that the thermostat is affected by weather conditions, there being considerable variation in the current flow, without any change having been made in

the adjustment ... in temperature, wind velocity, etc.

*E. Charging current kept approximately constant by manipulation of rheostat, and ampere input determined by ampere-hour meter. This meter so designed as to compensate for the ampere-hour efficiency of the battery when the battery is fully charged, acting to complete a circuit through the trip coil of a circuit-breaker. This breaker when opened cuts the battery off charge.*

This method of charging is dependent upon the accuracy of the meter. The meter should, therefore, be checked for calibration at regular intervals. As an additional check on the meter, voltage and specific-gravity readings at several pilot cells should be taken during the latter portion of charge so as to determine that when the meter indicates a complete charge the battery is actually in that condition. It is believed that this method will give better results than any previously mentioned. In order that the gravity readings may be reliable, the level of the electrolyte in all cells should be adjusted previous to beginning the charge, and the specific gravity of the electrolyte in all cells corrected after charge is completed, allowance being made for temperature.

*F. A definite fixed resistance is placed in series with the battery and a definite constant voltage is maintained across both battery and resistance.*

With this method the ampere-hour input is determined by an ampere-hour meter operating a circuit-breaker to cut the battery off charge as in method E.

Care must be exercised in determining the proper resistance and voltage to use, and especially must the voltage be held very closely approximating the predetermined value chosen. It may be said in general that the higher the voltage chosen (which conditions the use of the greater charging resistance) the greater will be the permissible fluctuation of voltage. Increased voltage, however, increases the amount of energy consumed and reduces the amount of the "taper" effect.

The committee believes that this system, known as the constant-potential system, is most preferable of the various systems considered for charging batteries operated in straight storage service for the reasons that:

The minimum amount of attention is required from the operator who has only to connect the batteries to the charging plant.

Resistance and voltage being taken at such values as to permit using the highest current rate that will not injure the battery, the latter will be fully charged in a minimum time. Since the current is reduced to normal at end of charge, excessive evolution of gas at this portion of charge is avoided, thus maintaining the efficiency of charge and minimizing the depreciation of the battery.

Overcharging of the battery and so wasting power is eliminated, as energy is automatically cut off on completion of charge.

The results obtained will depend upon the accuracy of the meter and the constancy of the voltage. With regard to this point the remarks under method D apply equally well.

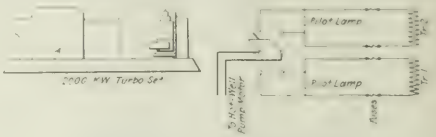
This method has the disadvantage that the rate of current flow is affected by the physical condition of the battery, that is, whether the cells are short-circuited or sulphated by the temperature, level and specific gravity of the electrolyte, age of battery, and whether antimony and certain impurities are present in the cells.

It has the further advantages that for the best results it is probable that different terminal voltages and resistance will probably be required for each of the three different types of batteries, namely, Faure, Planté and Edison, although it is believed that very good results will be obtained if the initial charging rate (neglecting the first momentary rush of current) does not greatly exceed the three-hour or double normal rate and the final charging rate does not greatly exceed the normal or eight-hour rate of the Planté battery.

In a minority comment included with the report, Mr. R. Norberg declared that since a great percentage of batteries as actually operated are far from normal, such batteries would stand a great chance of damage if charged according to the recommended method F. He therefore proposed to recommend method F as theoretically the best method, where the voltage of the battery is normal and absolutely known, but for practical purposes under general service conditions he advised method E.

## Duplicate Operation of Hot-Well Pump

To insure the continuous operation of the hot-well pump, it is often advisable to provide for duplicate sources of power supply. In one Middle West plant mounted on the frame of a 2000-kw turbine set is a double-pole double-throw switch by means of which the pump motor can be thrown onto either its special transformer bank or a duplicate set provided for emergency operation in case the fuses of the first set are blown. Each circuit feeds a pilot lamp mounted on the machine frame, so that the attendant can observe at a glance if a fuse has blown in either line or if the operation of the pump has been interrupted.




CIRCUIT FOR DUPLICATE OPERATION

## Selecting Samples of Coal for Calorimeter Test

What method is commonly used for selecting representative samples of coal for calorimeter tests are to be made? Are these tests of much value as station records? S. B. F.

Where coal is used for fuel it is very important that a regular analysis be made and a record kept, so that the coal consumption for different months can be compared. When a test is to be made on coal used for fuel an amount large enough to be representative of the shipment is selected and placed upon the shoveling floor. This pile of coal is then shoveled into two equal heaps and then one of these is selected and again divided. This process of division is continued until the amount of coal left in one heap is small enough to be subjected to calorimeter test. The calorimeter test can be made upon a small amount from each car unloaded during the month. Where the plant is of sufficient size to warrant the expense it is better to install instruments in the plant, so that an analysis can be made for each car of coal unloaded. The data thus obtained, together with the aid of a simple and inexpensive instrument for measuring the percentage of $CO_2$ in the gas of combustion, will be of great help in the boiler room.

## Indirect and Semi-Indirect Illumination

What is the distinction between indirect and semi-indirect illumination? E. R. M.

In indirect lighting all of the light is first projected onto the ceiling from which it is diffused throughout the room. In semi-indirect illumination part of the light reaches the working plane directly from the light source without undergoing ceiling reflection. Among the advantages of the latter form over pure indirect lighting are its higher efficiency and the absence of contrasting dark fixtures silhouetted against the brightly illuminated ceiling surface.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*The Present Status of the Unipolar Machine.*—C. TRETTIN.—The large unipolar machine driven by a steam turbine was originally developed in the United States, first by Noeggerath and later by Lamme, and has been able to hold its own in spite of some deficiencies of the first designs, since high-speed direct-current turbo-generators with commutators were formerly rather unreliable in operation or did not exist at all, the latter being the case in the United States. The rapid development of the steam turbine, which now is absolutely reliable for speeds of 3000 r.p.m. and outputs of 8000 hp, leads, however, to very serious requirements of a modern turbo-generator. The high-speed commutator direct-current generator has been much improved lately so that the unipolar machine can compete with the direct-current commutator machine successfully only in the limited field of generation of very strong currents at low voltages. A direct-current commutator machine of 3000 r.p.m. is now perfectly reliable in sizes up to 900 kw. The author outlines the designs of Noeggerath and Lamme and briefly discusses their differences. The Noeggerath design has recently been taken up and further developed by the Siemens-Schuckert company. The author discusses the inherent difficulties in the construction of unipolar machines. They are of two kinds, namely, electrical difficulties (reaction, eddy currents), which have been studied in detail by Noeggerath, and mechanical difficulties (stresses, centrifugal forces, etc.). It is pointed out that the future of the unipolar machine depends essentially on the material of the slip-rings, which has to fulfil the following requirements: The permeability should be as small as possible to avoid eddy currents; the voltage drop below the brushes should be as small as possible; the mechanical strength should be as great as possible; the material should remain nicely polished at high-current densities below the metallic brushes. The author thinks it is quite possible that a bronze will be found which fulfils these requirements. In plants in which very high currents are required at comparatively low voltages the disadvantages of the unipolar machine are of less account. These disadvantages are the high weight, the low efficiency (82 to 86 per cent), and the necessity of careful attendance at the brushes. The latter disadvantage may be overcome if it should be found possible later on to replace the metallic brushes by graphite or carbon brushes. The unipolar machine has at present one great advantage over all other types of electric generators. This is its great overload capacity. It is quite possible to short-circuit it at full voltage without any danger to the brushes and winding. It is also possible to overload it temporarily by even 300 per cent.—*Dingler's Polytechn. Journal*, Vol. 328, Nos. 9 and 10, 1913.

*Electrolytic Iron for Construction of Electric Machines.*—MAX BRESLAUER.—Electrolytic iron has recently been placed on the market in Germany. The author shows that considerable savings in active material in the construction of electrical machines can be obtained by the use of this chemically pure iron. He first discusses the magnetic properties of electrolytic iron in comparison with other kinds of iron and then takes up the use of electrolytic iron in the construction of induction motors and transformers. The paper is to be concluded in a later issue.—*Elek. Zeit.*, June 12, 1913.

### Lamps and Lighting

*Tungsten-Filament Lamps.*—An editorial discussion of the recent report on tests of tungsten-filament lamps made by the British engineering standards committee. The lamps tested were those on the market some eighteen months ago and showed great improvements over the older lamps but left much to be desired with respect to rating. The objects of the tests were to obtain data as to the degree of uniformity in the individual lamps composing batches of metallic-filament lamps of given nominal ratings, and also to obtain data as to the behavior of metallic-filament lamps on life tests, with a view of ascertaining the value of the watts per candle-power on life tests which corresponds to a given candle-power drop after 1000 hours. The lamps were assumed to have been manufactured to conform to the values of watts and candle-power which were advertised in the respective makers' catalogs for the rating in question. From the target diagrams and tables it appears that "individual lamps on the market at that time, with the exception of those of one maker, vary considerably from their normal ratings, while even that maker whose lamps do not so vary cannot flatter himself exceedingly, as the lamps in question were supplied to a government department, a type of consumer that is, as is well known, extremely rigorous with its lamp-testing, so that these particular lamps can hardly be considered an ordinary works product. As regards the results of the candle-power tests, only 40 per cent of the batches tested came within the percentage limits laid down by the carbon-lamp specification and the same percentage within the makers' suggested limits. On the wattage basis the percentages complying with the two specifications were 48 and 79 respectively." The percentage limit described in the British standard specifications for carbon lamps is $\pm 12\frac{1}{2}$ per cent for candle-power and $\pm$ 8 per cent for watts. Life tests were conducted on a basis of 1.2 watts per cp—that is, the voltage was found at which each lamp consumed 1.2 watts per cp and the lamp was then run at this voltage for 1000 hours or until it broke. Lamps with a life of several thousand hours are exceptional. "Moreover, the percentage of lamps which do not exist even for 1000 hours is higher than would be believed, especially in the case of high-voltage lamps. The candle-power throughout, however, seems to remain sufficiently constant to be satisfactory, and this statement applies equally to both high-voltage and low-voltage lamps."—London *Electrician*, June 6, 1913.

*Regeneration of Incandescent Lamps.*—E. A. KRUEGER.—An illustrated description of his method of regenerating incandescent lamps in which most parts of the lamp can be used repeatedly and the cost of regeneration includes only the opening of the globe, substitution of new filaments and evacuation of the globe.—*Zeit. f. Beleucht.*, May 20, 1913.

*Metallic Filament.*—A note on a recent British patent (No. 9941, 1912) of F. Hansen and W. F. Mohr. To increase the specific resistance, tungsten oxide is converted into trioxide, to which is added boric acid-anhydride to saturation. This is then dried and heated in a neutral atmosphere and reduced by heating with zinc powder. The zinc is removed and is made into a paste and squirted.—London *Elec. Engineering*, May 29, 1913.

*Osram Lamp with Ductile Tungsten.*—H. REMANE.—An enlarged illustrated reprint of his paper presented before

the Polytechnic Society of Graz, which has already been abstracted in the *Digest.—Zeit. f. Beleucht.*, May 20 and 30, 1913.

*Steel-Mill Lighting.*—C. E. CLEWELL.—An illustrated article giving notes on steel-mill lighting and emphasizing that overhead lighting is most important. Notes are given on the illumination of open-hearth furnaces, machine shops, foundries, pattern shops and loading sheds. A table is added giving engineering data from actual lighting systems in typical steel-mill locations by means of arc lamps, mercury-vapor lamps and tungsten lamps.—*Elec. Journal*, June, 1913.

### Installations, Systems and Appliances

*Relays.*—A note on a recent British patent (No. 30,059, 1912) of F. H. Nicholson. A U-tube containing a conducting liquid, for example, mercury, is pivoted so that it can turn freely. A magnetic flux is maintained by a U-shaped electromagnet directly through the conducting liquid in the central portion of the U-tube through which the feeble currents are caused to pass. The interaction of the flux produced by this current with the permanent flux sets up a flow of the liquid, which, therefore, rises in one of the end chambers and falls in the other. The center of gravity being thus disturbed the tube tilts and closes the local circuit.—London *Elec. Eng'ing*, June 12, 1913.

*Resistors for High Temperatures.*—A note on a recent British patent (No. 111,380, 1912) of G. Cooper and the British Prometheus Company. The resistor surface is impregnated with a colloidal solution of one or more of the noble metals. To effect this a layer of oxide or other absorbent compound is formed on the surface of the resistor, the coating solution is then applied and subjected to heat and heavy pressure by a suitable machine.—London *Elec. Eng'ing*, June 12, 1913.

### Electrophysics and Magnetism

*Glow Discharge from Wires.*—J. S. TOWNSEND.—The force required to produce a discharge from the surface of a wire is investigated theoretically, on the hypothesis that the conductivity of the gas is produced by the ions generated by the collisions of positive and negative ions with molecules of the gas. The case in which the discharge takes place from a wire to a large coaxial cylinder is considered, and the critical forces at the surfaces of wires of various diameters, corresponding to different pressures of the gas between the wire and the cylinder, are deduced from the sparking potentials for parallel plates at various distances apart. The forces calculated by the theory are in good agreement with experimental determinations.—London *Electrician*, June 6, 1913.

*Disintegration of Radium A.*—W. MAKOWER AND S. RUSS.—An abstract of a (British) Physical Society paper. When an atom of radium A disintegrates an alpha particle is expelled which carries with it two positive atomic charges. At the same time the radium B atom formed recoils with a single positive charge. To account for these facts it is necessary to suppose that three negative electrons are expelled during the process. If these are emitted with a high velocity, they should appear as beta rays capable of detection by the ionization they produce or by their photographic action. On the other hand, they might consist of a slowly moving delta radiation which would escape detection by either of the above methods. The experiments which were made by both methods in the hope of detecting beta rays from radium A failed to reveal any such radiation.—London *Electrician*, June 6, 1913.

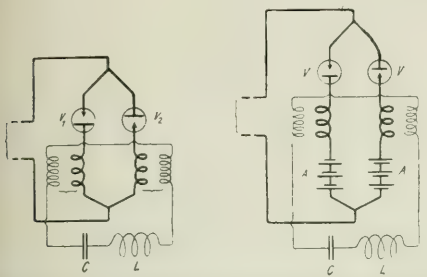
### Units, Measurements and Instruments

*Vibrator Galvanometer Design.*—H. F. HAWORTH.—An abstract of a (British) Physical Society paper. (1) The maximum amount of power available for vibrating the moving system of a vibration galvanometer of the moving-coil type is $V^2/4R$. As the frequency of the instrument is raised the losses increase rapidly, and hence it is advantageous to be able to increase the useful power input per unit voltage. To do this the resistance of the instrument must be decreased. This can be done in a galvanometer of the Duddell type by leading the current in and out at the bottom bridge and short-circuiting the wires at the top bridge, and it results in a great increase of sensibility. A lower resistance also requires a lower flux density. (2) Owing to the losses in the moving system increasing at a greater rate than the first power of the frequency, and inasmuch as the frequency of the system increases at a lower rate than the reciprocal length of the string on account of the mass of the mirror, the flux density must be increased as the frequency increases in order that the back emf of the moving system may always be half that of the applied potential difference. As the losses are low at low frequency and the mass of the mirror is not large, then, compared with the mass of the wire, the flux density required is moderate, but at high frequencies the flux density required is large. In order to obtain this result economically it is convenient to make the depth of the poles small compared with the maximum length of the wires. This gives a sufficient field for the long wires, and for short wires one is able to obtain the necessary flux density because the total flux can still be put through the moving system. (3) A combination of (1) and (2) makes a very satisfactory instrument with a much flatter voltmeter-sensibility-frequency curve than is obtained usually.—London *Electrician*, June 6, 1913.

*Energy Losses in Condensers.*—L. W. AUSTIN.—An account of measurements of energy losses in some condensers used in high-frequency circuits at a maximum emf of 14,500 volts, this being the value frequently employed in the newer wireless sets. The losses in the compressed-air condenser used (0.00575 mf) amount, at a pressure of 15 atmospheres, to an equivalent resistance of between 0.1 ohm and 0.2 ohm. Condensers in which brushing is prevented by the nature of their construction show no change in resistance between the limits of observation, 4000 to 20,000 volts, indicating that the internal losses are independent of the voltage. Leyden jars of commercial types immersed wholly in oil show losses only slightly greater than those of the compressed-air condenser. The paper and micanite condensers tested show very much larger losses. The resistances of the different Leyden jars in air vary between 1 ohm and 1.8 ohms at 14,500 volts. Between 10,000 volts and 20,000 volts the equivalent resistance increases approximately in proportion to the square of the voltage. Placing Leyden jars in parallel series, the capacity remaining the same, does not diminish their brushing losses below 20,000 volts. Immersing only the edges of the conducting coatings of Leyden jars in oil gives an equivalent resistance midway between that when wholly in air and that when wholly in oil. Brushing losses are much increased by any semi-conducting material on the surface of the glass at the edges of the conducting coatings of Leyden jars.—*Bulletin Bureau of Standards*, Vol. IX, No. 1, 1913.

*Aluminum Valve.*—J. ZENNECK.—An article illustrated by diagrams on electrolytic cells with an aluminum electrode and a lead electrode and a 5 per cent solution of ammonia phosphate. The author emphasizes the importance of high-current densities not only during the process of formation of the cell, but also after the stationary condition has been reached. He also describes experiments made with high-frequency currents. His results show that even with frequencies of 4,000 or 10,000 cycles per second a good rectifying effect can be obtained, but that a high-current density is necessary to give a good valve effect. In order to use a high-current density cooling of the aluminum electrode is necessary and the arrangement used by the author for this purpose is described. The aluminum cell may be used for transformation of frequencies, as shown in Fig. 1 in which the condenser circuit $L$ $C$ is tuned to double the

frequency of the alternating current supplied by the machine *M*. The author's experiments show that with a frequency of 4000 and 10,000 cycles per second from the machine strong oscillations having a frequency of 8000 or 20,000 cycles per second are obtained in the condenser circuit. Fig. 2 shows a modification of the arrangement in which a direct current is superposed on the alternating




FIGS. 1 AND 2—CURRENT DIAGRAMS FOR TRANSFORMATION OF FREQUENCY

current by inserting the storage batteries *A* as shown. When the number of batteries was properly chosen the effect was considerably improved, although the current taken from the storage batteries was only about 1 milliampere.—*Phys. Zeit.*, June 15, 1913.

*Electrodynamometer for Heavy Currents.*—P. G. AGNEW.—An illustrated description of a tubular electrodynamometer for heavy currents. To obtain the same current it is usual to strand the windings of the field coils of electrodynamometers, and the strands should also be thoroughly mixed, so that all shall have the same effective resistance and inductance. For heavy currents this becomes a matter of extreme difficulty. The author describes a tubular instrument consists of two coaxial copper tubes, thus giving a circular magnetic field in the space between the tubes. On direct current the distribution may be assumed to be uniform over the cross-section of the tubes, but on alternating current the stream lines are crowded toward the outside of the inside tube and toward the inside of the outside tube, and the amount of this change depends upon the frequency. But with axial symmetry the magnetic field at any point is independent of the current distribution. Expressed in the usual terms there is no magnetic field between the tubes due to the outside tube, and that due to the inside tube is independent of the skin effect. The construction of the instrument is described and its constants and dimensions are given, together with results.—*Bulletin Bureau of Standards*, Vol. VIII, No. 4, 1913.

*Air Condensers.*—H. SCHERING AND R. SCHMIDT.—A translation in abstract of their recent German paper on the construction of air condensers at the Reichsanstalt.—London *Electrician*, May 30, 1913.

### Telegraphy, Telephony and Signals

*Mechanical Devices to Assist Manual Operation of Telephone Exchanges.*—W. SLINGO.—A paper read at the joint meeting of the (British) Institute of Electrical Engineers and the Société Internationale des Electriciens in Paris. Apparatus by which operators can be assisted in dealing with the traffic of the ordinary manual telephone exchanges are described in detail. These include traffic distribution, call-wire selectors and alarm signals. On groups of outgoing call-wires between very busy exchanges much trouble has been experienced as a result of confusion during busy periods owing to one operator interrupting another in their desire to dispose of the traffic and delay experienced by the A operators in finding a slack call-wire at such periods. An automatic call-wire selecting equipment has been installed at the Central Exchange, London, which has for its object the selection and isolation of a call-wire when one

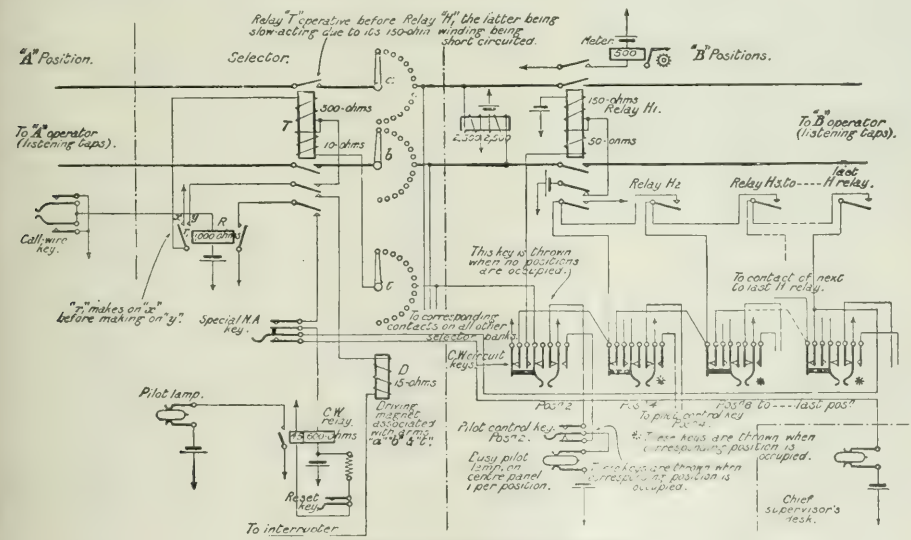



FIG. 3—DETAILS OF SELECTIVE MECHANISM

electrodynamometer in which an entirely different means of obtaining the same end is employed. Evidently the ultimate requisite in an instrument for transferring from alternating to direct current is that the torque shall be the same, and it is immaterial whether we make the current distribution the same or the field due to the current the same. is required by an A operator. There are 10 call-wires in the group affected, which, before the introduction of the new conditions, were operated from 10 call-wire keys, the circuits of which were multipled over 160 A positions. When the selecting equipment was introduced the ten keys per position were replaced by one key per position. Each

connection with the same B operator at the same time. A click is heard in the A operator's receiver when a disengaged call-wire is obtained. A lamp located on the chief supervisor's desk glows when all the accessible B positions are simultaneously engaged with traffic passing over the call-wires. The continued glowing of this lamp will indicate that delay is being occasioned, the A operators having difficulty in finding a free B operator, and that, therefore, additional B positions should be staffed to cope efficiently with the traffic. The details of the selective mechanism are shown in Fig. 3. Each A position is provided with a selector, and each selector has associated with it two relays, an R relay and a T relay. The contact banks of the selectors are multipled together and are connected to the group of B positions, so that each B position is represented on each bank by a separate set of contacts. With each B position there is associated an H relay and a retardation coil. The *a* and *b* arms of the selectors are connected with the A operator's telephone circuits through contacts of the associated T relays, and the selector bank contacts are connected with the B operator's telephone circuits through contacts of the H relays. On the depression of a call-wire key by an A operator, the arms of that selector which corresponds to the particular position concerned commence to seek over the contact bank, and automatically come to rest on the contacts of the first accessible and disengaged B position. The T relay associated with the A position and the H relay associated with the B position are now operated, so that the two speaking circuits are connected. On the release of the call-wire key on the A position the selector arms do not move from the position occupied. The T and H relays are, however, released, and disconnect the A operator's telephone circuit from the B operator's circuit. During the time the call-wire is in use the T relays remain operated, and this renders the multiple contacts on the particular B position engaged against the other selectors by reducing the potential on the *t* contacts from 22 volts to nearly earth potential. The T relays of other selectors whose arms may pass over these contacts, therefore, will not be operated. When a B position is rendered inaccessible to the selectors by the B position call-wire key being normal, the battery is disconnected from the *t* contacts corresponding to the position so that in this case also the T relays of searching selectors will not be operated. Motor interrupters are used for supplying the interrupted current to drive the selectors.—London *Electrician*, June 13, 1913.

### Miscellaneous

*Lightning Rods.*—S. RUPPEL.—A report to be presented at the annual convention of the German Association of Electrical Engineers on the protection of buildings against lightning. The author emphasizes that there are still many regulations concerning lightning rods in existence which make their construction and maintenance difficult. For this reason the number of buildings provided with lightning rods is still small, and this is especially true in agricultural districts. Since 93 per cent of all the damage done by lightning occurs in agricultural districts, lightning rods should be provided there. The largest part of the damage done—about 92 per cent—is due to fires caused by lightning which could have been prevented by very simple lightning rods. Simple lightning rods could be constructed anywhere if the rules of the Berlin Electrical Society were followed. Municipalities should erect them. *Elek. Zeit.*, June 5, 1913.

*Electric Shock.*—J. P. LANGLOIS.—A long discussion on accidents by electric shock and electric execution, dealing especially with the effect of the voltage, the current, the resistance of the body, the time of contact, the position of the electrodes, the frequency, etc. Notes are added on the treatment and the revival of people suffering from electric shock.—*Revue Gén. des Sciences*, April 30, 1913 (abstracted in *La Lumière Élec.*, May 31, 1913).

*Kareis.*—An obituary notice of Josef Kareis, one of the founders and the first secretary of the Electrical Society of Vienna.—*Elek. und Masch.* (Vienna), June 1, 1913.

# Book Reviews

WIRING DIAGRAMS OF ELECTRICAL APPARATUS AND INSTALLATIONS. New York: McGraw-Hill Publishing Company. 439 diagrams. 254 pages. Price, $2.

A collection of circuit diagrams, taken from actual practice, representing more or less completely all branches of the electrical art except telephony and telegraphy. Armature winding is not included, as the publishers state that it would occupy too much space. Obviously the material has been gathered almost entirely from manufacturers' bulletins, but it embraces in a single publication drawings obtained from a large number of sources. The subjects covered are generators, feeders, transformers, regulators, converters, batteries, boosters, substations, motors, motor control, distribution, lamp mechanisms, rheostats, controllers, arresters, instruments, circuit-breakers, railway signals and interior wiring. The drawings almost without exception are clear and distinct. Where they are not entirely self-explanatory a brief text is added. This volume should be of considerable service to the practising electrical engineer.

LA TÉLÉGRAPHIE ET LA TÉLÉPHONIE SIMULTANÉES ET LA TÉLÉPHONE MULTIPLE. By K. Berger. Translated into French by P. Le Normand. Paris: Gauthier-Villars. 134 pages, 111 illus. Price, 4.5 francs.

A treatise on simultaneous telegraphy and telephony as well as on multiple telephony, from the standpoint of the engineer. The presentation is according to the telegraph-telephone systems of the German government. A very brief historical sketch of the subject is given in the introduction. The work is then divided into two sections, namely, (1) simultaneous telegraphy and telephony, (2) multiple telephony, or simultaneous multiple telephonic conversation over a circuit or group of circuits, with special reference to phantom circuits. Various arrangements which have been developed in America are not referred to in the book, which is confined to German systems. The treatment is very practical and detailed, however, with respect to those systems. The book will recommend itself to telegraph and telephone engineers interested in European systems.

BOOK OF STANDARDS. 1913. National Tube Company, Pittsburgh, Pa. 559 pages, illus. Price, $2.

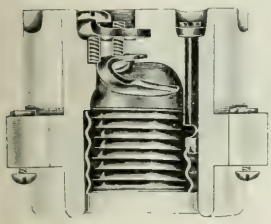
This volume contains tables and useful information pertaining to tubular goods as manufactured by the National Tube Company. It is got up in regular handbook style, the mechanical work being excellent. Besides a great many practical data on piping and tubing for all uses, there are 140 pages on tubular wrought-steel poles; also data on tubular columns, tubular and solid beams, flow and measurement of water, physical properties and flow of gases, steam and air, tables of the properties of tubes and bars, and conversion tables. Other useful features are a glossary of terms used in the pipe and fitting trade and an extended list of definitions. The volume is well indexed. One of the commendable features is the practice of giving the source or authority for the engineering data presented. Altogether this makes a very handy volume for the engineer who needs data on piping or tubing more or less frequently in his work.

# New Apparatus and Appliances

**An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers**

## Receptacle Socket

A new receptacle illustrated herewith has been brought out by the Chi-Ill-Electric Company, 5124 North Ashland Avenue, Chicago. It consists of a porcelain receptacle and a galvanized-steel conduit-box cover made in 3-in. and 4-in. sizes to fit all standard conduit boxes. A yoke is placed under the shoulder of the porcelain receptacle, clamping the steel cover to the porcelain and also acting as a reinforcement to the latter. A brass finishing cover is placed over and fastened to the steel cover.



RECEPTACLE SOCKET

The screw shell is fastened to the porcelain by means of legs to which the shell is riveted. These legs extend through the porcelain and are connected to riveted and soldered contacts on the back of the socket. Other types of receptacles are made without the galvanized-steel cover and without the finishing plate, a plain polished brass cover taking the place of the steel cover and finishing plate. Plain brass plates are made in 3-in. and 4-in. sizes to fit standard outlet boxes.

A valuable feature characterizing the Chi-Ill socket is the distance that is provided between the polarities. The contacts of the device are so arranged as to give easy access to the wiring.

## All-Porcelain Socket

In the all-porcelain socket shown in the accompanying illustration a quick make-and-break switch mechanism is used, which accounts in part for the high 660-watt, 250-volt rating secured. This switch is smaller than the socket which it supersedes, and is easier to install. The casing consists of two halves, to one of which the mechanism is permanently attached. To wire the socket only one screw need be removed, allowing the halves to be separated. This makes accessible the two binding screws to which the cord is attached. A reducing bushing for the cord is supplied and provision made for standard-socket shade holders. The indicating operating bar is situated where the thumb and finger are naturally placed when grasping the socket. As the push-bar is in a horizontal plane, the socket is not twisted or jarred when operated, and only one hand is required.



PORCELAIN SOCKET

The 660-watt rating makes this push-button socket particularly suited for use with heating and cooking appliances and small motor-driven devices. As there is also a demand for a porcelain socket of this kind for fixture work, it is

Manufacturing Company, of Milwaukee, contemplates the marketing of such a model with 0.125 in., 0.25 in. and 0.375 in. brass nozzles.

## Motor-Driven Typewriter

The motor-driven typewriter and adding machine, illustrated herewith, is manufactured by the Crawley Company, 185 Madison Avenue, New York City. Although it is driven by an electric motor contained within the case, the entire action is purely mechanical, and in this respect the machine differs widely from all previous attempts to produce an electric typewriter, as there are no contacts to be made and broken. The motor runs continuously, driving a belt, which belt in turn drives a jack-shaft to which the type-bar operating mechanism is attached. The carriage throw-back, line space and adding mechanism (which last named is contained in the same case) are all likewise electrically driven.




MOTOR-DRIVEN TYPEWRITER

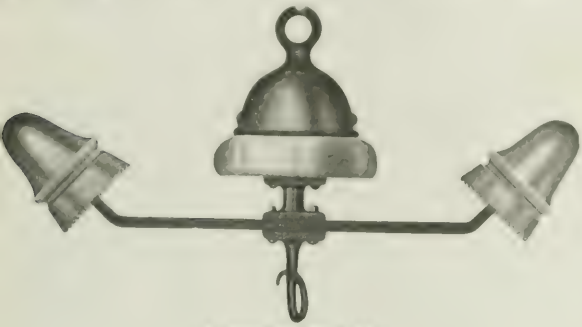
The idea has been, as the manufacturers point out, to supply electrical energy, which is cheap, to take the place of human energy, which is costly. It is estimated that on the Crawley electric typewriter the stenographer annually saves some 300 miles in distance traveled by her fingers, to say nothing of the energy conserved. This is due to the fact that the type-bar action is virtually set on a "hair-trigger" like an automatic gun or like a linotype machine and the depression of the keys is but 3/16 in. as compared to 5/8 in. on the manually operated typewriter.

An additional feature is found in the small lever on the side of the machine by which the tension on the actuating spring may be strengthened, thus making the blow of the type harder for carbon work.

The motor is of a special type designed and manufactured by the Westinghouse Electric & Manufacturing Company after considerable investigation and exhaustive testing of

## Arc-Lamp Hanger

The important feature of the arc-lamp hanger recently brought out by the Line Material Company of South Milwaukee, Wis., lies in the fact that even though the insulator be broken the lamp cannot be dropped. A transverse



HANGER FOR ARC LAMP

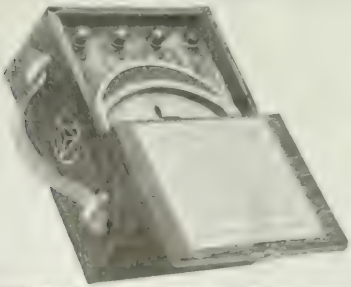
3/4-in. rivet, which passes under a malleable-iron yoke connecting two vertical bolts, blocks the fall of the yoke to which the pigtail lamp hook is secured. It is stated that the insulation will resist a pressure of 20,000 volts.

## Portable Phase-Rotation Indicator

When installing polyphase motors, generators, meters, etc., it is frequently found that the direction of rotation is reversed owing to the transposing of windings or leads which cause incorrect phase rotation. This is especially true when motors or meters are connected up by the construction men, who frequently find it necessary to reverse leads and cables.

Changes in shop or distribution circuits causing accidental reversal of phase may cause serious damage if the men installing the equipment do not check out the phase position. The process of confirming these positions is somewhat difficult for the ordinary man to understand, as it involves the use of complicated connections and phasing lamps. When it is absolutely necessary to have motors start in the correct direction, such as on presses, elevators and certain shop tools, it is essential that the phase rotation be predetermined.

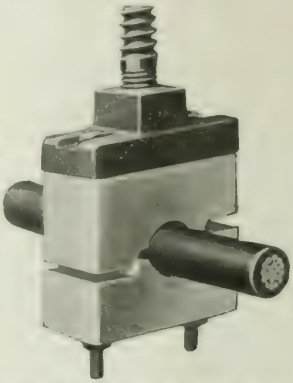
The portable phase-rotation indicator illustrated here-



with indicates on the dial the phase position in polyphase circuits. Its connection to the circuit requires no more experience than is necessary to connect up a voltmeter. Deflection of the pointer to the right or left indicates the phase position, enabling the correct installation of equipment initially. This indicating instrument is manufactured by the

## Cable Hanger for Mine Service

A cable hanger to facilitate the hanging of feeders in mines has recently been placed on the market by the Electric Service Supplies Company, of Philadelphia, Pa. These hangers are designed for holding cable of from 0.5 in. to



CABLE HANGER WITH CABLE IN PLACE

1 in. in diameter inclusive and permit the placing or removal of the cable after the hanger has been permanently installed. As shown in the illustration the hanger consists of two split porcelain insulators notched and fitted together to receive the cable. The porcelain insulators are fastened together with bolts extending through the cast-iron head. The clamping surface of the insulators is ribbed to prevent any tendency of the cable to slip through the clamp and damage the insulation. These hangers, which are 3.25 in. wide and 4.5 in. high, are supported by galvanized lag-screws or expansion bolts.

## Compact Turbo-Generator for Marine Use

Certain classes of marine service demand electric generators of high efficiency with minimized weight and dimensions. This class is perhaps best represented by the United States torpedo-boat destroyers, in which space and other important features are sacrificed in favor of high speed.

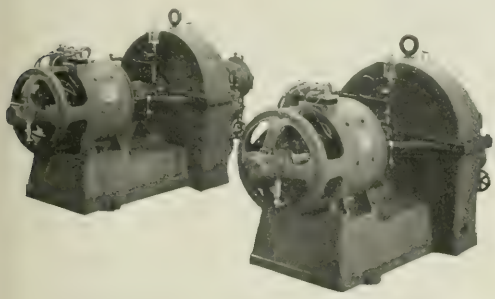
The accompanying illustration shows two turbine-driven generators recently supplied in accordance with naval requirements for destroyers. These machines are

TABLE I—RESULTS OF HEAT-RUN TESTS

| [illegible] | Temp. Deg. C. After Four-hour Full Load Run | Temp. Deg. C. After Two-Hour One-Third-Overload Run |
|---|---|---|
| [illegible] | 22.5 | 24.5 |
| [illegible] | 21.5 | 25.0 |
| Shunt field | 21.0 | 21.5 |
| Interpole coil | 17.5 | 20.0 |
| [illegible] | 30.5 | 25.0 |
| [illegible] | 30.5 | 25.0 |

rated at 10 kw, 125 volts and 3600 r.p.m., take steam at 200 lb. pressure, and are designed to exhaust against any pressure from that of 26 in. of vacuum to 3-lb. back pressure. It is stated that the maximum steam consumption under these conditions is 53.8 lb. per kw-hr. at full load. When tested for voltage regulation these sets [illegible] maximum variation of 2 volts between no load

and full load. Table I shows the temperature rise in degrees Centigrade in different parts of the machine. The temperatures in the first column were taken after a four-hour full-load run, and those in the second column after two hours' operation at 33⅓ per cent overload. The



TURBO-GENERATOR SETS FOR DESTROYER SERVICE

temperature of the surrounding air was constant at 25 deg. C.

Table II sets forth some interesting facts regarding the rough usage and heavy fluctuating loads to which these

TABLE II—GOVERNOR REGULATION

| Load Variation | Steam Pressure in Pounds, Condensing | Steam Pressure in Pounds, Non-condensing | Maximum Variation, per Cent |
|---|---|---|---|
| 90 per cent to no load | | 160 | 1.1 |
| No load to 95 per cent | | 160 | 1.78 |
| Full load to no load | | 200 | 1.1 |
| No load to full load | | 200 | 1.9 |
| Full load to no load | 200 | | 2.5 |
| No load to full load | 200 | | 1.4 |
| Full load to 20 per cent load | 200 | | 0.8 |
| 20 per cent load to full load | 200 | | 1.6 |

sets may be subjected and still remain within the specified limits of voltage regulation. The net weight of the set is 1350 lb. The generator was built by the Diehl Manufacturing Company, of Elizabeth, N. J., and the turbine by the Terry Steam Turbine Company, of Hartford, Conn.

## Motor-Driven Blowers for Ventilating

It is said that every grown person needs 3600 cu. ft. of fresh air every hour, and without this amount may suffer lowered vitality and reduced efficiency for accurate work.

In the accompanying illustrations are shown two applications of motor-driven blowers for office ventilation. In the Pennsylvania Railroad station at Pittsburgh the ventilating problem was solved economically by installing in each office a small motor-driven ventilating set such as the one seen in Fig 1. The set is placed on the floor near the radiator and draws in fresh air through the existing ducts, forcing it out through the radiator and thus filling the room with fresh warm air. Electrical energy to drive the motor is obtained from the lighting circuit. Some of the inside offices use these sets in summer as well as in winter.

Another type of installation, shown in Fig. 2, has been found convenient in the winter. In this installation a small motor-driven blower is arranged with a few pieces of piping so that fresh air is drawn from the outside and delivered against a steam-heated radiator. The intake of the blower is piped with a gate between it and the board set in the window to give access to the outside air, the blower outlet delivering the air at the top of the radiator. The air is prevented from blowing along the floor by a galvanized-iron box which surrounds the radiator on all four sides, extending from the floor to the top of the radiator. Thus the cold air is delivered at the top of the radiator in a



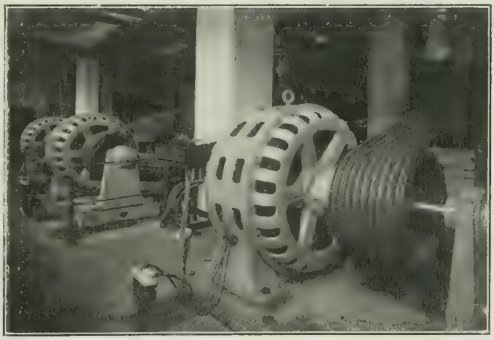
FIGS. 1 AND 2—TWO SCHEMES FOR VENTILATING OFFICES

downward current, and before it can find its way out of the box again it must rise around the radiator and become warmed. The blower shown is capable of furnishing 175 cu. ft. of air per minute, a sufficient supply for three persons. The Sirocco blowers shown in both of these installations are driven by Westinghouse motors.

## A Motor-Driven Ice and Cold-Storage Plant

The Diamond Ice Company, Seattle, Wash., which uses electric-motor drive for all its machinery, has a refrigeration equipment rated at 195 tons per twenty-four hours. One-third of this rating is used for cold storage and the remainder for the manufacture of ice. The ammonia direct-expansion system is used, and the ice is made in plates 17½ ft. by 8½ ft. by 1 ft., tank space being provided for making ninety-six such plates.

The illustration shows three 125-hp Westinghouse induction motors, each driving a 65-ton Wolfe-Rinde ammonia compressor. In addition to these, there are in use also two 4-hp motors operating cranes for raising ice from the tanks, two 7.5-hp motors on hoists above the cranes, two 4-hp motors for the tipping mechanism which handles the



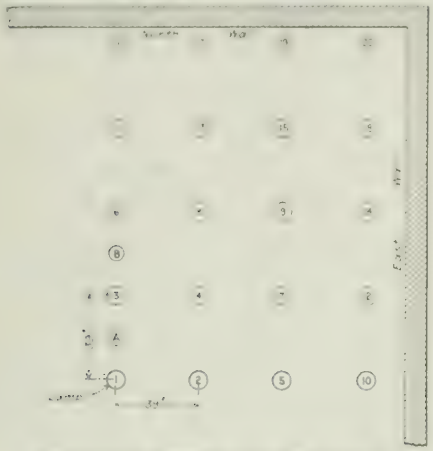
MOTOR-DRIVEN ICE AND COLD-STORAGE PLANT

ice to the sawing tables, one 4-hp motor on the saw, one 2-hp motor on a 45-ft. conveyor which raises the ice 5 ft. to the storage room, one 0.5-hp motor driving the overflow pump, one 1.5-hp motor driving the air-compressor for agitating the water in the tanks and one 15-hp motor for driving a 2-ton elevator which serves four floors.

The energy consumed by these motors last year for the

## Results of Horizontal Illumination Survey

[illegible] of the Armour Institute of Technology at Chicago in order to determine the efficiency of the system of indirect illumination installed there have brought out interesting data. The room was 14.5 ft. in height, 23 ft. in width and a little more than 27.5 ft. in length. The ceiling of the



[illegible] AND TEST STATIONS

room was finished in cream white and the walls were of a dark tan color. A corner of the room showing the arrangement of the test stations and the position of the lamp is shown in an accompanying illustration. The survey was [illegible] this corner of the room and readings were taken

[illegible] DATA TAKEN WITH REFLECTOR

| [illegible] | Intensity. | [illegible] | [illegible] |
|---|---|---|---|
| [illegible] | [illegible] | 112 0 | 0 81 |

from the different stations as shown in the data of Tables I, II, and III.

The lighting unit employed in all of the tests was a 500-[illegible] tests a 24-in. Alexalite diffuser furnished by the Central Electric Company of Chicago was interposed to provide the indirect illumination. All readings were taken with a Sharp and Millar photometer.

In the first test, the results of which are given in Table I, the working plane was taken 31 in. above the floor and readings were taken consecutively for each station as

TABLE I—DATA TAKEN WITHOUT REFLECTOR

| [illegible] | Intensity. [illegible] | Average Volts | Corrected Intensity [illegible] 112 Volts |
|---|---|---|---|
| [illegible] | [illegible] | 112 8 | 3 40 |
| [illegible] | [illegible] | 112 5 | 4 [illegible] |
| [illegible] | [illegible] | 112 2 | 3 87 |
| [illegible] | [illegible] | 112 8 | 2 [illegible] |
| [illegible] | [illegible] | 113 0 | [illegible] |
| [illegible] | [illegible] | 112 [illegible] | [illegible] |
| [illegible] | [illegible] | 112 3 | [illegible] |

shown by the data. The average observed intensity was later corrected on a 112-volt basis to facilitate comparison. The average intensity was found to be 1.74 ft.-candles on the working plane, and with an available 1105 lumens as the effective flux, the number of lumens per watt on the working plane was 2.17.

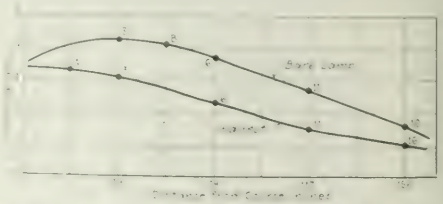
The second test was made with the bare tungsten lamp and with the working plane as before, 31 in. above the floor. The results of this test are given in Table II, and comparison of the direct and indirect lighting is drawn in the

TABLE III—EFFECT OF VARYING HEIGHT OF WORKING PLANE

| [illegible] | [illegible] Working Plane [illegible] | [illegible] [illegible] |
|---|---|---|
| [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] |
| [illegible] | 13 [illegible] | 15 00 |
| [illegible] | 11 [illegible] | 11 00 |

curves presented in Fig. 2. The results given in Table III show the effect of varying the height of the working plane when the lamp is fitted with the same diffuser used in the first test.

Interesting facts are brought out by a comparison of the results shown in Tables I and II. By consulting data or curves it may be seen that the intensity of the illumination




[illegible] COMPARISON OF DIRECT AND INDIRECT LIGHTING

directly beneath the unit is the same with the diffuser interposed as it is with the bare lamp. With this system of indirect lighting the brightest point in the room is directly beneath the unit, the intensity dropping off as the test stations recede from the center of the room. It would seem at a glance that there should be a dark spot beneath the unit, but the results show that this is not the case.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Electrical Heating Specialties Exported.**—The William E. Slaughter Company, of 1712 Michigan Avenue, Chicago, Ill., manufacturer of the Schwartz line of electrical specialities, states that a large shipment of these heating devices has just been sent to South America. The company will shortly put on the market a new electric curling iron.

**Transformer Orders Continue Good.**—Advices come from the Moloney Electric Company, of St. Louis, Mo., manufacturer of transformers, that both its Canadian and its St. Louis factory are well supplied with orders and are working about four nights a week. The company says that the business booked at this date is about three times the amount booked at the corresponding date last year.

**Rehabilitating Rotten Poles.**—A brief note of general interest comes from the Illinois Electric Company, of Chicago, Ill., in which it says: "Our sales force finds that the Orr process of pole reinforcement is rapidly increasing in popularity. This method of repairing butt-rotten poles is being adopted by many of the larger telephone and electric light companies and is fast coming into general use."

**Rheostats for Battery-Charging Switchboards.**—The Fashion Automobile Station, at 4610 Cottage Grove Avenue, Chicago, Ill., has recently installed two new battery-charging boards, the first of which was equipped with thirty circuits and the second with forty-five circuits. Compression-type resistance rheostats made by the Allen-Bradley Company, of Milwaukee, Wis., were used throughout this installation.

**Insulator Company Enlarges Its Plant.**—The Pittsburgh High-Voltage Insulator Company, of Derry, Pa., writes as follows: "The demand for our product has made necessary the building of additional kilns and the increasing of our floor space. We have one new kiln completed and in operation and two more in process of erection. A new building measuring 90 ft. by 200 ft. has been completed and work has been started on another building 40 ft. by 540 ft. in size."

**Paint Factory Buys Equipment.**—The James Clark, Jr., Electric Company, of Louisville, Ky., recently sold to the Chicago White Lead & Oil Company seven motors for use in the paint and lead factory of the latter company, these motors ranging in size from 10 hp to 50 hp. The same company will furnish the electrical equipment to be installed by the Eminence Distillery Company, of Eminence, Ky., consisting of an engine and generator, with a number of motors.

**Motor Drive for Veneer Mills.**—The Astoria Veneer Mills & Dock Company, of Long Island City, N. Y., is installing a 360-hp De Laval mixed-pressure steam turbine driving an Allis-Chalmers 240-kva alternator. Two motors of the latter make are already ordered, one of 60-hp and another of 7½-hp rating, which will be used for driving veneer-making machinery. The generating unit has ample capacity to care for future additions to the drive equipment. A 600-amp Krantz switchboard is also to be supplied for this installation.

**Fixture Business Has Excellent Outlook.**—According to the Philadelphia Electrical & Manufacturing Company, the business outlook in its line for the summer months is excellent. A contract has just been closed with the Albany & Northern Railway Company, at Albany, N. Y., for 900 sets of street-lighting fixtures to be used on ornamental iron poles. Announcement is also made of the fact that new price lists, Nos. 18, 19, and 20, are just out, covering street-lighting fixtures, tungsten arc lamps, lighting standards and line material only.

**Pittsburgh Company Growing.**—Word is received from the Elliott Company, of Pittsburgh, Pa., to the effect that the increase in its business has been so rapid as to render its present quarters entirely inadequate. To meet the extra requirements this company has purchased the 33 acres and plant at Jeannette, Pa., owned formerly by the Clifford Cappel Fan Company. By this purchase the Elliott Company will secure about 2½ acres of additional floor space, and it is expected that the new plant will be thoroughly overhauled and modernized and ready for operation by the first of October.

**Testing Batteries in Demand.**—The testing batteries manufactured by E. Marcuson, of 136 Liberty Street, New York, are now being used not only as portable outfits but also in laboratories in connection with cable-testing sets. They have been improved recently, as noted in the *Electrical World* of June 28, by the addition of a new form of commutating switch, which has been devised for obtaining various voltages at the terminals. Orders for these testing batteries have recently been received from the Edison Electric Illuminating Company, of Boston, Mass.; Rensselaer Polytechnic Institute, Troy, N. Y.; United States Signal Corps; Waterbury Company, of New York, and others.

**Activity of the Wire Inspection Bureau.**—Reports from the Wire Inspection Bureau, 80 Maiden Lane, New York, indicate that a considerable quantity of copper-steel wire and a fair amount of railway signal and transmission line wire are being inspected; also moderate quantities of high voltage isulators, steel towers and hydroelectric machinery, much of the work on the latter two items being for the government. The bureau is introducing a system for the purchase of high-grade rubber-covered wire to individual specifications and taking into consideration the manufacturer's reputation, with an inspection service that includes not only the regular factory inspection but also a series of follow-up and identification tests. It is stated that this plan is operating successfully.

**Generating Apparatus for Private Estate.**—Fairbanks, Morse & Company, of 30 Church Street, New York, are supplying a 15-hp gasoline engine directly connected to a 10-kw direct-current generator for use on the estate of Walter Williams, at Montclair, N. J. The energy supplied will be used for illuminating and for operating air compressors, the latter in turn furnishing air for pumping in connection with a large artificial lake on the estate. The Electric Storage Battery Company, of Philadelphia, is supplying the storage battery set, which consists of sixty-two "chloride accumulator" cells and eight counter-electromotive-force elements with auxiliaries, and is known as its standard Type A 110-volt isolated-plant equipment. The switchboard is being furnished by the Trumbull Electric Manufacturing Company, of Plainville, Conn.

**Several Companies Install Waterwheels.**—Forty vertical turbine units are being built by the Camden Waterwheel Works, of Camden, N. Y., for installation on the New York State Barge Canal, and the same company is building the headgates for the locks on this canal. The turbines are to be directly connected to generators of the same type and will be controlled by the Lombard governors, made by the Lombard Governor Company, of Ashland, Mass. The energy generated will be supplied to the motors which operate the lock gates, and also to the lamps along the canal. In addition to the above units, this company is at present furnishing a 2500-hp horizontal turbine to the Rochester (N. Y.) Railway & Light Company (to be directly connected to a generator), a quadruplex unit and a duplex unit to the St. Regis Paper Company, of Watertown, N. Y., and one duplex unit to the Taggart Brothers Company, of the same place.

**Supply Dealers and Central Stations of Louisville, Ky., Co-operate.**—[illegible] installation [illegible] among the [illegible] supply dealers of Louisville [illegible] past years by the [illegible] Lighting Company and the [illegible] Company in selling [illegible] and lamps at cut prices through the elaborate and expensive appliance departments which they maintained. The above companies are shortly to be merged into the Louisville Gas & Electric Company, which will control and operate the public utilities of Louisville. This new concern will not compete with local dealers for the appliance business, but will simply carry samples and take orders for them, which will be turned over to the dealers, according to a plan arranged by a committee [illegible] the dealers and the [illegible] of the company.

**Fairbanks-Morse Electrical Equipment for Carborundum Works.**—Additional electric generating and drive equipment [illegible] to be installed at the plant [illegible] Manufacturing Company, of Chester, Mass. This will consist of a four-valve engine, of Fitchburg Steam Engine Company make, directly connected to a 125-kva Fairbanks-Morse alternator, which will supply energy to six motors of the latter company's manufacture, ranging in size from 10 hp to 75 hp. This apparatus will furnish power for driving machinery in a new extension to the present plant, 500 ft. by 60 ft. in dimensions and three stories in height. A 600-amp switchboard is being furnished for the same installation by the Condit Electrical Manufacturing Company, of Boston, Mass., and there is to be an extra panel for motor circuits. Weston Model 24 instruments are to be installed on the switchboard. The wiring is to be placed in exposed conduits.

**Lock-Gate and Valve-Operating Mechanisms Supplied.**—In addition to the contract held jointly with the Hyde Windlass Company, of Bath, Me., for supplying gate and valve-operating mechanisms for the New York State Barge Canal work (mentioned in the June 21 issue of the *Electrical World*), the Wheeling Mold & Foundry Company, of Wheeling, W. Va., sends word that it has just finished some big government work of a similar nature. It recently completed the delivery at the Isthmus of Panama of ninety-two miter-gate-moving machines, 118 rising-stem gate-valve-operating mechanisms and forty-five miter-gate forcing machines, all electrically driven and comprising, aside from the electrical equipment, the entire operating mechanism of the Panama Canal locks. At present the company is making the steel castings for ninety towing locomotives for use at the canal. For these the General Electric Company is supplying the electrical equipment.

**Stage and Auditorium Lighting Apparatus Selling Well.**—From the Universal Electric Stage Lighting Company (Kliegl Brothers), of 240 West Fiftieth Street, New York, an optimistic statement is received concerning their business outlook. They say: "Although most theaters are now closed for the summer, we are unusually active and are furnishing material for two new local theaters, the Shubert and the Ames Gotham, as well as for the Toronto (Canada) Theater. A number of shipments of theatrical appliances have been made by us recently to Australia, in preparation for the coming season. The outlook is extremely bright. We have lately supplied apparatus to the Albany (N. Y.) High School, including border lamps and a curved footlight, 40 ft. long and wired for 192 lamps in three colors. This footlight is of the disappearing type, resting beneath the floor level and covered with temporary flooring for ordinary occasions, and being raised for special entertainments to a height of 7 in. above the floor level, in order to allow the light to spread evenly at the performers' feet and at the back drop. Several hundred feet of concealed lighting strips were used in this auditorium."

**Toledo Utility Company Increasing Its Equipment.**—From the Toledo Railways & Light Company comes the following letter relative to the installation of new equipment of various kinds at its plant: "We are installing a 12,500-kw horizontal Curtis Rateau steam turbo-generator set, together with five 660-hp Stirling water-tube boilers (supplied by the Babcock & Wilcox Company and noted in the June 21 issue of the *Electrical World*), one additional 250-ft. steel stack, 15 ft. in diameter, and a 1500-kw Westinghouse frequency-changer set, 25-60 cycle. We are contemplating the installation of a 2000-kw, three-wire direct-current motor-generator set, 25 cycles on the alternating-current side. A radial brick chimney 200 ft. high and 12 ft. in diameter is being built at our Detroit Avenue station by the Kellogg company. Several transforming substations are in process of erection, ranging from 300 kw to 1500 kw capacity, for use in supplying new energy consumers. Work will start shortly on a 33,000-volt transmission line, which will extend completely around the city of Toledo, to supply energy to the industries in the outlying districts. From this high-tension power belt energy will also be drawn for operating the interurban railways."

**Sturtevant Economizers in Wide Demand.**—An economizer shipment of unusual size and interest was recently made to the Commonwealth Edison Company, of Chicago, by the B. F. Sturtevant Company, of Hyde Park, Mass. These economizers are for use on unit No. 12 at the Fiske Street station and will be installed in four sections, one for each boiler. Induced draft will be provided by four No. 14 Sturtevant Multivane exhaust fans equipped with water-cooled bearings and directly connected to 75-hp induction motors. The fans discharge into a stack 19 ft. in diameter and 260 ft. high above the boiler-room floor. Each boiler contains 12,260 sq. ft. of heating surface and 3000 sq. ft. of superheating surface. The boilers are equipped with two chain-grade stokers containing 136 sq. ft. of surface each. Each boiler is capable of evaporating a maximum of 80,000 lb. of water per hour, with feed water at 250 deg. Fahr., into steam at 210 lb. pressure, 225 deg superheat. About 13,000 lb. of Illinois slack coal will be burned per hour. Among the other companies which have recently ordered Sturtevant economizers are the Cleveland Electric Illuminating Company, of Cleveland, Ohio; the Southern California Edison Company, of Los Angeles, Cal.; the Delaware & Hudson Railroad Company, and the Rochester (N. Y.) Electric Light Company, to which concerns shipments aggregating 31,200 hp have been made.

**Recovery of Secondary Metals in 1912.**—In the following table is shown a comparison between the quantities and estimated values of "secondary metals" recovered in this country in the years 1911 and 1912. The above classification includes the copper, lead, zinc, tin and antimony recovered from scrap metal, sweepings, skimmings, drosses and foundry wastes. The figures are found in a report of the United States Geological Survey. While for many purposes these secondary metals cannot take the place of the "primary metals" (those obtained direct from the ores) they form an important part of the total domestic supply as shown in the last column of the table where are given the percentages of the total supply which the secondary metals constituted in 1912:

PRODUCTION OF SECONDARY METALS IN THE UNITED STATES IN 1911 AND 1912

| Metals | 1911 Short Tons | 1911 Value | 1912 Short Tons | 1912 Value | Per Cent |
|---|---|---|---|---|---|
| Secondary copper, includ- | | | | | |
| [illegible] | 93,845 | $12,711,250 | 66,441 | $21,543,325 | 17 |
| [illegible] | 80,370 | 16,874,400 | 101,523 | 27,279,516 | .. |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | 24,288 | 4,882,800 | [illegible] | [illegible] | [illegible] |
| [illegible] | 24,288 | [illegible] | 30,[illegible] | [illegible] | [illegible] |
| [illegible] | 44,774 | 5,464,800 | 52,251 | 7,780,400 | 2[illegible] |
| [illegible] | [illegible] | [illegible] | 3,912 | [illegible] | [illegible] |
| [illegible] | [illegible] | 12,353,[illegible] | [illegible] | 14,301,368 | 2[illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | 35,[illegible] | [illegible] | 26,020 | [illegible] |
| [illegible] | 889 | [illegible] | 2,493 | [illegible] | [illegible] |
| Total value..... | | $52,585,390 | | $77,[illegible] | |

**Electrical Domestic and Office Supplies.**—The following companies are in the market for electrical supplies and appliances for domestic and office use, such as heaters, cookers, fans, irons, etc.; also for electric-railway supplies, work-shop plant and tools: Pará Electric Railways & Lighting Company, Ltd., Caixa No Correio No. 29, Pará, Brazil; Manáos Tramways & Light Company, Ltd., Caixa No Correio No. 148, Manáos, Brazil; Venezuela Electric Light Company, Ltd., Apartado 175, Caracas, Venezuela; Compañia de Luz y Fuerza Motriz de Cardoba, Calle Rivera Indarte 155, Cardoba, Argentine Republic; Compañia Luz y Fuerza de Parana, Parana, Entre Rios, Argentine Re-

public; Compañia de Electricidad de Merida, S. A., Apartado Postal 193, Merida, Yucatan, Mexico, and the North Melbourne Electric Tramways & Lighting Company, Ltd., of Mount Alexander Road, Ascot Vale, Victoria, Australia. Manufacturers of the above-mentioned apparatus are invited to send catalogs descriptive of the same together with prices and discounts, addressing the manager of the company in each case.

**Middle West Utilities Company Buys Kentucky Property.**—The Kentucky Utilities Company, one of the subsidiaries of the Middle West Utilities Company, has purchased the property of the Cumberland Light & Ice Company, of Pineville, Ky., and is said to be negotiating for other public-utility properties in the State. It is said that a large central generating plant will be built at Winchester.

**Water Supply to Generate Electric Energy.**—It is proposed that the portion of the water supply to Madrid, Spain, which is brought to the city by the Isabel II Canal be utilized for the production of electricity, and it is estimated that 3000 hp could be developed in this way. Until recently there has been fierce competition between the companies supplying electric energy to that city, but a consolidation of interests has caused the rates to advance to a very high figure.

**Electrical Trade in Great Britain During 1912.**—A recent report from the Consular Service states that the electrical trade in Great Britain in 1912, while not particularly large in volume, was very satisfactory in the promise it gave of future expansion of the industry. An increased use of electrical energy in the colliery districts and in the shipbuilding industry together with the growing demand for electric trucks and domestic appliances is taken to indicate a general period of activity and prosperity for the electrical trade in the future.

**Electrical Installations in Big New York Buildings.**—L. K. Comstock & Company, of 30 Church Street, New York, are at present engaged in equipping three large buildings now under construction in New York City. The Western Union Building, at Dey Street and Broadway, will have an isolated plant, as will the factory of the Loose-Wiles Biscuit Company, at Thomson Avenue and Meadow Street, Long Island City, of which mention was made in the *Electrical World* of June 28. Supplementing the previous note, it may be stated that at the last mentioned plant the wiring is to be placed in exposed conduits and arranged for four panels per floor, with a maximum of six outlets per circuit. There will be in all about 4000 single-lamp interior outlets, and another 4000 lamps will supply the exterior illumination. At the new building of the Consolidated Gas Company the wiring is to go into concealed conduits and the switchboard, supplied by the Metropolitan Engineering Company, of New York, is to be built right into the tiled wall of the operating room, ample space being left at the back of the board for inspection and repair work. In the part of this building to be occupied later by the gas company, combination gas and electric fixtures are to be installed, with the gas burners arranged for automatic electric ignition.

**Development of the Lens Sign Business.**—The American Sign Company, of Kalamazoo, Mich., which makes the "American Lens" electric signs, has just moved into its large new factory at the corner of Willard and Cooley Streets in Kalamazoo and extending nearly the entire block from Cooley Street to West Street. This company says that it has the largest establishment exclusively devoted to the manufacture of electric signs in the country. It began its career in 1908 and the business has grown rapidly from the start. Last October the capital stock was increased to $150,000. The new factory provides over 30,000 sq. ft. of floor space and is provided with the latest time-saving and sanitary conveniences. Electric welding is used in making the frames of the signs. One of the features of the building is a display room for the exhibition of a large number of signs of different design. By means of a switchboard any desired sign can be illuminated. The "American Lens" sign is illuminated from the interior by electric incandescent lamps through the Meniscus "searchlight" lenses, for which the company owns the patents. The lenses transmit the light rays in nearly parallel lines, preserving the outline of the letters or design and preventing blurred effects. The company asserts that it saves the purchaser 80 per cent in the cost of electricity for operation as compared with all-lamp signs. A specialty is made of novelty flashing effects. The electrically illuminated great seal of the United States displayed on the Capitol in Washington during the inauguration of President Wilson last March was made by this company. C. M. Davis, the president and general manager of the company, has held that position since the start. H. F. Coon, of Detroit, is vice-president and treasurer, and W. R. Fox is secretary. These gentlemen, together with F. K. Root, the auditor, and N. J. Baumann, assistant superintendent, constitute the board of directors. Edward Baumbeck is superintendent and Benjamin Close is sales manager. The company has a branch factory in New York and contemplates the establishment of branches on the Pacific Coast and in the South.

**Stoker Sales Active Lately.**—From a statement made the latter part of last week by the American Engineering Company, of Philadelphia, Pa., concerning the sales of its Taylor stokers, it would appear that the demand for this apparatus has not suffered any decrease through tariff agitation or any other cause. Among the electrical concerns which have recently purchased these stokers are the General Electric Company, West Lynn, Mass.; Montreal (Canada) Light, Heat & Power Company, United Illuminating Company, of New Haven, Conn.; Detroit Edison Company, of Detroit, Mich.; Philadelphia (Pa.) Electric Company, and Elmira (N. Y.) Water, Light & Railroad Company. A number of railroad and industrial companies have also bought stokers of this type recently, including among others the New York, New Haven & Hartford Railroad Company, Cos Cob, Conn.; Boston (Mass.) Woven Hose & Rubber Company; American Brass Company, Waterbury, Conn.; Bay State Street Railway Company, Chelsea, Mass.; Tremont & Suffolk Mills, Lowell, Mass.; Cochran Chemical Company, Boston, Mass., and the Dominion Iron & Steel Company, Sydney, N. S.

## Industrial Securities

| Security | Capital Stock Listed | DIVIDEND Per Cent | Period | QUOTATION June 25 | July 1 |
|---|---|---|---|---|---|
| Allis-Chalmers, t.r., 5th pd | $19,800,000 | | | 7¼ | 6⅞* |
| Allis-Chal., pf., t.r., 5th pd. | 16,050,000 | | | 14 | 14 |
| Amalgamated Copper | 153,887,900 | 1¼ | Q | 64⅜ | 65⅛ |
| American Tel. & Tel. | 344,471,400 | 2 | Q | 128½ | 127½ |
| Electric Storage Battery, c. | 16,074,425 | 1 | Q | 45½ | 46½ |
| General Electric | 101,363,600 | 2 | Q | 137½ | 135½ |
| Mackay Cos., c | 41,380,400 | 1½ | Q | 83 | 89* |
| Mackay Cos., pf. | 50,000,000 | 1 | Q | 68 | 68* |
| Western Union Tel. | 99,747,600 | ¼ | Q | 61½ | 62 |
| Westinghouse, E. & M., c. | 34,496,400 | 1 | Q | 60 | 58⅜* |
| Westinghouse, E. & M., pf. | 3,998,700 | 1¼ | Q | 109 | 109* |

*Last price quoted.

### NEW YORK METAL MARKET PRICES

| | June 24 Bid. | June 24 Asked. | June 30 Bid. | June 30 Asked. |
|---|---|---|---|---|
| Copper. | | | | |
| Standard, spot | 13.62½ | | 13.87½ | |
| | £ s d | | £ s d | |
| London, standard, spot | 63 15 0 | | 64 2 6 | |
| Prime Lake | | 14.75 | | 14.87½ |
| Electrolytic | | 14.50 | 14.50 | to 14.62½ |
| Castings | | 14.37½ | 14.37½ | to 14.50 |
| Copper wire base | 15.75 | to 16.00 | 15.75 | to 16.00 |
| Lead | | 4.35 | | 4.35 |
| Nickel | 40.00 | to 45.00 | 40.00 | to 45.00 |
| Sheet zinc, 1 to 1 smelter | | 7.25 | | 7.00 |
| Spelter, spot | 5.15 | to 5.20 | 5.30 | to 5.35 |
| Tin, spot | 43.25 | to 43.75 | 42.50 | to 42.75 |
| Aluminum | | | | |
| Prompt delivery | 23.00 | to 24.00 | 23.00 | to 24.00 |
| Future | 22.00 | to 23.00 | 22.00 | to 23.00 |

### OLD METALS

| | | |
|---|---|---|
| Heavy copper and wire | 13.50 | 13.50 |
| Brass, heavy | 8.75 | 8.75 |
| Brass, light | 7.75 | 7.75 |
| Lead, heavy | 4.25 | 4.25 |
| Zinc, scrap | 4.12½ | 4.12½ |

### COPPER EXPORTS

| | |
|---|---|
| Total tons to June 30 | 57 |

## Business Notes

**Worcester Electric & Manufacturing Company.**—Mr. Joseph Mitchell, [illegible] manager of the Boston office of the Worcester Electric & Manufacturing Company, the latest addition to the Westinghouse [illegible]

**Lockwood, Greene & Company,** [illegible] for industrial plants, 60 Federal Street, Boston, have removed their New York [illegible] the Architects' Building, 101 Park Avenue. The New York representatives of this concern are Frank A. Wing and John M. Tracey.

**Franklin Electric Manufacturing Company.**—Mr. Thomas G. Grant [illegible] Company, Philadelphia, Pa., but will continue to represent the Franklin Electric Manufacturing Company, manufacturer of incandescent lamps, Hartford, Conn., in eastern Pennsylvania, Delaware, Maryland and southern New Jersey, with temporary offices at 1704 Arch Street, Philadelphia, Pa.

**Mr. R. W. Weekes,** of Maxwell House, Arundel Street, Strand, London, has just taken into partnership Mr. Alfred O. Kolkhorst, M. I. E. E., and the future name of the firm will be Weekes & Kolkhorst. Mr. Kolkhorst has resided for many years in Chile, acting as general manager of the Chilean Electric Tramways & Light Company, of Santiago, and of the Valparaiso Electric Tramways & Light Company. He also acted as manager of the Over Sea Electric Power Company, which furnished electricity from its hydroelectric station to the city of Santiago, Chile.

## New Industrial Companies

**The American Engine & Electric Company,** of Buffalo, N. Y., was recently incorporated under the laws of Delaware with a capital of $8[illegible]. W. H. Pyle, Wilmington, Del., chief incorporator.

**The Electric Commercial Company,** Evanston, Ill., has been incorporated with a capital stock of $6,000 to deal in electrical apparatus. The incorporators are Morris K. Levinson, E. Roesing and A. S. Dwyer.

**The Phelps Manufacturing Company,** capitalized at $10,000, was incorporated at Providence, R. I., to manufacture and sell electrical and mechanical apparatus and chemical preparations. Incorporators: E. I. Whitaker, William A. Peck and J. C. Kendrick.

**The American-Oriental Electric Appliance Company** has been granted a charter for a term of fifty years to transact a general business in electrical appliances in Honolulu, Hawaii. Capital stock, $10,000, with permission to increase capitalization to $1,000,000. The officers of the company are: H. H. Taylor, president; F. E. Thompson, vice-president; W. T. Yin, treasurer, and C. Q. Yee Hop, director.

## Trade Publications

**Electric Supplies.**—The Union Electric Company, Pittsburgh Terminal Warehouse, Pittsburgh, Pa., has recently issued a new fifty-six page discount sheet, applying to its No. 6 electrical supply catalog.

**Ornamental Posts.**—An article on ornamental street-lighting systems has been published in the form of a folder by the Electric Railway Equipment Company, Cincinnati. Various types of ornamental posts are illustrated.

**Battery Switches.**—In an eight-page leaflet printed by the Trumbull Electric Manufacturing Company, Plainville, Conn., a complete line of battery switches made by the company is shown. Brief reference is made to each type and a price list given.

**Irrigation Pumps.**—The increasing interest in the subject of irrigation makes timely and interesting the well-illustrated thirty-two-page pamphlet issued by the Goulds Manufacturing Company, Seneca Falls, N. Y., on its irrigation pumps. Illustrations are given of a number of successful installations, showing the wide variety of conditions met.

**Polerector.**—A leaflet has been issued by W. N. Matthews & Brother, St. Louis, Mo., which tells about its "polerector." By the use of this device it is claimed that two linemen and a boy to handle the team can erect in a day an average of forty to fifty poles of any length up to 50 ft.

**Appraisals.**—H. M. Byllesby & Company, Insurance Exchange Building, Chicago, through the department of examinations and reports, have issued a folder—"The Valuation Problem"—known as Department Bulletin No. 5. In this circular are set forth the facilities possessed by the Byllesby company for making valuations of public utilities.

**Fixtures.**—In a publication of the Tungstolier Works of the General Electric Company, Conneaut, Ohio, are described briefly several complete sets of fixture designs, and much information is given on the semi-indirect unit. The number dated May-June, 1913, contains twenty-four pages devoted to brief descriptive items and illustrated articles on lighting units, fixture making and holders, and hints to dealers and solicitors.

**Connectors.**—A sixty-two-page catalog, published by Dossert & Company, 242 West Forty-first Street, New York, refers to Dossert solderless connectors for solid and stranded wires and gives price lists, code words, dimensions and useful information. The different types of connectors, together with the use for which each is intended, are fully described, while the dimensions of all standard connectors are given. The catalog is well illustrated.

**Fuel Economizers.**—Two articles from engineering publications have been reprinted under one cover by the Green Fuel Economizer Company, Matteawan, N. Y., known as Bulletin No. 148. "Heating and Ventilating a Large Factory," taken from the *Iron Age*, and "Heat Transmission Through Building Walls of Corrugated Iron," reprinted from the *Engineering News*, are the articles that compose the pamphlet, which is fully illustrated with photographs and drawings.

**Control Apparatus.**—The automatic control of machine tools is the subject of a paper by Mr. H. F. Stratton, reprinted from the *American Machinist*, published by the Electric Controller & Manufacturing Company, Cleveland, Ohio, under the title "More Chips." The pamphlet describes a system for controlling motor-driven machinery, which in many cases increases the output by from 10 to 40 per cent; through the use of this apparatus more chips are made, and hence the title of the pamphlet.

**The Valuation Problem.**—The department of examinations and reports of H. M. Byllesby & Company, of Chicago, has issued its Bulletin No. 5. This bulletin relates to "The Valuation Problem." It is stated that the valuation of public-service utilities is developing rapidly into a separate and difficult profession, the mission of which is to lay the foundation for the settlement of far-reaching industrial disputes. H. M. Byllesby & Company offer their services in making valuations for railroads, public-utility companies and manufacturing enterprises.

**Stokers.**—Inclosed within an artistic cover, under the simple title "Morning," is a well-expressed reflection on the beginning of the worker's day, which leads to the statement that the stoker makes possible the laborless plant. In the morning only one person is necessary to keep the plant in operation, whereas in mills and factories thousands flock in the morning. With the use of the stoker the human element is practically eliminated. The brochure is copyrighted by the American Engineering Company, Philadelphia, maker of the Taylor stoker.

**Steam Turbines.**—The De Laval velocity-staged turbine is the subject of a well-printed 108-page pamphlet just issued by the De Laval Steam Turbine Company, Trenton, N. J. The book sets forth the history, theory and construction of this turbine. It contains a number of suggestions with diagrams for efficient utilization of the steam consumed for driving auxiliaries in large generating stations and a more efficient cycle for exhaust-steam heating and drying plants. Photographs, diagrams showing constructive features, and curves all add to the general interest of the descriptive matter.

# Personal Mention

**Mr. Charles Steele** has been appointed superintendent of ie municipal electric-lighting plant at Kingfisher, Okla.

**Dr. Albert C. Crehore** returned to New York on the *Minnetonka* June 30 from a two months' trip to Europe.

**Mr. Walter Eyke**, of Muskegon, Mich., has been appointed general superintendent of the Muskegon Light & raction Company.

**Mr. F. A. Nims**, of Muskegon, Mich., has been appointed ıccessor to Mr. John T. Young as president of the Musegon Light & Traction Company.

**Mr. Cyrus Leland, Jr.**, has succeeded Mr. W. C. Stewart s superintendent of the electrical department of the Atchin Railway, Light & Power Company, Atchison, Kan.

**Mr. J. C. Reighard**, retiring manager of the Penn Central Light & Power Company at Lewistown, Pa., was the uest of honor at a banquet tendered to him by the local lks Club on June 20.

**Mr. Harry G. Hake**, formerly instructor in electrical engineering at the University of Illinois, has been appointed ssistant professor of electrical engineering at Washington niversity, St. Louis, Mo.

**Mr. I. O. Ingalls**, formerly engineer in the arc lamp department of the General Electric Company, at Lynn, Mass., as become associated with the city lighting department at dmonton, Alberta, Canada.

**Mr. Martin S. Decker** has been designated as chairman f the Public Service Commission of the Second District f New York by Governor Sulzer as successor to Mr. Frank V. Stevens, who resigned recently.

**Mr. Raymond L. Patterson** has resigned his position as ngineer in charge of the manufacture of ductile tungsten nd molybdenum wire for the Westinghouse Lamp Company, Bloomfield, N. J., to become associated with the ooker Electrochemical Company at Niagara Falls, N. Y.

**Mr. Val. A. Fynn**, consulting engineer to the Wagner lectric Manufacturing Company, St. Louis, Mo., left New ork June 30 on the *Mauretania* for a three months' trip o Europe. After visiting his home in London Mr. Fynn ill spend considerable time climbing mountains in Switzerland and Italy.

**Dr. William Marconi**, who spent the month of June in is country chiefly in looking after his interests in the atent suit described in our issue dated June 28, 1913, left ew York for London July 2 on the *Mauretania*. He will eturn to New York in October for the opening of the adio-telegraph station at Belmar, N. J.

**Mr. A. S. Herbert** has resigned his position as general anager of the Siemens Company of Canada, Ltd., and has een appointed general manager of the branch offices of he Siemens company in Australia. His successor in anada is Mr. C. A. Ablett, who has been closely associated ith the electrification of rolling mills in Europe.

**Hon. George W. Anderson**, nominated to the Massachuetts Public Service Commission, was born in Acworth, . H., in 1861. He was educated at Cushing Academy, shburnham, Mass., Williams College and Boston University Law School, and has practised law in Boston since 1890. n 1912 he was the Democratic candidate for attorney-eneral.

**Mr. V. Ford Greaves**, who was for a number of years onnected with the research department of the Jefferson hysical Laboratory, Harvard University, and recently enered the government service as radio inspector, has been ade chief of the radio service of the Bureau of Navigation, epartment of Commerce, which has charge of the enforcement of the new radio laws.

**Mr. B. S. Josselyn**, who retired as president of the Portnd Railway, Light & Power Company, Portland, Ore., n July 1, 1913, was the honor guest at a banquet at he Arlington Club in Portland given by the other offiers of the company and a number of his business assoiates outside of the company. Eleven pieces of silver, omprising a Paul Revere set, were presented to Mr. Josselyn by the officers and employees of the company, Mr. . I. Fuller making the presentation speech.

**Hon. George P. Lawrence**, nominated to the Massachusetts Public Service Commission by Governor Foss, is a native of North Adams, Mass. He graduated from Amherst College in 1880 and studied law at Columbia University. He was admitted to the bar in 1883, and from 1885 to 1894 was judge of the district court of Northern Berkshire. He has served three terms in the Massachusetts Senate, being president of that body in 1896-7, and has served continuously as a member of Congress since 1899, having been elected in 1897 to fill an unexpired term.

**Mr. William Stanley**, who was the recipient of the Edison medal on June 26 at the convention of the American Institute of Electrical Engineers, has long been famous in the history of electrical development in this country as one of the leaders in high-tension work. He was born in Brooklyn, N. Y., Nov. 22, 1858, and was educated at the Williston Seminary at East Hampton, Mass., and at Yale; but electrically he is a self-educated man. While engaged in the nickel-plating business in New York in 1879 he became acquainted with Mr. Hiram Maxim, who was then one of the foremost electrical engineers in the country. Mr. Stanley became principal assistant to Mr. Maxim, and when Mr. Maxim left the United States for the Paris Exposition in 1881 Mr. Stanley became assistant to Mr. Edward Weston. In 1882 he joined the staff of the Swan Electric Light Company, where he invented a method of exhausting incandescent-lamp bulbs, and during 1883 and 1884 he conducted a private laboratory at Englewood, N. J., devoting himself to storage-battery work chiefly. His acquaintance with Mr. George Westinghouse began in 1884, and a contract was made by which Mr. Stanley was to devote his time to developments in which he was interested and Mr. Westinghouse was to promote them as a business enterprise. During tnat year Mr. Stanley installed and equipped a lamp factory at Swissvale, Pa., designed some direct-current machines adapted to operate incandescent lamps, and was generally occupied with a system for this line of work. In the spring of 1885 he was taken sick and removed to Great Barrington, Mass., and while recovering there concentrated his attention on the problem of alternating-current distribution and submitted his plans to Mr. Westinghouse and a number of friends. Failing to secure the indorsement he had looked for, he rented a mill at Great Barrington and ultimately developed a 500-volt alternating-current system the energy from which was distributed in Great Barrington through the medium of transformers connected in multiple. The Westinghouse companies, realizing the value of the system, immediately took steps to develop the manufacturing details, and the great achievements that soon followed at Niagara Falls were largely contributed to by the Stanley inventions. In the winter of 1890-1891 Mr. Stanley organized the Stanley Electric Manufacturing Company at Pittsfield, Mass., his associates in the enterprise being Messrs. John F. Kelly and C. C. Chesney, and the famous S. K. C. apparatus came as the result of this organization. Later the Stanley Instrument Company was organized for the manufacture of a new form of wattmeter, and for several years Mr. Stanley devoted his time to this enterprise. When the Stanley companies were bought by the General Electric Company Mr. Stanley engaged in consulting work for that company, his time being devoted principally to the development of an electric stove built to conserve heat.

# Obituary

**Ernst Ruhmer**, who died lately at the early age of thirty-five, was one of the best-known and most fertile contemporary German inventors. Among his inventions were a selenium photometer, a device for measuring and recording the intensity of daylight, an arc-lamp interrupter, a television apparatus, a system of light telephony using selenium cells and controlled projector beams, and apparatus for photographically recording and mechanically reproducing sound waves. Mr. Ruhmer was the son of an engineer and was educated at Charlottenburg, Berlin and Giessen. He later established an electro-physical laboratory near Berlin and wrote several books on the subjects of wireless telephony and telegraphy, selenium-cell operation, etc.

# Construction

## New England

Mortimer Madsen, town clerk.

WORCESTER, MASS.—Bids will be received until July 14 by the Board of Trustees, Worcester State Asylum, at the office of Fuller & Delano Co., architects, 44 Front Street, Worcester, for the general construction and electric wiring of a number of buildings.

## Middle Atlantic

Juengst, Jr., manager.

EAST WORCESTER, N. Y.—The Great Bear Lt. & Pwr. Co., which recently acquired the lighting plant at Schenevus, is planning to purchase one 100-kw single-phase generator, two switchboard panels, two series tub transformers, 500 5-ft. four-pin cross-arms, 25 miles of No. 4 copper wire and a number of meters and 40-watt tungsten lamps. The proposed extensions will be in charge of George H. Blake, and the manager.

will be purchased during the next two months by the municipal light and water plant. E. L. Kingsbury, superintendent.

HILTON, N. Y.—The Hilton El. Lt., Pwr. & Ht. Co. (formerly the Hilton, Tel. Co.) expects to purchase within the next three months one 100-hp marine boiler, a new generator and a feed-water heater. J. E. Cooper, president and manager.

LE ROY, N. Y.—The LeRoy Hydraulic Elec. Gas Co. is now changing from 133 cycles to 60 cycles; it also plans to change the street-lighting system in the near future, for which the necessary equipment

PERRY, N. Y.—A new street light equipment will be installed here, and the Perry El. Lt. Co. will purchase the material for same during the next three months. C. W. Torrey, superintendent; E. L. Phillips, engineer.

town clerk.

PUNXSUTAWNEY, PA.—Supplies and material for a transmission line to furnish energy for mine operations will be purchased within the next three months by the Jefferson Lt., Ht. & Pwr. Co. W. M. Krise, manager.

Barre, Pa., is seeking quotations for one three-wire 25-kw, 125-250-volt direct-current generator, belted, 200-amp-hr. storage battery, switchboards, meters, lightning arresters, wire, cross-arms, guys and glass insulators.

be purchased at once by the Lakewood Wtr., Lt. & Pwr. Co. H. M. Whitehead, superintendent.

Westinghouse Parsons turbine with Alberger surface condenser; also one Stirling water-tube boiler with Murphy stoker and Foster superheater.

facing an old steel stack and flue, have recently been added.

Within the next six months the Keyser Lt. & Ice Co. expects to erect a 300-hp engine, a 300-kw generator, a 150-hp boiler and switchboard complete. N. J. Crooks is secretary and treasurer.

KEYSTONE, W. VA.—The Keystone Lt. & Pwr. Co. has been taken over by the Appalachian Pwr. Co., Bluefield, W. Va.

Bids will be received until Aug. 4 for the construction complete, including electric conduits and wiring, interior lighting fixtures and approaches, of the United States post office at Salisville, W. Va. O. Wenderoth, supervising architect, Washington, D. C.

WILLIAMSON, W. VA.—The Williamson Lt. & Ice Co. expects to increase the rated output of its ice plant from 10 to 30 tons. O. S. Welch is superintendent.

office of the supervising architect, Treasury Department, Washington, D. C., for the masonry and roofing contract in the United States Marine Hospital, Chicago, in accordance with drawings and specifications on file in the office of the Supervising Architect at Washington.

WASHINGTON, D. C.—Sealed proposals will be received at the office of the supervising architect until Aug. 4 for the construction complete, including electric conduits and wiring, interior lighting fixtures and approaches, of the U. S. post office at Xenia, Ohio. Drawings and specifications may be obtained from the custodian of site at Xenia, or from O. Wenderoth, supervising architect, Washington, D. C.

## North Central

months for 24 hangers and other equipment for installing an incandescent

purchasing a three-phase, 60-cycle, 110-220-volt motor-driven outfit for pumping water. The water and light plant combined has an abundance of power and will have a pumping capacity of 1,000,000 gal. a day. D. R. Cowan, manager.

GREEN SPRING, OHIO.—The Green Spring El. Lt. & Pr. Co. expects to install within the next two months an oil engine and a 10-kw three-wire, 110-220-volt direct-current generator, which have already been purchased. Within the next three months the purchase will be completed include 50 2-wire, 5-amp direct current meters. D. S. Scott, manager.

LOUISVILLE, KY.—The Louisville Gas & Elect. Co. will have a substantial and well-equipped garage and stables for its transportation department, where both motor-driven and horse-drawn vehicles will be cared for. The building will be heated with natural gas and lighted with electricity. A well-equipped machine and blacksmith shop will be provided to take care of necessary repairs.

PERRYVILLE, KY.—The Perryville Ice & Ltg. Co., recently established, is planning to increase its capacity to give 24-hour service. W. J. DeBaun, general manager.

WALKERTON, IND.—Construction work contemplated during the next few months by the municipal electric-light department includes the erection of a 90-kw, three-phase outdoor substation. Energy will be purchased from the Plymouth (Ind.) El. Lt. & Pwr. Co. The necessary meters and switches for the above substation will also be purchased shortly. The street lighting system will be changed to [illegible] A. F. Tuteur is superintendent of the electric-light department.

BROWNING, ILL.—The village board has granted a franchise to the Illinois Public Service Co., of Mattoon, Ill., to supply current to Browning. A transmission line will be built from Beardstown.

BUSHNELL, ILL.—The Central Ill. Pub. Serv. Co. expects to erect within the next ten days a 300-kw transformer substation, to be used for transforming energy from 33,000 to 2,300 volts, and the town is to have 24-hour service. J. H. Freeman, Jr., local superintendent.

CHICAGO, ILL.—The municipal electric lighting plant of Chicago expects to make a number of extensions and improvements in the future. Among other equipment to be purchased are the following materials: Four or six 3000-kva substations to deliver energy to 15,000 flame arc lamps, with suitable switching and protective equipment for the above; 80,000 30-ft. tubular steel poles, wire, cable and ducts; 15,000 [illegible] series tungsten lamps. Rose [illegible]

FREEPORT, ILL.—The contract for lighting Taylor's Park, mentioned May 24, has been awarded to Albert Barnes. The contract calls for seven ornamental lamp-posts, some with two lamps and others with one. The electric wires will be laid underground.

HOMER, ILL.—U. S. Thompson, owner of the electric lighting plant [illegible] A new boiler feed pump will also be bought.

MANITO, ILL.—The municipal electric light plant is planning [illegible] the next six months, on the C., P. & St. L. R. R. siding, 30 ft. x 140 ft., large enough to [illegible] water works in the future. Within the year there will be purchased [illegible] boiler and one 50-75-hp engine, motor-driven.

ATTOON, ILL.—The municipal electric lighting plant within the three months expects to erect a 5-mile 2300-volt transmission line. ipment to be purchased includes among other things one 350-hp water- boiler, one 2300-volt 75-kw alternating-current generator, one elec- lly-driven pump, alternating-current voltmeters and ammeters, poles, ators, crossarms and transformers. W. S. Bury, city electrician.

ETROPOLIS, ILL.—The municipal electric lighting plant has re ly purchased a new Ideal engine and a 100-kw three-phase generator. cycles, 2300 volts. Tub transformers and street lighting fixtures will urchased shortly. P. M. Richards, superintendent.

OLINE, ILL.—Bids will be asked for at once for the installation "white way" along Fifteenth Street. Modern five-lamp ornamental s are to be erected from Fourth Avenue to Eighth Avenue, and be extended north of the railroad tracks. There will be 16 posts block. The property owners are to pay for the posts and also the energy consumed by the lamps.

ORTON, ILL.—The Bloomington & Normal Ry. & Lt. Co., which ates the Morton Lt., Ht. & Pwr. Co., is building a substation in ton to handle the service of the town from Bloomington. For erting from 25 cycles to 60 cycles, frequency changes are being alled and considerable work is being done rebuilding the outdoor t. M. G. Linn, general superintendent, Bloomington, Ill.

URPHYSBORO, ILL.—The street-lighting system is being changed n arc to tungsten by the Murphysboro Wtr. Wks. & El. Lt. Co., O. Settle, superintendent.

AUVOO, ILL.—The Nauvoo El. Lt. & Pwr. Co. expects to erect within next few months a 6-mile transmission line. There will be purchased ew generator, transformers, poles and incandescent lamps. The pany intends to change from 220-volt direct current to 110-volt alter- ng current. Jos. Nelson, manager.

ALESTINE, ILL.—The municipal lighting plant expects to build extension to its present plant. S. H. Markee, city clerk.

EORIA, ILL.—The rebuilding of the power plant of the Peoria Gas El. Co. is expected to be completed within the next few months. re will be installed a 5000-kw turbo-generator condensing equipment, 0,000-sq. ft. Sturtevant economizer and fan and switchboards. A smission line to Farmington and Elmwood, Ill., and several sub- ions will be built within the next few months, and there will shortly urchased incandescent street lighting equipments for small towns.

ILVIS, ILL.—The railroad plant at this place is having an entirely lighting system installed. A. Wanamaker is the electrical engineer harge of the installation.

PRINGFIELD, ILL.—The City Council opened bids for con- ction and material for a transmission line from the municipal elec- light plant to the water-works station on the Sangamon River, as ows: The A. H. Barth El. Co. bid $11,072 for red-cedar poles and 2 wire; for white-cedar poles and No. 0 wire, $12,653; for white- ar poles and No. 2 wire, $11,902. The Champaign Gas & El. Co. $9,960 for red-cedar poles and No. 2 wire; for white-cedar poles No. 0 wire, $11,998; for white-cedar poles and No. 2 wire, $10,369. Champaign company also submitted a bid for work on red-cedar s and No. 0 wire, the figure being $11,765.

OWAGIAC, WIS.—Two 6.6-amp, 60-cycle, 1100-volt primary, 8-kw 12-kw constant current regulators will be purchased within the next e months for the municipal electric lighting plant. William E. nolds, superintendent.

ALESVILLE, WIS.—Within the next two months the Davis Mill is contemplating building an addition to its hydroelectric plant. er on it is the company's intention to change from direct to alter- ng current, and the necessary equipment for this change will be cha ed. B. W. Davis, manager.

A FARGE, WIS.—The La Farge Milling Co., which owns the er-power rights, is talking of building a new dam and constructing ower station.

AKE MILLS, WIS.—The municipal electric light and water plant in the next two months expects to purchase a one-panel 13,000-volt chboard, with switches and protective devices, and early in the fall eries street-lighting system will be installed. B. C. Engsberg, super- ndent.

IPESTONE, MINN.—The Pipestone El. Lt., Ht. & Pwr. Co. has ended its system a distance of 2 miles to Indian School and installed ew street-lighting system in Pipestone, besides adding five addi- al miles of line to the system. The generators, boilers and other ipment necessary for these improvements have been bought. Trans- mers will shortly be purchased for changing the system from direct rent to alternating current; total about 100 kw. A 15-kw series ting transformer and panel have already been purchased. J. W. mpbell, Jr., manager.

IRGINA, MINN.—On Aug. 1 the Virginia El.. Pwr & Wtr. Co. ects to deliver possession of its plant to the city of Virginia for a sideration of approximately $600,000. The plant will be run for city by a commission of three local citizens. O. H. Griggs, sident.

INDOM, MINN.—At the special election recently held to vote the proposition to issue bonds to the extent of $15,000 for improve- ments and extensions to the municipal lighting plant, mentioned June 21, the measure was defeated. G. Neufeld, city clerk.

WORTHINGTON, MINN.—Some line extensions are contemplated by the municipal light and water plant. W. H. Buchan, superintendent.

ALTON, IA.—Electroliers for Main Street are being discussed.

HAMPTON, IA.—The Hampton El. Lt. & Pwr. Co. expects to purchase at once two alternating-current, 60-cycle, three-phase generators, one 75-hp, 2400-volt three-phase induction motor, one engine, an entirely new complete switchboard and a few transformers. M. A. Harrison, manager.

HARTLEY, IA.—Early in July a 50-hp oil engine will be purchased by the municipal electric-light plant, together with a 250-volt, three-wire generator. R. E. Lampman, superintendent.

LINN CREEK, MO.—The Naingua Heights Development Co. will build a station adjoining this place, to furnish lighting and motor service for the grounds of its pleasure park, club houses and bungalows. The equipment has not yet been determined upon. R. G. Scott & Sons, Linn Creek, Mo., are the engineers in charge of the work.

MAYVILLE, N. D.—Bids will be received until July 15 (readvertisement) by C. A. Vangen, city auditor, for furnishing material and equipping a complete electric light plant. Clausen Engr. Co., engineers, Commercial Building, St. Paul, Minn.

CHANCELLOR, S. D.—An electric-light system is to be installed here.

HARTINGTON, NEB.—It is reported that K. S. Gaynor, Sioux City, Neb., has purchased the electric light plant at Hartington and will have it thoroughly overhauled before placing it in operation.

CONCORDIA, KAN.—The Concordia El. Lt. Co. will build a substation at Burr Oak, in addition to making the extensions mentioned June 7. L. K. Green, vice-president.

KANSAS CITY, KAN.—The town recently voted $200,000 for the purpose of extending the electric-light plant.

## Southern States

MOUNT OLIVE, N. C.—S. L. Oliver, manager of the municipal electric lighting plant, announces the closing of a contract for wiring the Presbyterian Church at Mount Olive, which will be the first indirect system of lighting in the town. The National X-Ray Reflector Co., Chicago, planned the installation. Wiring supplies of all kinds will shortly be purchased.

UNION, S. C.—Within the next few months the commissioners of public works will spend about $5,000 in improving the municipal lighting plant. The expenditure will practically double its equipment. On Main Street an entirely new line of poles will be erected.

AMERICUS, GA.—There will be a consolidation of the Americus Gas & El. Co. and the Americus Pwr. Co. during the next sixty days, under the name of Americus Pwr. Co. W. M. Case is the general manager.

MARSHALLVILLE, GA.—The bond issue proposed for an electric light plant has been defeated.

PUNTA GORDA, FLA.—R. K. Seward, clerk, reports that the municipal electric light and water plant has contracted with the Punta Gorda Ice Co. (a Southern Utilities Co. property) for energy to operate the city plant for 10 years. The ice company will install a 100-kw alternator. A plan is on foot to bond the city for $60,000 for paving and sewage. The city will require considerable wire and about 500 additional 60-watt and 100-watt, 110-volt lamps this fall.

ST. ANDREWS, FLA.—The St. Andrews Ice & Pwr. Co., which has recently been granted a franchise to operate an electric light plant here, will be in the market for two 75-kw alternating-current generators, engines, switchboards, lightning arresters, wiring material and other supplies. One 80-hp and one 120-hp boiler have already been installed. For complete list of materials address J. H. Drummond, St. Andrews, Fla.

ST. PETERSBURG, FLA.—A power house will be erected during the next six months by the St. Petersburg Investment Co. Contracts have been placed for generators, boilers and engines. Within the next two months the company plans to purchase wire and poles for a two-mile transmission line. H. C. Case, general superintendent.

WATERTOWN, FLA.—The East Coast Lumber Co. plans to install an electric light plant to operate its mill and to furnish light and power to the town.

CHATTANOOGA, TENN.—The Chattanooga & Tennessee Pwr. Co. will erect an auxiliary plant to develop 25,000 hp. W. E. Boileau, general manager, Chattanooga.

HUNTINGDON, TENN.—The municipal water and electric lighting plant expects within the next three months to purchase 5 miles of No. 8-10-6 copper wire, poles, cross-arms and insulators, 40 tungsten street hoods complete, and a 6-amp, 1100-volt, constant-current transformer, with switchboard. J. M. Dill, manager.

BREWTON, ALA.—The Downing Industrial School is considering the installation of a private lighting plant, at an approximate cost of $55,000. W. W. Downing is chairman of the building committee.

HARRISON, ARK.—Improvements and additions will be made to the plant of the Harrison El. & Ice Co., Mr. R. M. Fielding, treasurer and

& Wtr. Co. and Local Tel. Co., will operate the electric lighting plant

CHICKASHA, OKLA.—Bids will be received until Aug. 4 for the construction, complete, of the United States post office and court house at Chickasha, Okla. O. Wenderoth, supervising architect, Washington, D. C.

ARANSAS PASS, TEX.—C. J. Stanzel, Aransas Mach. & Boiler Wks., has been granted a franchise by the City Council for the erection of an electric generating station.

DEL RIO, TEX.—[illegible] O. Wenderoth, supervising architect, Washington, D. C., for installing complete an electric passenger elevator in the United States post office at Del Rio.

## Pacific States

BELLINGHAM, WASH.—[illegible] Nooksack River, held by the Whatcom Co. Ry. & Lt. Co. (a Stone & Webster corporation), were declared void recently by Judge Cushman in the United States District Court, and the land, which includes 300 ft. of waterfall, reverts to the federal government. The water power is estimated to be worth several million dollars, and a $500,000 power house built by the Whatcom company near the property will be practically valueless. The company furnished electrical energy to Bellingham and vicinity. It was contended by the government that the sole object of the company in seeking the sites was to take the power opportunities and that no mineral deposits, veins or lodes ever existed on them.

EVERETT, WASH.—The County Commissioners were recently petitioned by the Pacific Northwest Traction Co. for permission to construct, operate and maintain electric transmission lines in Township 28. The Pacific Co. is closely identified with the Puget Sound Traction, Lt. & Pwr. Co., one of the Stone & Webster properties.

GOLDENDALE, WASH.—The Oregon-Washington Tel. Co., recently organized at Hood River, Ore., has taken over the leases, franchises and contracts of the Home Tel. Co., of Hood River, White Salmon Valley Tel. Co., of White Salmon, Wash., and the Goldendale (Wash.) Tel. & Tel. Co., and will operate them under the name of the Oregon-Washington Tel. Co. It is reported that reconstruction work has been ordered to begin at once.

MONTESANO, WASH.—An application has been made by F. Norton Babo and F. L. Harung for a franchise to operate an electric light and water system. If granted, work will be started shortly. F. L. Harung, who, with Mr. Babo, recently organized a company for this purpose, is prominently identified with the Hoquiam Sash & Door Co.

OLYMPIA, WASH.—The Olympia Water Works has received a franchise for the city for the installation of a 1000-kw plant and will furnish electricity as well as steam heat in the business district. C. A. Harmony, [illegible]

SEATTLE, WASH.—The Puget Sound Traction, Lt. & Pwr. Co. expects within the next six months to install one 1000-kw, 13,200-to-600 volt direct-current motor-generator set; three 50,000-volt oil switches in its Jefferson Street substation; two 200-amp automatic feeder regulator panels for lighting circuits as well as an up-to-date protective relay system on its transmission lines. The company will also erect within the next half-year a 52-mile, 60,000-volt transmission line and will install three 60,000-volt oil switches, three 13,000-volt oil switches, two 60,000 and 13,000-volt lightning arresters and one panel switchboard with meters for two 13,000-volt feeders. It will also erect 9 miles of 13,000-volt transmission lines and distribution lines. W. J. Grambs, superintendent light and power.

SPRINGDALE, WASH.—The Camas Valley Tel. Co., operating in this city and vicinity, plans new construction work as well as reconstruction of existing equipment.

BAY CITY, ORE.—The City Council recently granted an electric service franchise to the Bay City Land Co., which has taken over the present lighting plant, which will be reconstructed at once. The city reserves the right to purchase the plant in 1920, or at the end of any three-year period thereafter.

PORTLAND, ORE.—The Northwestern El. Co. has completed plans for a substation and transformer house, to be erected in the Albina district, Portland. Work will begin immediately.

PORTLAND, ORE.—Bids are being received for the installation of a boulevard lighting system on the East Twelfth Street bridge across Sullivan's Gulch, Portland. Plans are in the office of A. L. Barbur, city auditor.

BURBANK, CAL.—The city of Burbank and the Burbank El. Lt. & Pwr. Co. have joined in an application to the State Railroad Commission asking that the city of Burbank be given permission to purchase the plant of the Burbank El. Lt. & Pwr. Co.

CHINO, CAL.—The Home Tel. Co., of Chino, has applied to the State Railroad Commission for permission to construct and operate a telephone and telegraph system in the city of South Pasadena, Cal.

The City Council of Los Angeles has under its consideration an ordinance providing for the extension of the ornamental lighting system on Hill Street, from Pico Street to Washington Street. A similar ordinance is being considered for Ninth Street, between Main and San Pedro Streets.

PALO ALTO, CAL.—The City Council has authorized the purchase of an oil engine and generator for the municipal lighting plant, at a cost of $27,000, bonds for which were recently voted, amounting to [illegible]

PERRIS, CAL.—Bids are being received by the board of city trustees for furnishing and installing an electrically driven pumping equipment, in accordance with specifications in the hands of the city clerk.

RIONIDO, CAL.—The Mount Jackson Wtr. & Pwr. Co. has applied to the State Railroad Commission for permission to issue bonds to the amount of $11,000 for the purpose of paying off existing indebtedness and of making extensive improvements in its system.

TURLOCK, CAL.—The Yosemite Pwr. Co. has just completed a 10-mile power line from Turlock to Denair, and will soon begin the installation of a distribution system in Denair.

VISALIA, CAL.—It is rumored that the Mount Whitney Pwr. & El. Co. is preparing plans for the Tuolumne Lt. & Pwr. Co. project. It is planned to start work this summer on the immense power project to generate power from the north, middle and south forks of the Tuolumne River. It is estimated that the work will cost about $2,000,000.

WOODLAND, CAL.—The Sacramento Valley El. Ry. Co. is reported to have sold its bonds in Europe, and the work of installing the projected electric lines on the west side of Sacramento will begin at once.

FAIRVIEW, MONT.—The county commissioners at Glendive are reported to have granted C. W. Jennison a franchise for an electric system at Fairview.

BOULDER, COL.—The Central Colorado Pwr. Co. is erecting about 30 new towers on its transmission line near Shoshone in order to reduce the length of some heavy spans.

TRINIDAD, COL.—The Trinidad El. Trans. Ry. & Gas Co. expects to construct within the next half year 60 miles of 44,000-volt high-tension transmission line, which will require 1800 kva in transformers to reduce the tension to 2300 volts. Geo. J. Gauthier, superintendent of [illegible]

## Canada

PORT MOODY, B. C.—The City Council has requested the Western Canada Pwr. Co. and the British Columbia El. Co. to submit bids for the installation of a street-lighting system in the district bounded by the two main thoroughfares as well as adjoining streets and avenues. The work of installing the system will be ordered by the Council shortly. The lighting of the South Shore district is also under contemplation.

## Miscellaneous

PORT ELIZABETH, SOUTH AFRICA.—The American Consul at Port Elizabeth reports that an electric lighting plant, to cost about $50,000, will be installed by the municipalty of Cradock, Cape Province, South Africa. Address B. A. Paterson, town clerk, Cradock, Cape Province, South Africa.

# New Incorporations

ALHAMBRA, ILL.—The Alhambra Mutual Tel. Co. has been incorporated with a capital stock of $2,500 to maintain and operate telephone lines. The incorporators are: C. Warber, Christ Rabberman, H. C. Henschen, F. W. Brumworth, August Abert, Patrick Farrell, Adolph Leuscher and J. D. Harris.

NORTH CHESTERVILLE, ME.—The North Chesterville Lt. & Pwr. Co. has been organized for the purpose of making, selling and supplying electricity, with a capital stock of $10,000. Officers: President, C. H. Pinkham; treasurer, L. S. Keith, both of Farmington, Me.

HICKORY, N. C.—The Wautauga El. Co. has been incorporated with capital stock of $50,000. Incorporators: N. S. Dasher, J. L. Riddle, H. C. Menzies, J. D. Elliott and others.

FORWARD, PA.—The Forward El. Co. has been granted a charter to operate in Forward Township, Butler County, and Pittsburgh, with a capital stock of $5,000.

HARRISBURG, PA.—The Jackson El. Co. has been granted a charter to operate in Jackson, Butler County, and Pittsburgh, with a capital stock of $5,000.

BIG WELLS, TEX.—The Big Wells Wtr., Lt. & Ice Co. has been incorporated with a capital stock of $10,000. Incorporators: Paul C. Levering, H. C. Ziegler and S. A. Armstrong.

# Directory of Electrical Associations, Societies, Etc.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, H. O. Hanson, Mobile, Ala.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Secretary, L. O. Howard, Smithsonian Institute, Washington, D. C.

AMERICAN ELECTRIC RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary-treasurer, Matthew R. Boylan, Public Service Railway Co., Newark, N. J. Annual convention, Atlantic City, N. J., Oct. 13-17.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, H. C. Donecker, 29 West 39th St., New York. Annual convention, Atlantic City, N. J., Oct. 13-17.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION. Secretary, H. C. Donecker, 29 West 39th St., New York. Annual convention, Atlantic City, N. J., Oct. 13-17.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary-treasurer, Eugene W. Stern, 103 Park Ave., New York City. The council meets the first Friday of every month.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Ernest Merritt, Cornell University, Ithaca, N. Y.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, W. W. Macon, 29 West 39th St., New York.

AMERICAN WATER WORKS ASSOCIATION. Secretary, J. M. Diven, 271 River St., Troy, N. Y.

ARKANSAS ASSOCIATION PUBLIC UTILITY OPERATORS. Secretary, W. J. Tharp, Little Rock, Ark.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Geo. C Holberton, Pacific Gas & Electric Co., San Francisco, Cal. Annual meeting, Cooperstown, N. Y., Sept. 8.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, James Farrington, Steubenville, Ohio.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago. Annual meeting, Chicago, Oct. 20-24.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 112 West Adams St., Chicago.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, H. G. Martin, Toronto Electric Light Co., Ltd., Toronto, Can.

COLORADO ELECTRIC CLUB. Secretary, C. F. Oehlmann. Meets every Thursday at Albany Hotel, Denver, Col.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary, Thomas F. Kennedy, 900 15th St., Denver, Col. Annual meeting, Denver, Oct. 6.

ELECTRIC CLUB OF CHICAGO. Secretary, W. M. Connelly, 1417 Monadnock Block, Chicago. Meet every Thursday noon at Hotel Sherman.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Ernest S. Cowie, 1613 Grand Ave., Kansas City, Mo. Annual meeting, St. Louis, July 12.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert Petermann, Milwaukee, Wis.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, Marquette Building, Chicago.

ELECTRICAL CREDIT ASSOCIATION OF PHILADELPHIA. Secretary-treasurer, John W. Crum, 1324 Land Title Building, Philadelphia, Pa. Executive committee meets second and fourth Thursday of each month.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. Secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Meeting, San Francisco, second Thursday of each month.

ELECTRICAL DEVELOPMENT ASSOCIATION, INC. Secretary, Zenas W. Carter, 53 State St., Boston, Mass.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, Harvey Robinson, 124 West 42d Street, New York. Meeting, fourth Tuesday of each month.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA, NEW ENGLAND SECTION. Secretary, L. L. Edgar, 39 Boylston St., Boston.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, Engineering Societies Building, 29 West 39th St., New York.

FLORIDA ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, H. C. Adams, West Palm Beach, Fla.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, J. D. Israel, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia, Chicago and Pittsburgh.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, A. Newburger, 1153 Myrtle Ave., Brooklyn, N. Y. Meetings second and fourth Wednesdays, New Grand Hotel, New York.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary and treasurer, J. V. Zartman, 120 South Meridian St., Indianapolis, Ind.

INSTITUTE OF OPERATING ENGINEERS. Secretary, L. Houmiller, 29 West 39th St., New York.

INSTITUTE OF RADIO ENGINEERS. Secretary, E. J. Simon, 81 New St., New York. Meeting first Wednesday of each month.

INTERNATIONAL ASSOCIATION FOR TESTING MATERIALS. Secretary, H. J. F. Porter, 29 West 39th St., New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL COMBUSTION ENGINEERS' ASSOCIATION. President, Charles Kratsch, 416 West Indiana St., Chicago. Meeting, second Friday of each month at Lewis Institute.

INTERNATIONAL ELECTRICAL CONGRESS. Secretary, J. A. Barr, Exposition Building, San Francisco, Cal. San Francisco, 1915.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England. Next plenary meeting, Berlin, Sept. 2-6.

IOWA ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Secretary, H. B. Maynard, Waterloo, Ia.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia.

JOVIAN ORDER. Jupiter (president), F. E. Watts, 239 West 39th St., New York; Mercury (secretary), E. C. Bennett, St. Louis, Mo.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary-treasurer, W. H. Fellows, Leavenworth, Kan.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, W. H. Bower Spangenberg, 625 Poydras St., New Orleans, La. Meets second Thursday of each month.

MAINE ELECTRIC ASSOCIATION. Secretary, Walter S. Wyman, Waterville, Maine.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary-treasurer, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn.

MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATER WORKS ASSOCIATION. Secretary-treasurer, F. D. Beardslee, St. Louis, Mo.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, Wm. L. Smith, Concord, Mass.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y. Annual meeting, Chattanooga, Tenn., July 16.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederick P. Vose, 1343 Marquette Building, Chicago.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION, COMMERCIAL SECTION. Secretary, E. L. Callahan, 29 West 39th St., New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION, EASTERN NEW YORK SECTION. Secretary, R. E. Russell, Schenectady, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION, GEORGIA SECTION. Secretary-treasurer, M. H. Hendle, Augusta, Ga. Annual meeting, Macon, Aug. 14-16.

NATIONAL ELECTRIC LIGHT ASSOCIATION, HYDROELECTRIC AND POWER TRANSMISSION SECTION. Secretary, L. H. Conklin, Scranton, Pa.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MICHIGAN SECTION. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich. Annual meeting, Ottawa Beach, Aug. 19-21.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MISSISSIPPI SECTION. Secretary, F. J. Duffy, Natchez, Miss.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEBRASKA SECTION. Secretary-treasurer, S. J. Bell, David City, Neb.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEW ENGLAND SECTION. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NORTHWEST SECTION. Secretary, N. W. Brockett, Pioneer Building, Seattle, Wash. Annual meeting, Seattle, Wash., July 16-18.

Pearl St., Boston, Mass. Meets last Thursday of each month.

fourth Tuesday of each month.

New York Electrical Credit Association (affiliated with the National Electrical Credit Association) Secretary, Franz Neilson, 80 Wall St., New York. Board of directors meets second Thursday of each month.

Societies Building, 33 West 39th St., New York.

New York Electric Railway Association. Secretary, Charles C. Dietz, United Traction Co., Albany, N. Y.

743 Lumber Exchange, Minneapolis, Minn.

Ohio Society of Mechanical, Electrical and Steam Engineers. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio.

Oregon Electrical Contractors' Association. Secretary, J. E. Kilkenny, St. John's, Ore.

Pennsylvania Electric Association (State Section N. E. L. A.). Secretary-treasurer, Walter E. Long, 1000 Chestnut St., Philadelphia, Pa.

Railway Signal Association. Secretary, C. E. Rosenberg, Bethlehem, Pa.

Society for Electrical Development, Inc. Secretary-treasurer, Philip S. Dodd, 29 West 39th St., New York.

Society for the Promotion of Engineering Education. Secretary,

Southwestern Electrical and Gas Association. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

Vermont Electrical Association. Secretary-treasurer, A. B. Marsden, Manchester, Vt.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 76 West Monroe St., Chicago, Ill.

Western Society of Engineers, Electrical Section. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meeting, fourth Monday of each month, except January, July and August.

Wisconsin Electrical Association. Secretary, George Allison, Stephenson Building, Milwaukee, Wis.

# Weekly Record of Electrical Patents

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York]

1,065,344. TOY CONSTRUCTION; J. L. Cowen, New York, N. Y. App. filed April 22, 1912. Electric automobile taking current from

1,065,361. ELECTRODE BOX; H. B. Hartman, Philadelphia, Pa. App. filed Aug. 11, 1911. For purification of water and other electrolytic operations

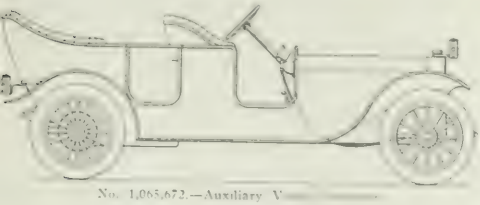
1,065,362. FLOW-RESPONSIVE CIRCUIT CONTROLLER; H. B. Hartman, Philadelphia, Pa. App. filed Aug. 11, 1911. For use in connection with apparatus for the electrical purification of water.

1,065,363. REVERSING-SWITCH MECHANISM; H. B. Hartman, Philadelphia, Pa. App. filed Aug. 11, 1911. To periodically reverse polarity of electrodes in electrolytic water purification plant.

1,065,380. ELECTRODE CONTACT CLAMP; J. G. Marshall, Niagara Falls, N. Y. App. filed Jan. 8, 1913. Power-actuated electrode clamps for electric furnaces.

1,065,388. PANELBOARD SUPPORT FOR OUTLET BOXES; W. F. O'Neill, Wilkinsburg, Pa. App. filed June 28, 1912. Eccentrics for varying position of panelboard within the outlet box.

1,065,426. ELECTRIC HEATER; H. W. Beers, Guadalajara, Mexico. App. filed Aug. 22, 1912. Portable; body of refractory material which incloses the resistance heating unit.



No. 1,065,672.—Auxiliary V

1,065,434. CIGAR LIGHTER; C. S. Drake, Milwaukee, Wis. App. filed July 20, 1912. Wick electrically ignited and automatically extinguished

1,065,465. ELECTRIC HEATER; J. Nathan, Coutolenc., Cal. App. filed

1,065,478. REPEATING TRANSMITTER FOR FIRE-ALARM TELEGRAPH SYSTEMS; N. H. Suren, Needham, Mass. App. filed July 22, 1910. Actuating means for the circuit-operating device

Squirrel-cage rotor in which the

1,065,550. ELE H. Rieken, Chicago, Ill. App. filed

tion without first being brought to

there.

mounted on pivoted arm which is carried to circuit-closing position by engagement of the car with the receiver

cago, Ill. App. filed Nov. 6, 1911. Produces vapor of lime by subjecting lime to electric heat and then introduces said vapor into body of metal under treatment.

1,065,628. SIGNAL-SENDING DEVICE; H. O. Rugh, Sandwich, Ill. App. filed May 4, 1909. For use at central station to call number of stations connected to the same line wires and which are of the step-by-step or impulse type.

1,065,649. PNEUMATIC GOVERNOR; B. S. Aikman, Chicago, Ill. App. filed Jan. 11, 1910. For compressors; primary pressure chamber with high-pressure and low-pressure valves controlling connection between the pressure chamber and the piston chamber and atmosphere.

1,065,653. MUNICIPAL LIGHTING AND POLICE - SIGNALING SYSTEM; J. P. Barrett, Chicago, Ill. App. filed July 12, 1911. Street lamps utilized to signal the police.

1,065,657. ELECTRIC CONTROLLER; A. E. Berdon, Lafayette, Ind. App. filed Jan. 6, 1911. For charging storage batteries on automobiles and car-lighting systems.

1,065,672. AUXILIARY VISUAL INDICATOR; H. R. Elliott, Columbus, Ohio. App. filed Jan. 22, 1912. Speedometer controls circuit through signal lamps which give indication to pedestrians, etc., of speed of vehicle.

1,065,683. ANNUNCIATOR; H. J. Heeney, Boston, Mass. App. filed Oct. 12, 1910. For releasing a target or bank of targets.

1,065,690. REGULATING AND REVERSING APPARATUS FOR REGENERATIVE GAS FURNACES; H. Kopper, Mülhein-on-the-Ruhr, Germany. App. filed Aug. 19, 1912.

1,065,692. TROLLEY WHEEL; J. Kress, New Rochelle, N. Y. App. filed May 20, 1911. Spring-tension knuckle joint between trolley harp and pole.

1,065,704. FILM-COATED METALLIC ARTICLE AND METHOD OF MAKING THE SAME; R. D. Mershon, New York, N. Y. App. filed Dec. 21, 1911. Article is subjected to a boiling bath of the film-producing agent and an electric current is passed through the article and the bath.

1,065,722. TRAIN CONTROL; F. M. Raymond, Saugatuck, Conn. App. filed March 21, 1913. Trolley is diverted from the main line to a branch conductor of different (preferably zero) potential.

1,065,737. INSULATOR AND SUPPORT; A. J. Slonecker, Trenton, N. J. App. filed July 31, 1912. Has a spiral live-wire-receiving groove and rotates to permit of slackening or tightening of the live wire during the swinging of the wires.

1,065,760. MEANS FOR SWITCHING BOOSTER TRANSFORMERS; W. Zedlerbohm, Charlottenburg, Germany. App. filed Oct. 19, 1911. For readily and safely disconnecting and connecting the booster transformers from and to the system.

1,065,771. TROLLEY; M. A. Born, Oconomowoc, Wis. App. filed Oct. 7, 1911. Restoring wheels on opposite sides of trolley wheel with spring-pressed contact elements between the restoring wheels and trolley wheel.

1,065,804. GONG-ACTUATING MECHANISM FOR ELECTRIC CARS; R. A. Heifley, Denver, Col. App. filed June 24, 1912. Gong-actuating switch on controller handle.

1,065,805. TELEPHONE ATTACHMENT; S. J. Heimbuecher, Jr., Pittsburgh, Pa. App. filed June 29, 1912. Receiver supported by extensible lazy-tongs structure which is attached to the ordinary receiver hook.

1,065,851. TROLLEY REPLACER; G. A. Spaeth, Columbus, Ohio. App. filed March 14, 1913. Has a relatively fixed insulated replacer roller and a slidably mounted trolley wheel which may be withdrawn below the plane of the replacer roller.

1,065,884. SIGNAL DEVICE; C. F. Marston, New York, N. Y. App. filed May 26, 1911. For automobiles; to notify following vehicles of proposed movements.

1,065,886. PROCESS OF PRODUCING RADIATOR SECTIONS; I. A. Randel, Chicago, Ill. App. filed Jan. 24, 1912. Copper shell is

# Electrical World

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**Receivers for Kuhn Utilities**

The fate that has befallen the house of J. S. & W. S. Kuhn, of Pittsburgh, should not pass unheeded. One brother headed the First-Second National Bank, the other dominated the American Water Works & Guarantee Company, and both as a firm advertised widely and sold the securities of forty utilities. To this close community of interests is due whatever success has heretofore attended the firm's transactions, because, notwithstanding the fact that interests as unrelated and as diverse from one another as irrigation is from coal mining were held by the American Water Works & Guarantee Company, the latter has been successful as a holding company, earning about $1,750,000 last year. That success, however, has been predicated upon its ability to command large resources, and this it has been able to do because of the banking connections of the Kuhns. Robbed of this affiliation it tottered into receivership, and if it is not overcapitalized, a suspicion which is warranted by the wide diversity of its holdings, it must either unload or fall. The indications are that the fiscal agents of the American Water Works & Guarantee Company have discounted the future in their promotion schemes. Many of the underlying properties are good; but the finest property cannot forever pull along with it heavy burdens placed on it by financiers greedy of gain. In its investigation of the First-Second National Bank the government has intimated that it found something else besides slow assets and conditions deserving the attention of the Department of Justice, but whether these are as grave as would appear at first blush time only can tell. Collateral prized highly by the bank officials did not appear to be worth much to the government investigators or to other Pittsburgh bankers. This would point to pyramiding—an evil to which holding companies are peculiarly susceptible—and in times of financial stress the crumbling of one stone is sufficient to cause the whole structure to tumble.

**$25,000,000 of Exports**

We shall soon have the figures for June as to the exports of electrical apparatus, and these will undoubtedly show that for the first time in our history the amount for one year will reach and overrun $25,000,000. The returns for May are just to hand and have a very agreeable and satisfactory significance in that respect, as the total exports for eleven months had already reached $24,458,084. At this rate, the rounded year should give more nearly $27,000,000. As for May itself, the gain over 1912 is quite impressive, exhibiting a jump from $2,068,346 to $2,588,887. We have not gone through the entire returns, but a cursory glance at them is enough to indicate that very few branches of American industry whose product finds a foreign market can evidence any such capacity for expansion as that. In a good many other lines there is a distinct falling off or a condition of stagnancy. Even these quoted electrical figures are susceptible of a better interpretation, for many additional items ought to be included, as, for example, electric locomotives, which for some mysterious reason are grouped under "engines." It must not be forgotten that an overwhelming proportion of our copper, going abroad or staying at home, is of electrolytic refining, and that in other lines of metallurgy and chemistry the electrical percentage is gaining all the time. The department of American manufacture that has not felt the inspiring touch of electricity is a rare one, so that every year the summation of electrical output in goods for domestic use or for export becomes more and more difficult. The government authorities appear already to have "thrown up their hands" when it comes to giving complete and analyzed data as to the exports. We wish sometimes there were a body or society that could take up the fostering of this electrical export trade. It is obviously not the province of the American Institute of Electrical Engineers, the National Electric Light Association, or other national organiations of standing and repute, but it certainly ought to be somebody's job. The new Society for Electrical Development has chosen the home field for cultivation, and so far as we know makes no effort to reach outside except in Canada; but it is increasingly evident, especially when such figures of growth confront us, that a big foreign market awaits cultivation and development. Why cannot the Jovian Order take up the battle cry of a larger foreign trade? It would help the order and help the manufacturer and his employees. A standing committee of the organization could soon make its energies and efforts felt in the systematic pushing of everything American electrical all the time for everybody abroad.

**A Neglected Opportunity**

The scriptural injunction "Let your light so shine before men that they may see your good works" should be heeded by every central station without an electric sign upon the roof of its generating plant and substation buildings, for it is doubtful if a better means of advertising one's service from the housetops can be found. Certainly this form of publicity is greatly neglected, considering its low cost, both for installation and for operation. By using simple pipe framing for the support of letters formed by low candle-power tungsten lamps and supplying energy at nominal cost, a forceful appeal can be made to the public, particularly when the plant is located in

close range of any kinds of heavy travel. If taken only a few words to say the practical exposition to the advantages of electric service and give him the telephone number of the commercial department, and the company which fails to do the salesman a brilliant opportunity in more senses than one.

## London's Electrical Energy Supply

A recent chocolate paper in the London *Electrician* gives an account of the effective but inordinately intricate system of supply which meets the electrical needs of the world's greatest metropolis. The electricity supply in the metropolitan district is in the hands of thirty-one separate undertakings, part of them, including the largest individual outputs, being private corporations and the rest municipal undertakings by the various borough councils. It is euphemism to call the supply heterogeneous; some more inclusive and forceful word is necessary to describe the situation. One can find single-phase at 50 and 85 cycles, three-phase at 50 and 25 cycles, and both alternating-current and direct-current three-wire systems at all voltages utilized in such wise. Each borough has worked independently for the most part, and consequently one finds likewise steam plants of every conceivable kind, from simple reciprocating engines to the latest type of turbo-alternators, through about every sort of high-pressure, low-pressure and mixed-pressure turbine which has yet turned up on the British market.

A very interesting thing to note, however, is that four of Ferranti's original 10,000-volt alternators are still in operation after nearly a quarter of a century in the Deptford station of the London Electrical Supply Corporation, sufficient evidence both that Ferranti was ahead of his time and that he knew how to build extra good alternators in the days when such machines were none too common. The two largest electricity works in the system have between 40,000 kw and 50,000 kw in connection, and from that the list runs down to as low as 700 kw. No American city in the whole history of electrical development has displayed so variegated a system of supply, for the enterprises on this side of the water to a large extent have been private ones and have been consolidated before the state of things even remotely approximated that in London.

A curious fact which deserves investigation is that, somehow or other, the London plants manage to furnish, on the whole, astonishingly cheap energy both for motor service and lighting, and the charges run low whatever system of rates is employed. In most of the plants use is made of some form of demand system of charging, almost always moderated, however, by flat rates and sliding scales of various kinds. In fact, the systems of charging are as far from standardization as are the stations themselves. Some of the larger stations are built and operated on a strictly modern line and are able to turn out energy very cheaply. One, for example, reports a coal cost as low as 0.4 cent on less than 15,000,000 kw-hr. per year. This station has motor-service rates [illegible] to 1.2 cents. Many of the unified [illegible] efforts to obtain heating and [illegible] special low rates are usually offered. [illegible] been developed by enterprising publicity methods and has risen to the point in at least one station where the output for these purposes is about 40 per cent of the lighting output and practically double the motor output. Judging by reports, the London stations present a very much more striking appearance separately than if regarded as what they are not, a consistent whole. Unquestionably a unification of the supply system would result in very considerable savings in some regions of the metropolis. The actual state of things, however, seems to indicate that, given a dense population to be served and an area which compared with the American practice is small, a well-equipped and well-administered station can turn out and supply energy at an astonishingly low figure, a figure quite comparable with that reached in many a larger and more pretentious station handicapped by less density of load.

## Telephone Transmission Phenomena

Appearing in the *Digest* this week is the concluding abstract of a very comprehensive paper on telephone transmission by Mr. A. J. Aldridge, read before the Institution of Electrical Engineers and reprinted in large part in the London *Electrician*. One of the interesting features to telephone engineers on this side of the water is the author's calculating scale for use in transmission calculations, which apparently shortens materially the somewhat involved computations required in transmission work. Among the author's significant conclusions, verified by oscillograph studies of voice current, is the equivalence of a single frequency of 800 cycles for use in transmission calculations. While this result is not new, the method of analysis and the experimental observations add weight to the similar conclusion reached by other investigators. The author brings out a number of facts in regard to reflection losses which, although known in this country, have not been extensively discussed. The normally accepted equivalents of uniform lines, loaded or non-loaded, do not, when added together, give the true equivalent of a through line of composite character. The reason for this is the loss or gain which occurs at junctions of dissimilar sections, termed the reflection equivalent. While the latter in many cases involves an actual loss, this is not always the case, as when a section of non-loaded terminal cable is connected to a long line of loaded open wire. The reflection losses become most noticeable in the case of short lines, where the reflection equivalent bears the maximum ratio to the total equivalent of the line. However, the over-all transmission is the same in either direction over a line of compound or composite character, although the distribution of losses in the two cases will be dissimilar. In the case of short lengths of loaded cable, taken alone, the reflection losses become so predominant that as the line is further shortened the transmission, instead of becoming better, really becomes worse.

In all transmission calculations the electrical constants [illegible] play a fundamental part. It is well established that the true constants, measured with direct currents or [illegible] frequencies, change very materially as the [illegible] increases and the apparent constants at high fre-

ncy depart in great degree from those first mentioned. is fact was brought out both in the discussion of Mr. lridge's paper and in Dr. A. E. Kennelly's paper on the of an artificial aerial telephone line, read at the perstown convention of the A. I. E. E. What is found e true of the real line is also found in a measure to be e of artificial lines. This aspect of the question, now t the hyperbolic theory propounded by Dr. Kennelly been well established and verified, becomes of lead- importance, and it is to be hoped that papers dealing h the variation of line constants, so called, with the fre- ncy will be forthcoming at a near date. In this direc- , perhaps, there is a field for achieving some further rovement in transmission efficiency.

## Phase Compensation

lthough the disadvantages of low-power-factor loads on nsmission systems have long been recognized, only with- he past few years have steps been taken to improve the er-factor to a marked extent or to compensate for its ct upon transmission systems. Among the many meth- developed for this purpose the one most commonly em- ed is that involving the use of synchronous apparatus "condensers." This method is discussed at considerable gth in this issue in connection with several papers on the ject presented at the recent convention of the American itute of Electrical Engineers. A method involving the of the induction type of apparatus, which may seem to er considerably from the above but is really essentially same so far as operating results are concerned, is de- bed in an article by Mr. Val. A. Fynn, the second instal- t of which appears in this issue.

s ordinarily constructed, the induction type of appara- depends for its exciting magnetomotive force upon lag- wattless current taken from the supply system through primary coils of the machine. However, this is not an ntial feature of the apparatus; magnetomotive force can applied locally to the secondary coils, thereby varying amount of wattless current in the primary coils to any red extent. By means of a commutator on the revolv- secondary magnetomotive force may be applied in any sen space-phase position with reference to the stationary nary coils. It is evident at once that by placing the sta- ary secondary circuit in direct space-phase with the nary circuit, any magnetomotive force introduced into secondary will directly affect the magnetomotive force ired in the primary circuit, depending only upon the tive time-phase positions of the primary and secondary gnetomotive forces.

is, perhaps, not so well known that when the station- secondary circuit is placed in space-quadrature to the nary circuit, magnetomotive force introduced in the ndary circuit affects the primary current in the same ree as though the primary and secondary circuits were cident in space-phase. In this case, however, between two currents there is a displacement in relative time- se equivalent to the displacement in space-phase of the nary and secondary circuits. Mr. Fynn has devised an llent method for applying phase compensation to the induction type of machine. Current in the proper time-phase position for producing exciting magnetomotive force in the secondary is obtained by transformation either directly from the main supply system or indirectly therefrom by means of a secondary coil located on the stationary core of the machine in position to be affected by the machine's transformer flux. Experience has confirmed the theory that magnetomotive force applied to the secondary in space-quadrature to the primary coil can be so adjusted as to supply all of the exciting magnetomotive force required by the machine, thereby reducing to zero the wattless-volt amperes taken from the supply system and increasing the power-factor to unity.

## The Rating of Incandescent Lamps

Some important data regarding tungsten lamps have recently appeared in a report of the British National Physical Laboratory. The chief matter of interest is the report on the life of various commercial lamps purchased on the open market. The makers of the various lamps are unfortunately not stated. The result of the test was rather disappointing. The lamps, to be sure, were of the smaller sizes, part of them of the 220-volt type, but the breakage prior to 1000 hours was very serious, more than 70 per cent of the 220-volt lamps succumbing before this period and more than 30 per cent of the 105-volt lamps. On the other hand, those lamps which survived for 1000 hours generally maintained the candle-power within the 20 per cent drop.

Another important feature of the test was a trial of the lamps at a specific consumption of 1 watt per candle as against the standard 1.2 watts per candle. Under this condition the drop in candle-power was enormously increased in all the lamps, and the result showed plainly that for the lamps tested a specific consumption of 1 watt per candle is considerably smaller than is safe. In a general way, the report states that in the neighborhood of 1.2 watts per candle a variation of 0.20 watt per candle will lengthen or shorten the life by about 25 per cent. Unfortunately the details of the lamps are not sufficiently well given for obvious reasons to enable one to place them as regards manufacture and character of filaments. It is sufficiently evident, however, that the British lamps at least do not show from these tests anything like such good results as would be obtained from American lamps of standard manufacture. Whether this is because the manufacturers on this side of the water are decidedly ahead of the game in skill or whether Great Britain has been made the dumping ground for lamps which would not pass muster elsewhere we cannot say with certainty, but we are inclined to believe that the chief difference is the former one. There is no doubt that any impartial set of tests of American lamps would show much better results than those here indicated. Some of the performances recorded from American lamps of the larger sizes are truly remarkable and show that great strides have been made in tungsten-lamp manufacture within the last year or two. It is also highly probable that present types of British lamps would show considerable improvement over those covered by the report here noted.

# The News of the Week

## Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

### Collapse of Kuhn Projects

On July 7 the various projects controlled by the Kuhn interests at Pittsburgh collapsed. On that day the First-Second National Bank of Pittsburgh was closed by order of the Controller of Currency, the First National Bank of McKeesport suspended and the American Water Works & Guarantee Company and the banking house of J. S. & W. S. Kuhn were forced into the hands of receivers. Acording to the Assistant Secretary of the Treasury the examination made by the Treasury Department showed favoritism in the bank loans and in general an extremely bad condition in that the First-Second National Bank was apparently financing the private projects of those in the institution. The failure of the First-Second National also precipitated a run on the Pittsburgh Bank for Savings, of which Messrs. J. S. and W. S. Kuhn were president and vice-president respectively; but the run abated considerably on July 8 when both the Kuhns resigned.

J. S. & W. S. Kuhn, Inc., are incorporated in Delaware with a capital stock of $500,000. The firm has interested itself largely in Western irrigation projects, controls the West Penn Traction & Water Power Company, a group of bituminous mines in Pennsylvania and is at present engaged in building a hydroelectric development on the Cheat River in West Virginia. Mr. W. S. Kuhn is president of the First-Second National Bank of Pittsburgh, vice-president of the American Water Works & Guarantee Company, vice-president of J. S. & W. S. Kuhn, Inc., president of the Sacramento Valley Irrigation Company, president of the Twin Falls North Side Land & Water Company, president of the Kittanning & Leechburg Railway, vice-president of the Pittsburgh Bank for Savings, vice-president of the First National Bank of Allegheny and a director of the Colonial Trust Company, Commercial Trust Company and Commercial National Bank of Pittsburgh. Mr. J. S. Kuhn, besides being president of the First National Bank of Allegheny, First National Bank of McKeesport and the Pittsburgh Bank for Savings, is president of the American Water Works & Guarantee Company, a director of the Colonial Trust Company and Freehold Bank of Pittsburgh, director in Kuhn, Fisher & Company, Inc., of Boston, director of the Security Investment Company and Twin Falls North Side Land & Water Company, director in the Westinghouse Electric & Manufacturing Company, vice-president and director of the United Coal Company, West Penn Traction Company and the West Penn Traction & Water Power Company.

The American Water Works & Guarantee Company, which originally owned and operated six water works and two glass plants, now owns, controls and operates about forty constituent companies in seventeen states. It issued no bonds but has $10,000,000 preferred and $10,000,000 common stock. Its powers as a constructing and a holding company cover water works, gas, electric light, heat, sewerage and drainage plants, irrigation works, canals, steam railroads, street railways and industrials wherever located. Its stock holdings, however, are chiefly in water works, its electrical properties comprising the West Penn Traction & Water Power Company, the principal subsidiary of which is the West Penn Traction Company; Great Shoshone & Twin Falls Water Power Company of Idaho; Southern Idaho Water Power Company, Mount Vernon (Ind.) Electric Light & Power Company, Wellsville (N. Y.) Electric Light, Heat & Power Company and the Hydroelectric Company of West Virgina. Since 1889 the stock of the American Water Works & Guarantee Company has paid an annual dividend of 6 per cent, and in June, 1912, a stock dividend of 150 per cent was declared from the surplus. The securities of the subsidiary companies aggregate $110,718,800, of which $73,128,800 is in stock, and of this the American Water Works & Guarantee Company holds $46,481,050 (par value), the book value being given as of May 1, 1913, as $10,433,362. The funded debt of the subsidiary companies is $37,580,000.

The government has made no statement other than that the capital of the First-Second National Bank had been impaired. It is significant that the Pittsburgh Clearing House committee after a careful investigation refused aid. Diversified opinions have been expressed by persons supposedly conversant with the situation as to the cause of the failure and its effect on public utility securities. A financiers the Kuhns are not highly regarded by New York banking houses, and it has been suggested that the Pittsburgh firm has been pyramiding financially and has been too optimistic as to the future. Questioned as to the class of public utility securities which might have caused embarrassment, a Pittsburgh banker has vouchsafed the information that the Kuhn interests have quite a lot of money tied up in the California-Idaho Company, which controls extensive irrigation projects in the Sacramento Valley, and also in the Hydroelectric Company of West Virginia, which is erecting a hydroelectric plant on the Cheat River near the Pennsylvania-West Virginia state line. Many millions have been sunk in the irrigation projects and only a few hundred thousand dollars of the securities have been disposed of. In the case of the Cheat River developments, which will entail an expenditure of approximately $15,000,000, about $4,000,000 has already been expended and the work is only partially completed. Much opposition has been encountered in the latter development from individuals claiming rights on the river and also from the State governments. Whether or not the American Water Works & Guarantee Company will be split up into its constituent companies, each of which will be operated separately, is problematical. None of the other banks in Pittsburgh is affected, nor has the trouble extended to any other investment center. However, the belief is prevalent that the failure will have some effect on the sale of public utility securities, which under present money conditions are hard to sell at best.

### I. E. S. Officers

As a result of the letter-ballot election recently conducted by the Illuminating Engineering Society, the following officers were chosen for various terms beginning Oct. 1913: President, Mr. Charles O. Bond; vice-presidents Messrs. George H. Stickney and Ward Harrison; general secretary, Mr. Joseph D. Israel; treasurer, M. L. Marks; directors, Messrs. F. J. Rutledge, C. A. Littlefield and F. A. Vaughn. Messrs. Israel and Marks were re-elected to their respective offices.

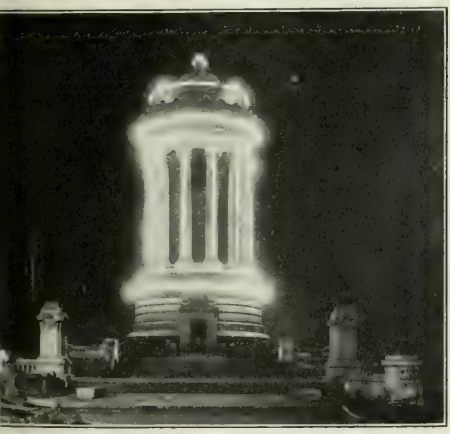
## Electrical Development Society Activity

a full meeting of the board of directors of the Society Electrical Development, Inc., held at the headquarters ne Engineering Societies Building, New York, on July rrangements were made for carrying forward actively olans of the society so that the work in aid of the elec- l industry may be well under way by the beginning of fall lighting season. The organization committee ad- ed additional funds for this purpose, and the member- campaign will be pushed with vigor so that pledges ing $200,000, the minimum required, may be obtained ne earliest possible moment. All persons who are in- sted in the aims of the society are urged to become bers at once in order that their pledges may aid in ging the total without delay to the necessary minimum. a small part of the amount pledged will be needed for beginning of the active work, but it has been agreed the subscriptions must reach $200,000 before any of it be used.

uch information concerning the aims of the society is n in the prospectus now being distributed to all per- interested. The by-laws of the society are so drawn o give equal representation to all branches of the elec- l industry. A general invitation is extended to all in- luals, partnerships and companies composing the elec- l industry to become members. Although the dues based on the gross amount of the sales made annually he members, yet it is unnecessary for a member to e public the information concerning the exact amount is sales. A member may subscribe in accordance with assification in groups, of which there are seventeen, group representing sales of from one and one-quarter vo and one-half times the amount of the next lower p.

## trical Illuminations on New York's Sane Fourth

aborate electrical illuminations this year took the place ne usual municipal displays of fireworks with which York City has been celebrating recent sane Fourths uly. Public buildings and monuments were outlined



SOLDIERS AND SAILORS' MONUMENT

thousands of electric lamps, and the trees of numer- city parks were studded with Japanese lanterns and colored lighting units. In all, some 17,000 8-cp lamps used, the energy for operating the displays being fur- ed gratis by the New York Edison Company, so that nly cost to the city was the installation of the lamps, h was done by private electrical contractors. The illumination was continued July 4, 5 and 6, being operated each night from 7:30 p. m. to 12 midnight.

The outlining of the City Hall, pictured herewith, required 3000 lamps and was furnished complete by the Edison company. Washington Arch, at the foot of Fifth Avenue, was outlined with 2000 lamps. One of the most effective displays was that attained with 1000 lamps on the



ILLUMINATION OF CITY HALL

Soldiers and Sailors' Monument, Riverside Drive, also shown in an accompanying illustration. In the Mall, Central Park, 3000 lamps were inclosed in Japanese lanterns, gracing the trees, walks, fountains and water vistas, while colored lanterns projected their variegated illumination over the scene. Nearly 2000 lamps were used to outline Bronx Borough Hall, this decorative installation having been similarly donated by the company. In a dozen outlying parks strings of electric lamps were festooned through the trees, and moving-picture exhibitions of patriotic films were presented during the evening of the Fourth.

## Program for Ohio Convention at Cedar Point Next Week

The nineteenth annual convention of the Ohio Electric Light Association will be held at Cedar Point, Ohio, July 15 to 18. Among the papers to be presented at the convention, which opens with an address by President J. C. Martin, Wilmington, Tuesday afternoon, will be the following: "Cooking by Unity-Load-Factor Electric Ranges," by Mr. M. L. Turner, Cleveland; "Retention of Business of Dissatisfied Customers," by Mr. T. F. Kelly, Dayton; "New Business," by Mr. J. E. North, Springfield; "Developing and Diversifying the Present Load," by Mr. H. E. Armstrong, East Liverpool; "The Human Equation," by Mr. S. G. McMeen, Columbus; "Meters," by Mr. A. H. Bryant, Cleveland; "Long-Distance Transmission," by Mr. M. H. Wagner, Dayton; "Franchises," by Mr. J. V. Oxtoby, Detroit, and "Illumination as a Commercial Product," by Mr. A. M. Seeger, Toledo. The usual elaborate entertainment program has been provided, including the annual banquet, reception, dances, musicales, boat rides, ball games, Jovian rejuvenation, etc. Mr. D. L. Gaskill, Greenville, Ohio, is secretary of the Ohio Electric Light Association.

## Convention of National Electrical Contractors' Association

The thirteenth annual convention of the National Electrical Contractors' Association will be held at Chattanooga, Tenn., July 16, 17, 18 and 19. The headquarters and registration bureau will be at the Hotel Patten, at which place the open and business sessions will also be held. A directors' meeting is scheduled for the morning of July 15, and

at the open [illegible] to be held on the morning of July 16 speakers on subjects of general interest to the trade will be heard. The afternoon will be devoted to a business session for members only, and in the evening there will be a lecture on [illegible] followed by a reception and dance. A rejuvenation of the Sons of Jove is also scheduled for the evening of July 16. The sessions on July 17 and 18 are to be held behind closed doors and on the evening of July 18 the annual dinner for guests and members will be held at the Hotel Patten. The entertainment features comprise an automobile trip to Chickamauga Park and Fort Oglethorpe on July 17; an afternoon tea to be given by the Chattanooga Electric Club at the Hotel Patten on the afternoon of July 18; a trip to Signal Mountain with luncheon at the Signal Mountain Inn on July 19, and a trip by special train to the Tennessee lock and dam in the afternoon.

## Standardization of Electric Cooking Apparatus

Reference has been made in this journal to the activities of the English society known as "The Point Fives," which is composed of managers of organizations supplying electricity. The title of the society is derived from the effort to further a secondary rate for electricity, under certain conditions, of a half-penny, or 1 cent in American currency. At a recent meeting there was a rather interesting debate on the standardization of electric cooking utensils, which resulted in the following recommendations:

Domestic and other ranges (consisting of oven, grill and hot-plates) should have each a sub-circuit separately fused and protected by a switch. The oven should have two or more circuits.

Switches and fuses should be placed in such a position that they cannot become unduly heated or damaged by liquids being spilled over them, and so that they may be easily accessible.

Provision should be made for the efficient grounding of all apparatus.

Ranges should be fitted with at least one indicating device, separately fused, which will show clearly whether any circuit is turned on.

Manufacturers and designers should endeavor to develop a hot-plate which will work satisfactorily at red heat.

## Effect of Foreign Co-invention on Validity of Domestic Patent

An interesting patent cause between the Westinghouse Machine Company and Coloman De Kando, complainants-appellants, and the General Electric Company and A. H. Armstrong, defendants-appellees, was decided last month by the United States Circuit Court of Appeals for the second circuit, Judge Lacombe rendering the opinion, which is given here in substance.

The real point at issue was the extent to which the validity of an American inventor's patent is affected by simultaneous or even prior, but independent, invention in a foreign country. The case grew out of an interference in the Patent Office, entitled De Kando versus Armstrong, which was decided adversely to the former and his assignee, the Westinghouse Machine Company. The interference was between an application of De Kando's filed July 3, 1906, and a patent issued to Armstrong, No. 811,758, on Feb. 6, 1906, on an application filed June 28, 1905. The invention in question was a system of separate or individual resistors for the secondaries of three-phase induction motors on electric locomotives, designed to assist in equalizing the load among the motors or between two or more locomotive units coupled together. The merit of the system consisted in overcoming the difficulty which would arise if a common resistor were used and the respective motor speeds were not identical, under which conditions the motors would be unequally loaded.

The suit was brought under Section 4915 of the United States Revised Statutes, which provides that whenever a patent on application is refused either by the commissioner or by the Court of Appeals of the District of Columbia upon appeal the applicant may have remedy by a bill in equity and the court may adjudge the matter. The bill in this cause was dismissed by Judge Ray in the United States District Court for the northern district of New York, and then appeal was taken. Judge Lacombe reviewed certain facts set forth in the evidence given below, as follows: De Kando, the foreign co-inventor, made his invention in 1904 or prior thereto and applied it on the Valtellina railway in Italy in the spring of 1904. In March of the latter year a well-known American engineer visited De Kando, saw the invention in use and in May returned to America with a full description of it which he subsequently imparted to others, and on June 19, 1905, presented before the American Institute of Electrical Engineers. The purpose of this visit was to obtain knowledge of De Kando's invention and introduce it in this country. Armstrong's date of conception was prior to 1901 or 1902, but he did not file application until June, 1905.

Judge Lacombe pointed out that the crucial question was whether Armstrong, in the admitted circumstances, was entitled to the grant of his patent. This question involves two sections of the patent law, Sections 4886 and 4923 of the United States Revised Statutes, next given:

"Section 4886. Any person who has invented or discovered any new and useful art, machine, manufacture or composition of matter, or new and useful improvements thereof, not known or used by others in this country before his invention or discovery thereof, and not patented or described in any printed publication in this or any foreign country before his invention or discovery thereof or more than two years prior to his application, and not in public use or on sale in this country for more than two years prior to his application, unless the same is proved to have been abandoned, may, upon payment of the fees required by law, obtain a patent therefor."

"Section 4923. Whenever it appears that a patentee, at the time of making his application for a patent, believed himself to be the original and first inventor or discoverer of the thing patented, the same shall not be held to be void on account of the invention or discovery of any part thereof having been known or used in a foreign country before his invention or discovery thereof, if it had not been patented or described in a printed publication."

The complainants contended that when the knowledge of De Kando's invention was brought to this country in May, 1904, it became "known" in the legal sense before Armstrong's application was filed. The Court of Appeals of the District of Columbia held in substance that for the purpose of defeating a patent application reduction to practice in a foreign country is a nullity unless the invention is patented or described in a printed publication, and the present opinion leans to the same view. If Section 4886 stood alone, the case might be different, since the De Kando invention was known in this country prior to the Armstrong date. But the patent law is contained in many sections and they must be construed together. Section 4923 deals specifically with the effect of knowledge and use in a foreign country and it makes no distinction whether such is made or such knowledge is acquired by persons who, after using the thing or acquiring the knowledge, remain abroad or come here. The patent taken out here for the same thing shall not be void on account of such use or knowledge unless the invention had been patented or described in a printed publication. Thus Section 4923 qualifies Section 4886, and the Circuit Court affirmed the decree of the lower court and sustained the validity of the Armstrong patent.

## Kelvin Memorial at Belfast

A memorial statue to the late Lord Kelvin was unveiled the Botanic Gardens Park of Belfast on June 19. The ney for the statue was subscribed by the people of the y and the statue itself was executed by Mr. Albert uce-Joy. The figure is 10 ft. high and stands on a 13-ft. anite pedestal. It represents the subject standing erect th the left hand extended and holding in it a design of e of his discoveries—an adaptation of the gyroscope. the right hand is a pencil pointing to the drawing. The



STATUE OF LORD KELVIN

ılptor has depicted the illustrious scientist in the prime life and intellectual power and has made a special effort bring out the personality of the man. By the side of the ure, which is draped in a doctor's gown, stands a rep- sentation of the well-known Kelvin compass. At the un- iling ceremony Sir Joseph Larmor delivered a tribute ited to the occasion, dealing with Lord Kelvin's home ining, his life at Cambridge and Paris, his achievements d fame in the scientific world, the legacy in physical ence that he has left, his personal qualities and distinc- n as a patriot as well as a man of science.

The Glasgow University statue of Lord Kelvin is to be veiled in October by Mr. Birrill as lord rector, and the dress will be delivered by Mr. Balfour, the Gilford lec- rer. The Westminster memorial, which takes the form a stained-glass window, will be unveiled some time this nth. Members of British and American engineering cieties to the number of 1296 subscribed over $8,000 for e latter memorial.

## Organization of Louisville Merger Company

Final details looking to the organization of the Louisville is & Electric Company, the merger of the local utilities of uisville, Ky., were completed July 2, with the exception the taking over of the Kentucky Electric Company, de- red pending the formal dismissal of the city's suit to strain such action and the payment for the stock of the areholders pooled for the purpose.

The Louisville Gas Company, the Louisville Lighting mpany and the Kentucky Heating Company and its asso- ite corporations were joined under the new title and have ased activities as operating companies, although they will, course, continue to maintain a corporate existence. The uisville Gas & Electric Company of Kentucky, which places them, is capitalized at $11,000,000 and has author- d a bond issue of $15,000,000, $7,500,000 of which has been offered. The Louisville Gas & Electric Company of Delaware, its holding company, has $18,000,000 capital stock.

The board of directors of the new company is composed of Messrs. H. M. Byllesby, J. J. O'Brien, Arthur S. Huey and Otto E. Osthoff, of the Chicago organization of Byllesby & Company; James B. Brown, John W. Barr, Jr., John H. Whallen, Donald McDonald, Charles H. Doherty, Daniel E. Doherty, H. D. Rodman and Robert M. Trimble, Judge Matt O'Doherty and General George H. Harries.

The executive committee is made up of Messrs. H. M. Byllesby, G. H. Harries and Donald McDonald, ex officio, and Charles J. Doherty, James B. Brown and J. J. O'Brien.

The officers are Messrs. H. M. Byllesby, chairman of the board; George H. Harries, president; Donald McDonald, vice-president and general manager; James B. Brown, vice-president; F. C. Gordon, vice-president; R. F. Graf, secretary; T. B. Wilson, treasurer and assistant secretary; Herbert List, assistant secretary and assistant treasurer; Thomas W. Kennedy, assistant treasurer. It is stated that Mr. Graf's appointment is only temporary and that Mr. Kennedy will be the permanent secretary.

In addition to these elected officers, announcement has been made of the appointment of Mr. Herbert L. Harries, son of General Harries, to the post of assistant general manager. Mr. G. Wilbur Hubley, formerly chief engineer of the Louisville Lighting Company, has been appointed electrical superintendent. Mr. H. W. Fuller, who for six months has been general manager of the Louisville Lighting Company, is to return to the general offices of H. M. Byllesby & Company at Chicago.

## Electric-Service Rate Discussion in Chicago

At the meeting of the committee on gas, oil and electric light of the Chicago City Council on July 7 Mr. Ray Palmer, the city electrician, answered some of the objections made by Mr. William G. Beale, counsel for the Commonwealth Edison Company, to the report of Mr. Palmer on the rates of the Commonwealth Edison Company.

As to maximum rates, Mr. Palmer said that the classification of rates is a practical necessity. Maximum rates fixed on the basis of some small individual customers whose maximum demand is practically coincident with the maximum demand on the system would result in unreasonably high rates for the general public. If the rates must be fixed so as to result in a profit for the company in the case of every individual consumer, there would be practically no limit to the maximum rate.

In reference to the allowance to be made for the cost of paving over conduit, Mr. Palmer declared that full value is allowed, in his report, for paving in every instance where it was paid for by the company. As far as possible the valuation in the report has been made on the basis of original cost. In the Kings County lighting case the Appellate Division of the Supreme Court of the State of New York limits its decision on paving over conduit to the basis of reproduction value.

In relation to franchise value, Mr. Palmer contended that if a capital allowance is to be made for such value on the theory that the company is annually paying about $500,000 in taxes on this value, it follows that the company must pay the amount of such tax out of capital funds supplied by stockholders and not take the payment out of gross receipts and penalize consumers by a rate which includes this amount.

Referring to property acquired in advance of present requirements the city electrician said that in the case of generating-station and substation construction interest-carrying charges were added as a part of the construction cost to reimburse the company for the loss suffered in paying

interest on funds borrowed for construction purposes while a portion of the plant was in course of construction. Exclusions were made in the case of property which had no direct relation to the supplying of electricity or which was held for sale when a favorable opportunity arose.

Mr. Edward W. Bemis, public utility expert, explained to the committee the provisions of the new law creating a public utilities commission for the State of Illinois.

## Lexington Franchise Referendum Declared Invalid

The Kentucky Traction & Terminal Company, of Lexington, Ky., has double troubles at present, being engaged in a contest regarding its franchise, as already noted in these columns, besides having a strike of construction men on its hands. The city commission of Lexington recently awarded to the Lexington Utilities Company, the local subsidiary of the Kentucky Traction & Terminal Company, a twenty-year franchise which was later canceled, as the result, it was announced, of a popular referendum vote on the question. The company now protests that 643 names on the petition which resulted in the election were withdrawn, being either not registered or otherwise invalid. It is now, therefore, possible that the referendum will be declared null and void, and in this case the franchise granted by the commissioners will become effective. The construction men's strike, which started in Lexington and has since spread to other points where the local company operates, is based on the demands of linemen for a nine-hour day at 30 cents an hour instead of a ten-hour day at 27½ cents an hour.

## Submerged Weir for Niagara River

The International Waterways Commission has recommended to the United States and Canadian governments the building of a submerged weir in the Niagara River. The weir will extend from Hog Island, just above Welland River on the Canadian side, to a point opposite Gill Creek, on the New York shore. If carried out, the restriction to flow will raise the level of the upper waters of the Niagara through a height of 3 ft. for a distance of approximately 1.5 miles. The effect opposite Buffalo will be an increased level at low water of 1.08 ft. and at flood of 0.19 ft. The level of Lake Erie will be raised 0.31 ft. at low water, 0.39 ft. at mean level and 0.11 ft. at extreme flood level. Extending into the upper lakes, the mean level of Lake St. Clair would be influenced to an extent of 0.23 ft. increase and that of Lake Huron by 0.09 ft. The cost of the weir, including the levee necessary to protect adjoining shore properties, is estimated at $3,500,000. The proposed dam, it is claimed, will have no appreciable effect upon the waters below it, and Lake Ontario and the St. Lawrence River will not suffer from a perceptible decrease in flow from the Niagara. The commission pointed out that the weir would be of value in eliminating any injurious effect upon the level of Lake Erie due to the diversion of water at Niagara Falls for the generation of electricity.

## Decree in Copper-Clad Steel Infringement Case

In December, 1910, the Duplex Metals Company, manufacturer of copper-covered steel wire made under the Monnot patents and sold under the trade name of "copper-clad steel," brought a suit in equity against the Standard Underground Cable Company, alleging infringement of one of the Monnot patents and also unfair competition in trade. The latter concern was marketing a copper-covered steel wire which has been known as "Colonial copper-clad" and manufactured by the Colonial Steel Company. The cause was duly referred to a master in chancery and testimony taken, the record becoming voluminous. The chief contentions in the infringement case arose over the question whether the product sold by the Standard company was one in which the copper covering was actually welded to the steel core or base, for if such a weld existed, it was argued that the "Colonial copper-clad" product clearly infringed the Monnot patent, No. 893,932, granted July 21, 1908, for improvements in copper-clad iron and steel and owned by the complainants.

On June 25 last the case came before the court on motion by the complainant to dismiss the bill in respect to the charge of infringement, the motion being supported by an affidavit by one of the officers of the Duplex Metals Company and offered in its behalf, the substance of which is herewith given.

Prior to October, 1908, the defendant handled and sold the complainant's copper-covered steel wire, but sometime thereafter commenced to sell copper-covered steel wire manufactured for it by the Colonial Steel Company. Such of the latter wire as the affiant could obtain prior to October, 1910, was tested for a weld by means of mechanical tests such as bending, torsion, etc., tending to strip the copper from the steel, and declared to be unwelded. But during October, 1910, the affiant stated that he obtained certain samples of the Colonial wire which apparently were welded, and thereupon arranged to bring suit. In the affidavit it was stated that the metallurgical expert for the defendant had testified that the process of manufacturing copper-covered steel wire employed by the Colonial company could not produce a true weld between the copper and the steel, and in effect that such a process could produce no more than a strong mechanical adhesion of the metals. The affiant also stated his concurrence with the views of the expert for the defense.

Based upon this distinction between a weld, technically defined as such, and mechanical adhesion, as applied to a union between copper and steel, the complainant filed a motion to dismiss the infringement charge, without prejudice. This motion was opposed by the defendant, which argued that the dismissal should be upon the merits of the case, thus disposing of the infringement question instead of leaving it open.

The following decree was thereupon handed down on June 25 by the United States District Court for the western district of Pennsylvania, at Pittsburgh.

"Complainant having admitted that defendant's product referred to in the proofs herein does not infringe the Monnot patent in suit, No. 893,932, it is ordered adjudged and decreed that the bill of complaint herein, in so far as it is based on alleged infringement of said patent, be, and the same hereby is, dismissed on the ground that defendant has not infringed said patent, and so dismissed with costs to be taxed."

There still remains that part of the bill of complaint relating to the charge of unfair competition in trade in using the name "copper-clad," which the complainant alleges is its solely. It is expected that this will reach a hearing early in the fall.

## Methods of Large Engineering and Construction Company

At a recent meeting of the Boston Section of the American Institute of Electrical Engineers a paper was presented by Mr. Roy Manwaring Henderson, assistant construction manager of the Stone & Webster Engineering Corporation, Boston, Mass., on the organization and methods of that establishment.

Prior to giving a detailed description of the organization and its office and field methods, the speaker pointed out that the establishment and growth of such concerns have occurred as a result of the tendency toward centralization in

most lines of business, the increased size and scope of engineering and industrial undertakings, the better facilities afforded for handling complex projects by a single interest, and the additional engineering services which no previous type of organization was in a position to render.

Among the advantages secured by such an organization in handling work are the following:

(1) Elimination of the fundamental weakness of divided responsibility for engineering and construction.

(2) Elimination of the conflicting financial interests of separate contractors by utilizing an organization whose interests are identical with those of the owner.

(3) Elimination of time losses by making the period for construction overlap instead of following the period for engineering.

(4) Elimination of a further loss of time during the construction period due to lack of team work when the work is executed by a number of separate contractors.

(5) Elimination of the duplication of organization in at least the executive and clerical branches of separate contractors.

(6) Elimination of exorbitant profits frequently paid for extras occasioned by errors of omission and commission in the specifications, plans or contracts; also the heavy penalty paid for changes found necessary as the work progresses.

(7) Elimination of the loss to the client by reason of the fact that he formerly paid to each contractor or subcontractor in the contract price, a sum which had been included by the contractor as a contingency allowance or measure of the risk assumed. A large portion of the contingencies against which the contractors were protecting themselves never materialized, and if the owner could have assumed these risks himself he would have saved money in the majority of cases.

(8) The elimination of at least part of a corps of nonproductive but necessary inspectors.

The time element is worth further analysis.

Formerly plans and specifications were prepared after a careful investigation of physical and other local conditions. Contractors were then invited to bid or bet on what would be encountered many feet below surface of the ground or in a river-bed, and on how many holes would be found in the specifications through which extras could be secured, and in due course the successful bidder would receive a contract which he would usually handle by means of a number of sub-contracts, doing the fewest possible parts of the work himself. To complete this procedure and arrive at the point of beginning actual construction frequently required months.

In the case of the modern engineering and construction company the field engineers are hardly well started on their preliminary investigation of physical conditions which will govern plans and estimates of cost before the construction forces start their preliminary work of demolishing old structures, building rail or wagon roads, clearing timber, establishing camps, planning the construction plant, ordering and assembling construction equipment, scouting for materials and locating sources of labor supply, so that by the time the engineers can get out the location, excavation or foundation plan the construction force is sufficiently organized and equipped to start actual construction immediately. Thus at the very beginning weeks and more often months are saved, and until well along in the job the engineers have their own troubles in keeping up with the construction forces, while they have the benefit of the opinions of the construction men at the time the plans are being prepared so that they can give every consideration to the local conditions which will affect construction and costs. Only the smallest possible amount of work is given to subcontractors so that by far the greatest proportion of the work is under the direct control of the organization handling the job. Modern business methods, systematic preparation, definite assignment of responsibilities and a flexible line-up of departmental relations all contribute to increased efficiency, which results in saving time all along the line. These accumulated savings of time result in the power plant or building being completed and on an earning basis much sooner than was formerly possible, to which must be added the advantage of a reduction in interest charges during construction. These two items more than offset any imaginary or real additional cost incurred by reason of foregoing the questionable advantage of competitive bids.

## Canadian Electrical Association Papers

Last week's issue contained an account of the proceedings of the convention of the Canadian Electrical Association held in Toronto on June 25 to 27. Below are to be found abstracts of papers and discussions on the subjects of wiring rules, electricity on the farm, service, pole-type transformers and central-station advertising.

### Wiring Rules

In a paper entitled "The Hydro-Electric Rules and Regulations and the National Electrical Code," Mr. H. F. Strickland, of the Hydro-Electric Power Commission of Ontario, pointed out the difference between the rules promulgated by the Hydro-Electric Power Commission and those of the National Electrical Code. The Hydro-Electric rules and regulations have not been drafted with the idea of covering every conceivable form of construction as has been attempted in the National Electrical Code, but have been drawn for the purpose of covering all such inside wiring as will be met with in every-day practice and which anyone is liable to be called upon to perform. While a large percentage of the rules are an adaptation of the National Electrical Code, it has been a very difficult task to reclassify them and in many cases reword them in order to avoid cross-references and repetitions. In addition, the Hydro-Electric Commission has introduced a great many new rules and enlarged on many of the National Electrical Code rules. Prominent among the new rules not found in the National Electrical Code are those necessary for the protection of life.

*Discussion*

The paper called forth from Mr. S. B. Hood, of the Toronto Electric Light Company, Ltd., and Mr. A. A. Dion, of the Ottawa Electric Company, the criticism that the rules contained a number of contradictions, notably with reference to the grounding of the neutral in any system in which it is stipulated that the neutral should have no fuses but be solid straight through. Elsewhere the rules call for switches and circuit-breakers for this neutral system. A switch is also required between the house service and the meter, thereby eliminating all possibility of a central-station company using any sealed service equipment such as is now extensively employed to guard against theft of energy. Another point brought out was that branch fuses should be rated at 10 amp instead of 6 amp, as called for in the Hydro-Electric rules, so as to permit the use of appliances on any lamp socket. Attention was called to the fact that although the Hydro-Electric Commission made up the rules it would be incumbent upon the municipalities themselves to make the inspection, in which case if there were a private plant in that town it would be subjected to the supervision of its competitor. At the suggestion of Chief Engineer Gaby, of the Hydro-Electric Commission, a committee consisting of Messrs. A. L. Mudge, of the Electric Power Company, Toronto; F. G. Clark, of the Toronto Electric Light Company, Ltd., and W. G. Angus, of the Dominion Power & Transmission Company, Ltd., Hamilton, was appointed to confer with the commission on the rules, which had been put out on a tentative basis.

[illegible]

With the advent of [illegible] protective equipment and bi-metallic conductors which permit long spans and of more dependable and cheaper high-voltage transformers, it becomes possible to cut down investment in a rural distributing system and to go even to the use of steel conductors, using one conductor with a ground return for single-phase primary distribution in rural districts. A consideration of these conditions is important in getting after rural loads because, as pointed out by Mr. J. C. Parker, of the Rochester (N. Y.) Railway & Light Company, in his paper on "Electricity on the Farm," there is no justification for the same quality of service either with regard to continuity or close regulation in rural districts that is required in urban territory. In addition, the large obstacle of high cost of farm installation must be overcome. The actual installation must take the form of rugged, absolutely simple equipment capable of withstanding rough usage and keeping in operating condition without close follow-up from the maintenance department. The equipment must also be of a wide range of utility so that the same investment may serve a multiplicity of uses. While technical excellence justifies itself economically, in farm installations some other criterion must obtain, because, as pointed out by the author, in the case of a fodder-cutter rated at 2 tons, with energy at 5 cents per kw-hr. and labor at 15 cents an hour, the labor represented 18.6 per cent of the entire cost, the energy 26.2 per cent, and depreciation and interest 55.2 per cent. Therefore, no great loss will be incurred by the user of the apparatus if the efficiency of the equipment is very much lower, provided the investment cost is brought down. Mr. Parker also called attention to the prevailing literature used in soliciting farm business, the quality of which is such that it bespeaks a conviction that farms must be electrified on sentiment rather than as industrial propositions. Pruning of trees by means of a hot wire was among many of the suggested uses of electricity on the farm, and the author also hinted at the use of the electric motor as a remedy to farm labor troubles. In the opinion of the author, it is erroneous to try to supplant other forms of power by electric power instead of preaching electric power as a means of saving wastage. It is not that the electric motor will do more work at $1.50 a day than will the farm laborer, but that the electric motor can be induced to stay on the farm and be ready for work when wanted, while the farm laborer cannot. While the problems are chiefly those of the future, Mr. Parker emphasized the fact that in the preparing and obtaining farm business it will be necessary to break loose from some of the traditions in regard to line construction by making the lines that serve the farmers inexpensive through the use of small copper section, light structures and inexpensive protective apparatus, sacrificing, if necessary, closeness of regulation and to some degree perhaps continuity of service. The overloaded capacity of transformers will also have to be used and perhaps pushed to the limit. The wiring installations on the farm themselves will have to be of the most inexpensive sort, and the whole equipment of such a nature that the farmer will not have to tie up a large sum of money for one isolated function.

*Discussion*

Messrs. Maclachlan, Peeling and McClelland, of the Trenton Electric & Water Company, of Belleville, contributed to the discussion on Mr. Parker's paper. The Belleville company went after rural loads last fall and now has two lines in operation. At first the community plan was tried but afterward abandoned. Flat rates are successful in certain districts and meter rates in other sections. The speakers said it was bad policy to build the rural line before securing the business and that cheap and rugged equipment is desired. On installations ranging from 1 hp to 4 hp the cost approximates $110 for a 1-hp motor and wiring, $175 for 2 hp, $225 for 3 hp, etc. On one line 12 miles long the company has a connected load of 75 hp.

SERVICE

In his paper on "Service," Mr. Stephen L. Coles, of the Society for Electrical Development, laid stress on its importance in the upbuilding of any public utility, because no other one business comes so near to the people as does that of the central station. The successful sales manager of a central station, he said, has a better grasp of the social, political and business conditions in his community than any one else, and the success of a central station not only as a public utility but as a business proposition carried on for profit is in direct ratio with the service it gives. At the present moment, he maintained, the public is quite sufficiently informed to demand and insist upon service, and the central station has no alternative but to give it or else suffer competition. Every point of contact between the company and a customer is an opportunity for service, and the manner in which any such opportunity is grasped is an exact demonstration of the company's ability to give service.

*Discussion*

In discussing the paper Mr. W. Maclachlan, of Belleville, called attention to an article in the May number of *Harper's Magazine* entitled "The Power That Serves" and suggested that the association issue reprints. Mr. G. W. Magalhaes, of Toronto, said that service should come before rates and drew attention to the fact that most large companies now act as consulting engineers in illumination, motor installations, etc. The Toronto Electric Light Company, Ltd., also has a repair force for emergency service which is on duty day and night, and Mr. McDougall, of that company, told how oftentimes the company stretches a point in doing something for nothing in order to satisfy the customer. This is especially true in removing grounds on interior wiring circuits. The discussion then turned to the relations of central stations to contractors, and Messrs. A. A. Dion, of Ottawa; D. H. McDougall, of Toronto; W. Ostrom, a contractor of Belleville, and W. H. Munro, of Peterborough, took part. Mr. Dion said that his company carries a complete line of supplies but does not do wiring. Mr. McDougall said the Toronto Electric Light Company no longer sells fixtures and does no wiring. It co-operates with the local contractors' association and last year turned over 300 customers to local wiremen. He said the good-will of the contractors is an important asset and hoped for much from the Society for Electrical Development in clearing up differences. Mr. Ostrom said his company maintains six branches and at first thought central stations were antagonistic. The trouble he found arose over bad wiring, and this was remedied by the contractor setting aside a man to attend to complaints of that sort. The revenue obtained from this work pays the wages of the man and nets a handsome profit in addition. In Hamilton, it was pointed out, the wiremen are opposed to the lighting company because it sells supplies, and it was suggested that a company could be guided in the question of whether or not it should handle supplies, etc., by referring to the rating of local contractors in Bradstreet's or other mercantile agencies. Mr. Dion said that in Minneapolis, Minn., the company has abandoned the sale of appliances of all kinds.

POLE-TYPE TRANSFORMERS

In a paper entitled "Pole-Type Transformers" Mr. C. E. Sisson, of the Canadian General Electric Company, directed attention to some of the more important details entering into the design and structure of the modern lighting transformer both from an operator's and a manufacturer's point of view. He gave the essential features of a lighting transformer in the order of their importance as follows: safety, durability, economy of operation and first cost. The first three

are, of course, dependent upon insulation, aging, temperature rise, core loss, copper loss, regulation and magnetizing current. In the estimation of the author the insulation should be such that it will be practically indestructible. From an operating point of view reliability is of greatest importance, since upon it depends the continuity of service, with which goes the satisfaction of customers, while from an economic standard it cannot be ignored, as it determines the rate of depreciation that should be placed on the equipment. If the apparatus is to be more reliable, it is necessary to give attention to a better arrangement of parts and the selection of a better and more suitable method of insulation. The insulation must be free from and protected against absorption of moisture in addition to having dielectric strength sufficient to withstand normal strains of operation and test voltages required. This condition is obtained by drying the apparatus in a vacuum and filling it with a compound which will harden under normal conditions. Importance should also be attached to the question of uniform temperature in transformers. In speaking of the economy of transformer operation, the author pointed out that with the marked improvements in the quality of steel the losses in the present type of transformer have been materially reduced until for a given kva rating the transformer is the most efficient piece of electrical apparatus built. The improvements in the efficiencies at light loads illustrate clearly the fact of the reduction in core losses, while improvement in regulation is accounted for by the reduction in copper losses. A decided improvement has also been made in the regulation at low power-factors. This marked reduction in losses, combined with the better mechanical construction of the newer types of transformers, has made it necessary to place a very high depreciation value on the older apparatus installed. In the estimation of the author, this depreciation is more than offset by the decrease in the annual cost of core and copper losses coupled with the advantage of better continuity of service. He said it would be economical engineering on the part of central stations to replace many of their old transformers by newer and more efficient ones, even if the old transformers are still operative. Thus the depreciation charge to be placed against a transformer does not depend upon the natural life of the apparatus, but upon the time during which it can be profitably kept in service. Marked improvements cannot be reasonably anticipated, and while a more efficient transformer could be produced by increase in materials, any advantage in low losses would be offset by a higher cost since a decrease of 1 per cent in core and copper losses requires over 3 per cent increase in active material. The characteristics which should receive more careful consideration are long life with continued service.

*Discussion*

Messrs. S. B. Hood, of Toronto, and W. L. Bird, of Fort William, told of the troubles which had disappeared from their lines since they grounded the neutral. Heretofore it used to be the practice to go out and re-fuse both sides of the transformer after every storm. In Toronto the company has not lost a transformer in three years. Mr. A. L. Mudge, of Toronto, said his company employs pole-type transformers of the higher-voltage type, particularly for rural distribution work, with good results, and Mr. Sisson said 6600-volt and 11,000-volt transformers will be adopted more and more. Replying to questions of manufacturers as to the standardization of taps, it was brought out that taps are a great advantage in boosting voltage at times and in general central-station service and that it would be out of the question to discontinue them for manufacturing reasons.

CENTRAL-STATION ADVERTISING

Mr. D. H. McDougall, of the Toronto Electric Light Company, Ltd., in a paper on "Central-Station Advertising" divided the mediums into two classes, one in which the company comes in direct contact with the public and the other by printed advertising. The first he subdivided into five sub-topics as follows: Delivering the goods; courtesy to the public at every point of contact; direct personal canvass; periodical visits to consumers to solicit criticism and complaints, and prompt and cheerful attention to complaints of consumers by means of an efficient emergency force. The several methods of printed advertising the author classified in the following order of importance: Direct advertising, by which is meant a company magazine or house organ published monthly, circulars, letters, pamphlets, etc., sent direct to prospective customers or others it is desired to interest; daily newspaper advertisements; billboard, street car and electric sign advertising; weekly papers or magazine advertising; theater programs, charity and entertainment programs, etc. By means of attractive literature that will be read the author said more good can be done than by any other means provided the articles are true. The daily newspaper advertisement can be made effective if the reading public is sympathetic or interested in the company, but as a means of converting an antagonistic public it is of doubtful effect unless the papers themselves are fair or at least unbiased toward the company. A small antagonistic news item in the same edition as the company's advertisement will to a large extent neutralize the latter's effectiveness. The author pointed out the merits and demerits as advertising mediums of electric signs and billboards, street-car advertising and the other forms mentioned. On the whole, however, the best method, in the opinion of the author, of advertising the company's business is service, by which is meant delivering the goods in every branch of the organization with efficiency and courtesy.

A very general discussion on advertising methods followed the presentation of Mr. McDougall's paper. In Ottawa billboard advertising has been discontinued by the company. The Hamilton company has issued a four-page bulletin for three years, and the Toronto company has just begun the publication of a monthly bulletin for customers and the general public. Last year the Toronto company spent $20,000 in advertising, but line troubles invalidated most of it. The company is expending $3,000,000 on transmission lines and steam equipment to be in a position to give better service, and as soon as the work is complete a vigorous advertising campaign will be undertaken.

In a subsequent issue the papers and discussions covering the following subjects will be published: Graphic meters, integrating wattmeters with recording attachments, magnetite street lighting, flame carbon arc lamps, and electric vehicles.

## Public Service Commission News

CALIFORNIA COMMISSION

The Railroad Commission has rendered a decision denying the petition of the Sierra & San Francisco Power Company for authority to intervene and to present evidence in connection with the application of the Oro Electric Corporation to enter a portion of San Joaquin County. The commission found that the complainant did not operate in the section affected and had no representatives at the hearing.

NEW YORK COMMISSIONS

Governor Sulzer has nominated as members of the Public Service Commission of the Second District Mr. Charles J. Chase, Croton-on-the-Hudson, to succeed Mr. Curtis N. Douglas, and Mr. William E. Leffingwell, of Watkins, to succeed Mr. Frank W. Stevens. Mr. Chase has been in the employ of the New York Central & Hudson River Railroad for twenty years, while Mr. Leffingwell is a hotel proprietor.

# Current News Notes

Portola Illumination.—The Board of Supervisors of the city and county of San Francisco, Cal., has made an appropriation of $2,000 to provide for the special illumination of the city during the Portola celebration of next October.

* * *

Site of First Public Telegraph Office.—On July 4 on Seventh Street, between E and F Streets, N. W., Washington, D. C., there was unveiled a tablet marking the site of the first public telegraph office. This tablet was erected by the committee on permanently marking points of historic interest in the District of Columbia.

* * *

Chicago Home Rulers Still Active.—At its meeting of July 7 the City Council of Chicago adopted a resolution, introduced by Alderman Merriam, urging Governor Dunne to call a special session of the Legislature for the purpose of amending the law creating a state public utilities commission by introducing the original article providing for the municipal control of local utilities.

* * *

N. E. L. A. Exhibit Committee.—At a meeting of the exhibit committee of the National Electric Light Association held at Association Island, Henderson Harbor, N. Y., on July 8, Mr. James I. Ayer, of the Simplex Electric Heating Company, was elected chairman to succeed Mr. J. C. McQuiston. Mr. H. S. McConnaughy, 299 Broadway, New York, was re-elected secretary and treasurer.

* * *

Dazzling Automobile Head-Lamps Barred.—A new city ordinance in Chicago makes it unlawful for any person operating an automobile or other vehicle on the streets of the city to use any acetylene, electric or other headlamps the rays from which are intensified by any parabolic reflector or condensing lens, unless the lamp is shaded so that the light will not dazzle the eyes of other users of the highway.

* * *

Electrical Draftsman and Meter Inspector.—The State Civil Service Commission, Albany, N. Y., has arranged open competitive examinations for certain positions to be held in various cities throughout the State on July 26, 1913. Among the positions are those of electric meter inspector for the Public Service Commission at a salary of from $900 to $1,200, and of electrical draftsman in the office of the State architect at a salary of from $1,500 to $1,800. Applications for blanks can be obtained from the commission up to and including July 16.

* * *

Referendum Sought on Chicago Subway Question.—Mayor Harrison has asked the City Council of Chicago to authorize a referendum by the voters of the city in the election of next April on the question whether there shall be built (1) a downtown subway for the accommodation of the elevated roads to take the place of the present Union Loop, and to be paid for from the city's traction fund or (2) a comprehensive subway system following the routes laid out in the report of the subway commissioners of Sept. 10, 1912. Tentative ordinances covering these two plans have been prepared.

* * *

Some Mile-a-Minute Electric Vehicles.—While as a purely speed machine the ordinary electric vehicle is hardly likely to compete with modern gasoline automobiles, Messrs. W. H. Watson and R. J. Mitchell in a paper before the recent London convention of the British Municipal Electrical Association point out, however, that a specially designed Baker electric has achieved a distance of 1 mile in a second less than a minute, its equipment including a twelve-cell battery weighing 300 lb. and a motor scaling 100 lb. Another experimental Baker car has a record of a mile in forty-two seconds to its credit. There might thus be a fair chance of an electric vehicle gaining a world's record for a mile journey if anything useful seemed likely to be gained by the result. The ordinary electric automobile, however, can accelerate more quickly than many other road vehicles. On a test made recently in the London streets a 6-ton battery bus showed an acceleraion of 4.5 ft per second per second on the level—a figure 40 per cent in excess of the average value of this factor applying to London omnibuses.

* * *

Keeping the Wheels Going Round.—The feat of the juggler who keeps three or four balls in the air, all the while balancing a spinning plate on the tip of his nose, has its parallel in some of the problems which confront the construction engineer when he has to give uninterrupted service during plant reconstruction and replacements. Such a situation was involved in starting up the big Mississippi River water-power plant at Keokuk last month, for the old steam station from which the local community received its electrical energy stood at a level several feet below the surface of the water impounded by the new dam. Raising the water behind the dam preparatory to starting up the hydraulic units, therefore, apparently meant flooding out the steam plant, with an interval of two or three days during which neither plant would be operative. The dilemma was met, however, by throwing up an earth dike around the steam station and taking care of the seepage by pumps.

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## SOCIETY MEETINGS

Chicago Convention of Electric Vehicle Association.—As previously announced, the annual convention of the Electric Vehicle Association of America will be held in Chicago on Oct. 27 and 28. Mr. H. E. Niesz, manager of the Cosmopolitan Electric Company of Chicago, who is chairman of the Chicago Section of the association, will have general charge of local convention arrangements. Suggestions as to papers to be discussed may be sent to Mr. Niesz or to Mr. Harvey Robinson, 124 West Forty-second Street, New York, the national secretary of the Electric Vehicle Association.

* * *

Telephone Pioneers.—The third annual meeting of the Telephone Pioneers of America at Chicago, Oct. 16 and 17, will be addressed by Mr. N. C. Kingsbury, vice-president of the American Telephone & Telegraph Company; Mr. M. J. Carney, of the central group of companies at Chicago, and Mr. Thomas B. Doolittle, retired, of Branford, Conn. Mr. B. E. Sunny, president of the Chicago Telephone Company, is expected to make the welcoming address. The plan and scope committee in charge of the entertainment features consists of Messrs. B. E. Sunny, A. S. Hibbard and Frank E. Ketcham.

* * *

Electrical Contractors' Association of Missouri.—The Electrical Contractors' Association of the State of Missouri is holding its thirteenth annual meeting at the City Club, St. Louis, to-day. A reception of visitors and breakfast at Union Station Hotel will be followed by a business meeting for members only, after which luncheon will be served at the City Club. This afternoon the members and guests will be taken in automobiles to the ball game and dinner will be served at the Sunset Country Club. Sunday afternoon, July 13, the members and guests will be taken for an automobile ride about St. Louis, and in the evening a buffet luncheon and refreshments will be served at the Century Boat Club. The contractors will leave St. Louis on Monday in time to arrive for the convention of the national association at Chattanooga, Tenn., on July 16.

# A 40,000-hp Swiss Hydroelectric Plant

**Development at Biaschina, in southern Switzerland, utilizing 870-ft. head of Tessin River to furnish energy for nearby electrochemical industries**

THE Biaschina hydroelectric plant, recently completed in the south of Switzerland, is of interest not only by reason of its being one of the large electric stations in that region but also from the fact that its principal purpose is to furnish energy to electrolytic industries near by. Several of these electrochemical factories are now in operation, and the locality is rapidly becoming a center of industrial activity which will doubtless be increased in scope as time goes on.

Located in a mountainous region, the present plant makes use of the fall in the Tessin River between Lavorgo and Bodio, the turbine house being situated at the latter point. The St. Gotthard railroad follows the Tessin River in this region, which is an advantage both to the electric station and to the future industrial outlook of the district.

The promoter of the present hydroelectric and industrial project was the "Motor" Company of Baden, Switzerland. This corporation not only obtained the concession for the hydraulic and electrical work on the Tessin River but also purchased a considerable area of ground adjoining the turbine station at Bodio, with the intention of founding a center of electrical enterprise at this point. Accordingly the company proceeded to prepare the ground with this purpose in mind, not only carrying out the needed surface leveling work and installation of power lines, but also making railroad connection with the St. Gotthard system so that the latter's tracks will eventually connect the various electrolytic works installed at this point. The hydraulic works in the Tessin make available a potential energy supply which now reaches 40,000 hp at high-water periods, while the minimum supply is probably 25,000 hp.

### Electrochemical Applications of Output

Three electrochemical plants are already installed in the neighborhood of the station, the first of these being the Diamantin works, which are a branch of the Rheinfelden enterprise and are designed for the production of carborundum. Another is the Gotthard works for the manufacture of ferro-silicon and like products, which were founded by the "Motor" Company together with a syndicate of German financiers. Lastly there is the Nitrum plant, backed by German and Swiss capital, which is engaged in the manufacture of nitric acid and other nitrogenous products from atmospheric nitrogen and oxygen. Other electrochemical enterprises are expected to be founded here in the near future, so that the local region will rank among the leading European centers for this class of production.

Besides the uses above outlined, the plant furnishes energy for a local interurban electric railway which runs from Biasca to Acquarossa and will be later extended as far as Olivone in order to open up this region and bring it within reach of the St. Gotthard system.

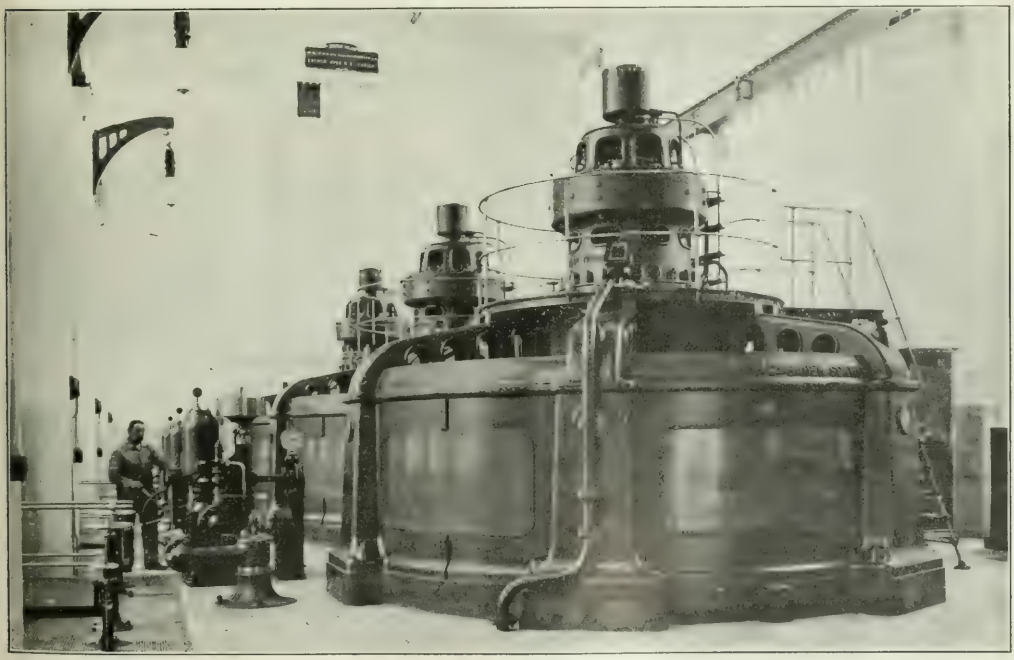


FIG. 1—INTERIOR OF GENERATING STATION AT BIACHINA

### Dam, Flume and [illegible] Intake

The barrage or dam for the Biaschina plant is built across the Tessin River in the vicinity of Lavorgo. At one side of the structure is a settling basin or forebay which serves as the starting point of the flume leading down the river valley to the point where the turbine house is located. This flume is made [illegible] tunnel for the greater



FIG. 2—POWER HOUSE NEARING COMPLETION

part of the distance, its total length being 5.4 miles. It is designed to deliver a maximum water supply of 4000 gal. per second, the rate of flow being 8 ft. per second.

The flume ends in an intermediate basin of considerable size lying above the turbine house and thus affording a reserve of 200,000 cu. ft. of water. From this receiving basin extends the pressure tunnel proper, which represents something of a departure from the usual form of intake by means of penstock tubes. In fact, the steep, rocky sides which overlook the turbine house made it almost impossible to carry the penstock down at the necessary slope, so that it was decided to use a rock-cut tunnel for the upper part of the work.

The Biaschina installation presents, therefore, a novel method of construction, at least as concerns the great height of the flume, about 600 ft., which is under pressure. Penstocks are employed only for the lower third of the height.

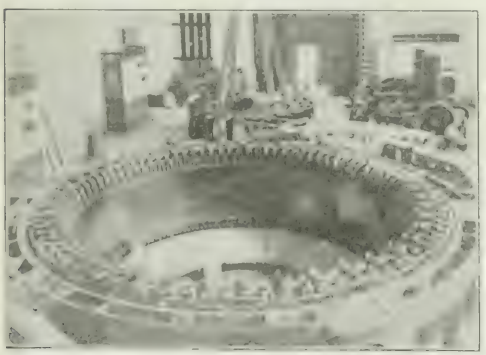


FIG. 3—[illegible] OF ALTERNATOR

The pressure tunnel is lined with concrete and has a smooth surface finish of cement, the internal diameter being 9.3 ft. and the cross-sectional area 62 sq. ft., with a maximum flow of 4000 gal. per second. The flume connects to two penstocks, each 5.5 ft. in diameter, which run parallel to each other within a tunnel leading down through the valley to the station.

### Four 10,000-HP Turbine Units

The four turbine units are mounted along the center line of the station, each penstock feeding a pair of these turbines. The units are of the vertical-shaft type and each is mounted in the usual way in a chamber beneath the machine floor. After leaving the turbine the water goes by way of the discharge passages into a common offtake conduit and thence by a 1300-ft. canal to the Tessin River. The available total head of water, measured between intake and tailrace levels, is about 870 ft., while the net fall, deducting losses, is 840 ft. to 850 ft.

The four turbines in the plant are of the Escher-Wyss Swiss type and are each designed to give 10,000 hp at their rated speed of 300 r.p.m., so that the machine capacity of the station totals 40,000 hp. Such turbines are able to stand individual overloads up to 12,000 hp without trouble.

The electrical equipment of the Biaschina station was furnished by the well-known Swiss firm of Brown, Boveri & Company, to which we are indebted for our present description of the plant. The principal electrical apparatus includes four three-phase alternators mounted on the turbines, as well as the switchboard outfit for the machines and for four outgoing feeders.

The alternators are of the rotating-field type and are designed to furnish 8800 kva at 80 per cent power-factor.

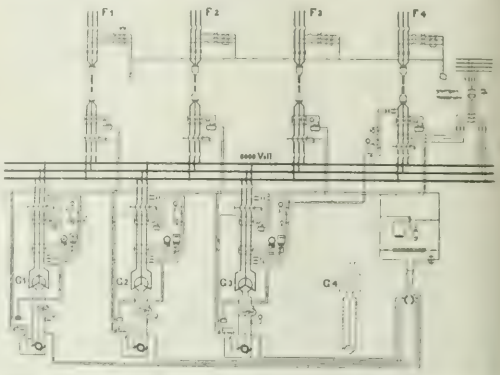



FIG. 4—DIAGRAM OF CONNECTIONS AT GENERATING STATION

They are also able to stand a 10 per cent overload for three hours, or a 25 per cent overload for thirty minutes. Working at the rated speed of 300 r.p.m., they deliver 8000-volt, 50-cycle, three-phase energy. The rotor, which is mounted on the turbine shaft, carries a set of twenty pole-pieces comprising the field members. On the shaft is fitted a heavy cast-steel hub which carries a series of Siemens-Martin steel rings, eighteen in number, and these latter serve as supports for the field pole-pieces, carrying the heavy strains due to centrifugal force. This method of mounting has been found to give very good results. Air spaces are left between the several rings of the series, and the incoming air passes through these spaces into the pole-pieces proper. These latter pieces are dovetailed into the steel-ring construction, as will be observed, and can be readily removed by taking out a key. The pole-pieces are made up of a main body of cast steel, with pole-ends, to the outer ends of which are dovetailed laminated-iron pole-faces. For the field-coil windings eighty turns of flat copper strips are used per pole.

### Details of Machine Construction

The stators were built in three pieces in order to give proper facility for transportation and are fixed upon solid foundation plates from which they are removable. As usual, the laminated iron of the stator or armature is held

between end plates, and it is here made up in nineteen sections separated by 0.4-in. ventilating spaces. The armature has 180 slots of the full open type and the winding consists of lathe-wound coils insulated with mica. Sets of openings in the outer iron shell of the stator give access to the interior and these are fitted with sheet-metal covers. The slip-rings are mounted between the rotor hub and the button bearing of the machine, as will be noticed, while the exciter occupies the customary position above the top bearing.

The exciter is an eight-pole shunt-wound generator with auxiliary pole and is designed for an output of 75 kw at 220 volts. Air circulation is well carried out, the cooling air being drawn up from the underlying turbine chamber and, after passing through the active parts of the machine, being discharged at the top. The rotor shell itself serves as a ventilator for this purpose, and the air stream is properly directed by the use of guide pieces mounted in the machine. In this way the ventilation is so effective that the machine runs well below the guarantee figure of 45 deg. C. The entire weight of the machine, including the exciter and upper bearing, is about 100 tons, while the rotating part, inclusive of the shaft, weighs some 38 tons. Losses in the machine at full load and 80 per cent power-factor are as follows: Stator iron, 150 kw; stator copper, 37 kw; field copper, 55 kw; ventilation and bearing friction, 50 kw; total, 292 kw. Based upon the 7000-kw rating this gives an efficiency of 97 per cent.

### 8000-Volt Bus and Distribution Arrangement

The alternators work in parallel on a single set of 8000-volt busbars, from which there are led off three feeders, in addition to apparatus for a fourth line to be used eventually. On the busbars are mounted section switches for independently cutting out any one of the machines or feeders. Between each alternator and the busbar there is a three-pole automatic circuit-breaker, an instrument transformer for the machine voltmeter, the ammeter, wattmeter, phase voltmeter and pilot lamps, and a two-pole retarding relay for the automatic circuit-breaker. Opposite each alternator is a separate board which contains the low-tension switches, instruments and control devices, while the high-tension circuits are mounted in the basement below the machine-room floor. Connections to each feeder from the busbars are made through a three-pole automatic oil circuit-breaker, the instrument transformers used for the

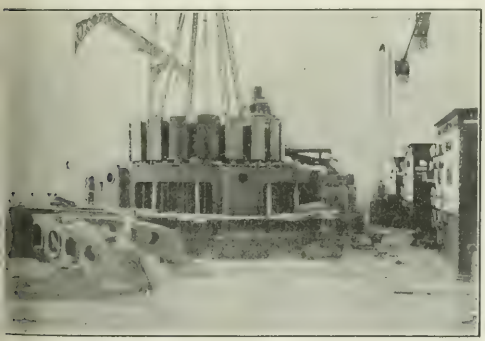


FIG. 5—PLACING ROTOR OF ALTERNATOR

feeder ammeter, and a three-pole retarding relay, the circuits running thence in three lead-covered cables to the lightning-arrester room. Cells here contain the apparatus for lightning protection of each phase of the outgoing line, including Siemens horn arresters, water resistances and choke coils. The four feeders are as follows: (1) Tie feeder connecting with the neighboring electric plant of Ticinetto; (2) supply to the Biasca electric railway; (3) feeder for the electrochemical plant; (4) feeder to be eventually installed.

### Permanent Construction Plant at Dam Site

In order to carry on the work of rock drilling, water pumping, lighting, etc., during the construction of the plant

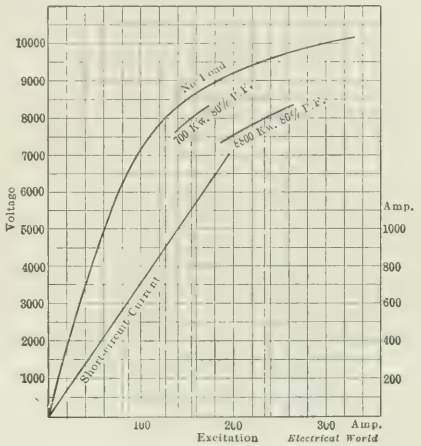



FIG. 6—CHARACTERISTIC CURVES OF A 8800-KVA GENERATOR

there was installed a small electric plant not far from the present station, which made use of the water of the Ticinetto mountain stream, a tributary of the Tessin River. At the outset it was decided to construct this development as a permanent plant so that it could be left in place instead of dismounting it after the work was finished. The Ticinetto plant utilizes a 550-ft. head of water, and the turbine house contains three turbine-alternator sets of the horizontal-shaft type.

The turbines run at 500 r.p.m. and are rated at 500 hp, being coupled to Brown-Boveri three-phase alternators. These machines are designed for an output of 420 kva at 80 per cent power-factor and deliver 8000 volts at a frequency of 50 cycles. Two power lines leave the station, one going to the town of Lavorgo for local use while the second line connects with the main station by the feeder already mentioned.

## Phase Compensation—II.

By Val. A. Fynn

The first instalment of the article entitled "Phase Compensation," by Mr. Val. A. Fynn, appeared in the *Electrical World* of July 5. In the following columns the discussion of the subject is resumed.

In any alternating-current motor the phase of the back emf is bound to follow the phase of the exciting flux. If then the phase of the exciting flux is altered relatively to the phase of the working emf, then the phase of the back emf will be correspondingly displaced relatively to the working emf. In the synchronous motor the phase of the exciting flux (and therefore the phase of the back emf) is displaced with reference to the phase of the working emf whenever the synchronously revolving field poles are momentarily accelerated or retarded, immediately resuming their synchronous rotation in this altered relative position.

Since by changing the phase of the exciting flux of an alternate-current motor relatively to the phase of the working emf, one can change the phase of its back emf, and since such a change in the phase of the back emf brings

about a change of phase between the terminal emf and the current taken by the motor, therefore, in an alternating-current motor one can control or adjust the phase relation between terminal voltage and current by controlling or adjusting the phase of the exciting flux relatively to the phase of the terminal emf. The manner in which the phase of the exciting flux is adjusted is clearly immaterial. In the synchronous motor this adjustment is brought about by a mechanical displacement of the field poles. It will be shown in what follows that the same thing can be achieved electrically, instead of mechanically.

It can well be assumed that the reader is thoroughly familiar with the electric magnetic and torque relations in direct-current machinery, but it seems appropriate to review certain conditions that have a bearing on the problems now under discussion.

If the armature shown in Fig. 17 were a perfect one—that is, devoid of all losses—then its speed would increase, under the influence of the working emf, until the generated back emf $e_1$ exactly equaled the impressed working emf. At this instant the current $I$ would become zero and energy would no longer be taken from the source 35. The speed can obviously never exceed the value at which $e_1$ equals $e_2$, for the reason that $e_1$ would then exceed $e_2$ and the motor would be called upon to return energy to the source 35. This is impossible unless the machine is driven by a prime mover of some sort and ceases to operate as a motor. The ideal speed at which the back emf equals the working or

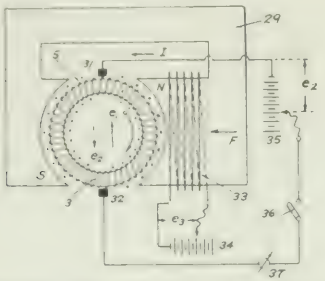



FIG. 17—SEPARATELY EXCITED DIRECT-CURRENT MOTOR

terminal emf is never reached in practice, for the reason that perfect motors do not exist—all of them require a certain amount of energy even to keep them running at no load. In practice the speed will increase until the difference between the working and the back emf has been reduced to just that value which is sufficient to drive through the resistance of the armature circuit enough current to cover the no-load losses of the machine. This condition is illustrated by the vector diagram shown in Fig. 18, which has been prepared on the assumption that 5 amp at 25 volts is sufficient to keep the motor in question running light. Under these conditions the value of the back emf at no-load speed must be 20 volts and its direction must be exactly opposite to that of the working emf. The resultant of these two components must necessarily coincide with the larger and is, therefore, of the same direction as $e_2$. This resultant thus becomes equal to 5 volts, which voltage will force the required 5 amp through the resistance of the armature circuit, which is supposed to be 1 ohm.

Since the magnitude of the emf $e_1$ generated within the armature by rotation in the exciting flux $F$ depends on the speed and on the magnitude of the flux, it will be clear that the speed of the machine will change when the magnitude of the impressed emf $e_2$ or when the magnitude of $F$ is changed. If $e_2$ is increased, then the difference between $e_2$ and $e_1$ will become larger, the machine will take more current and will accelerate until a speed is reached at which the difference between $e_2$ and $e_1$ is again only just large enough to cover the losses in the machine itself, or to enable the latter to deal with its load. If $e_2$ is decreased, the reverse will take place because the difference between impressed and back emf will momentarily decrease, thus cutting down the current taken by the motor, reducing the motor input, and consequently allowing the load to decrease the motor speed. This speed will diminish until the difference between $e_2$ and $e_1$ has again reached a value sufficient to drive enough current through the armature for the machine to perform its duty. Similarly, if the exciting flux is increased, the back emf will momentarily rise, thus retarding the armature, and the speed will drop until equilibrium is re-established. If the exciting flux is decreased, then the speed of the motor will rise. But if both the working emf $e_2$ and the exciting flux $F$ are increased or decreased in the same proportion, then the speed will remain practically unaltered. Thus if $e_2$ and $F$ are doubled, then $e_1$ will immediately be doubled because of the doubling of $F$, and it will not be necessary for the armature to alter its speed materially in order to preserve a constant difference between $e_2$ and $e_1$. The same argument holds true in case of a proportional reduction of both $e_2$ and $F$.

These considerations at once suggest that the machine shown in Fig. 17 is capable of operating on an alternating circuit, and it is easily seen that the diagram shown in Fig. 18 will, under certain conditions, illustrate the operation of the machine on alternating current quite as accurately as it illustrates its operation on direct current. It is known that alternating emfs and currents vary periodically, increasing from a zero value to a positive maximum, decreasing to zero, rising to a negative maximum, and again decreasing to zero. If alternating currents are applied to the machine shown in Fig. 17 and it is found possible to cause the back emf $e_1$ to oppose the impressed emf $e_2$, at every instant, as shown in Fig. 18, then this figure will illustrate the conditions obtaining in the alternating-current-fed machine at some particular instant, and can be made to apply to any other instant by merely changing its scale.

When dealing with direct currents one is concerned only with the direction and the magnitude of the currents and emfs involved, but as soon as alternating currents are made use of, then the frequency of the currents, fluxes and emfs and also their time-phase relation must be considered. While it is true that the diagram in Fig. 18 will correctly represent the conditions in the machine shown in Fig. 17 when operated with alternating currents, in case it is found possible to cause the back emf $e_1$ always to be of opposite direction to the working emf $e_2$, yet it is not at once apparent how this condition can be secured. In order to ascertain the possibilities in this direction, consider Fig. 19, which is intended to represent the same machine as that illustrated by Fig. 17, but does so in a more diagrammatic manner. Thus the armature winding of Fig. 19 is merely indicated by a circle 5 and only part of the field magnet 29 is shown. The operation as a motor of the machine shown in Fig. 17 or Fig. 19 depends on its ability to generate within its armature a counter emf $e_1$ capable (at every instant) of opposing the working emf impressed on the armature brushes. If this working emf is an alternating one, then the back emf must also be an alternating one and must have the same frequency as the working emf. The first question which arises concerns the frequency of the exciting flux $F$. Given a flux $F$ of a certain frequency, how will the frequency of the emf generated in the armature 5 and appearing at the brushes 31, 32, be related to the frequency of $F$ and how will it vary with variations in the speed of rotation? The answer can be easily ascertained with the help of the simple arrangement shown in Fig. 19, where the field winding 33 is connected to the battery 34 through the adjustable resistance 38 and the reversing switch 40. Let the armature winding 5 be revolved in any desired direction, say counterclock, and let the magnet 29 be so excited that the flux $F$ is directed from right to left, then it i

known that an emf $e_1$ will appear at the brushes 31, 32, the magnitude of which will be constant as long as $F$ and the speed are constant. Now decrease $F$—for instance, by moving the contact 39 so as to include more and more of the resistance 38 within the exciting circuit—and it will be found that $e_1$ will diminish, even though the speed is kept constant. When the exciting circuit is broken and $F$ has become zero, it will be observed that $e_1$ is also zero. Now reverse the connections between the battery 34 and the exciting winding 33 by means of switch 40 and gradually increase the flux $F$ by cutting out more and more of the resistance 38. It will be observed that $e_1$ will increase in magnitude, but in the opposite direction, although the direction of rotation has not been altered. If the magnitude of $F$, as well as its direction, be periodically varied by moving contact 39 and reversing switch 40, then it will be found that $e_1$ will also vary periodically and will go through the same cycles through which $F$ is obliged to go by the manipulations of 39 and 40. These considerations, therefore, show that the emf appearing at a set of stationary brushes suitably disposed on a commutated winding 5 revolving within an alternating field $F$ will alternate with the same frequency as the field; its magnitude depends on the speed of rotation and on the magnitude of the field in which it rotates.

It is easy to construct an apparatus which will close the circuit of the exciting winding 33 by throwing switch 40 upward, gradually cutting out all the resistance 38 by moving contact 39 to the left, thus increasing the exciting current $i_3$ to its maximum, then moving contact 39 to the right and decreasing $i_3$ to zero, reversing the current through 33 by throwing switch 40 downward, moving contact 39 to the left, increasing $i_3$ to its maximum, again reducing $i_3$ to zero by moving 39 to the right, and so on. While these operations are being performed the flux $F$ would rise from zero to a positive maximum, fall back to zero, reverse its direction, increase to a negative maximum, and return to zero. One form of a mechanical device which will perform the above functions is shown in Fig. 20. It is so arranged that for each revolution of the handle $H$ the current $i_3$ will twice become zero, at points 1 and 3, and will twice reach a maximum, at points 2 and 4. Under these conditions the flux $F$ will go through one complete cycle for every one complete revolution of the handle $H$, and the number of cycles through which $F$ will go within one second will depend on the number of revolutions made by the handle within that time. The variations of the emf $e_1$ during every revolution of the handle $H$, and assuming a clockwise direction of rotation of the armature winding 5, can then be represented by the full line curve $e_1$ of Fig. 28. While the handle $H$ is turned through one complete revolution, the emf at the brushes 31, 32 will trace that part of the curve $e_1$ which is located between the points 2 and 2′ and so on. If the direction of rotation of the armature winding 5 is reversed, then the emf at the brushes will be reversed and will trace the dotted counterclockwise curve $e_1$ shown in Fig. 28.

Assume now that two batteries and two mechanical devices identical with the one just described and illustrated in Fig. 20 are provided and that each is placed in the hands of a separate operator. Let operator A set the pace with the device indicated in Fig. 21 and assume that he chooses to revolve his handle $H_1$ at a constant rate of 300 r.p.m., thus varying the emf at the terminals of his apparatus, according to the curve $e_2$ shown in Fig. 25. If to B is given the task of producing, with the help of his apparatus which is indicated in Fig. 22, a curve identical in shape and coincident at every instant with $e_2$ of Fig. 25, then he must, to begin with, revolve his handle $H_2$ at the same constant speed of 300 r.p.m.; the fulfilment of this one condition is not sufficient, for though B will thereby trace a curve of the same shape as that shown in Fig. 25, yet the two curves will not necessarily coincide in time, unless B takes additional precautions. Thus, while the curve traced by B has exactly the same shape as that traced by A, yet the former may not pass through its zero values at the same instant as does the curve traced by A. Further, even if both curves do pass through their zero values simultaneously, it is not said that they will simultaneously reach maxima of equal sign. In order that B may exactly duplicate the curve $e_2$ produced by A, and duplicate it at every instant so as to make the two coincide in time, he must revolve the handle $H_2$ not only at the speed at which $H_1$ is rotated but also in such a way as to perform, at every instant, exactly the same operations as are performed at that instant by the handle $H_1$. In other words, the two handles must not only revolve synchronously, but they must always be identically placed in space. Thus, when the handle $H_1$ is in its position 2, the handle $H_2$ should be in its position 2; when $H_1$ is in its position 3, $H_2$ should be in its position 3, and so on. These conditions may be briefly summarized by stating that in order to obtain two curves coinciding at every instant in direction, the two handles must revolve synchronously and co-phasedly.

Had B had the task of producing, with his apparatus, a curve with instantaneous values always equal but opposed to the instantaneous values of $e_2$ of Fig. 25, then he would have been obliged to revolve $H_2$ synchronously with $H_1$, as before, but to keep the former always in space opposition to the latter, the two handles then revolving in such a way that when $H_1$ is in its position 4, $H_2$ is in its position 2, and with $H_1$ at 1, $H_2$ should be at 3, and so on. A correct position of $H_2$ for the position of $H_1$ shown in Fig. 21 is shown in Fig. 22 by dotted lines. This may be briefly ex-

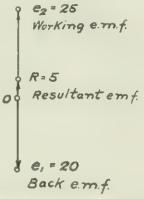


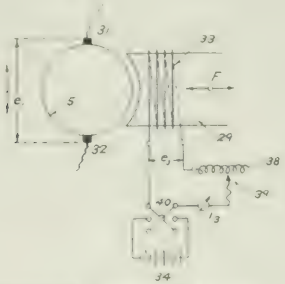

FIG. 18—PHASE DIAGRAM APPLYING TO THE OPERATION OF THE MOTOR SHOWN IN FIG. 17

pressed by stating that in order to produce two curves opposing each other in direction at every instant, the two handles $H_1$ and $H_2$ must stand in phase opposition and must revolve synchronously.

Since synchronous and co-phasal rotation of the levers $H_1$ and $H_2$ produces curves always coinciding in time (and direction), and since synchronous rotation of $H_2$ when displaced by 180 deg. in space from $H_1$ gives curves displaced in time by 180 deg. (and therefore always opposite in direction), then it is clear that synchronous rotation of the levers $H_1$ and $H_2$, when displaced in space by an angle of 90 deg. from each other, will yield two curves identical in shape but displaced in time by 90 deg.; that is, by an angle corresponding to the space displacement of the two levers. Such curves would assume the relative positions occupied by the curves $e_2$ and $e_3$, shown in Figs. 25 and 26 respectively.

Assume, further, that the operator A impresses the emf $e_2$ generated by his apparatus and the variations of which are shown in Fig. 25 upon the brushes 31, 32 of the motor shown in Fig. 17, and that operator B has the task of producing an emf $e_3$ which, when impressed on the field winding 33 of said motor, will enable the revolving armature winding 5 of the latter to generate at the brushes 31, 32, a back emf $e_1$ the instantaneous values of which are at every instant of nearly equal magnitude but of opposite direction to those of the working emf $e_2$. In order to fulfil these conditions it will be necessary for operator B to revolve the handle $H_2$ at the same speed as A revolves the handle $H_1$, and to keep $H_2$ throughout every revolution in

such ... instant phase opposition between $e_2$ and $e_1$, it being understood that ... the motor has begun to revolve. It will soon be found that the ... above conditions are fulfilled are those shown by full lines ... for B to put his emf $e_1$ through its cycle sooner than $e_2$ is put through its cycle by A. This time difference in favor of $e_2$ is necessary in order to compensate for the time lag which prevails in the exciting circuit 33 between the emf $e_2$ applied to its terminals and the current $i_2$ in that circuit in response to $e_2$. This time lag is non-existent as long as the exciting emf $e_2$ is constant, but makes its appearance as soon as said emf is made to vary rapidly. It is due to the inertia or inductance of the circuit 33, which prevents the current $i_2$ and therefore also the flux $F$ which is in time-phase with $i_2$, from instantaneously following the changes of the impressed emf $e_2$. It is known that a circuit of this description shows a time-lag of 90 deg. This fact is also expressed by saying that in an inductive circuit the magnetizing current $i_2$ lags by 90 deg. in time behind the impressed emf $e_2$. The conclusion is therefore reached that in order to operate the motor shown in Fig. 17 with alternating currents, in such a way as to secure a back emf $e_1$ which opposes the working emf $e_2$ at every instant, in the manner shown in Fig. 18, it is necessary to impress on the




... VARYING IN MAGNITUDE AND DIRECTION

field winding 33 an emf differing in time-phase by 90 deg., or thereabouts, from the emf $e_2$ impressed on the armature brushes.

It is, of course, well understood that emfs such as $e_1$ and ... of ... alternators, instead of making use of an arrangement such as is indicated in Fig. 20, but the conclusions reached with the help of this primitive apparatus hold good when it is replaced by ordinary alternators. If two separate alternators are made use of for the purpose of feeding energy to the motor shown in Fig. 17, then their field poles must show the space displacement indicated as suitable for the handles $H_1$ and $H_2$ in Figs. 21 and 22, on the assumption that the armature windings of these alternators are identically placed in space. Instead of making use of two such alternators it would naturally be much simpler to use a two-phase machine in which one set of field poles acts on two sets of armature windings displaced in space by 90 deg., as are the handles $H_1$ and $H_2$ in Figs. 21 and 22. In this case the armature winding 5 of the motor shown in Fig. 21 would be fed from one phase and its field winding 33 from the other phase.

Figs. 26, 27 and 28 indicate the time relation between the alternating emf $e_2$ applied to the terminals of the exciting winding 33, the exciting current $i_2$ in that winding, the exciting flux $F$ due to $i_2$, and the emf $e_1$ (back emf) generated at the brushes 31 and 32, for either direction of rotation of the armature winding 5. These relations are expressed with equal clearness by means of the phase diagram shown in Fig. 23. It is known that owing to the self-induction, or inductance, or inertia, of the exciting circuit 33, the exciting current $i_2$ will lag by 90 time-deg. behind the exciting emf $e_2$. This condition is shown in Figs. 26 and 27 by starting the curve $i_2$ at the point 2, whereas the $e_2$ curve is started at the point 1. While the curve $e_2$ falls from its positive maximum at the point 2 to its zero value at point 3, the curve $i_2$, representing a current lagging 90 deg. behind $e_2$, will rise from a zero value at point 2 to its positive maximum value at point 3, and will fall to a zero value at point 4 while the emf curve $e_2$ rises to its negative maximum. It is as if curve $e_2$ were traced by the movement of the handle $H_2$ of Fig. 22, while curve $i_2$ is traced by another handle ($H_1$ of Fig. 21) coupled to $H_2$ but displaced therefrom by 90 deg. against the direction of rotation.

With these remarks in mind, Fig. 23 will be easily understood, for the various vectors shown thereon may be thought of as handles, such as have been described in connection with Figs. 21 and 22, which revolve synchronously while preserving the relative positions occupied by the various vectors shown in Fig. 23, or in any other similar vector diagram. When the emf $e_2$ is impressed on the field winding 33, the current $i_2$ lagging 90 deg. behind $e_2$ is produced, and the latter generates an alternating flux $F$, which is practically in time-phase with that current. As long as the armature winding 5 is at rest, no emf will appear at the brushes 31, 32. If that armature is, however, revolved, then the emf $e_1$ appearing at the brushes will be of same frequency as the exciting flux $F$, and of the same direction as $F$, or of a direction opposed to that of $F$. The armature may be so wound that, for a clockwise rotation, the direction of $e_1$ will coincide with the direction of $F$. If that is the case, then the direction of $e_1$ will be opposed to that of $F$ should the armature be revolved in a counterclock direction. All this is expressed in the vector diagram 27, in which the curved arrow indicates the direction in which the handles or the vectors revolve, that is, in which time is measured. If the vector marked $e_2$ stands for the exciting emf, then the vector $i_2$, representing the exciting current, as well as the vector $F$, representing the motor flux, must, according to Figs. 26 and 27, lag 90 time-deg. behind $e_2$. According to Fig. 28, the vector $e_1$, representing the emf generated in the armature, must either be of same direction as the vector $F$ or of a direction opposed to it, according to the direction of rotation of the armature. Some little time has been devoted to the explanation of the interrelation between the curves shown in Figs. 26, 27 and 28 and the vector diagram shown in Fig. 23, for the reason that such vector diagrams offer an extremely convenient manner of studying alternating-current phenomena, are really based on surprisingly simple conceptions, and must constantly be used throughout this paper.

The conclusions arrived at so far may be summarized as follows:

(1) A shunt-wound direct-current motor will always revolve in such a direction that the emf generated in its armature by rotation in the exciting field and appearing at its brushes will be of opposite direction to the working emf impressed on the brushes.

(2) The maximum speed at which a shunt-wound direct-current motor will run at a given load is governed by the condition that for any load the magnitude of the back emf must differ from the magnitude of the working emf by an amount sufficient to force through the resistance of the armature a current of sufficient magnitude to deal with the load on the motor.

(3) If in a shunt-wound direct-current motor the exciting flux is varied at the same rate as the working emf, or if both are simultaneously reversed, then neither the speed nor the direction of rotation of the motor will change.

(4) If the working emf and the exciting flux of a shunt-

wound direct-current motor are rapidly varied through the whole range of values comprised between a positive and a negative maximum, then, according to 3, the machine will continue to run in one direction and at a constant speed; from which it is seen that such a motor can be operated with alternating currents.

(5) In order to operate a shunt-wound motor with

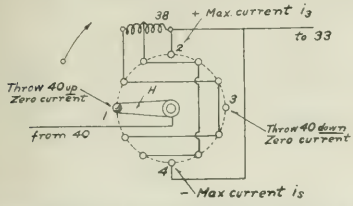
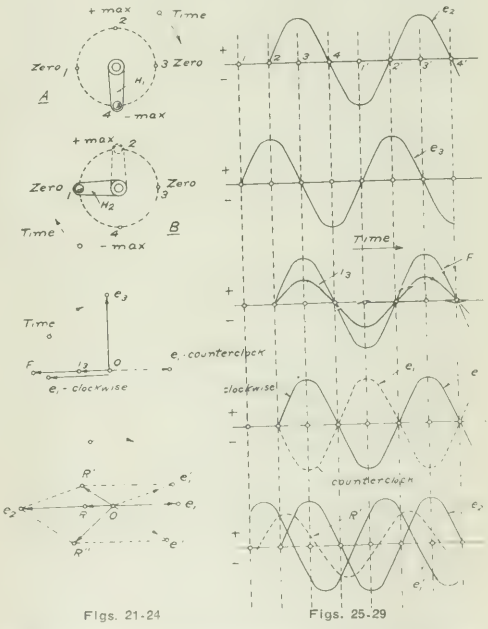



FIG. 20.—APPARATUS FOR PROGRESSIVELY CHANGING THE MAGNITUDE AND DIRECTION OF THE CURRENT TAKEN FROM A BATTERY

alternating current in such a manner that the back emf is always almost equal to the working emf but always opposed to it in direction, it is necessary, owing to the inertia or inductance of the field magnets, to impress on the latter an emf differing in time-phase by about 90 deg. from the working emf. If these conditions are fulfilled, then the vector diagram in Fig. 18 will correctly represent the conditions obtaining at a particular instant in a (shunt) motor whether operated by direct or by alternating currents.

The phase diagram shown in Fig. 18 is again reproduced in Fig. 24, of which it forms a part, and the statement may here be repeated that, when in a shunt motor operated by alternating currents the phase of the exciting emf $e_s$ is so chosen that the back emf $e_1$ is always of opposite direction to the working emf $e_2$, then their resultant $R$ will be of same phase and of same direction as $e_2$. This resultant $R$ always determines the phase and magnitude of the current taken by the armature of the motor. The foregoing discussion has clearly shown that it is just as easy so to select $e_s$ that the back emf $e_1$ will not be opposed to $e_2$ at every instant. Suppose, for instance, that the operator A, to whom reference has already been made, works the handle $H_1$ of Fig. 21 so as to produce the working emf ($e_2$) shown in Fig. 25 and that this emf is impressed on the brushes 31, 32 of the armature of the motor shown in Fig. 21; then the operator B should work the handle $H_2$ of Fig. 22 synchronously with $H_1$ and always keep it 90 deg. ahead of $H_1$, as shown by full lines in Fig. 22, in order that the back emf $e_1$ generated at the brushes 31, 32 by a counterclock rotation of the armature (see Figs. 25 and 28) may at every instant oppose the working emf $e_2$. Now let operator B move his handle $H_2$ synchronously with $H_1$, but only keep it 45 deg. ahead of the latter; then the emf $e_s$ generated at B will lead $e_2$ of Fig. 25 by only 45 deg., its first zero value falling midway between the points 1 and 2 and its first positive maximum value falling midway between the points 2 and 3. Consequently, the dotted curve $e_1$ of Fig. 28 will have its first zero value midway between the points 2 and 3 and its first negative maximum midway between the points 3 and 4. Transferring this curve $e_1$ to Fig. 29 and marking same $e_1'$ will show that while $e_1'$ still opposes $e_2$ during three-fourths of the time occupied by half a cycle, yet it is of the same direction as $e_2$ during the remaining quarter of each half cycle, and it is quite clear that now the resultant of $e_2$ and $e_1'$ cannot possibly coincide with either of these emfs. This resultant can always easily be ascertained by arithmetically adding the instantaneous values of $e_2$ and $e_1'$ for a number of points distributed over a complete cycle. This addition has been carried out in Fig. 29 and its result is shown by the curve marked $R'$. It will be observed that $R'$ reaches its maxima at a time when neither $e_2$ nor $e_1'$ is at its maximum value, thus showing that $R'$ differs in time-phase from $e_2$ as well as from $e_1'$. Remembering that in Fig. 29 time is measured from left to right, it is seen that $R'$ reaches its positive maximum ahead of $e_2$ and therefore leads $e_2$, whereas it reaches its positive maximum after $e_1'$ has reached its corresponding value, and $R'$ therefore lags behind $e_1'$. This same thing can be even more clearly indicated by means of a vector diagram. The vectors $e_1$ and $R$ of Fig. 24 have already been discussed, and show the conditions which obtain when the back emf opposes the working emf all the time. That same diagram, however, shows what happens when the back emf reaches its maxima too early or too late, as is the case in Fig. 29. Thus the vector $e_1'$ represents a back emf which reaches its maxima somewhat later than $e_1$, but which is only about 20 deg. behind time, instead of 45 deg. as was assumed to be the case in Fig. 29. In order to find the phase relation of the resultant of $e_2$ and $e_1'$ with respect to $e_2$, it is necessary merely to construct a parallelogram two sides of which are made equal to $e_2$ while the two others are made equal to $e_1'$, as shown in Fig. 24. The resultant vector $R'$ of Fig. 24 then indicates both the magnitude and the phase of the resultant emf $R'$ which is responsible for the phase and magnitude of the current through the armature of the motor. These remarks will make it obvious that in case the back emf reaches its maxima too early, as indicated by the vector $e_1''$ of Fig. 24, then the resultant $R''$ will lag behind the working emf $e_2$ instead of coinciding with it as is the case when the phase




FIGS. 21 TO 29.—TIME-PHASE RELATIONS BETWEEN THE WORKING AND THE BACK EMFS IN AN ALTERNATING-CURRENT MOTOR AND THEIR INFLUENCE ON ITS POWER-FACTOR

of the back emf exactly opposes the phase of the working emf, or instead of leading the working emf as is the case when the phase of the back emf lags behind the phase of the working emf.

The diagram in Fig. 24 really discloses the secret of phase compensation. If the phase of the exciting emf $e_s$ is so chosen relatively to the phase of the working emf $e_2$

that the back emf $e_1$ is of exactly opposite phase to the working emf, then the resultant emf $R$ in the armature circuit of the motor will be in time-phase with the working emf $e_2$. These conditions secure operation at unity power factor in case the motor is an ideal one and its armature reaction is neutralized, for then the armature current will be in time-phase with the resultant $R$ in the armature cir-

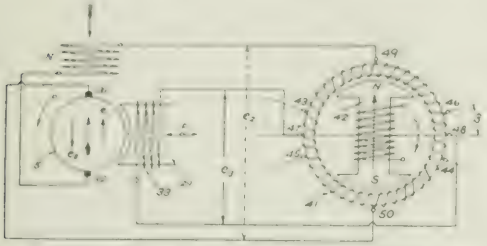
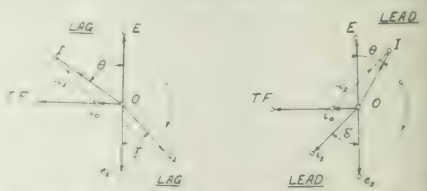


FIG. 30—ALTERNATING-CURRENT SHUNT CONDUCTION MOTOR OPERATED FROM A TWO-PHASE GENERATOR

cuit. But, in practice, the leakage fluxes cause the current to lag a little behind $R$, even when the armature reaction is neutralized, and if it be desired to cause an alternating-current motor to operate with a unity, or even with a leading, power-factor, all that it is necessary to do is to change the phase of $e_2$ so as to cause the phase of the back emf to lag behind the phase of the working emf by more than 180 deg., or, which comes to the same thing, to lead $e_2$ by less than 180 deg., in which case the resultant emf $R$ in the armature circuit of the motor will lead the working emf $e_2$. This resultant $R$ can always be made to lead $e_2$ sufficiently to cause the armature current either to coincide in phase with or to lead $e_2$.

The method of producing alternating emfs described in connection with Figs. 19, 20, 21 and 22 merely affords a convenient manner of explaining the various phenomena involved, but is by no means practical. In practice a shunt alternating-current motor would preferably be operated from a two-phase alternator, the connections being such as shown in Fig. 30. The armature winding 5 is provided with the brushes 31, 32 and is connected by way of these brushes in series with the neutralizing winding $N$, which is so disposed, connected and dimensioned as to cancel the armature reaction flux by producing from the stator an equal and opposite flux. This is indicated by the feathered arrows in Fig. 30. This motor armature circuit is connected to the points 49 and 50 of the generator armature winding 41, forming part of a two-phase alternator, the revolving field magnet of which is indicated at 42. The field winding 33 of the motor is also fed from this two-phase alternator; the connections shown indicate that the emf $e_2$ derived from 41 at the points 47 and 48 and impressed on the field circuit will differ by just 90 time-deg. from the emf $e_1$ derived from 41 at the points 49 and 50 and impressed on the armature circuit. From an earlier discussion it was learned that the vectors $e_1$, $e_2$ and $R$ of the vector diagram of Fig. 28 correctly represent the conditions existing in the motor of Fig. 30 when the latter is connected to the alternating-current generator in the manner shown. The alternator connections of Fig. 30 show that for the position of the field magnet indicated in that figure $e_2$ is at a maximum while $e_1$ is zero, and that the two, therefore, differ in time-phase by 90 deg. They are consequently correctly represented as to phase difference by the vectors $e_2$ and $e_1$ of Fig. 31. From Fig. 23 it is seen that for a counterclock rotation of the armature $e_1$ will always lead $e_2$ by 90 deg. In Fig. 31 $e_1$ will, therefore, be exactly opposed to $e_2$. Because $e_2$ is always larger than $e_1$ the resultant $R$ of the two will coincide in direction with $e_2$, and because the armature circuit comprising the neutralizing winding $N$ and the armature winding 5 is not entirely devoid of self-induction, the current $I$ produced in that circuit, under the influence of the resultant $R$, will lag behind the latter by a small angle $\alpha$. Because $R$ coincides with $e_2$, then the armature current $I$ will also lag behind $e_2$ by an angle $\alpha$, which in this particular instance is equal to $\alpha$. This diagram shows that the practical motor illustrated in Fig. 30, when subjected to quadrature emfs, must operate with a lagging current in the armature circuit.

The discussion of Fig. 24 has shown that in case the back emf $e_1$ is caused to reach its maxima a little later than the working emf $e_2$—in other words, if the back emf is made to lag a little behind the working emf, somewhat in the manner shown by the vector $e_1'$ of Fig. 24—then the resultant in the armature circuit can be made to lead the working emf. This condition of things can be easily secured with the help of an alternator such as shown in Fig. 30, provided the armature winding 41 of the latter can be tapped at different points. The discussion of the motor shown in Fig. 19 has shown that a change in the phase of the exciting emf $e_3$ will always bring about a corresponding change in the phase of the back emf, for the reason that the two must in every case differ by about 90 time-deg. Thus, if instead of taking the exciting emf $e_3$ from the points 47 and 48 of the alternator, which are displaced by exactly 90 space-deg. from the points 49 and 50 of the latter, this excitation were taken from the points 45 and 46 of that machine, which are displaced by less than 90 space-deg from the points 49 and 50, then the phase difference between the working emf $e_2$ and exciting emf $e_3$ would also become smaller than 90 time-deg., as shown in Fig. 32. In this figure the vector $e_3$ has been displaced from the position it occupied in Fig. 31 by a time-angle $\beta$ equal to the space-angle by which the line joining points 45 and 46 of the armature 41 of Fig. 30 differs from the line joining points 47 and 48 thereof. Knowing the location of the vectors representing the working emf $e_2$ and the exciting emf $e_3$, and knowing that the back emf $e_1$ must differ in time-phase by 90 deg. from $e_3$, the resultant emf $R$, which determines the phase and magnitude of the current in the armature circuit, can immediately be ascertained by constructing a parallelogram two sides of which are made equal to the vector $e_2$ and two other sides of which are made equal to the vector $e_3$, as shown in Fig. 32. It is at once seen that this resultant now leads the working emf $e_2$ by a very large angle. The phase position of the current through the armature circuit is determined by the fact that this current always lags behind the resultant emf in that circuit by the same small angle $\alpha$. This is also shown in Fig. 32 which figure clearly indicates that owing to the small change made in the phase of the exciting emf the current taken by the armature of the motor now leads the working em




FIGS. 31 AND 32—TIME PHASE RELATION BETWEEN WORKING EMF AND ARMATURE CURRENT AS AFFECTED BY A CHANGE IN THE PHASE OF THE EXCITING EMF

$e_2$ by a very large angle $\theta$, instead of lagging behind the emf by a small angle $\theta$ equal to $\alpha$, as was the case under the conditions considered in connection with Fig. 31. Had the exciting winding 33 of the motor shown in Fig. 30 been connected to the points 43 and 44 instead of the points 47 and 46, then the resultant $R$ would have lagged behind the working emf instead of leading it, and the lag of the cu

ent *I* shown in Fig. 31 would have been increased instead of being converted into a lead, as was proved in connection with Fig. 32. These remarks clearly show that it is possible to vary the time-phase relation between the working emf impressed on the armature of an alternating-current motor and the current taken by it to almost any desired extent, simply by altering the time-phase of the exciting emf relatively to the phase of the working emf, or, in other words, by altering the time-phase of the exciting flux relatively to the phase of the working emf.

The conclusions reached may be summarized by stating:

(1) That any practical alternating-current motor in which there is a time-phase difference of 90 deg. between the working and the exciting emf will operate with a "lagging" power-factor.

(2) That the power-factor of any alternating-current motor can be improved by causing the exciting emf either to lead the working emf by less than 90 time-deg. or to lag behind the latter by more than 90 deg.

(3) That the power-factor of any alternating-current motor can be diminished by causing the exciting emf to lead the working emf by more than 90 time-deg. or to lag behind it by less than 90 deg.

The same thing can also be expressed by saying:

(4) That any practical alternating-current motor in which the phase of the exciting flux either coincides with the phase of the working emf or differs therefrom by 180 time-deg. will operate with a "lagging" power-factor.

(5) That the power-factor of any alternating-current motor can be improved by causing the exciting flux to lag a little behind the working emf or to lead it by somewhat less than 180 deg.

(6) That the power-factor of any alternating-current motor can be reduced by causing the exciting flux to lead the working emf by a small angle or to lag behind it by a little less than 180 deg.

(7) Generally speaking, one can say that the power-factor in any alternating-current motor can be controlled, within the widest limits, by changing the phase of the exciting flux relatively to the phase of the working emf.

A further discussion of the subject of phase compensation will be presented by Mr. Val. A. Fynn in a subsequent issue.

## A. I. E. E. Papers and Discussions

In the following columns are to be found papers and discussions on the subjects of high-tension transmission, corona and synchronous motors which were omitted from the report of the Cooperstown convention of the A. I. E. E. in the issue of the *Electrical World* of July 5

### Constant-Voltage Transmission

From experience already obtained with the constant-voltage method of transmission-line operation in the case of several small lines, a number of the advantages of this practice were pointed out in a paper by Mr. H. B. Dwight. In the case of the constant-voltage scheme not only is the voltage regulated as usual from the generator end, but at the receiving end synchronous motors or condensers are also operated to control the received pressure by adjustment of the power-factor. By proper field excitation these machines may be made to offset the reactance drop of the line, which is greatest at low power-factors. The drop can thus be changed to a rise in voltage if the reactive component is leading instead of lagging, and this may even be sufficient to overcome the drop due to resistance also. While the synchronous-motor capacity required is from one-half to two-thirds the generator rating installed, adding considerably to the investment, the result is found not only in improved service but also in increased line capacity. The latter carrying capacity can be increased to twice or three times its ordinary value by such synchronous control, so that the saving in construction costs may more than offset the investment in additional machinery that would be necessitated.

Summing up, the author stated that the following advantages accrue from constant-voltage operation: (1) Better service—no variation in voltage. (2) Better protection,

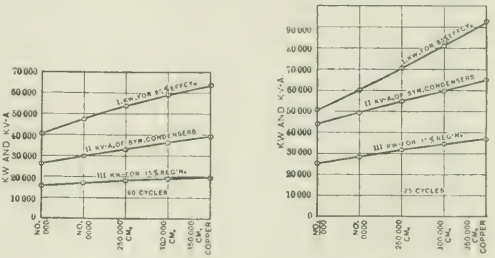



FIG. 1—CONDENSERS REQUIRED AND CARRYING CAPACITIES OF CONSTANT AND VARYING VOLTAGE LINES

due to high reactances. (3) Tendency to use 60 cycles. (4) Increased carrying capacity of line. The limit is changed from maximum voltage variation to maximum energy loss. (5) Lower total cost for long lines. The saving in cost is greatest for long lines or large networks, large quantities of power, large conductors, and for 60 cycles. (6) The method is easy to apply to existing lines. The change can be gradual, and no change is necessary in line construction.

The disadvantages were enumerated as follows: (1) Cost of attendance of additional rotating machinery. (2) Higher total cost for short lines. (3) In order to obtain the greatest economy from constant-voltage operation, the losses must be increased and the number of separate lines, which are useful as reserves, must be reduced. (4) Tendency of synchronous machinery to drop out of step, and delay in putting load on the line again after shut-down.

Taking estimates from a 200-mile, 33,000-kw, 116,000-

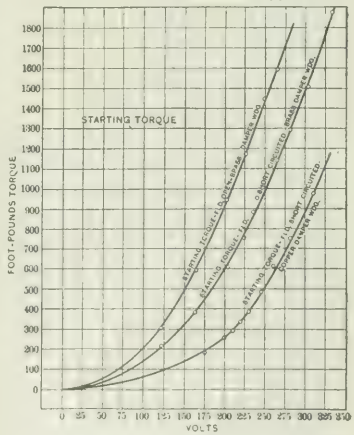



FIG. 2—COMPARATIVE STARTING TORQUE

volt system, the author showed a saving of $1,000,000 out of an investment of $2,200,000 required for the usual varying-voltage scheme of operation. Similarly, for a 100-mile, 54,000-kw, 113,000-volt line, the constant-voltage scheme would involve only $997,000 investment—a saving of $263,000 of the $1,260,000 which would be needed for the varying-voltage system.

the physical phenomena taking place in the windings of synchronous motors during the starting operation under a wide range of conditions. The machines tested were similar 2400-volt, three-phase units, one of 200-kva and the other of 150-kva rating. Both were provided with copper damping windings of low resistance, serving as dampers during synchronous operation and assisting in starting at light initial torques.

From the oscillograms and curves presented in the paper the following conclusions were drawn:

The effect of the closed field circuit on initial torque is negligible if damper windings of good design are used. With open field circuit during starting dangerous voltages are induced in the field winding. For all ordinary applications, at least, motors should be started with closed field circuit. Successively larger loads can be pulled into synchronism if synchronism is attained on the starting voltage without excitation, on the starting voltage with excitation, and on line voltage with excitation. For moderate loads the minimum starting current is obtained by considerably over-exciting the motor before changing to line voltage. For large loads, during starting and synchronizing, minimum starting current is obtained by under-exciting the motor before changing to line voltage. Further reduction in starting current is obtained by the use of reactance between the change from starting to line voltage, in which case excitation is delayed until the motor is near synchronism.

### Industrial Uses of Synchronous Motors

In a discussion of the industrial use of synchronous motors by central stations, Mr. John C. Parker pointed out

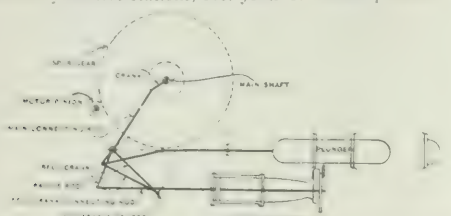



Fig. 8—Line diagram of Oilgear 600-gal. variable stroke pump

that the customer naturally takes little technical interest in such equipment since it is more expensive, less substantial, harder to operate and less adapted to small units. Its principal application is in large group drives not subject to frequent starting or to starting under load. The customer's motive for making such an installation must be found either in a rate schedule favorable to unity or leading-power-factor conditions, the sharing of the initial expense by the central station, or the offer of a special rate lower than that for induction-motor operation in cases where synchronous operation will improve distributing conditions.

Where the metered demand is based on the kilovolt-amperes rather than the kilowatts, the customer will have a material interest in keeping the power-factor as near to unity as possible. In the case of long-distance transmissions the incentive thus supplied may amount to from 10 to 30 per cent of the total cost of service. Automatic potential regulators should be inserted in the line to hold the voltage constant at distant points in the system, either with or without inductance in series with the line. Such control combines the two functions of load-carrying and regulation in a single piece of apparatus. It is recommended for use with series reactance in cases where the synchronous quadrature demand exceeds the lagging quadrature demand. The line may also be broken up into segments, with inductances inserted between the section points so determined with relation to the synchronous-motor taps that the potentials at adjacent inductances will be equally high above and below the voltage for which the regulator is set. In this way will be obtained the flattest voltage curve between inductances and improved regulation over the whole length of line.

By adaptation of the driven mechanism it is often possible to adjust the load to the motor-starting conditions as well as to variable output at constant driving speeds. A reciprocating pump, for example, may have its linkage so controlled by hydraulic means that the piston stroke can be varied between full-travel and zero, bringing the no-load torque at starting well within the range of the motor. Adjustable clearance spaces can also be employed with pumps handling gases.

### *Discussion*

The three papers by Messrs. H. B. Dwight, F. D. Newbury and John C. Parker were discussed together, although the Dwight paper was presented under the auspices of the high-tension committee and the other two under the industrial-power committee.

In opening the discussion Mr. F. D. Newbury told of one instance in which a sychronous condenser was used in connection with a long high-tension transmission line. He also said that a frequency of 60 cycles is becoming more general in railway work, since the 500-kw, 600-volt, 60-cycle synchronous converter is now standard. This machine, the speaker said, is stable in operation and holds in step satisfactorily at no load and small excitation.

Mr. R. B. Williamson of Milwaukee, Wis., said that Mr. Newbury's paper cleared up a number of doubtful matters connected with synchronous-motor operation and that the very complete oscillograms given in the paper left comparatively little room for discussion. It was worthy of note, he remarked, that the rotor of the motor tested was laminated instead of solid. Troubles in some of the early motors, made up from standard alternator parts, were due to such solid rotors, while now they are built on the squirrel-cage principle. He then described some tests on a 125-kw turbo-alternator with a round rotor operated as a synchronous motor. At half-voltage it was possible to exert quarter-load torque with one and a quarter times full-load current. On full voltage he thought it would have been possible to exert full-load torque.

Mr. H. M. Hobart stated that there are several available means for improving synchronous motor performance which only await application. The design of such motors should be, he thought, in the hands of induction-motor designers. High starting-torque characteristics are obtained on an induction motor at the expense of considerable heating and input at full speed, whereas the latter objections are eliminated in the synchronous motor when it falls into step at synchronism. In fact, said the speaker, the synchronous motor can be designed for better starting torque than an induction motor, and it can be made in small size.

Mr. Hobart remarked that economic limitations are forcing consideration of the very highest available transmission voltages, which make the paper of most timely importance. The conclusions stated, he thought, were very forcefully expressed.

Professor Theo. Hagood, Schenectady, N. Y., commented on the simplicity of the formulas given by Mr. Dwight, and exhibited a number of lantern slides showing the results obtained by the use of synchronous condensers in a transmission system which had been planned under his direction. The real starting point in transmission-line design is the decision as to the use of synchronous condensers.

Mr. W. I. Foster commented upon what he termed the chief undesirable characteristic of the self-starting synchronous motor, namely, the high value of the induced emf across the field terminals during starting. In the re-

volt machine field, said he, there is no great difficulty from this cause, but the 250-volt machine presents a more serious problem. Short-circuiting the field coils during starting removes the first difficulty but impairs the starting torque; it is also possible to help the situation by waiting to short-circuit the field coils until the machine reaches two-thirds synchronous speed, but the most satisfactory plan of all is to arrange the field circuit for low voltage. In response to questions from Mr. A. H. Kruesi regarding the machine tested, the author replied that it had twelve slots and six bars per pole and a 0.25-in. air-gap.

Mr. W. E. Funk, of Philadelphia, Pa., said that for economic reasons he recommended keeping the station power-factor at unity, instead of aiming for constant-voltage transmission, as the author had done.

Mr. H. W. Peck said that old synchronous apparatus in central stations might be worth more if operated as synchronous condensers than they would bring as scrap, and he planned to commence such an investigation at once upon his return home.

Mr. B. McCollum, of Washington, D. C., criticised Mr. Dwight's conclusions in the respect that savings in transmission cost arising from constant-voltage transmission had not been offset by the resultant increase in line losses and the attendant increase in cost of operation. The major improvement from this system of operation, said the speaker, is in better regulation and steadier operating conditions.

Mr. Dwight replied that the line energy loss is not a serious matter and would not affect the conclusions stated in his paper. The maximum, or peak-load, loss, he pointed out, is not the ruling consideration, but the average twenty-four hour loss. For almost any case it will pay to consider the use of synchronous condensers. He then gave some specific figures showing the increase in transmission-line rating secured by this method of operation. In reference to synchronous condensers for city distribution systems he gave it as his opinion that their use is questionable because the power-factor fluctuates, the wattless current sometimes being lagging and at other times leading.

Replying to a question from Mr. P. M. Lincoln in regard to types of rotor, Mr. Newbury said that the damper winding (squirrel-cage) of least resistance will give the largest pull-in torque but the smallest starting torque. The magnetizing current in an induction motor is much less than that in the synchronous-type machine, which fact is an element in favor of the squirrel-cage starting device. He also said that a salient-pole rotor is preferable to the round type.

Mr. M. O. Dellplain, Syracuse, N. Y., the next speaker, voiced his belief that synchronous motors are not yet as reliable as induction motors for central-station service, except in the relatively few cases of customers who have large installations. There is also lacking, he said, an economical polyphase meter to measure the customers' kva demand. Mr. H. W. Peck took up the discussion at this point and said that it is often possible to use synchronous motors, and that the cost of the necessary meters is not prohibitive in a large installation.

Dr. C. P. Steinmetz characterized the papers dealing with synchronous motors as very important, giving new and useful information. The modern synchronous motor, he said, is very well able to start from rest with considerable load and carry it successfully up to speed. Sometimes the synchronous motor will give more starting torque, sometimes less, than the induction motor. But the induction type cannot at the same time possess the best starting properties and the best running properties, while the synchronous type is handicapped by no such limitation. The synchronous type, he said, is distinguished by three typical differences: first, it does not have uniform magnetic reluctance in all directions, which is a characteristic of the induction type; secondly, it has a longer air-gap, which gives it an advantage in starting, and, thirdly, it has higher secondary resistance and greater starting torque.

The oscillograms given in Mr. Newbury's paper show many things, said Dr. Steinmetz, which were not brought out. The fluctuations in current, for example, correspond in the fluctuations of reluctance from pole to pole. It is also possible to construct the speed-time curve of acceleration and the speed-torque curve. That is to say, all the characteristic curves of the motion can be obtained from the oscillograms. The characteristic drops in torque at one-fourth, one-half and three-quarters of synchronous speed are thus shown. The large synchronous motor, he said, is one of the most important elements in an electrical system, and instead of impairing the power-factor improves it.

Mr. W. L. Merrill brought out the point that the comparisons made were based on the squirrel-cage type of induction motor which is well known to be inferior in starting characteristics to the wound-rotor, slip-ring type.

Dr. Steinmetz contended that the starting characteristics of a synchronous motor with squirrel-cage winding are naturally compared with the same type of induction motor because they are similar, and, moreover, most induction motors are of the squirrel-cage type.

Mr. F. D. Newbury, continuing the discussion, pointed out that the torque characteristics needed at starting vary with the conditions. For example, motor-generator sets require the maximum torque at starting, whereas in the case of motor-driven fans, air-compressors, centrifugal pumps, etc., the maximum torque occurs at full speed. The point was also made that it is difficult to obtain high torque at pull-in with motors of large output and slow speed; a standard figure has been 15 per cent.

Mr. R. B. Williamson mentioned the difficulty of determining the starting torque required for many kinds of machinery and spoke of a 2400-hp synchronous motor connected to a pulp grinder, requiring only 1200 hp under normal running conditions, although the starting conditions were severe.

Dr. Steinmetz stated that the matter of pull-in torque needs more study. A sudden jump or acceleration of speed from a definite slip to zero slip is required, and getting safely past this point is often more important than the dead drag or normal load torque.

Speaking of the round type versus the salient-pole type of rotor, Mr. F. D. Newbury said that the choice depends mainly on the cost, the salient-pole type being the cheaper.

Mr. W. J. Foster corroborated Mr. Newbury's view of the last problem, and recommended a broader polar arc, equal to from 80 to 85 per cent instead of the usual 60 to 65 per cent of the pitch.

Mr. H. M. Hobart stated that the torque of the round type of rotor increases all the way up to synchronism, but on this point Mr. Foster took issue and said that the torque drops at pull-in.

Mr. W. L. Merrill added that large induction motors are of the form-wound type and that if synchronous motors can be designed with equally good characteristics they will become very useful in central-station service.

Touching again upon the two types of rotor, Dr. Steinmetz claimed that the definite-pole type is inferior, with respect to starting torque, to the uniform reluctance type, but the reverse is true at pull-in. What is needed is a high-resistance squirrel-cage for starting and a low-resistance cage for pulling in. As between the two types of rotor there is no great difference and the choice, he said, is one depending mainly on economic considerations.

### Specifications for Testing High-Voltage Insulators

In an effort to draw up a "skeleton" or model specification form for the testing of insulators the high-tension transmission committee secured two tentative specifications, one by Mr. F. W. Peek, Jr., written from the viewpoint of the expert tester and scientist, and the other by Mr. J. A.

Sanford, Jr., prepared from the standpoint of the manufacturer. From these two the chairman of the committee, Mr. Percy H. Thomas, prepared a single specification embodying what are believed to be the best features of the preceding forms as well as suggestions obtained from members of the high-tension committee and others. Among the topics covered in the specifications are: Dielectric surface, cement, fragility, design, factory tests, arc-over tests, corona, voltage balance, uniformity, impulse tests, measurements, mechanical stress, mechanical inspection, protection of metal parts, galvanizing, glazing, absorption, crating, rain tests, dew tests, breakdown, corrosion, wave-form of test voltage, capacity of test apparatus, frequency, etc.

*Discussion*

In discussing the paper Mr. Sanford remarked that nearly every high-tension line in the country will show visible corona in perfect darkness. He thought that Mr. Peek's requirement of no sign of corona at one and three-tenths times line voltage too severe, as most insulators will show some visible corona in a perfectly dark roof at less than line voltage.

Mr. L. C. Nicholson read a communication describing tests on about 200 insulator units, showing that there is a connection between the dielectric strength or puncture voltage and the mechanical stress or load imposed, the inference being that the dielectric strength of a unit diminishes under mechanical stress. These results Mr. P. H. Thomas characterized as most important and urged the need of exhaustive investigation without delay. While it may turn out that the necessity of testing insulators electrically while subjected, prior thereto or simultaneously, to mechanical stress will be burdensome upon the manufacturer, such a course is worth while if the results seem to justify it. The point was also raised whether the Institute should formally adopt or approve an insulator specification, and whether instead it should not issue rules to serve as a guide to the writing of specifications.

A question was raised by Mr. H. W. Crozier, San Francisco, Cal., as to what had become of the proposition once advanced that every unit in the string should withstand the full line voltage, and also whether it would be necessary to stress every insulator mechanically in the acceptance test.

Mr. J. B. Taylor read a communication from one of the Japanese engineers present, describing the results of puncture tests in air and oil, giving values for the latter equal to only from 80 to 90 per cent of the former, for insulators of Japanese make. This was explained by Mr. F. W. Peek, Jr., as being probably due to electrostatic field concentration in the oil, but domestic insulators do not act in that manner. It was pointed out by Mr. P. H. Thomas that it is undesirable to have two methods of tests which could not be distinguished by their results.

Mr. L. C. Nicholson drew attention to the desirability of keeping the mechanical stresses as low as may be, using two or more strings in parallel if the expense is not prohibitive. There are other things about insulators which electrical engineers ought to know but do not, such as the effect of mechanical loads in actual service, the proper material for cement or a substitute for it, and the art of ceramics. Quoting from Mr. A. O. Austin's results, he said that temperature changes alone might induce porcelain stresses as high as 400 lb. per sq. in., while from his own tests 1000 lb. per sq. in. might cause electrical failure. There is also the fundamental question whether the type of design is correct. When dry a string will flash over as an entire unit, but when wet will flash from unit to unit, which raises considerable doubt as to the design. The suggested specification, he thought, was good as far as it went, but unconclusive. It seems to be declared, should go into the whole problem broadly and master the art of manufacture, giving special attention to the mixing room

Mr. C. O. Mailloux objected to the last point and said that just as "the shoemaker should stick to his last," so should the electrical engineer keep out of the porcelain works and confine himself to demands for final results. Calling attention to the great variation in the resistivity of water with the impurities present, Mr. P. M. Lincoln recommended that rain tests should be made with distillate, since natural precipitation itself is pure. Also, he said, the test should be made with the pin grounded, in order to reproduce service conditions.

Mr. H. T. Wreaks, of New York City, advised against going into the mixing room, illustrating his point with an example of the difficulties certain engineers plunged themselves into by attempting to specify the composition of certain rubber compounds used for wire insulation. In his experience he also found that the matter of crating insulators for shipment is very important from the practical point of view, as damage in transit may impair the insulator efficiency.

Prof. E. E. F. Creighton, speaking of vitrification of porcelain, said that it seems impossible to determine what it really is or to define it. But if the manufacturers refuse to make the necessary researches to disclose its true nature, then engineers must do so. There are other things to consider, said he, besides the water absorption test. Temperature and time both play exceedingly important parts in vitrification. In his experiments with clays, using an electric furnace, it was found very convenient to measure temperature by raising an incandescent lamp filament to equal incandescence with the clay mass, by sighting the former against the latter. The error in this method was within about 10 deg. in 1400 deg. Upon repeated applications of the temperature the vitrification increases, but less rapidly, and finally becomes constant, and at the same time the product becomes brittle. Insulators, the speaker said, are really used only at very high frequencies, as with lightning or arcing grounds. The phenomenon of corona in the air acts as a relief or safety valve under excessive electrical pressure. Finally, he thought, porcelain will be treated like any other insulation and never stressed above a certain percentage of its ultimate strength.

Mr. R. D. Mershon said that questions connected with the design tests should be disposed of first, if possible, leaving only routine tests to be taken up when the manufacturer is ready to deliver the product. It is not advisable, in his opinion, to go into ceramics, but he suggested some joint Institute meetings with ceramic engineers. Porcelain, said the speaker, is more unreliable than other electrical material, and information concerning it is vague, indefinite and conflicting. For illustration, a piece of porcelain which sustained a stress of 2200 lb. per sq. in. fractured when allowed to fall to the floor. An oil puncture test is desirable, but the trouble is to determine how it ought to be carried out; it is also very desirable that the puncture test when applied should give uniform results, or, in other words, that the product should be as homogeneous as possible. As to the rain test, the speaker said a rate of 1 in. rainfall in five minutes is greater than ever recorded. In order to insure a factor of safety under such service conditions it is better to raise the test voltage than to increase the precipitation so much above the maximum natural rate. It is also better to incline the axis of the insulator and use a vertical spray than the reverse. He pointed out that the specifications say nothing about handling the insulator after the cementing is done, although it is very important that the cement should not be permitted to freeze. In practice he has observed no difference whether the flash-over starts over the string as a whole, or from unit to unit, and in any case the breakage of units results from the heat of the "power" arc.

Continuing the discussion, Mr. E. M. Hewlett, of Schenectady, N. Y., said that the general design is the first point to be settled. The power arc will always throw itself clear

of the units regardless of whether the string flashes over initially as a complete unit or from disk to disk. The inspectors at the factory, he said, enjoy the "fireworks" and hence raise the rate of precipitation until they occur. An insulator hanging at an angle is under the advantage that the drip generally falls clear of the units beneath; the wind is also a factor. A moisture-absorption test of 0.1 per cent the speaker regarded as rather severe and likely to raise the cost. It is very important to call for uniform material. Ceramic workers, said he, can make any kind of porcelain wanted, but the handling of the product during the process is everything. Different kinds of clay do not serve equally well for all designs of insulators, but some varieties serve better under given requirements than do others.

Mr. H. W. Crozier, San Francisco, Cal., recommended the tongue or taste test as a quick means of discovering porcelain having absorption defects, while defective vitrification, he said, can be detected on sight by an experienced inspector. He also recommended soaking the porcelain in water and submitting it afterward to an electrical test, as a means of detecting absorption. Mr. P. W. Sothman, New York, pointed out that the same insulator will not give equal service everywhere. He was opposed to attempting to devise a perfectly general specification covering every detail, but advised a separate specification for each job and a steadfast adherence to it in each case. The speaker opposed any plan to tell manufacturers how insulators should be made, and advised limiting the specification wholly to results. He opposed Mr. P. M. Lincoln's opinion as to the use of distilled water in the spray test, and said that in general the test should reproduce as far as possible the actual conditions imposed by nature in the locality where the insulators will be used. The proposal to work out a detailed specification met with his opposition, and he preferred instead a set of notes or rules for general guidance in writing specifications. Prof. C. F. Scott, New Haven, Conn., stated that in his opinion the proper order of attacking the question was as follows: Designing, engineering, and commercial testing.

### The Electric Strength of Air

In the fourth paper of the series by Messrs. J. B. Whitehead and T. T. Fitch the study of the effect of pressure on corona formation was extended to include wider ranges of pressure and diameters of conductor than were attempted in the earlier investigations. The results reported by the authors show the close relation of the observed phenomena with the formula by Mr. F. W. Peek. A 10-kw, 100,000-volt transformer supplied the energy. For the pressure measurements a 20-cm iron tube, 90 cm in length, was used, the ends being fitted with fiber insulating caps 18 cm long. A gold-leaf electroscope permitted detection of the beginning of corona.

Observations made with carbon dioxide indicate that the critical corona intensity is independent of the absolute density of the gas but depends on the number and spacing of the molecules in accordance with the theory of secondary ionization. The critical corona-forming electric intensity in air has been determined over the range of pressure from 5 cm to 108 cm of mercury column for nine sizes of round conductor, including diameters from 0.23 cm to 0.95 cm. The ionization theory fails to show why the critical intensity varies with conductor diameter and why the intensity with respect to pressure changes does not follow a linear law. Corona begins and ends at approximately the same voltage on the emf wave, indicating that the rate of ionic recombination is very great.

### Precipitation and Positive and Negative Corona

In experiments reported by Mr. W. W. Strong, high-voltage alternating current taken from the secondary of a transformer was rectified by a Lemp synchronous commutator. The coronas produced by the resulting rectified current were then used to remove suspended matter from gases. Wires extending through the center of grounded 5-in. cylinders formed the discharge electrodes.

From the results obtained for the positive and negative coronas it is seen that the ionization of a gas affects the two coronas differently. Owing to experimental difficulties it could not be shown, as hoped, that the effects of the alternating-current corona were the additive effects of the two direct-current coronas, positive and negative. For given differences of potential the negative corona loss is less than the positive corona loss. In still air the sparking potential is approximately the same for both coronas, although the presence of even a small air current permits the potential difference to be raised considerably. Since the negative corona is much more uniformly distributed about the active electrode, and on account of its greater

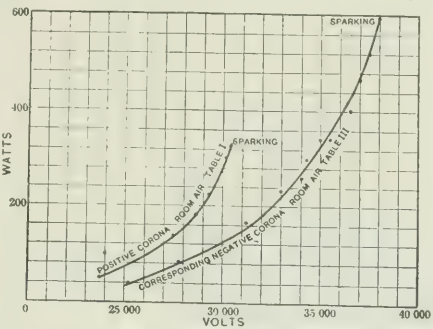



FIG. 4—WATTS LOSS OF POSITIVE AND NEGATIVE ELECTRODE

stability as regards sparking, the negative discharge is the most suitable for electric precipitation. The chamber described has a capacity for cleaning 800 cu. ft. of gas per minute and consumes about 300 watts under the best conditions of negative corona operation.

The positive corona loss in both room air and ionized furnace gas is about the same. Increasing the air velocity increases the sparking potential of a negative corona in ordinary air. The corona watt loss is also considerably greater in hot ionized gas than in air. The positive corona tends to go over to an oscillatory spark while the negative corona is more easily changed into an arc form of discharge. Presence of suspended matter in gases does not affect the corona currents greatly, but in hot gases it increases the sparking potential, probably owing to the disappearance of the smaller ions. The presence of suspended matter in ordinary air decreases the sparking potential.

### Corona and the Dielectric Strength of Air

The greater dielectric strength of air at the surface of small conductors was long attributed to a condensed film at the conductor surface. But the breakdown gradient, as expressed by Mr. F. W. Peek, Jr., in a third Institute paper on the subject, suggesting a theory of rupture, is as follows:

$$g_v = g_o\left(1 + \frac{k}{\sqrt{r}}\right)$$

This means that at breakdown the gradient is always constant and equal to $g_o$, at $k\sqrt{r}$ cm from the conductor surface, independent of the size of the conductor. The explanation seems to be that energy is necessary to start rupture and that, therefore, rupture cannot start at the surface, but only after the surface gradient has been increased to $g_v$, in order to store the rupturing energy between the conductor surface and $k\sqrt{r}$ cm away in air, where the gradient is $g_o$.

According to the above theory, if the wires were spaced very close together, $g_v$ would increase in value in order to

[illegible] distance.

[illegible] a spacing of [illegible] and [illegible] $g_0$ values as high as 200 kv per cm or 500 kv per inch have been reached. Spheres were used in these tests as it is impracticable to adjust cylinders at small spacings. The electron theory may also be nicely applied to the above, where [illegible] as the [illegible] ating distance."

### OSCILLOGRAPHIC STUDY OF CORONA

Mr. Edward Bennett presented a paper in which was described a method of obtaining oscillograms of the charging current of a 10-ft. length of wire, representing current strengths of the order of 0.005 amp. By passing this small current through the primary of a 1/100-milliamp current transformer a secondary current was obtained in the latter circuit closed through the oscillograph vibrator. A large number of oscillograms illustrate the paper, showing the wave-form of the charging current with the wire surrounded by corona, etc. For obtaining these records the air pressure surrounding the wire was reduced to 0.13 cm

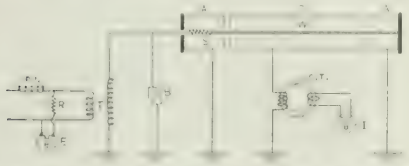


Fig. [illegible] CONNECTIONS FOR OSCILLOGRAMS OF CHARGING CURRENT OF A WIRE

of mercury. Among the effects illustrated may be pointed out the marked asymmetry in the current after corona begins, the relation between watts loss and impressed voltage, the beginning of the corona after switching, variation in results at high and low air pressures, distortion of wave-form due to ionization, quadratic relation between power expended in corona and impressed voltage, etc. A curve is also plotted showing the relation between the air pressure and the voltage required to cause the distortion to appear in the current wave-form.

*Discussion*

Mr. P. M. Lincoln remarked that corona loss varies as the frequency, and apparently while it requires energy to create it, a less amount is required to maintain it. This, he thought, leads to the conclusion that there could be no corona with continuous emfs and asked the authors to explain.

Prof. C. F. Scott recounted the history of experimental researches on corona, commencing with the work of Mershon and Ryan some fifteen years ago. He also commended the authors very highly for the latest contributions to the subject.

Mr. L. T. Robinson, Schenectady, N. Y., said that the details of these researches are becoming constantly of more interest and importance. In particular, he was interested in the possibilities of measuring high voltages by means of corona, since its occurrence is noted at a point which in each case is defined rather sharply. He asked the authors to discuss this point especially. The speaker also commended Professor Bennett's careful analysis of his results. Since only 0.0025 watt is required to operate the oscillograph, said Mr. Robinson, transformers for multiplying the current can be used to good advantage. Of course, this amount of power, although small, is considerably larger than the amount required, for example, to operate some types of Weston instruments, which need something on the order of 0.0001 watt.

Prof. A. E. Flowers, of Columbus, Ohio, speaking of precipitation by corona, said the subject has a considerable history in the realm of physics. Fleming and Wilson in England have studied it and Carpenter has investigated it in cement mills in the West. The speaker touched upon the work of Milner in England on high-frequency corona, carrying the frequency as high as 200,000,000 cycles per second. He illustrated Milner's results by drawing a number of different curves on the blackboard showing wave-shapes.

Mr. J. B. Taylor remarked briefly upon a differential method of measuring corona current which he suggested several years ago and which Professor Bennett had employed in his tests.

Prof. V. Karapetoff, of Ithaca N. Y., asked why in Dr. Whitehead's paper the dielectric strength of air at rupture should be 50 kv per cm instead of 30 kv or the usually accepted value.

In reply to a question by Mr. P. M. Lincoln, Prof. A. E. Flowers said that Watson in England had investigated corona phenomena with continuous emfs up to nearly 100 kv. Prof. V. Karapetoff remarked that the corona energy-loss curve is a parabola crossing the $Y$ ordinate above the origin, thus proving that there is some loss at zero frequency or with continuous emfs.

Dr. J. B. Whitehead then closed the discussion on his paper, remarking upon the value of the ionization theory of conduction in gases. It is not rational, he said, that an increased gas temperature should reduce the sparking potential, and he attributed such a result to the presence of solid particles. The same explanation may apply to the effect of air in motion. He took occasion again to question the soundness of the energy-zone theory advanced by Mr. Peek. Speaking of Professor Bennett's work, which he praised highly, he emphasized the importance of temperature and remarked that the copious ionization referred to is instantaneous. The energy loss is due, he said, to actual breaking down of the molecules and the passage of a conduction current. The discrepancy between the loss curves for parallel cylinders and concentric cylinders is accounted for by the difference between the paths in the two cases. In concentric cylinders the paths are short and straight, while in the case of parallel cylinders the paths deviate and some of the ions fly off so far as not to reach their destination during a half-cycle. Dr. Whitehead told briefly of his work in developing an apparatus to measure high potentials by means of corona, which he hopes soon to perfect and to describe in a communication to the Institute. Replying to Professor Karapetoff's question, he said that the rupture value of 30 kv per cm for air applies only to parallel-plane electrodes.

Mr. W. J. Hammer, New York, called attention to the properties of the surfaces of certain metals and the effect of chemical reagents upon them, with a possible bearing on corona phenomena.

Mr. F. W. Peek, Jr., in closing described the characteristic curve of corona loss, which he said would pass substantially through the origin if extrapolated, but added that in all probability it would take a different form near the origin, at lower frequencies, and cross the $Y$ axis at some definite value corresponding to the corona loss with continuous emfs. But between 25 and 60 cycles he said that his empirical formula for the energy loss, which varies as the frequency, is correct. In conclusion the speaker stated that the ionization theory can hardly be accepted as yet to explain all high-tension phenomena.

Professor Bennett closed very briefly, saying that the string galvanometer, in reference to which Professor Flowers asked a question, could not be used in this work on account of its long period. He also referred to a hollow cylinder enveloping a concentric cone which had been adapted by Professor Ryan for measuring high potentials by means of corona.

# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## New Showrooms in St. Louis

The Union Electric Light & Power Company opened its new electric appliance showrooms at the headquarters of the company, Twelfth and Locust Streets, St. Louis, on June 25. On the opening day "electric tea" was served, and a discount of 10 per cent was given on all articles purchased. Desk fans, vacuum cleaners, electric flatirons, toasters, coffee percolators, hair curlers and driers, electric grills, teapots and many other appliances are attractively displayed.

## Utilizing Fans to Drive Fly Chasers

An attractive and practical application of electric drive is employed in one of the fruit and confectionery stores run by Manusos Brothers of Chicago. The store, which is at the corner of Van Buren and State Streets, has two of its walls covered with plate-glass mirrors. In the summer it is difficult to keep these large mirrors spotless on account of the flies. To eliminate frequent cleaning an endless tape, about 0.75 in. wide, carried horizontally on rollers and supporting vertical strips of ribbon, is kept in motion by belts connected to the pendent-type electric fans already installed in the store. The ribbons are of various colors and are arranged in harmonious combinations. The suspended ribbons, which are spaced about 4 in. apart, traveling in one direction on one side of the movable belt and in the opposite direction on the other side, give a very pleasing effect. There are four 36-in. pendent electric fans in the store, and three of these are belted to pulleys which drive the endless ribbon. This installation required only a slight addition to the fans. A pulley was constructed with the support of the fan as an axis so as to be driven by arms connected to the fan blades.

## Increase in Electrical Energy Output at Minneapolis

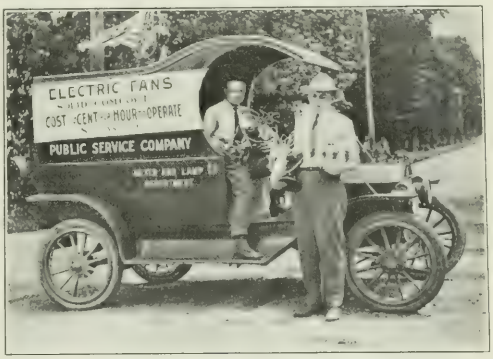
Two contracts recently secured by the Minneapolis General Electric Company indicate the rate at which new business is being secured in the Minnesota city. Figures show that the weekly electrical energy output for 1913 has increased from 35 to 50 per cent over the corresponding period last year. One of the latest contracts to be closed is that for furnishing the L. S. Donaldson Company with electrical energy to the amount of 846 hp. The Donaldson company, which owns the largest department store in Minneapolis, has operated a private plant for several years, making it one of the display features of the store. The contract provides for shutting down the private plant for seven months of the year. During the winter months the Donaldson company plans to continue operating its private plant in connection with furnishing steam for heating purposes.

A contract covering a period of ten years has also been secured by the electric service company with the Minneapolis Malt & Grain Company for furnishing 200 kw at 2300 volts. This contract also provides for shutting down a private plant.

Since the first of the year the actual connected motor load on the electric service company's lines has been increased 3500 hp, although this figure does not include the above-mentioned contracts. During the same period the lighting load has been increased 1503 kw. A large force of men is now engaged in constructing a 12,000-hp hydroelectric station on the Mississippi River at Coon Rapids, 12 miles above Minneapolis. When it is completed the energy developed there will be utilized by the Minneapolis company in handling the rapidly increasing load.

## A Fan Campaign at Joliet, Ill.

The Public Service Company of Northern Illinois has been conducting a successful electric-fan sale at Joliet, Ill., with the aid of the decorated delivery wagon illustrated.




DELIVERING ELECTRIC FANS AT JOLIET, ILL.

Surmounting the roof of the vehicle is a large fan arranged to run idly with the wind created by the motion of the car. On the sides of the car body are also signs reading "Electric fans—solid comfort—cost 0.25 cent per hour to operate; $8 and up." During recent hot spells electric fans have been delivered by the wagonload in the vicinity of Joliet. Mr. W. C. Hill is superintendent of the local district for the Public Service Company.

## Ten Essential Points in Electric-Truck Specifications

Although the proper selection of electric trucks is an engineering problem, its successful solution depends, more than anything else, upon the furnishing of accurate fundamental data to the manufacturer or his representative regarding service requirements. The following fundamental points were recently quoted as essential in avoiding unsuitable selections of equipment which prove injurious to purchaser and dealer alike:

1. What is the nature of the routes to be covered in the service? Is it all a town service or all a country service, or does it partake of both characters?

2. What is the general character of the streets and roads? Are they comparatively level or are steep hills numerous?

3. What are the distances which each vehicle must cover in a day's round?

4. What is the character of the load to be carried? Is it light but bulky, or heavy in comparison with the bulk?

5. Are the packages to be carried of large size, such as heavy furniture, pianos, safes or the like, or are they small, such as groceries, jewelers' boxes, light dry goods, etc.?

6. Are the goods and packages of such a nature that they must be protected from dust and rain or can they be carried in open wagons or so-called express bodies?

7. Are they of a fragile nature, calling for unusually flexible spring suspension if the load be moved at speed?

8. What quantity of goods will usually be loaded up for each trip? Will the load be carried the full distance or only half the distance? Do the vehicles ordinarily return empty or are they partly loaded?

9. What is the most convenient body construction to admit of easy loading and unloading of the class of goods to be handled?

10. Would it be desirable in the case of heavy goods to enable the power of the motor to be utilized in loading or unloading?

## An Illinois Farmer's Motor-Driven Feed Cutter

Among the farm customers of the Public Service Company of Northern Illinois in its Lake County electrified agricultural section, northwest of Chicago, is a dairyman who uses the feed cutter illustrated to prepare stock food for fifty head of cattle. With the aid of this machine he grinds the feed at a cost less than that which the mill charged for the same service, in addition to saving the time and trouble of transporting the raw stuff to the mill.

The 10-in. International grinder used is mounted on a second-floor gallery so that the feed as ground can be dropped directly down to the cattle's troughs. The 10-hp motor which drives the machine is installed on the ground floor of the barn, operating through a countershaft and belts. For two feedings daily for fifty cattle the outfit need be operated only half an hour daily. Although the farm is several miles from the town limits, the rate earned is about 7 cents per kw-hr., and the customer's bill averages $14 per month. This is less than the cost of the mill service alone, and the farmer is in addition saved the labor and time of hitching up a team, loading his wagon, driving several miles to the grist mill, waiting his turn and returning with the ground supply. As all this had to be done



MOTOR-DRIVEN FEED CUTTER

during daylight hours, valuable time was taken from other farm duties.

According to the dairyman's own statement, he can now grind a whole day's feed in the time formerly required to hitch up and load his wagon. The grinding can be done, too, after other chores about the place are completed, and it is usually not started until the evening milking is done. The machine will grind twelve bushels in twenty minutes. Single-phase 4400-volt energy is furnished to this customer from an extension to the nearby town distribution system. The schedule employed begins with a rate of 9 cents per kw-hr. maximum, but in the quantities in which service is here used an average rate of 7 cents per kw-hr. is obtained.

## Electric Ironing in Shirt-Waist Factory

The accompanying illustration shows a portion of the ironing section of the shirt-waist factory of Hugo Du Brock & Company, of Chicago. Electric flatirons are used,



USING ELECTRIC IRONS IN SHIRT-WAIST FACTORY

pilot lamps indicating which irons are in circuit. These lamps are placed in the iron boxes shown to the left of the center line of operators. Electricity supplied by the Commonwealth Edison Company is used for lamps, motor operation and industrial heating in this well-arranged factory. Sewing machines and cloth cutters are driven electrically.

In the pressing department 9-lb. irons are used. The distribution board has a capacity for six electric irons on each side. Each iron is always at the right temperature for quick and effective work and rests on an automatic regulating stand when not being used. If an iron is to be idle for some time, it is switched off altogether by hand, but otherwise the automatic current-regulating stand is very useful, as it reduces the flow of electricity when the iron is placed upon it, preventing undue heating and waste of energy.

## Metered Versus Flat-Rate Steam-Heating Service

The advantages of metered steam-heating service over flat-rate schedules of charging were pointed out in the report of the meter committee of the National District Heating Association at the latter's convention, which was held at Indianapolis.

Flat rates are, for instance, inequitable among customers. In one Illinois city the steam used per square foot of flat-rate radiation ranged from 150 lb. to 3000 lb. per season. Flat rates also make customers extravagant, causing wastes which are a burden on the whole system. Where the company installs temperature-control devices the inspection and maintenance necessary for these will largely offset the cost of maintaining and inspecting meters.

The accompanying table shows the comparative steam consumption and income for the seasons of 1910-11 and 1911-12 for a large heating company. Up to and including the season of 1910-11 the buildings in this table were on a flat rate. These flat rates were based on the consumer's

figures as to what it would cost him for heating. There were, all told, fourteen customers enjoying a flat rate. During the summer of 1911 the company "signed up" thirteen of these customers on a meter rate, losing one customer. These were installed, 240 out of 260 customers being thus equipped. For the next season the income from the heating business increased from a flat-rate business of $17,500 to $23,000 under metered conditions, a gain of $5,500. Despite the

COMPARATIVE STEAM CONSUMPTION AND INCOME

| Nature of Building | Radiation, Square Feet | Season 1910-11 | | Season 1911-12 | | Per Cent Difference | |
|---|---|---|---|---|---|---|---|
| | | 1000 Lb. | Income | 1000 Lb. | Income | Steam | Income |
| Office building | 6,738 | 3,189 | $1,200.00 | 3,552 | $1,470.40 | +11 | + 22 |
| Bank | 950 | 673 | 195.90 | 720 | 374.75 | + 7 | + 91 |
| Fraternal lodge | 4,080 | 797 | 358.65 | 726 | 376.80 | — 9 | + 5 |
| Stores and offices | 1,212 | 755 | 175.00 | 877 | 448.05 | +16 | +156 |
| Office building | 6,421 | 2,863 | 670.00 | 3,566 | 1,387.40 | +24 | +100 |
| Stores and apartments | 7,006 | 2,596 | 960.00 | 3,405 | 1,361.30 | +31 | + 41 |
| Stores and apartments* | 2,950 | 2,651 | 425.00 | 1,470 | 689.05 | —45 | + 61 |
| Hotel† | 2,718 | 3,236 | 650.00 | 3,330 | 1,335.25 | + 3 | +105 |
| Stores and manufacturing | 18,000 | 13,925 | 3,000.00 | 13,231 | 4,034.60 | — 5 | + 34 |
| Department store | 1,908 | 1,465 | 450.00 | 14,498 | 686.30 | + 3 | + 52 |
| Office building† | 25,000 | 18,058 | 3,500.00 | 22,066 | 5,295.84 | +22 | + 51 |
| Stores and lofts | 2,364 | 13,329 | 370.00 | 1,383 | 653.30 | + 4 | + 76 |
| Athletic club and hotel† | 2,300 | 22,500 | 3,500.00 | 24,705 | 5,929.20 | + 9 | + 70 |

*20 per cent of apartments empty. †Steam used for other purposes beside heating.

thirteen are still connected to the central station and are satisfied.

The season of 1910-11 had average weather conditions, but during the season of 1911-12 the temperature was considerably below the average. Accordingly, in this table, on account of the weather conditions, the economies practised by the consumers do not show up very clearly, but the meter records for this season, 1912-13, show in most cases a very large decrease as compared with the corresponding period of the two previous years. This table shows a large increase in the income during the season of 1911-12 as compared with a small increase in steam.

The schedule illustrates the way in which the change to meter basis affects the use of steam. The first result is an increase in the monthly bill. The customer comes to the company to know why the bill has increased and wants to learn some way by which the bill can be cut down. The same suggestions which were disregarded when steam was sold on a flat-rate basis then become very interesting to the customer, and economies are immediately put into operation.

In the discussion which followed the report Mr. E. Darrow, Indianapolis, observed that in operating a district-heating business service is the prime requisite and that a tendency to economize may interfere with the consumer's comfort. Metered service, he added, tends to develop peak-load characteristics, while the flat-rate demand continues twenty-four hours a day.

Mr. H. R. Wetherell, of Peoria, Ill., cited an Illinois city in which the use of meters, he said, had increased the revenue by 50 per cent while cutting the coal bills in half. Experiments which he reported confirmed the suspected fact that under flat-rate conditions a radiator might easily consume twice as much on a 35-deg. day with the windows open as on a zero day with windows properly shut.

Mr. C. R. Bishop, Lockport, N. Y., told of a recording device used in San Francisco by means of which each rotation of the metal test-dial pointer is electrically registered on a Bristol recording instrument, showing the hours of the day or night at which the high demands occurred. The mechanism is operated by a couple of dry cells, and the complete equipment costs only about $20. Clocks are also used to control butterfly values in customers' steam mains, shutting off or turning on the supply at any predetermined time.

Mr. L. T. Mason, Hornell, N. Y., reported that after fourteen years' operation of a combination electric and steam-heating plant the use of flat rates had made the heating proposition a losing one. Recently, however, meters

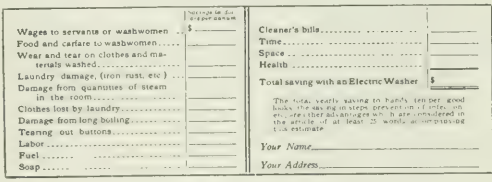
fact that a greater cubical content was heated during the latter season, the coal consumed decreased by 2763 tons, saving $6,500 in fuel bills.

## A Washing-Machine Contest at Chicago

To the person preparing the best arguments setting forth the savings effected by electric washing machines the Electric Shop, Chicago, offers to give an eighty-five-dollar Federal electric washing machine. No conditions are attached to this competition, in which anyone is permitted to take part.

Creation of interest in the machines is, of course, the purpose of the campaign which is being carried out with the aid of newspaper advertising, circular matter and personal solicitation. Following the newspaper advertisements circulars were sent out to a list of 25,000 names, while others were handed to visitors at the Electric Shop. Any person entering into this contest is, of course, already necessarily convinced of the advantages to be gained from the use of the machines, so that the way of the solicitor to make sales is well paved at the outset. To aid contestants in preparing their list of savings, blanks are furnished with spaces for estimating wages, food and car fare for washerwomen and servants, labor, fuel, soap, wear and tear on clothing and materials washed, tearing off buttons, laundry damage and loss, cleaners' bills, time, space occupied, damage from steam, time needed for boiling, and advantage accruing to health.

It had not been expected that many direct sales would be


Wages to servants or washwomen ... $
Food and carfare to washwomen ...
Wear and tear on clothes and materials washed ...
Laundry damage, (iron rust, etc.) ...
Damage from quantities of steam in the room ...
Clothes lost by laundry ...
Damage from long boiling ...
Tearing out buttons ...
Labor ...
Fuel ...
Soap ...
Cleaner's bills ...
Time ...
Space ...
Health ...
Total saving with an Electric Washer $
Your Name
Your Address

CONTEST ADVERTISEMENT

effected by this advertising, the returns hoped for being principally in the form of general publicity. However, the returns from the newspaper advertising have already been entirely satisfactory, and it is evident that the campaign will be successful financially. The arguments and testimony obtained will also furnish valuable material for use in future advertising campaigns.

# Illumination and Wiring

## Electrically Lighted Tennis Court

Electricity for lighting tennis courts at night has been introduced in the suburbs of Brooklyn, N. Y., with success. The illustration shows a typical installation at King's Lawn, situated near Ocean Boulevard on the road to Coney Island. This section of Brooklyn is being developed by a



ELECTRICALLY LIGHTED TENNIS COURT AT NIGHT

progressive builder, who not only completely equips his houses for electric service but as an added inducement to purchasers of homes offers the free use at night of a regulation tennis court lighted with tungsten lamps. The total equipment consists of fifty-two 100-watt lamps. Forty of the lamps are placed over the court proper, approximately 20 ft. above the ground, and give an excellent distribution of light. The rest are attached to the net framework that surrounds the court. As tennis is played practically every night from sunset to midnight, the consumption of energy is such as to make it a desirable load.

## Street-Lighting Changes at Hannibal, Mo.

The street-lighting system of Hannibal, Mo., operated by the local municipal electric plant, has in the last year been changed from 6.6-amp series inclosed arcs to a complete system of series tungsten lighting. The change was made in accordance with plans and recommendations by The Arnold Company of Chicago, which is consulting engineer for the municipality of Hannibal on matters connected with its electric-lighting plant. The engineer made a careful survey of the city, block by block, noting the advisable locations for lamps, and plans were outlined accordingly.

The old system consisted of 116 6.6-amp series inclosed carbon alternating-current arc lamps, of which eighty-five were located on brackets or span wires at street intersections and thirty-one were on eight high steel towers. There were also 118 series 80-cp tungsten lamps operated on the same circuits. The arc lamps were mostly located in the central part of the city and were spaced one block apart.

The general plan adopted in making the change was to substitute a 200-cp series tungsten lamp at all the more important corners in the central part of the city which had been generally served by arc lamps. The towers were taken down. At corners further away from the business center 100-cp series tungsten lamps were used. A total of 415 lamps were installed. The result has been a marked improvement in the illumination. At the same time there has been a reduction in the voltage required for each series circuit, so that with the present series regulators at the station more extensions of the street-lighting system will be possible than if the arcs had been retained.

The financial report of the plant for the year ended May 1, 1913, shows that the expense of the change (which consisted mostly of locating some new lamps and substituting tungsten brackets for arc lamps) was made out of operating expenses, and that still the operating expenses not including depreciation were but 61 per cent of the gross receipts. The city owns a very economical compound condensing plant and sells considerable energy to manufacturers, hence the good showing. The plant is under the supervision of Mr. A. M. Nipper.

## Postal-Car Lighting

In an address before the Chicago Section of the Illuminating Engineering Society, June 27, Mr. A. J. Sweet, Milwaukee, Wis., discussed the results obtained from the recent Baltimore & Ohio Railroad postal-car tests, data concerning which were presented in these columns March 29, 1913. Mr. Sweet took part in these experiments, which were conducted at Washington. The subjects investigated included efficiency of various types of lamps and reflectors, shadow effects, eye efficiency, required intensity and distribution of units.

As postal clerks have to work under considerable pressure from eight to ten hours at a stretch, eye fatigue is considered by Mr. Sweet as the governing factor in specifying the amount of illumination required. Tests were conducted with cars stationary and in motion to ascertain whether the amount of illumination required varied any. According to the data obtained, it appears that a car in motion requires less illumination than one standing still. This, however, may be accounted for by the fact that the men who took the stationary readings came into the cars from outside so that their eyes did not become fully accustomed to the artificial light as was the case when the car was in motion and the observers were kept inside all of the time.

Standard postal cars are divided into several sections each of which had to be studied separately to determine the means of obtaining the best results. In each end of the cars are sack storage portions in which close visual inspection is not required. Sack-rack sections require more illumination, but as experienced postal clerks sort the mail mechanically, the amount of illumination does not have to be so great as would appear at first thought. The letter case wings, on the other hand, require the best illumination and of such a character that no shadows are cast on the letters which the clerks are sorting. In front of the letter racks, which are arranged on a semi-cylindrical surface, is a sorting table about waist high. Standing as the clerk does in front of this table, it is necessary to receive both vertical and cross light in order to avoid shadows, to prevent direct reflection into the eyes, and to prevent glare on a level with the eyes due to light reflected from the label on the letter racks.

Advocates of half-deck lighting declare that this system gives more uniform illumination than the center-deck system, but the tests seem to show that for postal-car lighting one system is as good as the other. Mr. Sweet is confident that the half-deck system will become less and less popular as it causes harmful reflections into the eyes. He favors the center-deck system as less light is reflected in the clerks' eyes when sorting mail.

The best spacing found was 5 ft. center to center, for all types of reflectors with 50-watt lamps. Seven and one-half foot spacing was also found sufficient, but the arrangement of the car did not permit of dividing the lighting into sections as well as with the 5-ft. spacing, on account of overlapping of the light of the larger units which would have to be used with the longer spacing. Another feature incorporated in the sample specifications drawn up after study of the data was the placing of the lamps in the

respective reflectors so that when the eye is raised 20 deg. no filament can be seen from any part of the car. The minimum illumination which should be allowed according to these specifications is 2.25 ft.-candles for close, intense work. This value was obtained by taking an average of the minimum readings given by the men running the tests as ample illumination.

Color of head-linings was another subject investigated to see if it had any effect on the amount of useful light received. Even with a change in reflection coefficient of 10 to 50 per cent it was found that the useful light was increased only 10 per cent at the most. As maintenance is a large item in keeping a white ceiling clean, it was considered better to use larger lamps. This statement applies, of course, only to direct illumination; when indirect illumination is employed the color of the head-lining has a considerable effect as one would expect. It was found in these tests that indirect lighting was satisfactory in every case, but the additional energy consumption of such a system would hardly warrant its use on railway cars where storage batteries have to be carried.

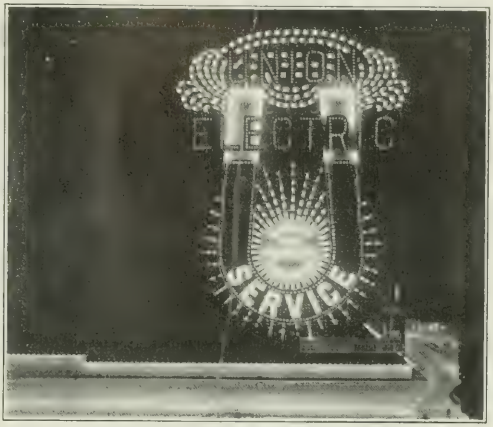
In closing Mr. Sweet said that other types of railway cars and street cars should receive separate study, as each type has to meet different requirements. Experiments being conducted in Cleveland at the present time by the committee on illumination of the Railway Electrical Engineers' Association are intended to apply to railway cars of all types and are being carried out in considerable detail.

## House-Wiring Campaigns

Workmen are usually preferred about the house when the doors and windows are open, or better still when no one is at home and the owner is enjoying himself at the seashore or in the mountains. Even the dwellers in flats manage to gain a respite from the heat of the city and are glad if the landlord takes advantage of their absence to make needed repairs or improvements. Therefore the hot summer months open up opportunities for the wiring of old houses and flats which many central-station companies are not backward in grasping. By means of cleverly written and well-illustrated literature the lesson is driven home that the wiring of an old dwelling or apartment does not mean ripping things up, smashing walls and ceilings and leaving the place as though a cyclone had struck it. Electrical contractors who make a specialty of such work manage to complete a wiring job without so much as a speck of dirt, and were it not for the switches and fixtures and the electric light itself the householder would hardly believe that his place had been wired. Even with the visible evidence it is a source of wonder to him how the work could have been done from within without leaving some trace of the workman's hammer. One company that has accomplished quite an amount of this kind of work is the United Electric Light & Power Company, of New York City, and a particularly telling set of photographs of apartments on its circuits in the process of being wired was shown in the *Electrical World* of May 31. Mr. J. Becker, the general sales agent of the company, has been very successful in his active campaign among the owners of unwired dwellings in the uptown sections of New York City, and certainly the work done by the United Electric Light & Power Company indicates very forcibly what might be accomplished elsewhere as well. As shown in the issue noted above, disorder does not attend the wiring of finished houses, and if this is brought to the attention of the owner or tenant, and the cleanliness, convenience, comfort and utility of electricity are accentuated, it ought to be an easy matter to add his name to the list of the company's patrons. The summer season is a particularly opportune time in which to sing the praises of electricity.

## St. Louis Company's Trade-Mark Sign

One of the most beautiful of central-station electric-sign displays is that recently completed by the Union Electric Light & Power Company, St. Louis, on the roof of its office building, at Twelfth and Locust Streets. This huge sign, 75 ft. in height and containing 1500 lamps, represents the Union Electric Company's trade-mark, in which a




TRADE-MARK SIGN, ST. LOUIS, MO.

horseshoe magnet and the words "Union Electric Service" are prominent features. The steelwork for the display alone weighs 20 tons, and the roof had to be specially reinforced from the building structure to make sure of supporting this extraordinary weight. Each pole of the magnet is 7 ft. across, and the letters themselves are 7 ft. high. Ten-watt and 25-watt tungsten lamps make up the display, which is controlled by a flasher mechanism that lights parts of the sign in succession, meanwhile keeping up the appearance of flowing movement along the "lines of force" between the poles of the magnet.

The Union Electric Light & Power Company's trade-mark sign here described was erected and is being maintained by the Brilliant Sign Company, St. Louis.

## Recent Telephone Patents

### Repeater Device

Mr. S. G. Brown, of London, England, is the inventor of a device for reinforcing telephone currents, the novelty lying in the microphonic contact of the retransmitter part. The contact is supported upon a reed of steel and an adjustment is effected partly through magnetic influence. A steady current is carried through both the contact and an adjacent electromagnet, and the contact pressure is automatically adjusted so that it will maintain sufficient current to provide a balanced condition.

### Party-Line System

Two patents have recently been issued covering party-line systems in which eavesdropping is made known to the parties who are legitimately using the telephones. In the system patented by Mr. J. W. Nilsson, of Balfour, N. D., a detector is provided which is actuated each time a hook switch moves up or down. These devices, of which there is one at each station, are equipped with a motor which drives a code wheel adjusted to the ringing code of the station at which it is situated. The motor rotates the code wheel once and stops and during this rotation an identifying series of buzzers is introduced upon the line.

# Letters to the Editors

## The Myriawatt

*To the Editors of the Electrical World:*

Sirs:—I have read Mr. W. D. Weaver's communication in your issue of June 28 with a great deal of interest as it seems to indicate how difficult it is to present a perfectly plain and simple proposition in such a way that "he who runs may read."

In the first place, as one of the authors of the use of the term "myriawatt," I have endeavored to emphasize on all occasions the fact that it is merely a multiple of the highly respectable watt, and, further, that neither of us has ever meant to discredit its parent, the watt, or its brother, the kilowatt.

Mr. Weaver seems to complain that the myriawatt is meant to be used for a trade name and attached to each boiler as a measure of size. Let me reassure him at once upon this point by referring to the paper presented at the June, 1912, convention of the A. I. E. E. Quoting from the opening paragraph of that paper: "The object of this communication is to introduce a new unit of power which, if adopted, will afford a basis of comparison of all converters of energy, thermal and mechanical, and also will be international in its character, as it is merely a new multiple of the watt." Again quoting from that paper: "The last two are practically the same, differing by only 2 per cent. The usual practice is to rate water-tube boilers on the basis of one boiler-horse-power per 10 sq. ft. of heating surface. "With modern plants, notably those in marine service, operating at from two to five times this rating, the ordinary method of determining nominal boiler capacity could be stretched 2 per cent without materially affecting the present rating; *i.e.*, the boiler might be rated at 34.150 B.t.u. per hour for each 10 sq. ft. of heating surface, instead of at 33.47 B.t.u. per hour for each 10 sq. ft. of heating surface. The myriawatt as a unit of boiler or producer output, and correspondingly a unit of input to all kinds of dynamical machinery is fixed in value by the watt, and by its very sound gives a clew to its meaning."

It is here distinctly recognized that there is no fixed ratio between the heating surface of a boiler and its output in heat units, and further that the existing trade rating of 10 sq. ft. of heating surface is not referred to as a boiler horse-power, but the evaporation of 34.5 lb. of water from and at 212 deg. Fahr. is the unit.

Boilers are now usually sold (as in European practice) upon the basis of square feet of heating surface covered by water, and the term boiler-horse-power is used but rarely in negotiations concerning the purchase of boilers for power purposes, owing to the well-recognized fact that we are able to obtain from three to five times as much output from a given surface as formerly obtained.

Once and for all, then, the myriawatt is *not* meant to apply to boilers but to their input in heat units in the coal or their output in heat units in steam, as well as to other purposes outlined in the paper referred to.

The term boiler-horse-power is, however, one used every day in making tests of the output of boilers, and the necessity of some unit of evaporation is obvious. The accidental discovery that one myriawatt was approximately equal to the heat units required to evaporate 34.5 lb. of water from and at 212 deg. Fahr. naturally suggested the logic of using the international unit of power—the watt—as the common standard for thermodynamic and mechanical, as well as electrical, work.

Mr. Weaver also questions the use of the Greek prefix "myria," as not having the definite meaning of ten thousand. In Webster's Imperial Dictionary, now before me, I find, in addition to the word "myria—ten thousand," the words "myriagram," "myrialiter," "myriameter" and "myriare," in all of which the prefix has the definite meaning of ten thousand. If "myria" is wrong, why is not "kilo" also wrong? Let us be consistent and stick to watts alone and talk about thirty-million-watt machines and about a daily output of one billion two hundred and fifty million three hundred and seventy-five watt-hours.

Mr. Weaver also takes the A. I. E. E. to task for allowing its name to be used in this "attempt to foist on the engineering public as a 'power unit' an existing trade rating." The officers of the A. I. E. E. need no defense at my hands or from any one who takes a proper view of the subject, but it does seem rather late to bring up anew a matter which was printed in the *Proceedings* over a year ago and had given to it the widest publicity in the hope that criticisms might be brought out, and which was again presented to the Institute at the February meeting held under the auspices of the standards committee, and also published in the *Journal* of the A. S. M. E. shortly after.

Part of the resolutions passed unanimously at a joint meeting of the standards committee of the A. I. E. E. and a special committee of the A. S. M. E. read as follows:

(1) "That the two committees in joint session recommend to their respective societies the use of the term myriawatt, as unit of thermal or mechanical power, as indicated in the above-mentioned paper."

(2) "That the two committees also jointly recommend to their respective societies the exclusive use of the myriawatt in connection with boilers, producers, turbines and engines and to discontinue the use of the term boiler-horse power."

By choosing the myriawatt instead of the kilowatt, we adopted the path of least resistance, as obviously if the kilogram was within 2 per cent of the pound or the meter within 2 per cent of the yard, there would be much less difficulty in securing the adoption of the metric system in this country.

In conclusion let me reiterate the statement that the myriawatt *per se* has nothing to do with the physical dimensions of the boiler, producer, engine or other energy transformer, but only applies to input or output as a convenient multiple of the international unit of power, the watt.

*New York, N. Y.* H. G. Stott

## The Boiler-Horse-Power

*To the Editors of the Electrical World:*

Sirs:—In order to keep a previous letter in these columns (June 28) within reasonable bounds as to the space occupied the writer withheld from it a section discussing boiler-horse-power in some detail, which portion is now presented in this communication.

In the earliest days of steam engineering the engine steam supply was expressed in gallons of water per hour per Watt horse-power. This latter rating was established by James Watt on the basis of 33,000 ft.-lb. per minute with a piston mean steam pressure of 6.94 lb. per sq. in. and piston speeds standardized by stages from 160 ft. per minute for engines of 2-ft. stroke to 256 ft. for 8-ft. stroke. Thus the capacities of engines of different sizes were not directly comparable on the Watt horse-power basis, but it seems to have been assumed that the lesser efficiency of the smaller engines would to some extent compensate for the disparity. Later Watt computed nominal horse-power by multiplying the square of the piston diameter in inches by the cube root of the stroke and dividing by 47.

In the early part of the last century a rating for boilers was established on the basis of 1 cu. ft. of water evaporated per horse-power-hour. Such a rating had early been used, but its general adoption was hastened by a showing that it corresponded nearly to the Watt engine rating. About the same time or soon after two other boiler-horse-power ratings came into use, namely, one based on 1 sq. ft. of grate surface and the other on 1 sq. yd. of heating surface.

As improvements in boilers and engines were made,

was found that an engine might develop five times or more the power given by the rule of Watt; that in different types of boilers the coal consumption ranged from 5 lb. to 100 lb. per sq. ft. of grate; that the heating surface per cubic foot of water evaporated varied from 5 to 70, and that the ratio of heating to grate surface, instead of being 27 as fixed by the ratio of square yards to square feet, ranged from 15 to 80. To meet these conditions, various coefficients—that last refuge of pseudo-science—were applied to fit the "standard" formulas to different types and sizes of boilers, or purely empirical formulas were substituted, such as one basing the boiler rating on the square root of the sum of the grate and heating surfaces.

An authoritative writer, in commenting more than sixty years ago upon the conditions illustrated in part above, said: "It would have prevented much needless confusion if the duty of the boiler had been entirely separated from that of the engine, as, indeed, they are two very distinct things." And yet at the present day an attempt is being made to re-establish definitely a condition that in the early days of steam engineering led only to confusion and vexation of spirit. While there is no longer so great a disparity among boiler factors as formerly, yet variations in fuel, types of boilers, rate of combustion and evaporation and relative efficiency of heating surfaces remain independent variables that render it impossible to establish, now or ever, even a roughly approximate general relation between boiler and engine capacity.

The present method of rating boilers was first brought forth prominently at the Philadelphia Centennial Exposition of 1876, in the report of a committee including Thurston, Emery and other well-known engineers of the day, to whom had been assigned the task of making economy tests of boilers installed about the exposition grounds. At that time 70 lb. was the usual boiler pressure, and to furnish a standard of comparison an evaporation of 30 lb. of water per hour at this pressure (equivalent to about 34.5 lb. from and at 212 deg.) was taken to represent an engine-horse-power demand. In point of fact, this consumption even at that day applied only to small engines or to larger ones of types already obsolescent. Corliss and related types of engines were at the time being sold on a guaranteed consumption of less than 20 lb. of water, and the multiple expansion engine was already being hailed as the coming type. The only significance in the adoption of the basis of 34.5 lb. of water appears to be that this figure accorded with a prevailing boiler trade-rating situation.

In 1884 the American Society of Mechanical Engineers reaffirmed, though not without opposition from leading engineers, this rating, namely, that a boiler-horse-power "should be considered equal to 34.5 lb. of water evaporated from a feed-water temperature of 212 deg. into steam at the same temperature." In 1899 the subject was again taken up by the society, and for the above clause the following was substituted: "The committee recommends that, so far as possible, the capacity of a boiler be expressed in terms of the number of pounds of water evaporated per hour from and at 212 deg. It does not seem expedient, however, to abandon the widely recognized measure of capacity of stationary or land boilers expressed in terms of boiler-horse-power." At the present time the subject is again before the society, and in a preliminary report the committee in charge, recognizing the validity of these objections to the boiler-horse-power in these days of high steam pressure and steam turbines, recommends the abandonment of the horse-power as a standard of boiler capacity and the adoption as such standard of "1 lb. of water evaporated into dry steam from and at 212 deg. per hour"—relegating to a foot-note the boiler-horse-power with the remark, "A subsidiary unit which may be used for stationary boilers is a 'boiler-horse-power, or 34.5 lb. of water evaporated from and at 212 deg. per hour.'"

Thus, after an inglorious career of almost a century, and at a moment when the boiler-horse-power is being finally abandoned by the steam-engineering profession as an anachronism, a body representing the electrical engineering profession is asked to erect it, in an obsolete value and with all of its inherent defects, to the status of a "new power unit," and, moreover, in such form as forever to make impossible revision of value.

What favor the myriawatt proposition appears to have met with has apparently been through reliance on the assertion of its friends that it represents a decimal relation between boiler and engine capacity, but a moment's reflection will reveal the error of such an assumption. For example, since by definition the myriawatt is the product of the heat units in a pound of steam evaporated from and at 212 deg. (9704) and of a certain definite quantity ($a$) of water per horse-power-hour, and since there are 3415 heat units in the kilowatt-hour, we have as the boiler and engine ratio the expression $970.4a/3415$. Now, it will at once be apparent that this ratio will only be 10 when the value of $a$ is 35.2, or when an engine-horse-power corresponds to a consumption per hour of 35.2 lb. of steam, an excess of about 2 per cent over the present boiler rating. In the case of the usual larger engine of to-day, taking, say, 15 lb. of steam per hp-hr., the actual ratio would become not 10, but 23; and in the case of a steam turbine using 10 lb. of water the ratio would become 35.2. It will thus be seen that the decimal relation applies only in the solitary case of an engine using, on the 212 deg. basis, 35.2 lb. of steam per hp-hr. The assumed merit of the myriawatt in enabling the thermal efficiency of an engine to be determined almost by inspection is a still more remarkable *jeu d'esprit* than the decimal relation above considered, but its analysis is left to those who have an eye for the curiosities of pseudo-science.

Though somewhat aside from the direct subject of this letter, the apparently growing use of the expression "British thermal unit" and the plentiful sprinkling of "B.t.u." through papers relating to steam engineering seem to excuse some comment on the practice. Formerly American writers were content to use the simple expression heat or thermal unit, or at most to refer to "lb.-Fahr. units" when a distinction was thought to be necessary. If we leave aside the temperature at which the unit of heat is determined and which in any event would introduce a correction entirely too small for recognition in practical calculations, there appears to be no justification whatever for changing to the cumbersome British from the simple American practice, which latter, moreover, accords with modern scientific nomenclature. Our British cousins, from whom we have so unfortunately inherited our abominable system of weights and measures, are surely the last of all to accept as authorities on any kind of engineering nomenclature, for their first impulse appears to be to make such nomenclature militantly British. Thus, to the kilowatt-hour they have applied the name "Board of Trade Unit" (B. T. U.), and it is only recently that they have, after twenty years, commenced to follow the rest of the world in substituting $I$ for $C$ as the symbol for current. There are other ways of paying a tribute of admiration to a great country and a gifted people than by copying their foibles.

*Charlottesville, Va.* W. D. WEAVER.

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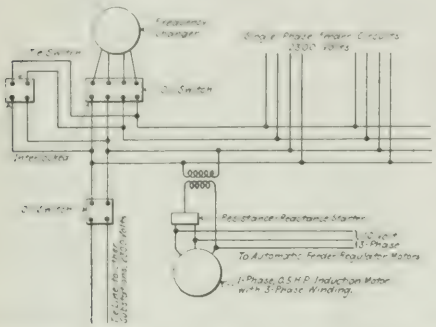
[The quantity to which it has been proposed to apply the term "myriawatt" is represented by the amount of heat units required to evaporate during a certain time interval a certain amount of water under specified conditions. It is not only approximately, but accurately, equal to ten kilowatts. Fortunately, the old "boiler-horse-power," which is a constant quantity in itself but bears a variable ratio to the variable quantity of steam required for producing a horse-power in engines of different types, is approximately equal to one myriawatt, and the birth of the myriawatt means the death of the boiler-horse-power.—EDS.]

# Field of the Operating Engineer

**A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers**

## Polyphase Feeder-Regulator Motors Operated from Single-Phase Feeder Circuit

It is quite generally known that a three-phase motor operating on a single-phase system will supply three-phase energy at its terminals. The principle has been applied by the Kansas City Electric Light Company, of Kansas City, Mo., in one of its substations. During light loads the frequency changer in one of the electric-service company's substations is shut down, and single-phase energy is supplied over a single-phase tie-line from another substation. The frequency changer when operating supplies two-phase energy, which is distributed to single-phase feeder circuits in such a way as to maintain a balanced system.



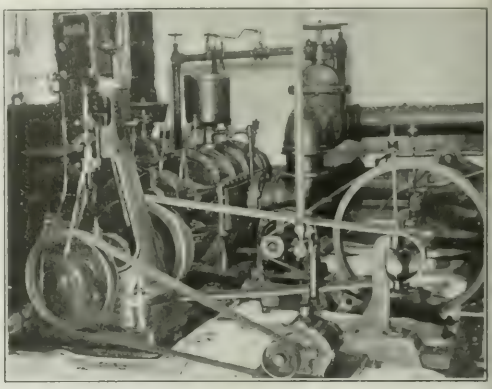

CONNECTION DIAGRAM FOR OPERATING AUTOMATIC FEEDER-REGULATOR MOTORS FROM SINGLE-PHASE SYSTEM

As the automatic feeder-regulator motors require polyphase current for operation, an induction motor, connected as shown in the diagram, is employed to furnish three-phase energy when the frequency changer is shut down. Although rated as a 0.5-hp single-phase machine, the motor is equipped with three-phase windings. A step-down transformer supplies the energy needed for the motor. A resistance-reactance starter is connected between the motor and one of the low-tension terminals of the transformer for starting on single-phase energy. With the arrangement shown in the diagram, it would be possible to operate the apparatus from a distance.

## Conversion of Steam-Driven Gas Exhauster to Motor Drive

The combination plant at Mankato, Minn., furnishes gas, electric-lighting and street-railway service, its electrical section being operated in conjunction with the Rapidan hydroelectric station a few miles distant. Formerly the rotary exhauster for the gas plant was driven by a small vertical engine, but with the hydroelectric plant supplying all the power needs of the community steam frequently had to be kept up to supply this single auxiliary. Now motor-drive has been substituted for the exhauster engine with a saving in coal.

As shown in the illustration, a 3-hp motor was attached to a short jack-shaft and connected with the flywheel of the engine, the piston-rod and eccentric gear having meanwhile been disconnected. This gives a steady and regular speed to the exhauster. The regulation to carry the proper vacuum on the hydraulic mains is made with the same float which before operated on the butterfly valve at the throttle of the steam engine, but which is now connected to a butterfly valve installed on a by-pass line of pipe, tapping the inlet and outlet of the exhauster. In this way a certain amount of gas is allowed to return to the inlet side, should the exhauster be operating at a speed more than sufficient for the proper vacuum on the hydraulic main.



3-HP MOTOR DRIVING A GAS EXHAUSTER THROUGH A SHORT JACK-SHAFT AND ENGINE SHAFT

The arrangement, according to Mr. R. E. Brown, manager for the Consumers' Power Company at Mankato, saves a ton of coal a day, for it was formerly necessary to keep steam up in a 150-hp boiler, the smallest unit in the station, in order to run the exhauster engine.

## Water-Spray Filter for Turbo-Generator Ventilation

All air about a power house, no matter how cleanly the surroundings may be, is heavily charged with dust and fine gritty particles in suspension, and unless care is taken to filter it before passing though machines to be ventilated, the windings become coated and the air ducts choked up, and with the consequent rise in temperature the efficiency of the machine rapidly falls off.

Where no filters are provided, the varnish and insulating fabric on the end windings become in time seriously affected by the heat and the constant sandblast action due to grit-charged air moving at high velocity over their surface, thus making it porous. If a machine in this condition is allowed to cool down in a humid atmosphere, the insulation, from the absorption of moisture, rapidly falls below a safe figure, which is probably the real cause of many mysterious "burn-outs" for which it has been difficult to account.

The type of air filter in common use consists of closely woven cloth, tightly stretched on wooden or wickerwork frames. The general practice is to allow one-fifth of a square foot of filter medium per cubic foot of air per minute, or 1 sq. ft. of area per kilowatt of rated output. In the case of large machines this becomes a most unwieldy surface to handle efficiently.

In a paper before the Incorporated Municipal Electrical Association at London, June 19, Mr. J. Christie, engineer and manager of the Brighton (England) municipal plant, described an improved type of water-spray filter which is in use at his Southwick generating station. This equipment consists of a strong rectangular galvanized sheet-iron chamber, one end (the air intake) being open and fitted with louvers.

This filter is installed in the basement adjacent to the machine foundations and 2 ft. inside the air inlet a water screen is fitted. This consists of a series of small nozzles spaced 6 in. apart uniformly over the entire area. Some 6 ft. beyond the screen a moisture eliminator is fixed. This is a sort of baffle, very similar to that used in an oil separator such as is fitted in the exhaust steam pipe between the low-presssure cylinder of a reciprocating engine and the condenser. Thence the air passes directly into the alternator.

The base of the chamber forms a fresh-water tank holding 300 gal., and is fitted with a ball cock to keep the level constant and to make up for any evaporation.

A 2-hp motor-driven centrifugal pump circulates this water at a pressure of 20 lb. to 25 lb. per square inch through the system. The nozzles project this water in the form of a finely atomized spray directly against the incoming air. When the apparatus is working, the spray has the appearance of a dense steamy bank of clouds. All solid matter in suspension in the air is caught and precipitated in the tank. Any beads of moisture or grit carried through with the air are effectively trapped by the eliminator, and nothing but pure cool humid air is carried into the machine. In some localities during the winter months with this class of filter it will be desirable to fit a small steam coil in the water tank just sufficient to keep the water from freezing.

The advantages of the water-screen filter over the cloth type are its compactness, absence of fire risk, simplicity of cleaning, low resistance to passage of air, and incidental cooling of the air enabling the machine to carry overloads of 10 to 15 per cent.

The apparatus can be quickly and easily cleaned, it being only necessary to drain off the water at intervals depending on the amount of dirt in the air (once every two weeks or so), wash out the tank with a hose pipe, fill up and start the pump again. All this can be done in a few minutes and without even taking the machine off load.

The resistance to the air is always constant, and is less than one-third that of a cloth filter, so that the power for driving the main fan is proportionately less, while the total energy consumed by the outfit as a whole shows a substantial saving over that required by a cloth filter, after making allowance for the circulating pump.

The air passing through the filter is not only pure, but is generally several degrees colder than the surrounding air, due to its being reduced to wet bulb temperature, consequently its cooling effect on the machine, volume for volume of air, is proportionately greater, this difference in temperature being generally most marked in the summer time just when the extra cooling effect is of the greatest value.

In tropical climates or in situations where the surrounding air is at an abnormally high temperature, it is posssible, by introducing a small refrigerating plant into the water-circulating system, to "super-cool" and control the temperature of the air down to a degree far below the corresponding wet-bulb temperature.

The first cost of a water-screen filter, of course, varies with the size of the alternator to which it is fixed. In machines of, say, up to 3000 kw it is some 60 per cent greater than a cloth filter, but in the case of machines of 5000 kw and upward, the advantage lies with the water-screen type.

Owing to the increased cooling effect obtained, especially during hot weather, an extra 10 to 15 per cent overload can

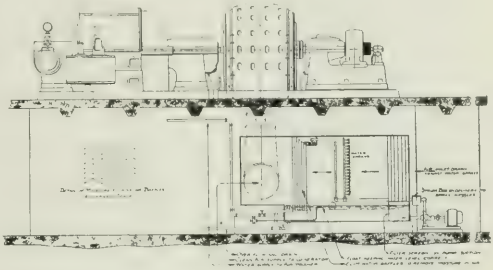


DIAGRAM SHOWING AIR PATHS THROUGH AIR WASHER AND AIR DUCTS OF GENERATOR

be carried on any machine so equipped without increasing the temperature rise, and if a super-cooling refrigerator is fitted in the water system, this overload capacity can be still further increased to 25 or 30 per cent. In the near future, predicted Mr. Christie, turbines of ample power to carry extra heavy overloads will always be provided. The attendant will then simply load up the alternators to which they are coupled till their temperature attains a predetermined maximum safe limit, electrically controlled thermometers on the switchboard superseding the ampere and wattmeters now used. Under such conditions the limiting load on a machine will not be governed by its nominal rating, but by its actual ability to do the work without overheating.

## Protection Against Ultra-Violet Light

What kind of glass is necessary to protect the eyes against ultra-violet light, without interfering with the passage of ordinary light? W. L. L.

Ordinary glass is quite opaque to ultra-violet rays and will fully protect the eyesight while admitting the passage of ordinary visual wave-lengths. In the mercury-vapor arc, for example, a large amount of ultra-violet radiation is produced, but where such an arc is inclosed in a glass tube or outer globe the ultra-violet waves are practically entirely cut off and their destructive effects rendered harmless.

## Parallel Operation

If four alternators in a station are operating in parallel and it is desired to "tie in" the station with a like system at times of peak load, is it possible to synchronize the entire station with the other system, or must the alternators be transferred and synchronized one by one? The four alternators in the home station and the machine of the exterior system spoken of are operating at approximately the same frequency and voltage. R. B. C.

It is possible under the conditions given to synchronize the two generating systems. The speed and voltage of the home station may be manipulated to bring the two systems into step, for if the speed or voltage of one alternator of the four is changed slightly the others, being in synchronism with it, will be caused automatically to follow the change. When a period of synchronism between the two systems is secured as indicated by the synchroscope or synchronizing lamps it is only necessary to close the switch connecting the home station buses to the tie line, as in any other paralleling operation.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*[illegible]*.—A paper read before the British Municipal Electrical Association on air filtration, cooling and ventilation of large steam turbo-driven alternators, in which the importance of removing the dust and fine gritty particles from the forced-draft air was pointed out and the disadvantages of the ordinary air filter were discussed. The author described the wet system of "air-conditioning chamber," which he has employed successfully with the latest alternator installed at his plant.—London *Electrician*, June 20, 1913.

*[illegible]*.—A note on a recent British patent (No. 11,957, 1912) of the Siemens-Schuckert Company. A heavy flywheel is connected to each machine through a spring coupling in which considerable friction is set up by the relative displacements of the parts. Alternatively the frictional resistance due to the movement of a liquid in a restricted part of a vessel rigidly attached to the machine may be used.—London *Elec. Eng'ing*, June 19, 1913.

### Lamps and Lighting

*Sealing Wires in Glass.*—A note on a recent British patent (No. 15,342, 1912) of the British Thomson-Houston Company and the General Electric Company of this country. Iron-chromium alloys containing from 20 to 30 per cent of chromium have the same temperature-expansion coefficient as has lead glass and adhere to the glass so as to make a perfectly vacuum-tight seat.—London *Elec. Eng'ing*, June 5, 1913.

*Selective Radiation.*—W. W. Coblentz.—The fourth paper of his long serial on selective radiation from various substances. The first deals with the radiation constants of platinum and reaches again the conclusion that there are no real radiation "constants" for metals. The author then discusses the emission of spectra of neon, helium, and mercury; the emissivity of different parts of an acetylene flame; the variation of emissivity with the thickness of the radiating layer; the radiation from a uniformly heated cavity and from its inclosing walls, and standard spectral-energy curves. Some notes are added on light filters which absorb all the infra-red and on the transmission of prism materials.—*Bulletin Bureau of Standards*, Vol. IX, No. 1, 1913.

*Alternating-Current Mercury-Vapor Lamps.*—A note on a recent British patent (No. 11,870, 1912) of E. E. Darmois and M. A. E. LeBlanc. An inductance is connected in series with the lamp which has a pair of electrodes for each phase. The supply pressure across the lamp and inductance must not be less than 800 volts at 50 cycles per second. To start up the lamp, it is heated by surrounding the tube adjacent to one electrode with a metallic conductor connected to the other electrode. To reduce the temperature of the mercury electrodes, iron, nickel or other metal with a higher thermal conductivity is inserted in the mercury.—London *Elec. Eng'ing*, June 12, 1913.

*[illegible]*.—An illustrated article in which the authors show that the tungsten lamp with shades greatly reduces lighting costs, the reduction is [illegible] at least $13,000 a year and probably $15,000, as the life of the lamps exceeds 800 hours. The resultant useful illumination is increased 80 per cent, while cost reduction is about 40 per cent. With tungsten lamps voltage variations will not cause such large candle-power variations as occur with carbon lamps. Continuous lighting service may be secured by means of a selector switch or an equivalent device. Lamps placed deep in intensive reflecting shades are optically harmless, and the complete unit becomes pleasing.—*Elec. Journal*, June, 1913.

### Generation, Transmission and Distribution

*London Electricity Supply.*—A long illustrated article and an editorial on the electricity supply of London. In 1892 there were eleven supply companies in London, and this number is thought to have been quite sufficient. But at about that time the municipal spirit seems to have sprung up very vigorously, with the result that in later years, although the number of companies did not increase very materially, there was a very large growth of undertakings owned by London municipal authorities. Thus at the present time London is served by seventeen companies and fourteen local authorities. The effect of this has been to divide London into a large number of comparatively small areas, more particularly on the north side of the river. On the south side of the river the areas are chiefly controlled by companies and are larger. Generation on a large scale and therefore at low cost has been largely hampered by short-sighted municipal policy. Two later schemes to provide a remedy have failed. The requirements of the different districts in London are very different. Some are large factory districts, others are purely residential districts. In some electric heating and cooking are of almost vital importance; in others they are quite neglected. It is thought that the railways should get their energy supply from the lighting stations, but so far only one railway company is doing so. Notwithstanding all the disadvantages "the prices in London compare generally very favorably with those in large cities in other parts of the world. For example, the price for energy supplied for lighting appears to be considerably lower in London than in Berlin, and the same is true for energy for motor service. A mean price of about 2 cents per kw-hr. for motor service is no small achievement." Concise illustrated notes are given on the energy supply from the following stations: Brompton and Kensington Electricity Supply Company, City of London Electric Lighting Company, Hackney Borough Council, Hampstead Borough Council, London Electric Supply Corporation, Metropolitan Electric Supply Company, Poplar Borough Council, St. Marylebone Borough Council, St. Pancras Borough Council, Shoreditch Borough Council, Stepney Borough Council, West Ham Corporation, Westminster Electric Supply Corporation.—London *Electrician*, June 13, 1913.

*[illegible]*.—Weidig and Jensch.—The conclusions of their article illustrated by diagrams. The wave-form of the voltage curve is of considerable influence on the losses. If the maximum voltage is the same, the corona losses are greater for a wave-form with a flat maximum than for a wave-form with a pointed maximum. Results are then given of measurements of the corona losses on a line consisting of two wires in parallel. The effect of the frequency is next discussed. The corona losses increase with the frequency. The relation between the losses and frequency is given by a linear function, but the losses at

proportional to the frequency. The authors then dis- s the phenomena in the moment when the corona losses beginning to manifest those. A comparison is next en between the results of the measurements with those ulated from formulas. Finally oscillographs are given he starting and final periods of the corona phenomena.—*k. Zeit.*, June 12, 1913.

*Distribution of Electrical Energy Over Large Districts.*—Klingenberg.—The first part of a long and profusely strated paper to be presented at the next meeting of the rman Association of Electrical Engineers. The author phasizes that exact calculations of transmission lines e little practical importance and that approximate thods are sufficient. He gives some general principles the configuration of networks and then deals with the hitectural design of large transformer stations. The er is to be continued.—*Elek. Zeit.*, June 19, 1913.

*Transmission Line.*—A profusely illustrated description the high-tension transmission line and the substations of Central Georgia Transmission Company.—*Elek. Zeit.*, ne 12, 1913.

*Mechanical Gearing.*—Illustrated notes on some mechan- l gearing systems of British companies for the speed uction of steam turbines.—London *Electrician*, June 13, 3.

### Traction

*Electric Tramways in Germany.*—G. Dettmar.—Statis- al data on electric traction in Germany in 1911 on the is of the statistics of German street railways and light lways. The statistics cover 550 lines, and out of this 210 electric, namely, 191 street railways and 19 interurban lways. Since the statistics in the whole cover 246 street lways, 84 per cent of all German street railways are ctrically operated. The total track length of German ctric traction lines was 4915 km (2950 miles), the num- of cars 21,309, the capital invested $298,000,000, the rage interest 5.48 per cent (against 4.34 per cent in 08). The total number of passengers transported during year was 2,615,400,000. The voltage used is increas- .—*Elek. Zeit.*, June 12, 1913.

*Railway Station.*—A description of the Lot's Road sta- n of the underground electric railways in London. This the largest power house in London and supplies energy r the Metropolitan district, the Baker Street and Wa- loo, the Charing Cross and Hampstead and the Great rthern & Brompton railways. These aggregate about miles of double track. The average energy consumed day is 450,000 kw-hr., giving at times a maximum de- nd of 42,000 kw. The generators for supplying energy these lines are centralized in a station at Lot's Road, m which energy is transmitted on a three-phase system 11,000 volts and 33 cycles to twenty-five substations dis- sed along the routes. From the substations the energy distributed on a direct-current 600-volt third-rail and rth-rail system. The Lot's Road station has a total rat- of 48,000 kw, there being eight 6000-kw turbine sets ca- ble of carrying 50 per cent overload for two hours.— ndon *Electrician*, June 13, 1913.

*Tramway Track, 1883 to 1913.*—F. Bland.—A paper d at the Blackpool congress of the Tramways and Light lways Association. The author gives a historical ac- nt of the methods of track construction employed on mways, dealing with points and crossings, rail joints l junctions.—London *Electrician*, June 20, 1913.

*Railless Traction.*—H. England.—A paper read at the ckpool congress of the Tramways and Light Railways sociation. The author deals with the progress of rail- s traction legislation and afterward examines in detail various provisions in the bills that have been introduced this purpose in Great Britain. Some operating costs of systems already at work in England are also given.— ndon *Electrician*, June 20, 1913.

*Increasing Profits on Interurban Tramways.*—E. H. Edwardes.—A paper read at the Blackpool Congress of the Tramways and Light Railways Association. Dealing with the two main questions of how tramway costs can be reduced and the receipts increased, the author pleads for simplicity in construction and suggests the inauguration of a freight-carrying scheme, especially in industrial districts such as are to be found in Lancashire.—London *Electrician*, June 20, 1913.

*Electric Automobiles.*—W. H. L. Watson and R. J. Mitchell.—A paper read before the British Municipal Electrical Association. The authors deal with the possibilities of the employment of electric vehicles in England and show the suitability of such a vehicle fitted with an Edison accumulator for this work. Results of operating such vehicles and their general design are described.—London *Electrician*, June 20, 1913.

*Rules for Tramway Employees.*—A. V. Mason.—A paper read at the Blackpool congress of the Tramways and Light Railways Association. The author discusses some points of interest and controversy in "Rules and Regulations for the Tramway Employees," recently published by the Tramways and Light Railways Association.—London *Electrician*, June 20, 1913.

### Wires, Wiring and Conduits

*Feeder Protection.*—A note on a recent British patent (No. 11,559, 1912) of E. G. Waters. Should one of two parallel cables become faulty it is cut out. To effect this the primaries of two series transformers are connected in the feeder circuits, while the secondaries are connected in opposition through wattmeters or reverse-power relays operating separate circuit-breakers in the respective feeders. In addition two other series transformers with primaries similarly connected and secondaries cross-connected are used, so that normally little choking action is obtained, but on the occurrence of a fault the impedance of the combination is greatly increased and the power available for cutting out the faulty main is increased.—London *Elec. Eng'ing*, June 19, 1913.

*Grounding.*—The proposed rules of the German Association of Electrical Engineers on protective grounding.—*Elek. Zeit.*, June 12, 1913.

*Ionization in Gases and Gaseous Mixtures by Roentgen and Electronic Radiations.*—C. G. Barkla and A. J. Philpot.—An account of an experimental investigation in which the relative ionizations produced in various gases and vapors by the complete absorption of corpuscular radiations set free by homogeneous X-radiations were determined. No change of relative ionization with velocity of the ionizing corpuscles was observed. The relative ionizations due to complete absorption of corpuscular radiation were found to agree closely with the relative ionizations due to complete absorption of a Roentgen radiation and all its secondary radiations. The results indicate that the complete absorption of a given X-radiation by different gases results in the emission of the same number of corpuscles. The ionization coefficients for homogeneous X-radiations in a number of gases and vapors were determined, and the generality of the laws given by one of the authors was further verified. The ionizations in gaseous mixtures due to the complete absorption of corpuscular radiation were determined. On the most obvious and most probable interpretation of the results these indicate the relative numbers of ions produced in the two constituent gases of a gaseous mixture. In $C_3H_5Br$ and air the relative absorptions of energy were found very closely in agreement with the relative masses of $C_3H_5Br$ and air. The ionization of X-rays of gaseous mixtures has been shown to differ considerably from the sum of the ionizations in the two individual gases. The difference shows the effect of corpuscles from one gas being absorbed by the other, the nature of the deviation being what could be foretold from the authors' experiments on ionization by

corpuscular radiation. The magnitude of the effect, however, is not so great as should be expected on the simplest theory of ionization by ejected corpuscles alone. The possible causes have been discussed.—*Philos. Mag.*, June, 1913.

*Ionization by Gases* [illegible]—NORMAN CAMPBELL.—A paper in which the existing information as to the emission of delta rays is reviewed. Some new experiments on the delta rays excited by very slow beta rays are described. They are in complete accordance with the work of von Baeyer and Gehrts and provide little new information. An attempt is made to discuss the experimental results on the basis of the theory of ionization by moving charged particles put forward by Sir J. J. Thomson. It is concluded that, while that theory cannot at present provide a complete explanation of the facts, it is qualitatively in agreement with them.—*Philos. Mag.*, June, 1913.

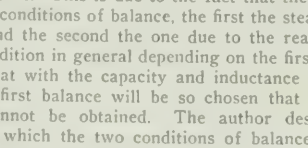
### Electrochemistry and Batteries

*Electric Iron-Ore Reduction.*—JOHN CRAWFORD.—A profusely illustrated account of the latest advances of electric iron smelting at the plant of the Noble Electric Steel Company, in Heroult, Cal. The differences in furnace design and operation from Scandinavian practice are explained as the result of the local California conditions.—*Met. and Chem. Eng'ing*, July, 1913.

*Electro-Analysis.*—J. G. FAIRCHILD.—An illustrated article on the electro-analysis of copper alloys with rules on the determination of tin, phosphorus, copper, zinc, iron, manganese and nickel and suggestions on the analysis of white metals. Some precautions to be taken are mentioned.—*Met. and Chem. Eng'ing*, July, 1913.

### Units, Measurements and Instruments

*Comparing Inductance and Capacity.*—W. E. FORSYTHE.—In comparing inductance and capacity by the ordinary bridge methods it is often difficult to know just what resistance to choose. This is due to the fact that there are generally two conditions of balance, the first the steady-current balance, and the second the one due to the reactance, the second condition in general depending on the first. It often happens that with the capacity and inductance to be compared the first balance will be so chosen that the second balance cannot be obtained. The author describes the method in which the two conditions of balance are practically independent. The arrangement of the circuit is given in the cut, where *P*, *R*, *S*, *Q*, *r*, *s* are non-inductive




CONNECTIONS FOR COMPARING INDUCTANCE AND CAPACITY

resistances, *L*, the reductance, being compared with the capacity *C*. The author then shows mathematically that there are three conditions of balance, namely, (1) $S = s + Q$; (2) $S = s + r$; (3) $L = r^2C$. From (1) and (2) it is seen that $Q$ must equal $r$. Thus, to balance the bridge, set $Q = r$, and then with direct current on the bridge, obtain the steady-current balance, $Q + s = S$. Then with the alternating emf applied to the bridge obtain the inductive balance, with either an alternating-current galvanometer or a telephone. This last balance is obtained by shifting from $Q$ to $s$, keeping at the same time $r = Q$. Thus, while the bridge has three conditions of balance, two of these due to the reactance can be set at the same time without disturbing the steady-current balance.—*Phys. Review*, June, 1913.

*Precision Resistors for High-Frequency Alternating Currents.*—K. W. [illegible] & A. WENNER.—The first part of an investigation carried out in the German telegraph experiment station on precision resistors for high-frequency alternating currents. In the present instalment the authors discuss the time-constant of resistance coils, a method for measuring the time-constant of coils of medium and high resistance, the modification of this method into a substitution method, the construction of the resistances of comparison and a method of measurement for coils of low resistance, and give the results of measurements.—*Elek. Zeit.*, May 29, 1913.

*National Physical Laboratory.*—A continuation of the annual report of the work of the (British) National Physical Laboratory in 1912. The present instalment deals with the work on the Lorenz apparatus; mercury standards of resistance, wire standards of resistance, resistance bridges, the Weston standard cell, comparison of resistance with mutual inductance and evaluation of the ohm in absolute units, power-factors of condensers and change of capacity with frequency, capacity effects in mutual inductometer, condensers for high frequencies, wave-meter tests, magnetic tests, areas of magnetic search coils, the low-frequency microphone hummer, etc.—London *Electrician*, May 30, 1913.

*Insulating Materials.*—The proposed regulations of the German Association of Electrical Engineers on testing electrical insulators.—*Elek. Zeit.*, June 12, 1913.

*Meters and Measuring Transformers.*—The proposed rules of the German Association of Electrical Engineers on the conditions which electric meters and measuring transformers must fulfil to be certified.—*Elek. Zeit.*, June 12, 1913.

### Telegraphy, Telephony and Signals

*Telephone Transmission Calculations.*—A. J. ALDRIDGE.—The conclusion of the illustrated paper in which the author considers the theory of telephonic transmission from the non-mathematical point of view, describing an apparatus for simplifying the calculations and showing its applications to various problems. In the present instalment the results of experiments are given with respect to the predominant frequency of the voice and the harmonic composition of the waves produced by continuously repeating, 1, 2, 3, 4, 5 The voices of five men and one woman were tested. The volume of any voice is fixed by the sum of the volumes of the various components, the higher harmonics giving chiefly the effects of quality and articulation. In all the cases considered the fundamental was of the order of 5 per cent of the principal harmonic, and it is evident, therefore, that the harmonic is by far the most important factor for telephonic purposes. The results seem to show that the voice may be represented by a very low value fundamental of about 160 and a large fifth harmonic of 800 cycles per second. For practical purposes only the fifth harmonic need be considered. The author concludes with some notes on the use of a single frequency for general testing. An account of the discussion which followed is also given.—London *Electrician*, June 13, 1913.

*Antenna Resistance.*—L. W. AUSTIN.—The author describes tests in which three methods for measuring the resistance of an antenna as a function of the wave-length are compared. The first is the substitution of an air-condenser in place of the antenna and ground, the second is the decrement method of determining resistance, and the third is based on the Bjerkness equation of the current square in the second of two coupled circuits. The first is the most accurate method and the last is the least so, but by far the simplest for ordinary station testing. Various diagrams give the results of measurements of the resistances of a number of antennas, both at shore stations and on ships.—*Bulletin Bureau of Standards*, Volume IX, No. 1, 1913.

*High-Frequency Wave Filters.*—G. M. B. SHEPHERD.—The use of a periodic loaded line, or an arrangement o

ondensers and inductances electrically equivalent to same, s a wave-form filter or sieve. The theory of wave filters s considered, and constructional particulars based on ractical experience are given of such a filter for tele-honic work.—London *Electrician*, June 13, 1913.

**Miscellaneous**

*Tramways and Light Railways Association.*—An account f the fifth congress of the Tramways and Light Railways Association held at Blackpool, England. The attendance vas nearly 300.—London *Electrician*, June 20, 1913.

# Book Reviews

THE YEAR-BOOK OF WIRELESS TELEGRAPHY AND TELEPHONY, 1913. London: The Marconi Press Agency. Fully illustrated. Supplemented by a wireless map of the world. 564 pages. Price, 2s. 6d.

This is the first of a series of annuals intended to summarize yearly progress in radio-telegraphy and telephony. The volume at hand contains, in a form convenient for eference, much material of value to technical as well as ay readers, and should prove of unquestioned utility to the nany workers in the commercial fields which bear upon nd make use of wireless signaling. It is scarcely to be xpected that the historical portion of the book would em-hasize or even do full justice to all whose efforts have ombined to develop the modern practice of radio-com-nunication to its present efficient form, so that scantiness r absence of reference to scientists not directly allied with he various Marconi interests will prove no more disap-ointing than has the similar treatment given in several arlier and otherwise excellent treatises on the art. The ections including the entire London convention and the arious national regulations governing wireless telegraphy vill be useful to those concerned with conditions of work-ng in foreign countries, while a collection of the funda-nental mathematical relations underlying the design of adio instruments and a brief five-language dictionary of echnical terms should be of direct interest to engineers. n addition to general data, the book contains a discussion f British patents and a number of well-presented scientific rticles. Dr. Eccles' comments on the facts and theories f long-distance signaling are especially worth reading, and everal descriptions of instruments and methods used by he Marconi companies are attractively brought forward. The volume contains a large number of illustrations and, hen its purpose is considered, can be criticised only on the core of insufficient indexing. It is hoped that in such uture editions as may appear there will be more detailed lphabetical references to both text and illustrations.

THE ELECTRIC PROPULSION OF SHIPS. By H. M. Hobart. London and New York: Harper & Brothers. 167 pages, 44 illus. Price, $2.

A timely book on a new and exceedingly important ap-lication of the electrical conversion and transmission of nergy for marine propulsion. As is well known, the screw ropeller is essentially a slow-speed machine, and ever since s earliest applications it has been standard practice to rive it by slow-speed directly connected reciprocating ngines. The advent of the steam turbine, which is essen-ally a high-speed, non-reversible engine, did not at first eem to have any perceptible influence upon marine prac-ce. Nevertheless, its high economy of both fuel and pace encouraged efforts to reach a compromise speed, omewhat too high for best propeller efficiency and too low or best turbine efficiency, in order to secure direct turbine rive. Others devoted their efforts to developing spur re-uction gears, with considerable success. But the most exible and efficient of all speed reduction gearing appears o be the electric drive.

The author in his treatment of the subject seems both conservative and fair, and in order to make his plea for electric propulsion the more appealing, considers the whole question of ship propulsion from all standpoints. In his introductory chapter he very clearly states his purpose as endeavoring to provide a bridge over which the marine engineer may journey into the electrical engineer's territory and obtain an understanding of the latter's enthusiasm over the probability that there is a legitimate and fairly wide field for electrical machinery in ship propulsion. There are sixteen chapters in all, devoted to the size, resistance, momentum and power consumption of ships, efficiency of propellers, different types of prime movers, speed-reducing gears, and the various proposals for electrical speed reduction. The volume will be most instructive reading for every engineer who desires to inform himself on the developments in this field and its most recent aspects.

ELECTRIC ARCS. Experiments Upon Arcs Between Different Electrodes in Various Environments and Their Explanation. By Clement D. Child, Ph.D., professor of physics at Colgate University. New York: D. Van Nostrand Company. 203 pages, 58 illus. Price, $2.

A perusal of this work will serve to show the complexity of the conditions and the unexpected difficulties one meets with in exploring the physics of the electric arc. In many cases the laws that govern the phenomena of the arc are not known, despite all the work that has been done. The author has, therefore, adopted the satisfactory course of giving an extended review of what experimenters have thought about the laws and also a discussion of results obtained. For the benefit of the reader who would like to pursue the subject further, to each chapter there have been appended copious references to original papers bearing on the theoretical aspect of the subject.

AMERICAN TELEGRAPH PRACTICE. By Donald McNicol. 1913. New York: McGraw-Hill Book Company. 507 pages, illus. Price, $4.

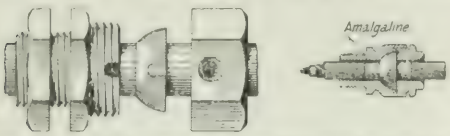
A textbook on American telegraph systems and equipment based to a large extent on a series of lectures recently delivered by the author in the evening technical schools connected with Columbia University. The author states that his aim has been to present a detailed exposition of the various systems of telegraphy in use in this country at the present time, together with a complete description of modern methods of operation and an extensive compilation of the formulas used in practical telegraphy. In view of the subject matter, the title is perhaps too comprehensive, since overhead and underground line construction are not included, although there is a chapter on specifications for wires and cables; neither is there anything on traffic handling or office layouts. Out of twenty-four chapters, there are fourteen on circuits and equipment and these form the real meat of the book. In this treatment practically all the telegraph systems in use in America are very well described, excepting possibly the leased-wire system of the American Telephone & Telegraph Company. Only one chapter is devoted to high-speed automatic telegraphy, a limitation which seems to be justified by its comparatively limited use by American companies. However, a very good condensed bibliography of the literature on such systems is given in an appendix. A special chapter is also devoted to simultaneous telegraphy and telephony. One important respect in which the author could have increased the value of his treatise is by making frequent reference to the authoritative literature of the art, and in general acknowledging the sources of data or information drawn upon. On the whole the volume can be well recommended as a textbook for students of telegraphy and for superintendents, managers, operators, wire chiefs and plant employees in general. The typography and illustrations are excellent.

# New Apparatus and Appliances

**An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers**

## Water-Tight Glands for Bulkheads

A device which makes it possible to pass wires and cables through ship bulkheads and other water-tight compartments has recently been designed by Mr. T. Harden and is being put on the market by the Metal Jointing Company, Ltd., of Adelphi House, London. The gland consists of a steel cup and back-nut which bear upon a hemisphere of lead cast to the sheath of the cable. To install the gland the lead sheath of the cable is first wrapped with a special alloy called "amalgaline," and then the back-nut, shown in Fig. 1, is screwed up until the pouring holes are vertical. The molten metal is poured through these holes to fill the hollow space and form the hemisphere of lead. The nut can then be backed away and the lead sprue or runner sheared off. The illustration (Fig. 2) of a section of a



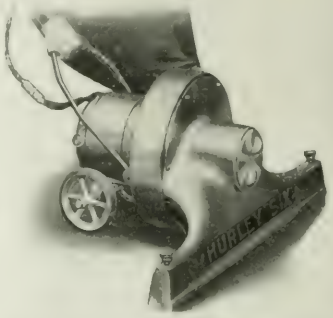

FIGS. 1 AND 2—SIDE VIEW AND PARTIAL SECTION OF GLAND

gland for smaller wiring shows how the cup and nut bear against each other, thus preventing the entrance of water. It will be noted that even though the pressure brought to bear on the nut is very severe, damage to the cable sheath will not result, because the stress is exerted in a longitudinal direction on the hemisphere of cast lead and not upon the sheath itself.

It is stated that these glands, which are being made in several different styles, have been appproved and adopted by the Admiralty following a series of tests carried on to discover any possible mechanical or electrical weaknesses.

## Electric Vacuum Cleaner

A new electrically operated vacuum cleaner has been put on the market by the Hurley Machine Company, Chicago, the claim being made that this apparatus cannot become clogged with lint, threads or ravelings, because of the construction of the nozzle and the suction fan. Both the cleaning nozzle and the motor driving the fan are mounted on three small rubbed-tired wheels in such a manner that the nozzle is raised from the floor sufficiently to allow the right amount of air for cleaning purposes to flow into it. In the rectangular opening of the nozzle is a rubber comb which is pressed against the nap of the carpet by helical springs in such a manner that the dirt is stirred up and sucked into the dust bag which is attached to the handle of the apparatus. The suction fan consists of a cast-aluminum disk with projecting blades so constructed that lint and threads cannot become entangled in it. The fan is direct-connected to the shaft of a General Electric motor. In the aluminum casing surrounding the motor is an insulated bushing, through which runs a flexible cord connecting the motor with a switch located on the end of the handle where it can be operated by the palm of the hand. The wiring between the motor and the switch is run through a groove in the handle; between the motor and the point where the wire enters the groove is a separable plug coupling which makes it possible to disconnect the motor from the handle when desirable. A flexible cord, 20 ft. long, which is secured to the handle just below the switch, can be used to connect




ELECTRICALLY OPERATED VACUUM CLEANER

the vacuum cleaner with any electric-service receptacle. For cleaning draperies, walls, etc., it is only necessary to unscrew a cap on the front of the cleaner and fasten the hose onto the machine. The apparatus is compact and light and is made in two sizes for use on direct or alternating current at 110 or 220 volts. One size of the machine is capable of delivering 140 cu. ft. of air per minute and the other size 95 cu. ft. of air per minute. The first weighs 10.75 lb. complete and consumes 140 watts, while the other weighs 9 lb. and consumes 125 watts. Both machines are so designed that they may be shoved under chairs, sofas, etc., in cleaning, the handle being adjustable to any angle.

## Ornamental Electric Lamp Fixtures from Clay

Almost from the very beginning of electricity's service to man, clay in pottery form has been used as insulation for electrical energy. By adapting pottery to different styles of fixtures for diffusing the light of electric lamps clay is now performing an additional function for illuminating purposes. These novel and ornamental fixtures have opened up a new line of possibilities to interior decorators. Of further interest is the fact that these lighting fixtures were brought out in this country and are now setting the styles in England, France and Germany, reversing the usual rule of originating fashions.

The designs were conceived and worked out in the old American pottery, which has been established and in continuous operation since 1805. The first half dozen sets of portable lamps made from pottery three years ago were shown in a private exhibition to connoisseurs in New York and following their praise of the color combinations the manufacturer designed the present line of luminaries, including large and small portable lamps, chandeliers, shower lamps, wall lamps, solarium, ceiling and indirect-lighting units.

Among the beautiful glazes which are obtained in these amental fixtures are the mirrored flambe, luster, crystal l matte classes. The first four classes present mirror surs with varied tones and colors in combinations not un- those seen in the sky at sunset. The matte class are zes with a texture such as is revealed in the petals of



FIGS. 1 AND 2—PORTABLE LAMPS

vers and the skin of fruit. The glazes are obtained by ering the dried clay pottery with a preparation and "fir-" the design in a kiln at high temperature. Some glazes uire a clear fire with plenty of oxygen to insure complete nbustion, while others demand a smoky kiln, and still ers an alteration of these fire qualities. Slow and fast ling of the pottery after it has reached the proper tem- ature have varying effects on the glaze.

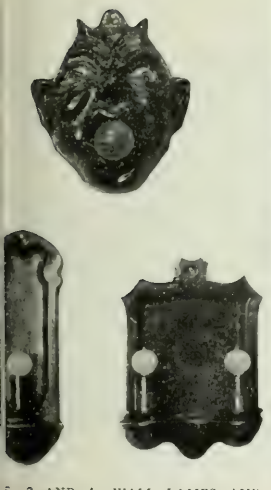
flambe. Figs. 3 and 4 show a group of wall lamps and an indirect fixture with a 17-in. bowl which is finished in a glaze of crystal blue.

The fixtures of pottery were developed and are being put on the market by the Fulper Pottery Company, Flemington, N. J.

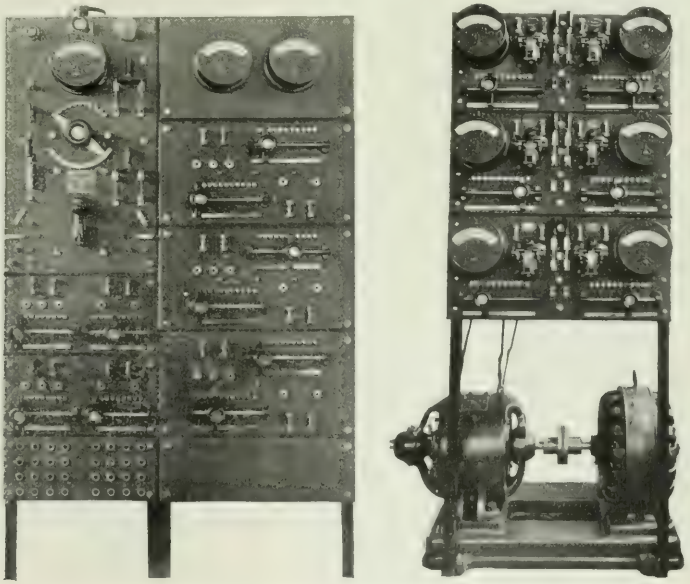
## Vehicle Battery-Charging Apparatus

At a recent meeting of the Chicago Section of the Electric Vehicle Association, Mr. J. P. Lyons, Chicago, described a new battery-charging equipment which the Electric Products Company, of Cleveland, Ohio, has just put on the market. The outfit, which is illustrated herewith, consists of a motor-generator set or rotary converter, a machine panel and a distributing panel. The number of distributing panels depends on the number of batteries to be charged. On the distributing panels are switches which automatically cut off the batteries as soon as they are charged and leave an indication showing a record of the condition. When the last battery is charged the switch cutting out the battery also operates the main-line switch on the alternating-current side of the rotary converter or motor-generator, as the case may be, thus eliminating the waste of energy which would result from allowing the rotary to run idle after all of the batteries are charged. The apparatus also disconnects the rotary when the alternating-current line is de-energized and starts the machine up again when service is restored. Practically no attention is required by the equipment.

Another innovation in battery-charging apparatus described by Mr. Lyons is used in connection with an installation of mercury-vapor rectifiers or motor-generator



S. 3 AND 4—WALL LAMPS AND INDIRECT FIXTURE



FIGS. 1 AND 2—TRANSFER PANEL AND BATTERY-CHARGING INSTALLATION

he four illustrations shown herewith convey some idea ncerning the shapes and designs of the various types of tures. Fig. 1 shows a large portable lamp with a ring e, standing 19 in. in height. The shade is 17 in. in meter and the fixture is finished with a matte glaze. The ll portable lamp shown in Fig. 2 is 16 in. high, with a . shade, and is finished in the black and blue of the sky

sets supplying energy at different voltage. This consists of a transfer board by means of which 24-volt and 50-volt batteries can be grouped to the best advantage for charging, without wasting energy in rheostats. Some of these transfer boards together with the distributing boards have been installed in the Colonial Club Garage and in several private garages in Chicago.

## Electrically Operated Slot-Machine Camera

A new electric photographic machine, which is entirely automatic in its action, has been invented and brought out in Paris by an engineer, Mr. H. Ashton-Wolff. The apparatus is coin-operated and takes an attractive platino-bromide portrait upon a postal card. A series of electric devices operated in an ingenious manner take the photograph and



SLOT-MACHINE CAMERA

put it through the various operations before delivering it in the finished state. Simple and reliable magnetic mechanism is used, there being no springs, cams or levers to cause complication.

When the customer inserts the coin in the slot an electric sign appears giving directions for the pose. A mirror finder enables the sitter to observe when he is in the center of the picture. During the brief time of exposure, which is practically instantaneous, a strong artificial light illuminates the person or object to be photographed. A signal indicates that the pose is finished, and the light is extinguished. The postal card is then put through the successive operations of developing, washing and drying by various electrical devices. After exposure, the card drops down into an ebonite dish or tank in which developing takes place. All solutions are stored in receptacles at the top and are fed through an electromagnetic valve and measurer combined, so that the amount used is invariable. The card develops a positive print in black and white by the use of a new chemical process which is one of the principal features of this device. The print is obtained by a single process and is ready to be delivered at once. It remains only to send a second or fixing bath into the tank through an electromagnetic valve, the first solution having been evacuated. The washing of the print by ordinary water is carried out in the same way. The dish into which all these baths flow then opens by means of electromagnets and the finished card drops into an electric drier, which dries it quickly but without softening the gelatine. The photograph is dried in fifteen seconds and is subsequently passed through a slot and delivered to the customer.

One of the interesting parts of the machine is a commutator for operating all the various circuits at the proper time, this distributer being a round disk on which are metal segments for the contacts. An arm carrying a certain number of brushes or contact pieces is passed over the disk so as to close the circuits in proper order. It is essential to avoid all sparking at the contacts, otherwise the commutator would rapidly burn out. This the inventor has overcome by using an outer circle with a series of strips which make contact with the arm before the latter leaves the main contacts. As the arm touches one of these points a small portion of the current is shunted into a solenoid, which consumes only 5 watts. This distant solenoid operates a metal point placed in mercury so that the current is broken here instead of on the commutator. The arm or lever makes one revolution covering all contacts needed for one photograph, and is driven by a small electric motor. The energy for operating this motor is received through the arm as it turns, and by means of specially devised resistors variations in speed are produced corresponding to the action going on at the precise moment. Such speeds can be set at will for any part of the machine by turning a small disk. In summer, for instance, when the heat makes the baths act more rapidly, the action of the chemicals can be shortened as may be required for good results and so left during the whole of the hot season.

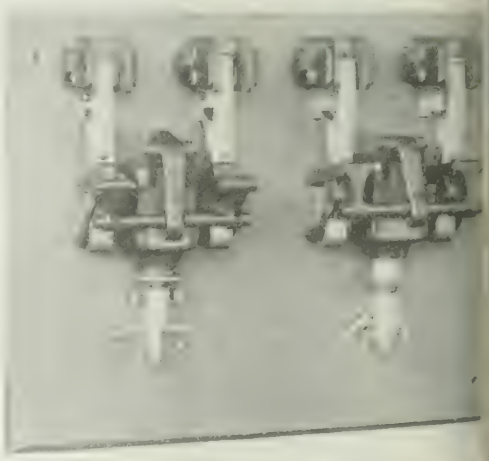
The machine, it is said, will turn out 100 postal cards without any supervision or recharging, and the solutions will keep for one month at least. Each part of the machine is a separate device mounted on spring clip contacts so that it can be withdrawn instantly. In fact, the whole machine can be taken apart in this way without handling any wires. The refilling of the machine takes ten minutes.

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## Automatic Switching Apparatus

The maintenance of continuity of electric service to customers makes it imperative that means be provided for switching on reserve units instantly to supply energy in case of failure of the main source. The circuit-breaker shown in the illustration is designed for this type of service. It consists of two double-pole, single-coil, solenoid operated, magnetic-blowout circuit-breakers, each of which remains closed only while the solenoid is energized. The circuit-breaker shown on the left is connected in the main supply circuit and, under normal operating conditions, is closed, the one on the right remaining open.

When the supply of energy from the main source fails



AUTOMATIC CIRCUIT-BREAKER BOARD

the circuit-breaker on the left opens and the metallic disk directly underneath this solenoid bridges the gap between the contact blocks below it. The action of this disk connects the operating coil of the circuit-breaker on the right across a storage battery or other source of energy. The operation of this breaker connects the feeder with the auxiliary source of energy, thus avoiding an interruption

ervice. When the primary service is restored the solenoid of the circuit-breaker on the left is again energized, thereby causing the circuit-closing disk to be withdrawn from he contact blocks. This action breaks the circuit of the olenoid of the circuit-breaker on the right, cutting off the upply of energy from the auxiliary source.

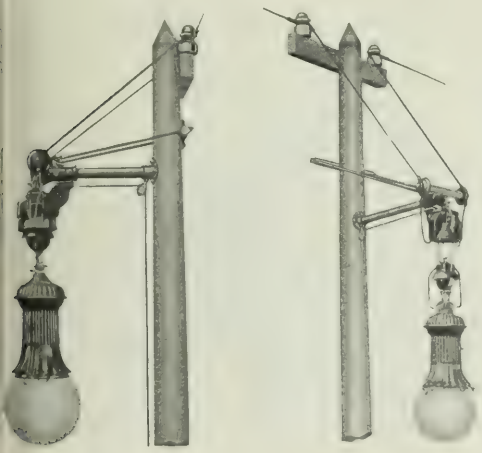
Each circuit-breaker is provided with a dash-pot and a et of auxiliary contacts, to which are connected the termiıals of a resistor. The auxiliary contacts are bridged when he circuit-breaker is open. When the plunger in the dashpot rises as the circuit-breaker closes, the bridge across he auxiliary contacts is removed, connecting the resistor n series with the operating coil. The resistor is not cut n, however, until the circuit-breaker is completely closed, ecause the dash-pot introduces a time interval between the losing of the circuit-breaker and the opening of the uxiliary contacts.

The switching apparatus described above is manufacured by the General Electric Company, Schenectady, N. Y.

## Cut-Out Hanger for Arc Lamps

A simple and compact hanger to take the place of susension equipment now used with series arc lamps has reently been put on the market by the Thompson Electric Company, Cleveland, Ohio. By means of this hanger the owering of any lamp in a series lighting circuit autonatically cuts the lamp out of circuit without disturbing he operation of the other lamps. All wiring is carried in traight lines from the poles to the hanger, thus saving a onsiderable amount of wire and averting trouble incident o hanging loops, which under present practice cause a good eal of the arc-lamp trouble. Again, since the lamp is deached from the circuit when lowered there is no danger rom shock to the trimmer.

The illustrations Figs. 1 and 2 show the hanger with the amp in the operating position and with the lamp slightly owered and disconnected from the circuit. The lamp can e disconnected and lowered by pulling the lowering rope.



FIGS. 1 AND 2—HANGER IN TWO POSITIONS

s will be noted, the lamp is supported by a double-fall rope o that the trimmer in lowering the lamp handles only onealf its weight. The lowering rope is looped under and at ight angles to all live parts and is kept far enough away rom the current-carrying parts to provide a high insulaion to ground. It is stated that these hangers have withtood an electrical potential of 23,000 volts and on a mechanical test have supported a weight of more than 1000 lb.

Fig. 3 shows details and a partial section of the hanger with the lamp in the operating position. Energy for operating the lamp enters through the bar *A*, passes through catch *C*, then through the lamp, returning through parts *D* and *B* consecutively. Insulation between *C* and *D* prevents

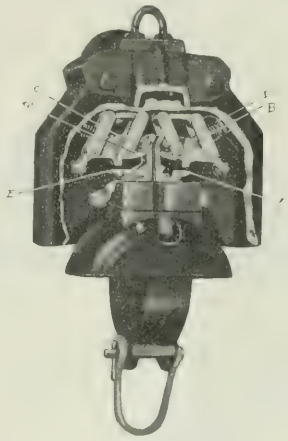


FIG. 3—DETAIL AND PARTIAL SECTION OF HANGER

any arcing at this point. The letters *E* and *F* indicate pawls which hold the catches apart while the lamp is being lowered. The contacts are arranged to "wipe in" so that they will remain bright and clean.

Although the illustrations herewith show the hangers installed only from mast arms, they are also made in styles permitting their use on span wires.

## Trackless Trolley Bus

The Field Electric Bus Company, of 135 Broadway, New York City, is now manufacturing electric buses of two types. One type of bus is equipped with Edison storage batteries and the other type, described in the *Electrical World* of June 14, 1913, is supplied with electrical energy from overhead trolley wires. The latter type does not carry storage-battery equipment.

## An Improved Insulating Material

A new insulating material known as "micarta" and intended to take the place of hard fiber glass, porcelain, hard rubber, built-up mica, pressboard, rawhide, molded compounds and the like has been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

This insulating material is used for commutator bushings and brush-holder insulation, for noiseless gear blanks, for conduit for automobile wiring, for spools for spark-coil and magnet windings, for refillable fuse tubes, for "wireless" coil separators, for arc shields in circuit-breakers, for water-meter disks and for other purposes.

Micarta is a tan-brown, hard, homogeneous material having a mechanical strength about 50 per cent greater than hard fiber. It can readily be sawed, milled, turned, tapped or threaded, if a sharp-pointed tool is used and the work done on a lathe. It can be punched only in thin sheets and cannot be molded. Micarta is not brittle, and it is claimed that it will not warp, expand or shrink with age or expo-

sure to the weather. The finished product takes a high polish, presenting a neat appearance.

Two grades of the material are made. That known as "bakelite micarta" will stand a temperature of 150 deg. C. (300 deg. Fahr.) continuously or 260 deg. C. (500 deg. Fahr.) for a short time. It is infusible and will remain unaffected by heat until a temperature sufficient to carbonize it is reached. It is said that bakelite micarta will stand an electric arc better than hard fiber, hard rubber, built-up mica or any molded insulation containing fibrous or resinous materials. The coefficient of expansion of this product is low, being approximately 0.00002 in. per deg. C.

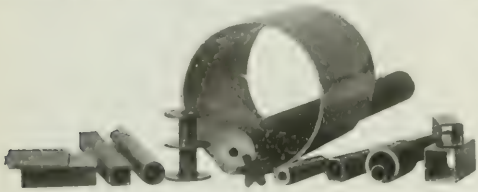


FIG. 1—INSULATING MATERIAL IN SEVERAL SHAPES

This grade of the insulation is insoluble in practically all of the ordinary solvents such as alcohol, benzine, turpentine and weak solutions of acids and alkalis, hot water and oils. It is indifferent to ozone, which is an advantage over hard rubber, resins and the like when used for electrical purposes. It is non-hydroscopic and is impervious to moisture.

The other grade, designated as No. 53 micarta, has the same mechanical and electrical properties as bakelite micarta but differs in its chemical and thermal properties. The plain micarta behaves toward chemicals and heat very much as an ordinary resin. This grade is not used in plate form.

As proof of the uniformity of structure of bakelite micarta, the accompanying illustration of a fracture is shown. The tube was held tightly on a metal mandrel and a compressive force was applied at one end of the tube. When the force became sufficiently great the tube split as shown. The uniformity of the wavy fracture proves the homogeneous structure of the material. Such a break is known as a harmonic fracture. The strains in a homogeneous

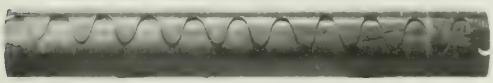


FIG. 2—A FRACTURE IN MICARTA

material under stress follow a sine wave law. If one part of the material is weaker than the rest, the strain at this point becomes greater and the harmonic wave is distorted. However, it will be seen from the illustration that the strain closely followed the true harmonic wave, indicating that every part of the material was as strong as any other part.

## Pole-Type Voltage Regulator

Formerly the apparatus for voltage regulation has been limited to the indoor type and installation at remote points would have necessitated building substations which in many cases would have made the expense of installation prohibitive.

The General Electric Company has placed on the market an automatic voltage regulator for outdoor service which has been arranged so that it can be installed on a pole or in any other convenient place. This regulator is designed for single-phase, 60-cycle circuits and will regulate the voltage within 10 per cent above or below normal if the power which is carried by the circuit does not exceed 25 kva.

The regulator, which is of the induction type, has two windings arranged on separate iron cores, the primary or shunt winding being connected directly across the circuit and the secondary winding connected in series with the line.

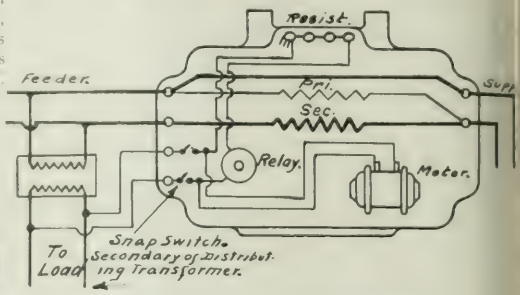



FIG. 1—DIAGRAM OF CONNECTIONS

The primary core with its winding is constructed so that it can be rotated within the core of the secondary or stationary coil. In this manner the effect of its flux upon the secondary coil may be varied, causing the voltage of the feeder to be increased or decreased.

Movement of the rotor is effected by means of a small single-phase motor which runs continuously. Normally this motor is mechanically disconnected from the rotor and connection therewith is controlled by a voltage relay the winding of which is energized from the regulated side of the feeder.

A device provided for limiting the movement of the rotor consists of two cams mounted on a common arm turning on the shaft of the ratchet wheel. When the limit of

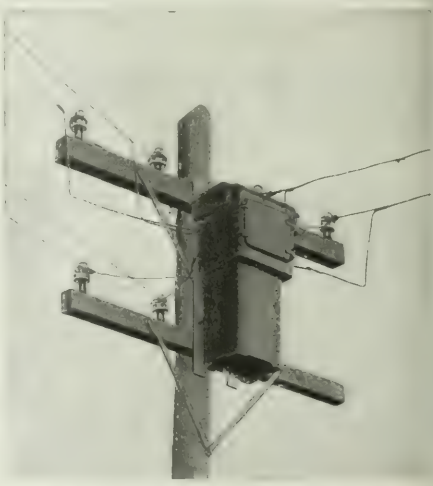


FIG. 2—VOLTAGE REGULATOR INSTALLED ON POLE

travel is reached a cam is moved up beneath the pawl and prevents it from engaging with the ratchet wheel. All parts of the regulator are inclosed in a dust-proof and rain-proof tank. The core and coils are located in the lower part of the tank and immersed in oil. A door provided in the upper part of the tank allows access to the mechanism for adjustment and oiling.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Lighting Contract Awarded.**—The Engberg's Electric & Mechanical Works, St. Joseph, Mich., has secured the contract for the electrical equipment of the Citronelle Light, Ice & Power Company, Citronelle, Ala., including one 55-kva single-phase alternator and a 12-ft. by 10-ft. engine, with switchboard complete. References to this plant appeared in our issues of May 10 and June 21.

**New Power House for Pennsylvania State Hospital.**—Of the appropriation of $195,000 recently made by the Legislature of Pennsylvania for improvements to the state hospital at North Warren, Pa., $125,000 will be expended for the construction and equipment of a new power house. The building will be of pressed brick and stone and attractive in appearance. Automatic stokers will be used in the boiler room; and patent smoke consumers will be installed.

**Isolated Plants to Be Installed.**—Charles E. Knox, consulting engineer, 101 Park Avenue, New York, is now working on the design of a 700-kw installation with elevators and wiring for the Hallenbeck-Hungerford building, at Lafayette Place and White Street, New York. He is also designing a 1000-kw plant with motor-drive equipment, elevators and wiring at St. John, N. B. In neither of these cases has the contract been let for the apparatus or materials.

**Canadian Underground Cable Installation.**—G. M. Gest, of Montreal and New York, has been awarded the contract for constructing a system of underground conduits for the town of Outremont, Quebec. A twin system will be built, one set being used by the town for the distribution of light and power in the future, and the other set by the Bell Telephone Company. Mr. Gest has undertaken to construct the conduits in 250 good working days. Altogether five tenders were sent in for the work.

**Street-Lighting Activity in Canada and in Texas.**—A local concern in the lighting-pole business has recently received an order for sixty combination luminous-arc and trolley poles for use on one of the main thoroughfares of Galveston, Tex. The same company states that in Canada there is particular activity in these lines. It has just supplied to the city of Peterborough, Ont., 100 poles of the same type as above noted and has negotiations in progress with several other Canadian cities for the supplying of ornamental poles for street lighting.

**Cedar Rapids Power Development Progressing Rapidly.**—From Mr. George C. Clarke, chief engineer for Fraser, Brace & Company, 1328 Broadway, New York, it is learned that rapid progress is being made on the hydroelectric development for the Cedar Rapids Manufacturing & Power Company, at Montreal, Can. At present there are six shovels busy on the job and concrete work on the power house foundations will be started during July. It is expected that the first units will be installed toward the latter part of October. About 100,000 kw will be available when the present plant is completed, and a reserve capacity of 50,000 kw will be left for future development.

**Kerr Turbine Business Excellent.**—The Kerr Turbine Company, of Wellsville, N. Y., is experiencing the largest volume of business in its history. Export orders have been received recently from England, India and the Sandwich Islands. The company has developed a 500-kw alternating-current unit for which it is expected there will be a large demand. In the shops at this time there are seventy-two turbines building, which will aggregate about 10,000 hp, and an order has just been placed by one of the large pump manufacturers for sixteen Kerr turbines. Among the recent shipments of "Economy" turbines the following are the more important: Four 800-hp turbines for driving 25,000,000-gal. pumps, Chicago Water Works; an 850-hp turbine for similar service at Nashville, Tenn.; two 100-kw and two 150-kw turbo-generator sets for the Republic Coal Company, Roundup, Mont.; two 35-kw generator sets for the steamship *Washington Irving;* three 75-kw sets for the new steamship *Seeandbee* for Great Lakes service; four turbo-pump units for Swift & Company; two for the Detroit General Hospital; two for the Pittsburgh Crucible Steel Company, and two for the Carnegie Steel Company.

**Texas & Pacific Railway's New Orleans Terminal.**—Arrangements have been completed for the construction of a large terminal station for the Texas & Pacific Railway Company at New Orleans, La., and it is expected that actual construction will begin shortly. Besides the building of the station proper, there is extensive grading work to be done, and the tracks are to be shifted to some extent. One of the company officials placed an estimate of $5,000,000 as approximately the cost of the entire project. Extensive electrical equipment will be installed, but no data are at present available on this point. The architects are Messrs. Favrot & Livaudais, of New Orleans.

**New Electric Car Models for 1914.**—The Anderson Electric Car Company, of Broadway and Eightieth Street, New York, which handles the Detroit electric line of pleasure cars and trucks, announces that several new models are to be put out in 1914, S. W. Menefee being in Detroit this week inspecting them. A new limousine designed especially for the New York trade is among the offerings for the coming year, which include also a forward-drive car which can be operated from either the front or the rear seat. The storage-battery equipment for these cars is supplied by the Edison Storage Battery Company, of Orange, N. J. The new models are scheduled to appear about Sept. 15.

**Canadian Engineering Concern Reorganized.**—Under the reorganization of the business of W. N. Dietrich, electrical and mechanical engineer, Montreal, Quebec, the scope of the undertaking has been enlarged. The company is known as Dietrich, Limited, and undertakes conduit installations, transmission lines and power plants and heating. The president is W. N. Dietrich, who was formerly electrical engineer for the Canadian Pacific Railway Company's entire system, while the vice-president is G. E. Templeman, previously superintendent of construction in the engineering department of Allis-Chalmers-Bullock, Ltd. The company is now doing extensive electrical work in the provinces of Quebec and Ontario.

**Big Asbestos Company Adding to Its Equipment.**—The H. W. Johns-Manville Company, Forty-first Street and Madison Avenue, New York, is enjoying in nearly all of the lines handled by it very good sales, and in its line of refrigerating machines its production department is having trouble keeping pace with the sales department. In order to take care of the increasing demand extensive building operations have been necessary. At Manville, N. J., an immense factory is in process of construction which will when completed add materially to the manufacturing facilities of the company. Two large three-phase, 60-cycle Curtis turbo-generators of General Electric make are to be installed at this plant, together with three exciter sets. A Westinghouse-Leblanc condenser and six 500-hp Babcock & Wilcox boilers will form part of the equipment also. An aggregate of 2800 hp of Westinghouse motors at ratings from 150 hp down will be installed for drive purposes. There are seven buildings in the group at Manville. The generating equipment is in a building by itself and the layout has been planned to allow for a future development of 5000 kw additional. The wiring is all underground there.

At the Canadian plant [illegible] crushing equipment is being increased. At the plant of the Asbestos Shingle Company, Riverdale, Ill., 500 hp in General Electric and Westinghouse alternating-current motors is being installed. This concern, which is a subsidiary company, draws its energy from the lines of the Illinois [illegible]

**Dominion Power & Transmission Company Adding to Its Generating Equipment.**—The Dominion Power & Transmission Company has made some large extensions during the year. Two large turbine units have been provided for its Decew Falls generating plant, while the expansion of the Steel Company of Canada at its Hamilton plant adds a very large consumer. An additional transmission line from Decew Falls to Hamilton is also among the proposed extensions. This company is contemplating building a million-dollar steam auxiliary plant. The presence of needle ice at Decew Falls in the winter, resulting in a temporary shutting down of the generators, has induced the company to guard against similar occurrences by making its steam auxiliary capable of producing 30,000 hp—sufficient to meet the demands of the present.

**Detroit Edison Company Optimistic on Present Industrial Condition.**—Speaking of Detroit's industrial condition, Alexander Dow, president of the Detroit Edison Company, said recently: "Our output to factories shows no falling off in the volume of demands for power. It is true a few factories are being closed just now for the usual summer inventory, but the day load carried by our plant shows no reduction. In fact, the load is more than 30 per cent greater than it was last year at this time." The Detroit Edison Company has just sold to Spencer Trask & Company, of New York, $1,000,000 of first mortgage 5 per cent gold bonds at par. Funds derived from the sale of the bonds will be employed in meeting part of the expense of constructing and equipping the mammoth new East Side power plant on which the Detroit Edison Company has commenced work.

**Turbo-Alternator Installation for an Illinois Factory.**—An isolated generating plant is being constructed by the Whitman & Barnes Manufacturing Company, of Chicago, at its factory in West Pullman, Ill. A 1150-kva turbo-alternator is to be installed which will furnish energy for the operation of about 1200 hp in motors. This company manufactures machinists' supplies and agricultural implements and the plant covers a ground area of 1400 ft. by 600 ft. As the buildings which constitute the factory lie in a continuous row, a cable duct 1350 ft. long will be constructed beneath the buildings, in which two sets of three-phase feeder cables will be laid. Each cable contains three conductors having 350,000 circ. mils cross-section. The motors will be operated on 440 volts. The wiring for the new layout is being done by the Freeman-Sweet Company of Chicago.

**Westinghouse Financing.**—The Westinghouse Electric & Manufacturing Company has sold to Kuhn, Loeb & Company a new issue of $3,250,000 two-year 6 per cent collateral notes due Aug. 1, 1915. The proceeds will be used to pay off $4,000,000 three-year 6 per cent collateral notes due Aug. 1, 1913, $750,000 being supplied in addition from the surplus treasury funds of the company. A premium of $10 in cash is being offered by the bankers for each thousand-dollar note exchanged for the newer securities, the collateral back of which must have a market value 50 per cent in excess of the value of the notes outstanding and the income from which must exceed the interest on the securities. The business of the Westinghouse Electric & Manufacturing Company thus far this year has exceeded that of any other period in the history of the company, and it is certainly gratifying to note that in refunding a maturing issue of securities the company has actually decreased the amount issued.

**Expansion of the Utah Securities Corporation.**—A short time back seventeen hydroelectric properties in Idaho, Utah and Colorado were consolidated under the name of the Utah Securities Corporation, and at the time of the merger the aggregate capacity of the several plants was in the neighborhood of 56,700 hp. Since the consolidation three additional properties, with a total of 18,100 hp, have been acquired by the corporation. There is now under construction at Grace, Idaho, a 29,250-hp addition which will be completed early in 1914. At Oneida, Idaho, a new development is projected which will have an initial capacity of 27,000 hp and will be completed in the latter part of the same year. The corporation is operating at present about 1454 miles of transmission and distributing lines and has now under construction a 130,000-volt steel tower line, 135 miles long, between the above-mentioned plants and about 147 miles of high-tension transmission lines in other sections. Electric energy from these lines is used for street-railway, irrigation, pumping and mining operations as well as for lighting and electric drive.

**Local Installations of Semi-Indirect Fixtures.**—The Lighting Studios Company, of 16 East Thirty-third Street, New York, has recently completed the installation of about 1500 semi-indirect lighting fixtures in the Forty-second Street Building, at Forty-second Street and Madison Avenue, and of between 600 and 700 similar type fixtures in the Associated Architects' Building, 101 Park Avenue, New York. In both cases their Doric moonstone hemispheres were used. The first-named building is twenty-four stories high, and the floor plans from the third to the twenty-third floors inclusive are similar. In the largtr offices there were placed two 14-in. globes each containing two 150-watt tungsten lamps, and in the smaller offices a single 12-in. globe with a 250-watt lamp was found adequate. It is notable that this building was planned for direct lighting, and the decision to install the semi-indirect system was made at the last moment, after it had been proved that the latter would be the more economical. An important objection to its adoption was the fact that it practically precludes the use of desk lights, since the outlets are rather inaccessible, but this disadvantage was more than offset by the economies obtained, and it is claimed that the desk lights are not required where the semi-indirect system is in use.

**Westinghouse, Church, Kerr & Company Doing Varied Work.**—Under the leadership of John F. Wallace, formerly chief engineer of the Panama Canal, Westinghouse, Church, Kerr & Company, who are now fairly well settled in their new quarters at 37 Wall Street, New York, are taking up a varied line of work, well scattered over the country, that promises to keep busy their large and able corps of engineers. For the British Columbia Electric Railway Company, of Vancouver, B. C., considerable work is in progress. Shops are to be designed and built at Barnaby, B. C., including accommodations for all the construction and repair departments. Electric drive will be used largely in these buildings and they will be lighted electrically, but the contracts for these parts of the equipment have not yet been let. For the same company there are to be constructed carhouses and shops at Vancouver, North Vancouver and Victoria, B. C. At the Hotel Nassau, Long Beach, N. Y., the machinery is being overhauled, together with the kitchen, sanitary and refrigerating equipment. A boiler plant is being built for Cluett, Peabody & Company, Troy, N. Y., in which will be installed two 300-hp horizontal-return tubular boilers of D. M. Dillon make. From plans prepared by the A. B. Baxter Engineering & Appraisal Company, of Buffalo, N. Y., a foundry is under construction for the Northwestern Brass Company at Calgary, Alta. For the American Cyanamid Company, of Niagara Falls, N. Y., a number of buildings are being designed, erected and equipped with plumbing and heating systems, conveyors and electrical apparatus. Energy for this development will be taken from the 12,000-volt, three-phase, 25-cycle lines of the Ontario Power Company, and four of these high-tension lines will enter the plant. The necessary complement of oil switches and lightning arresters will be provided on the high-tension side and also a control board for the low-tension side. Three 800-kva oil-insulated, water-cooled transformers, 11,700/46 volts, delta to star-connected, will form the bank feeding each carbide furnace, and there will be four such banks. Three transformers of similar type, rated at 375 kva, 11,700/75 volts, and delta to delta-connected, will feed 216 cyanamide ovens. Again, three of the same type of transformers, wired for 11,700/440 volts, will supply the service energy for electric drive and lighting. It is understood that as yet none of the electrical equipment has been ordered.

## Statement of the Copper Producers' Association for June

The June figures on copper production and consumption in this country show some marked variations from the figures for May, as shown below:

| | June, pounds | | May, pounds | |
|---|---|---|---|---|
| Stocks on hand in the United States on first of month | | 67,474,225 | | 75,549,108 |
| Production | | 121,860,853 | | 141,319,416 |
| | | 189,335,078 | | 216,868,524 |
| Domestic deliveries | 68,362,571 | | 81,108,321 | |
| Foreign deliveries | 68,067,901 | | 68,285,978 | |
| | | 136,430,472 | | 149,394,299 |
| Stocks on hand at end of month | | 52,904,606 | | 67,474,225 |

## Industrial Securities

| Security | Capital Stock Listed | DIVIDEND Per Cent | Period | QUOTATION July 1 | July 9 |
|---|---|---|---|---|---|
| Allis-Chalmers, t.r., 5th pd | $19,800,000 | ..... | ..... | 6½* | 5⅞ |
| Allis-Chal., pf.,t.r.,5th pd. | 16,050,000 | ..... | ..... | 14 | 14* |
| Amalgamated Copper | 153,887,900 | 1½ | Q | 65⅝ | 63⅜ |
| American Tel. & Tel. | 344,471,400 | 2 | Q | 127½ | 126⅜ |
| Electric Storage Battery,c. | 16,074,425 | 1 | Q | 46½ | 45½ |
| General Electric | 101,363,600 | 2 | Q | 135⅝ | 137 |
| Mackay Cos., c | 41,380,400 | 1½ | Q | 89* | 89* |
| Mackay Cos., pf. | 50,000,000 | 1 | Q | 68* | 68* |
| Western Union Tel. | 99,747,600 | ¾ | Q | 62 | 60 |
| Westinghouse, E. & M., c. | 34,496,400 | 1 | Q | 58½* | 57 |
| Westinghouse, E. & M., pf. | 3,998,700 | 1¼ | Q | 109* | 109* |

*Last price quoted.

### NEW YORK METAL MARKET PRICES

| | June 30 Bid. | Asked. | July 8 Bid. | Asked. |
|---|---|---|---|---|
| Copper: | | | | |
| Standard, spot | 13.87½ | .... | 13.75 | to 14.30 |
| | £ s d | | £ s d | |
| London, standard, spot | 64 2 6 | | 63 3 9 | |
| Prime Lake | .... | 14.87½ | 14.75 | to 14.85 |
| Electrolytic | 14.50 | to 14.62½ | 14.50 | to 14.60 |
| Casting | 14.37½ | to 14.50 | 14.35 | to 14.40 |
| Copper wire base | 15.75 | to 16.00 | ..... | 15.75 |
| Lead | .... | 4.35 | .... | 4.35 |
| Nickel | 40.00 | to 45.00 | 40.00 | to 45.00 |
| Sheet zinc, f. o. b. smelter | .... | 7.00 | .... | 7.00 |
| Spelter, spot | 5.30 | to 5.35 | 5.40 | to 5.50 |
| Tin, spot | 42.50 | to 42.75 | 39.20 | to 39.50 |
| Aluminum: | | | | |
| Prompt delivery | 23.00 | to 24.00 | 23.00 | to 24.00 |
| Future | 22.00 | to 23.00 | 22.00 | to 23.00 |

### OLD METALS

| | | |
|---|---|---|
| Heavy copper and wire | 13.50 | 13.25 |
| Brass, heavy | 8.75 | 8.12½ |
| Brass, light | 7.75 | 7.25 |
| Lead, heavy | 4.25 | 4.25 |
| Zinc, scrap | 4.12½ | 4.37½ |

### COPPER EXPORTS

| | |
|---|---|
| Total tons to July 8 | 3,751 |

# Business Notes

**W. Edgar Reed**, consulting engineer, whose office was formerly in the Machinery Building, Pittsburgh, Pa., has moved to the Frick Annex in the same city.

**The Lansden Company**, until recently located at Newark, N. J., has changed its headquarters to Allentown, Pa. The company is a large maker of commercial electric vehicles and is preparing to finance an expansion in this line.

**The Industrial Instrument Company**, of Foxboro, Mass., is experiencing a large demand for its Foxboro improved recording gage designed with a siphon gage for measuring low ranges of pressure. A two-page illustrated leaflet describing this apparatus has recently been put out.

**The Shaefer-Frenzel Company**, of Detroit, has opened offices on the sixteenth floor of the new Dime Savings Bank Building. Joseph E. Shaefer, president, was formerly in the spark-plug business; H. Ray Haberkorn, vice-president, is a large contractor, and Arthur W. Frenzel, secretary-treasurer, was formerly with the Disco Electric Starter Company.

**C. H. Vom Bauer**, formerly with the American Electric Furnace Company, has recently been engaged as engineering salesman by Halbert P. Hill, Inc., 30 Church Street, New York. The latter concern has been appointed Eastern agent for the Electric Machinery Company, of Minneapolis, Minn., and Mr. Von Baur will have charge of this end of the business.

# New Industrial Companies

**The United Pump & Power Company**, of Chicago, has been incorporated at Chicago with a capital of $100,000. G. E. Lemon, 126 Liberty Street, New York, is one of the incorporators.

**The D. & R. Storage Battery Company** has been incorporated with a capital of $100,000. A. R. Lucker, J. E. Reid and Rudolph Drambourgh, 969 Kent Avenue, Brooklyn, N. Y., incorporators.

**The Steinbock Engineering Company** has been incorporated in New York to manufacture explosive motors for autos, with a capital of $250,000. Incorporators: H. E. Steinbock, Frank C. Sievers and A. R. Gormully, New York.

**The Steel City Electric Company**, of Pittsburgh, Pa., has been incorporated to manufacture and deal in electrical and mechanical devices, with a capital of $5,000. Horace S. Gould, 37 Wall Street, New York, is one of the incorporators.

# Trade Publications

**"Adaptiboxes."**—A leaflet issued by the Adapti Manufacturing Company, Cleveland, Ohio, gives a few reasons why "adaptiboxes" should be used.

**Rectifiers.**—A miniature of the regular 8 in. by 10.5-in. bulletin of the Wagner Electric Manufacturing Company, St. Louis, Mo., is being mailed. It refers to the Wagner alternating-current rectifier and is known as Bulletin No. 100.

**Fans.**—Westinghouse electric fans, alternating-current, are made the subject of a twenty-page booklet recently distributed by the Westinghouse Electric & Manufacturing Company. Desk and bracket fans, residence fans, oscillating fans, telephone booth fans, ceiling and column fans, as well as exhaust fans are all illustrated.

**Terminals.**—Bulletin No. 700-1 of the Standard Underground Cable Company, Pittsburgh, Pa., refers to its D. O. A. type of outdoor cable terminals. In its twenty-eight pages are contained illustrated descriptive matter, tables of dimensions, voltages, weights and instructions for installing outdoor cable terminals. This bulletin is the first of a new series that is to supplement other literature.

**Generating Sets.**—The generating sets made by the Engsberg's Electrical & Mechanical Works, St. Joseph, Mich., are the subject of many testimonial letters which have been assembled in a thirty-six-page booklet recently issued by the company. The Engsberg company makes generators and vertical-type engines of from 2.5 kw to 50 kw, which are especially adapted for small electric-light plants.

**Steel-Armored Hose.**—Catalog No. 521, issued by the Sprague Electric Company, New York, is devoted to its flexible steel-armored hose for railroad service. This material consists of a rubber hose completely covered with an interlocking galvanized steel armor, designed to offer extremely high resistance against external forces or internal pressure. Its use in railway work is described and illustrated.

**Electric Vacuum Cleaners.**—The Hurley Machine Company, Clinton and Monroe Streets, Chicago, has issued a folder referring to the Hurley "Six" and Hurley "Four" electric vacuum cleaners, two of its latest products. A special feature of this apparatus is the nozzle specially designed to pick up threads and ravelings. Every machine is complete with electric cord, switch, etc., mounted in the handle. It is only necessary to slip the two connectors (located at the lower end of the handle) together, and it is ready for operation.

# Personal Mention

**Mr. H. C. Case,** formerly of Philadelphia, has been elected general superintendent of the St. Petersburg (Fla.) Investment Company, which supplies electric service at St. Petersburgh and Gulfport.

**Mr. Henry L. Angloch** has been appointed superintendent of the Bureau of Electricity, Pittsburgh, to fill the vacancy caused by the death of Mr. Robert J. Daley, whose assistant he had been for nine years.

**Mr. C. A. Brant,** formerly of the Public Service Corporation of New Jersey, has been appointed secretary and general manager of the Toms River & Island Heights Electric Light & Power Company, Toms River, N. J.

**Mr. C. J. Pleming** has been elected secretary-treasurer of the Knoxville (Tenn.) Railway & Light Company as successor to the late Leon Fender. Mr. Pleming has been connected with the company for nearly nine years, beginning as private secretary to the president of the company, Mr. C. H. Harvey.

**Mr. C. A. Whipple** has been elected general superintendent of the municipal light and water system of Eugene, Ore., as successor to Mr. A. Meyers, who resigned July 1. Mr. Whipple, who is a graduate of the University of Washington and Cornell University, was formerly connected with the municipal system of Seattle, with the Puyallup development of Stone & Webster, with the Vancouver Power Company and with the Mount Hood Railway, Light & Power Company, of Portland, Ore. Up to the time of his election as general superintendent of the Eugene municipal plant Mr. Whipple was assistant electrical engineer of the Portland, Eugene & Eastern branch of the Southern Pacific Railroad.

**Mr. John F. Wallace,** president of the engineering firm of Westinghouse, Church, Kerr & Company, of New York, has been selected as the engineering adviser of the Chicago City Council committee on railroad terminals. Mr. Wallace will be required to make a report on the entire railroad-terminal situation in Chicago relating both to freight and passenger traffic. Mr. Wallace, one of the leading engineers of the country, was for some time a vice-president of the Illinois Central Railroad Company in Chicago, and at one time was chief engineer in charge of the Panama Canal operations. Not long ago his firm compiled a report in relation to the terminal facilities of the western Indiana group of railroads in Chicago. He is a past-president of the American Society of Civil Engineers.

**Dr. W. F. M. Goss,** dean of the College of Engineering of the University of Illinois, has been appointed chief engineer for the Chicago Association of Commerce committee on smoke nuisance and electrification of railroad terminals in Chicago. Dean Goss succeeds in this position the late Horace G. Burt. He has received a year's leave of absence from the university. He was chosen unanimously by the committee, of which he has been a member from the start. Dr. Goss was born in Massachusetts in 1858, and obtained his technical education at the Massachusetts Institute of Technology. For seventeen years he was a member of the faculty of Purdue University, being dean of the engineering school for a large portion of that time. Since 1907 he has been dean of the College of Engineering at the University of Illinois. The report of the Chicago Association of Commerce committee, which will be very elaborate, is expected to be made public before July 1, 1914.

**Dr. William McClellan,** who resigned a short time ago as chief and engineer of the division of light, heat and power of the Public Service Commission of the Second District, New York, has been retained as assistant to the president of the Buffalo General Electric Company, Buffalo, N. Y. Dr. McClellan was educated at the University of Pennsylvania and is a member of the council of the University of Pennsylvania Club of New York City and president of the Associated Pennsylvania Clubs, an organization of the alumni associations of the University of Pennsylvania in all parts of the world. He is a member of the Railroad Club of New York, the Engineers' Club of New York City and the University Club of Albany. He is a fellow and manager of the American Institute of Electrical Engineers and a member of the American Society of Mechanical Engineers. He is a director of the Automatic Train Stop Company and of the Campion McClellan Company, engineers and constructors, with offices at Philadelphia. Dr. McClellan will maintain offices at 141 Broadway, New York City, to assist in the operation and management of public-service properties.

**Mr. Charles O. Bond,** president-elect of the Illuminating Engineering Society, was born Nov. 15, 1870, near the town of Lehigh, Webster County, Ia. After graduation from the United States Naval Academy, Annapolis, Md., in 1890, he served one year at sea on board the U. S. S. *Enterprise* and U. S. S. *Philadelphia*. He later taught school in the States of Iowa and New York for five years, and in 1897 became connected with the United Gas Improvement Company in Philadelphia. In 1898, during the Spanish-American War, he served five months as an ensign in the navy on board the U. S. S. *Lancaster* and the U. S. S. *Newport*. At the close of the war he resumed his connection with the United Gas Improvement Company, taking charge of the photometric work of the company. While continuing in this position, he also held command of one division of the Naval Force of Pennsylvania for three years. Since 1909 Mr. Bond has been manager of the photometrical laboratory of the United Gas Improvement Company, which was established in that year. Mr. Bond was a charter member of the Illuminating Engineering Society and has served one term as a director and one term as a vice-president. He is also a member of the (British) Illuminating Engineering Society, the American Gas Institute, the National Commercial Gas Association and the Franklin Institute. He was an American delegate to the International Photometric Commission in Zurich in 1911.



CHARLES O. BOND

**Mr. Joseph D. Israel,** who has twice been elected general secretary of the Illuminating Engineering Society, has been connected with the lighting industry during the past twenty-six years. He is at present district manager of the Philadelphia Electric Company. Mr. Israel was born in Philadelphia, Feb. 28, 1868. In 1886 he was graduated from the Scientific School of the University of Pennsylvania with the degree of bachelor of science. After a post-graduate year in mechanical and electrical courses, the same university conferred upon him the degree of mechanical engineer in 1887. Immediately after graduation he became connected with the Edison Electric Light Company of Philadelphia, devoting his time to the underground street work. Shortly afterward he became superintendent of the street work of the company. He next became assistant to the manager of the company and later was made secretary and manager. When the company was merged with the Philadelphia Electric Company he became district manager of the latter company. Mr. Israel has been active in the local and national work of the Illuminating Engineering Society, the National Electric Light Association and the American Institute of Electrical Engineers. He is a member of the Franklin Institute and a director of the Commercial Section of the National Electric Light Association. He has contributed papers and reports to local and national meetings of the above-named societies and the Association of Edison Illuminating Companies.



JOSEPH D. ISRAEL

# Construction

## New England

WATERVILLE, ME.—The Central Maine Pwr. Co. is planning to erect 10 miles of 33,000-volt transmission line between Winslow and Shawmut, this being a line parallel with the present one. The material has already been purchased. H. W. Eells, general superintendent.

WARREN, N. H.—A fire caused by sparks from a passing engine resulted in the almost total destruction of the plant of the Warren Wtr. & Lt. Co. E. E. Carby, manager.

FITCHBURG, MASS.—John F. Malley and others have petitioned the City Council for a cluster lighting system from Summer to Water Street, to include Harvard Street as far as the Viaduct and Fifth to Water Street.

HOLYOKE, MASS.—Within the next two months the municipal gas and electric-light plant expects to purchase distribution cable for underground work. The conduits are now being laid, but the contract for the cable has not yet been awarded. John J. Kirkpatrick, manager city of Holyoke Gas and Electric Department.

HUDSON, MASS.—The municipal electric light and power plant has recently purchased one 250-kva, three-phase 60-cycle, 3600 r.p.m. turbo-generator. Within the next two months it is planned to purchase a condenser to be used with the above equipment. Geo. A. Brothers, manager.

MILFORD, MASS.—It is reported that about $9,000 will be spent on improvements to the plant of the Milford El. Lt. & Pwr. Co.

WORCESTER, MASS.—The Worcester Merchants' Association, through Mr. J. E. Bradley, president of the Osgood-Bradley Car Co., recently petitioned the Mayor to install an ornamental lighting system on the ground that it will boom Worcester.

STAMFORD, CONN.—The Stamford Gas & El. Co. has recently purchased a 2500-kw Westinghouse 2300-volt, three-phase turbine and one 650-hp B. & W. boiler for 200-lb. pressure and 150 deg. superheat; also a switchboard panel. G. B. Leland, superintendent.

## Middle Atlantic

DUNKIRK, N. Y.—The board of water commissioners is planning to purchase within the next two months a 400-hp horizontal water-tube boiler for the municipal lighting plant. B. C. Candee, superintendent.

GENESEO, N. Y.—The Geneseo Gas Lt. Co. expects to replace the present street-lighting system with a modern one. The company has not yet decided whether it will continue to supply energy from its own plant or to purchase it from another source. T. W. Landon, superintendent.

GREENWICH, N. Y.—The Booster Club is planning a special meeting at which a movement will be agitated for the installation of electric lighting throughout the town, which is situated near Glens Falls.

PRATTSBURG, N. Y.—At a special election held recently the proposition to light the village by electricity was carried by a majority of 39 votes. The work of installing the plan will soon commence.

PHILADELPHIA, PA.—The United El. Constr. Co. has been awarded the contract for the electrical equipment for the dispensary building to be erected for the American Viscose Co. at Marcus Hook, Pa., also the contract for similar equipment for the Villa Maria Academy, at Frazer, Pa., at a cost of $25,000.

ATLANTIC CITY, N. J.—The proposition of the Atlantic City El. Co. to place the wires along the ocean front under the Boardwalk has been received favorably by the Ventnor Council. It is proposed to install hollow iron standards 10 ft. in height and 12 in. in diameter at the base, the cost of which would be about $25 each.

TOMS RIVER, N. J.—In anticipation of the increased demand for energy the Toms River & Island Heights El. Lt. & Pwr. Co. will within the next two months erect an addition to its power house. The company has recently purchased a new Coatesville fire-tube boiler and is contemplating the purchase of a new 60-cycle, 1100-volt generating unit. An up-to-date switchboard and watt-hour meters will soon replace the older equipment. The borough of Island Heights is to have in operation during the next month the new series tungsten street-lighting system recently installed. The Toms River division will be similarly equipped. C. A. Brant, general manager.

AMHERST, VA.—The town contemplates voting on a $10,000 bond issue to secure electric light and water supply.

WASHINGTON, D. C.—Sealed proposals will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, until June 22 for furnishing various motor-driven tools for delivery at the Navy Yard, Mare Island, Cal.

WASHINGTON, D. C.—Sealed proposals will be opened at the office of the supervising architect, Washington, D. C., on Aug. 15, for the construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States Post Office at Bainbridge, Ga. Drawings and specifications may be obtained from custodian of site at Bainbridge, Ga., or from O. Wenderoth, supervising architect, Washington, D. C.

## North Central

ALBION, MICH.—The plant of the Commonwealth Pwr. Co. was recently destroyed by fire caused by lightning. The lighting system will be out of commission until a new plant can be equipped.

COVINGTON, MICH.—The State Railway Commission has given permission to the Sturgeon River Land & Development Co. to issue $8,700,000 worth of bonds, and the company has started work on the construction of a hydroelectric plant. At least 20,000 hp will be developed. The principal storage reservoir will form a lake about 6 miles long and 1½ miles wide, with an average depth of 22 ft. The power house will be located 4 miles from the reservoir. J. K. Gronholf, chief engineer.

DETROIT, MICH.—The Otis Elevator Co. will install an electric elevator in the Garland Theater building on Woodward Avenue.

ESCANABA, MICH.—The City Council has ordered 20 electric lamps installed in the municipal park.

GRAND RAPIDS, MICH.—A. W. Hompe, O. H. L. Wernicke, Charles A. Phelps and Bert MacCauley are interested in a hydroelectric project on the Rouge River. The plan is to erect a concrete dam and to furnish energy to the Grand River Club, the Grand Rapids Auto Co. and farmers in the neighborhood.

HUDSON, MICH. In about 60 days the Hudson El. Lt. Co. will purchase material to equip a plant in the town of Waldron and will require poles, wire and other line material, as well as a switchboard, transformers, meters and inside wiring material. G. V. Avis, secretary.

ISHPEMING, MICH.—The Buffalo Iron Mining Co. has been awarded the contract for the erection of the buildings and machinery supplies of the Homer mine in the Iron River district. An engine and a boiler house, and also a transformer house, 42 ft. by 36 ft., will be erected. An electrically driven air compressor will also be purchased.

KALAMAZOO, MICH.—The luminous-arc system of ornamental street lighting is favored by the local lighting commission after a thorough investigation of the tungsten cluster system. A recommendation to that effect has been sent to the Common Council.

KALAMAZOO, MICH.—A bond issue of $15,000,000 was recently authorized at a meeting of the stockholders of the Chicago-Michigan Ry. Co. This money will be used for proposed extensions of the company. The stockholders also authorized the building of two large electric power stations on the Manistee River, capable of developing 20,000 hp, to furnish energy for the company's lines.

MASON, MICH.—New machinery is being installed in the municipal lighting plant at Mason.

WATERVLIET, MICH.—The Watervliet Paper Co. is now installing electric motors to operate its machines.

CLEVELAND, OHIO.—City Auditor Thomas Coughlin has offered the city sinking fund commission an additional $500,000 of the municipal light plant bonds. The commission has already purchased $700,000 of these bonds, and if it is able to take the present offering the city will be able to open its new $2,000,000 plant about Nov. 1.

JACKSONVILLE, OHIO.—The City Council is reported to have granted the Hocking Pwr. Co., of Nelsonville, a franchise to furnish electricity in Jacksonville.

RATHBONE, OHIO.—The State Board of Administration has decided to erect a power plant at the Girls' Industrial School. Address W. E. Painter, chief engineer.

YOUNGSTOWN, OHIO.—Michael Liebel, Jr., president of the Youngstown Htg. Co., is seeking a franchise for the installation of an electric-lighting plant. It is the purpose of this company to furnish light, power and steam heat from a lighting plant to be built and operated in connection with the steam-heating plant in South Hazel Street.

CADIZ, KY.—A. P. White & Co., millers, who recently completed a large plant, are planning the installation of an electric-lighting equipment.

EDDYVILLE, KY.—The town recently purchased an electric-light plant from the State, which has operated it in connection with the State penitentiary at Eddyville, and the municipality is now arranging to install a street-lighting system.

ASHLEY, IND.—Within the next 60 days the municipal electric-lighting plant expects to purchase a 60-hp high-speed engine and to erect new arches in its boiler room. Shortly extensions will be made to the 500-watt street-lighting system. George W. Caryl, superintendent.

BRISTOL, IND.—The town is planning an ornamental street-lighting system, the energy for which will be furnished by one of the nearby lighting companies, perhaps the Hawks El. Co., of Goshen. Manager Hilbish of the telephone company is chairman of the lighting committee at Bristol.

CLINTON, IND.—The Clinton El. Lt. & Pwr. Co. within the next month expects to install two 200-hp water-tube boilers. C. M. Poor, superintendent.

KNIGHTSTOWN, IND.—A new air compressor is under test at the city lighting and water plant and will probably be purchased if satisfactory. N. Hiatt, superintendent.

ELGIN, ILL.—Dr. Ralph T. Hinton, superintendent of the Elgin State Hospital for the Insane, has recommended that a new boiler

[illegible]

[illegible]

SPARTA, ILL.—The Sparta Gas & El. Co. has recently installed a new [illegible]

URBANA, ILL.—The city, in connection with the Commercial Club, is figuring on an extensive installation of ornamental posts, about 225 in number, including the park system. The energy for lighting will be furnished by the Urbana Lt., Ht. & Pwr. Co., John A. Glover, general superintendent.

WASHBURN, ILL.—Within the next month the Washburn Ht., Lt. & Pwr. Co. expects to purchase one 35-kva to 40-kva, three-phase, 2200-volt, 60-cycle revolving-field generator with exciter. M. J. Lycan, secretary and treasurer.

WATAGA, ILL.—Within the next three months the Wataga Mill & Lt. Plant expects to erect 2½ miles of line and contemplates the purchase of four cars of poles. The extension will enable the company to serve eleven farmers whose houses will be passed by the new line. H. J. Kunkle, president and general manager.

WESTERN SPRINGS, ILL.—As soon as the new well is finished—it is now down about 800 ft.—a 35-kw, three-phase electric pump will be installed to supply water to the village in place of the steam pump now in use. G. Key, engineer.

BALDWIN, WIS.—The Baldwin El. Lt. & Fuel Co. expects to purchase a switchboard, alternating-current meters, lightning arresters, poles, wires, insulators and other equipment during the next two months and is planning to add also some labor-saving household appliances. S. F. Cave, secretary and manager.

HUDSON, WIS.—The Burkhardt Milling Co. within a few months expects to build an 18-mile transmission line from this place to Baldwin.

VIOLA, WIS.—The Viola Lt. & Pwr. Co. expects to erect a new concrete dam within the next few months and to purchase one 100-hp oil engine. J. N. Roherty, engineer in charge; C. J. Smith, manager.

CHISHOLM, MINN.—Separate bids for the electric work on the proposed public library will be received until July 16. Dr. A. B. Kirk, president library and reading-room board. Belle, Tyrie & Chapman, architects, Auditorium Building, Minneapolis.

CROOKSTON, MINN.—The recent report as to the establishment of a municipal lighting plant here was incorrect.

ELIZABETH, MINN.—It is planned to install an electric-lighting system at this place.

WARREN, MINN.—The municipal lighting plant here will enlarge its plant within the next year or so and contemplates the purchase of one 125-kw or 150-kw, 250-volt direct-current generator direct-connected to engine of suitable size; an open heater, boiler-feed pumps and an additional switchboard panel for the above unit. Electrical appliances and supplies will be purchased as needed from time to time. W. Haney, superintendent.

COUNCIL BLUFFS, IA.—The City Council has decided to extend the lighting district on Eighth Street to Lake View Park, a distance of 1 mile.

ELMA, IA.—The municipal lighting plant at this place contemplates the purchase of a 75-hp Corliss engine within the next two months. Frank Gue, Jr., manager.

FONTANELLE, IA.—An electric-light system will soon be installed at Fontanelle. It is proposed to construct a transmission line and purchase energy from Greenfield, Ia. J. B. Hill, consulting engineer, Iowa City, Ia., has been engaged to prepare plans and specifications for the transmission line and overhead distribution system.

IOWA FALLS, IA.—A complete transmission line, 20 miles long, will be erected within the next three months by the Iowa River Lt. & Pwr. Co., and one 200-kw alternator, a complete switchboard necessitated by changing from direct current to alternating current, transformer equipment and alternating-current meters will be purchased. J. C. Lundy, manager.

LE MARS, IA.—The Le Mars City Wtr. & Lt. Co. expects to purchase within the next three months one 185-kva or 200-kva, 1200-volt, 60-cycle, three-phase generator and a 280-hp engine. Later on the company also contemplates the purchase of a five-panel switchboard. M. Schafer, president and manager.

MANLEY, IA.—At a special election held recently the town voted to grant a franchise to F. J. Hanlon for the erection of a lighting and power plant. It is expected that the plant will be in operation within 90 days and that 24-hour service will be given.

MAXWELL, IA.—C. E. Lookingbill and W. C. Enfield have been negotiating with the Iowa Ry. & Lt. Co. for a transmission line to be run from Nevada to Maxwell. Here a company will be formed to sell energy for lighting and motors. The application of W. A. Curtis for a [illegible]

SAC CITY, IA.—Seven miles of high-tension transmission line will be erected within the next two months by the Sac City El. Co., which will light the town of Lytton. A switchboard, meters, oil switches, horn-gap arresters and step-up and step-down transformers will be purchased. H. W. Deininger, general manager.

SEYMOUR, IA.—The municipal lighting and water plant expects within the next four months to erect a transmission line 1.5 miles long to the coal mines and plans to purchase two transformers of 50 kw each, an automatic voltage regulator and the necessary poles for this extension, including lightning arresters. Two sets of rocking-grate bars will be purchased later in the year.

STORY CITY, IA.—Improvements are contemplated to the municipal electric plant. A new fireproof building will be erected, and the city will be in the market for a Corliss engine, fire-tube boiler and other equipment. W. H. Grover, Ames, Ia., is the engineer in charge of the improvements. M. Henderson is superintendent of the plant at Story City.

WALL LAKE, IA.—At a special election the proposition to issue electric-light bonds was carried.

KING CITY, MO.—The King City El. & Mfg. Co. expects to purchase at once a 30-kw, three-phase, 60-cycle, 2500-volt alternator with exciter. The company is also in the market for a switchboard.

LAGRANGE, MO.—Within a month or so the municipal electric lighting plant contemplates the purchase of a 25-kw, 60-cycle transformer. C. H. Hoskins, manager.

SEDALIA, MO.—The City Light & Trac. Co. during the next two months expects to purchase a 500-kw turbine with rotary converter and two panels for this unit, and also contemplates making a number of other improvements. Various campaigns for the introduction of labor-saving devices in the home will be inaugurated in the near future. H. D. Frueauff, general manager.

FRANKFORD, N. D.—G. A. Shone is the engineer in charge of the proposed electric-lighting system, for which plans and specifications have been prepared (mentioned April 26 and June 21). Definite plans have not yet been decided upon.

LARIMORE, N. D.—The establishment of a "white way" system, mentioned June 28, has been postponed indefinitely.

CANTON, S. D.—In addition to the equipment that is to be purchased by the Sioux Valley Pwr. Co., mentioned June 21, the 30-ft. poles required for the proposed 13-mile extension to its system will be purchased. The company has a substation at Inwood and one at Fairview. A. H. Latimer and C. H. Morgan are the engineers in charge of the work. The latter is also secretary of the company.

ELK POINT, S. D.—It is reported that Earl Jackson, of St. Paul, Minn., has been authorized by the City Council to draw plans for the installation of an electric-lighting plant here.

McINTOSH, S. D.—It is reported that W. D. Snyder and F. W. Luke have decided to construct an electric-lighting plant.

PAWNEE CITY, NEB.—During the next two months a 12-mile transmission line will be erected by the municipal light and water plant between Pawnee City and Steinauer, Neb. During the next month there will be purchased a triplex pump, with a rating of 160 gal. per minute, and one 500-gal.-per-minute turbine pump for the water-works system. Standards for the street-lighting system will be bought later. T. H. Lawrie, superintendent and manager.

POLK, NEB.—Bonds to the amount of $16,000 have been voted to install an electric-light plant.

ATCHISON, KAN.—The merchants located on East Commercial Street, between Second and Fifth, have petitioned the City Council to extend the "white way" through their section.

## Southern States

ALLENDALE, S. C.—A bond issue is being considered for the construction of an electric-light plant and water-works.

ORANGEBURG, S. C.—Bids will be received until July 16 by the Board of Public Works (J. G. Wannamaker, chairman), for $600,000 water and light bonds.

SUMTER, S. C.—The Sumter Ltg. Co. expects within the next eight months to install a new compression ice machine, with a rating of 50 tons. Within the next few months there will be purchased asbestos covering for the settings and drums of its Stirling boilers, shaker grates for the two boilers not already equipped with them, and an auxiliary cooling device for its jet condenser. Very shortly there will be installed fifteen more street series incandescent lamps. Information is wanted in regard to fuel economizers, which will be installed soon. E. [illegible] Moses, general manager.

UNION, S. C.—Within the next two months the municipal electric light and water-works plant will erect one mile of No. 10 lines for the suburban district, for which there has been purchased one 200-kw generator directly connected to a Corliss engine, which is now being installed. R. A. Easterling, manager and superintendent.

APALACHEE, GA.—C. A. Mees, of Charlotte, N. C., is engineer for the proposed hydroelectric plant of the Apalachee Pwr. Co. on the Apalachee River.

REYNOLDS, GA.—It is planned to erect an electric-lighting plant here. The town has a population of 1000. Estimates should be sent to J. A. Matthews, Mayor.

[illegible] GA.—J. B. Magruder has secured a franchise to install a lighting plant and also to build an ice plant.

WEST PALM BEACH, FLA.—A transmission line 18 miles long, to serve the towns of Lakeworth, Lantana, Hypoluxo, Boynton and Delray, lying south of West Palm Beach, will be erected by the Ariston Ice & El. Co. during the next half year. One 300-kw turbo-generator has already been purchased. C. H. Ellis, local manager.

DYERSBURG, TENN.—The municipal water and light plant expects within the next three months to purchase material for 16 ornamental five-lamp standards for a "white way" around the public square. G. A. Shafer, superintendent.

FRANKLIN, TENN.—A substation will be erected by the Harpeth El. Lt. & Pwr. Co. to connect with the lines of the Tennessee Pwr. Co.

NASHVILLE, TENN.—Bids will be received by Major H. Burgess, Corps Engineers, U.S.A., Nashville, until Dec. 11 (extension of date from June 24, mentioned first in issue of March 29) for a franchise for water-power development at Muscle Shoals, Ala. Bids will be for (1) a lump sum contribution by the company toward the entire work of construction of locks, dams, power houses, etc., or (2) it may provide for an annual payment to the United States at so much per horse-power, or a lump sum per year for the lease period, assuming that the United States puts in the above structures, and that the lessee installs hydroelectric equipment and installs necessary transmission lines, substations, etc.; or, (3) the bids may be a combination of these two methods of co-operation. The bids should be based on three different periods of lease, 100 years, 50 years and 20 years. Should any bidder be unable to make a proposition on the shorter term leases, he should so state in writing, giving his reason therefor.

BIRMINGHAM, ALA.—J. M. Dewberry, president of the Tidewater Securities Co., has asked for a franchise by which the right will be given the company to generate and sell electric energy in Birmingham.

VINITA, OKLA.—The Vinita El. Lt., Ice & Pwr. Co., which is now owned and operated by the Public Serv. Co. of Oklahoma, expects to purchase at once one 250-kva alternating-current generator, 60 cycles, 2300 volts, and various switchboard instruments. C. E. Lahman, local manager.

BEEVILLE, TEX.—T. W. Robertson, through A. H. Murrie, has purchased the Beeville Mfg. Co. (lighting and ice plants) for $110,000 from Mrs. Cora Ogden Wilson, of San Antonio.

COMMERCE, TEX.—The City Council is planning to establish a light and water system at at approximate cost of $10,000.

DENISON, TEX.—The Texas Pwr. & Lt. Co. has adopted plans for the proposed hydroelectric plant (first mentioned June 21) that it will erect on Red River, 3 miles north of Denison, at a cost of about $1,000,000. It will construct a system of transmission lines and supply electric energy to a number of towns in this part of Texas and in Oklahoma.

GONZALES, TEX.—Within a short time the Citizens' El. Lt. & Pwr. Co. expects to purchase one 300-hp Corliss engine and a waterwheel governor.

GRAND SALINE, TEX.—It is the plan of the Grand Saline El. Co. to install within the next 60 days 75 bracket street lamps and 12 five-lamp ornamental poles. W. W. White, manager.

HENDERSON, TEX.—To operate the fertilizer plant which the Henderson Cotton Oil & Gin Co. is building, the company contemplates the purchase of one 20-hp motor. O. E. Morris, superintendent.

HOUSTON, TEX.—The Texas Pub. Serv. Co., which has just been organized with its principal office at Houston, having a capital stock of $500,000, will construct electric light and power plants, gas plants and water-works systems in a number of towns in Matagorda, Upshur, Titus and Wilbarger Counties, according to the provisions of its charter. The incorporators are Albert Emanuel, of Dayton, Ohio; H. A. Van Eaton, Raymond Neilson, C. H. Wilson, R. C. Patterson and W. A. Parish, all of Houston.

ITASCA, TEX.—The Texas Lt. & Pwr. Co., which owns the plant at this place, is said to be planning to spend $12,000 in improvements.

SAN ANTONIO, TEX.—The San Antonio Gas & El. Co. has increased its capital stock from $1,160,000 to $1,500,000 for the purpose of providing for improvements to its properties. The San Antonio Tract. Co., an affiliated concern, has increased its capital stock from $1,210,000 to $1,400,000 for the same purpose. Mr. W. B. Tuttle is vice-president and general manager of both companies.

SHERMAN, TEX.—John Tulloch, Lity Building, Sherman, will open bids July 19 for electrical construction at the new hospital and power house.

WHITESBORO, TEX.—The municipal electric-lighting plant will be installed here just as soon as the bonds for $6,000 recently voted have been sold. The issuance of these bonds was mentioned June 28. J. C. Jones, city secretary.

## Pacific States

BREMERTON, WASH.—The city of Bremerton recently purchased the holdings of the Bremerton-Charleston Lt. & Fuel Co. It is understood that $90,000 was paid for the property. Reconstruction work will be begun at once.

ELLENSBURG, WASH.—The City Council has been petitioned by property owners in Third Street for the installation of a cluster lighting system.

SEATTLE, WASH.—Bids will be received at the office of the Port Commission, 843 Central Building, Seattle, until July 23 for electric hoisting machine with electric motor, controlling appliances, wire rope and electric wiring and conduit, for what is known as the Salmon Bay improvement of the port of Seattle. Plans and specifications are on file in the office of the commission. C. E. Remsberg is secretary.

FALLS CITY, ORE.—The Falls City El. Lt. & Pwr. Co. will extend its line 1 mile during the next six months, and two transformers, four arc lamps and a new switchboard will be purchased during that period. Henry Brown, superintendent.

KLAMATH FALLS, ORE.—The city contemplates the construction of a municipal lighting and water plant. City Attorney J. C. Rutenic has been instructed to write to Washington to learn under what arrangements the government will furnish energy for the proposed plants. The government owns practically all of the available water-power sites along the Link River, where the power will be generated. If a favorabe response is received from the Department of the Interior, work will begin at once.

PORTLAND, ORE.—The Northwestern El. Co. is planning the erection of a substation on the corner of Albina Avenue and Railroad Street, in Lower Albina, near Portland.

PORTLAND, ORE.—The Southern Pacific Ry. Co. has applied to the California Railroad Commission for permission to issue $30,000,000 in two-year, 5 per cent bonds, to be used in electrifying various lines owned and operated by the company. These extensions will involve an expenditure, it is reported, of almost $17,000,000.

BURNEY FALLS, CAL.—The Pit River Pwr. Co., recently organized by F. J. Sheehan, of San Francisco, will build a plant at Fall River Mills, Shasta County, and supply energy to all the towns and valleys within a radius of 60 miles. It is expected that about 20,000 acres will be irrigated. Mr. Sheehan is seeking the approval of the State Railroad Commission to issue bonds sufficient to complete the financing of the project. It is anticipated that active construction work will begin shortly.

COLFAX, CAL.—The State Railroad Commission has given D. C. Gillen authority to sell his electric distribution system in Colfax to the Pacific Gas & El. Co. for the sum of $12,000. (Mentioned also June 21.)

LOS ANGELES, CAL.—The Southern California Edison Co. is planning to extend immediately its lines to Ingledale Acres, near Los Angeles, and will cover the entire tract with 2200-volt lines and 220-110-volt secondaries.

MAYFIELD, CAL.—City Engineer F. A. Nikirk has advised the purchase and installation of an electric motor at a cost of $400 to provide for an auxiliary pumping plant, as the present supply of water is shrinking rapidly.

PASADENA, CAL.—City Engineer Smith is drawing plans for a motor-driven sewage pump to be installed at the corner of Grand Avenue and Columbia Street, Pasadena. Bids will be received soon for the pumping equipment.

PIEDMONT, CAL.—The board of trustees has secured estimates on the cost of installing a municipal lighting system with underground wires. The report showed that an underground system covering 11.5 miles of street, with arc lamps, will cost $44,000, with $20,000 for poles and wires. Tungsten lighting could be installed for $51,000, with poles and wires costing $22,500. E. C. Prather, city engineer.

PORTOLA, CAL.—A resolution was carried by the board of supervisors last week for a special appropriation of $5,000 to be used in illuminating the city during the festival next October.

SAN DIEGO, CAL.—The San Diego El. Ry. Co. is planning to extend the two large conduits which carry salt water to the condensers at its plant at the foot of Broadway, San Diego. About $100,000 will be expended.

SAN FRANCISCO, CAL.—The State Railroad Commission has rendered a decision granting permission to the Pacific Gas & El. Co. to issue $5,000,000 in bonds. The proceeds of the sale will be used in carrying to completion the work on its Bear River hydroelectric project.

SAN LUIS OBISPO, CAL.—The improvement of the Arroyo Grande plant of the San Luis Obispo Lt. & Pwr. Co. is to be started soon.

SANTA BARBARA, CAL.—The Santa Barbara & Suburban Ry. Co. has been granted a franchise to build and operate an electric line to the Normal School grounds on Mission Ridge, Santa Barbara. Work will be started immediately.

STRATHMORE, CAL.—A 60,000-volt transmission line will be built from the Tule River power plant of the San Joaquin Lt. & Pwr. Co. to this place, and from here to Famosa, where a new substation has just been erected.

SUTTER CREEK, CAL.—Sealed bids will be received up to July 21 for an electric-lighting system for Sutter, in accordance with plans and specifications on file with the clerk, Minnie Provis.

WHITTIER, CAL.—A. R. Rideout, who is building up a 1000-acre estate on the extreme western end of Puente Hills, will install a large lighting plant on his property and arrange for an ornamental street-lighting system.

PARMA, IDAHO.—A cluster lighting system will be installed on the principal streets in the early future. Address city clerk.

PARK CITY, UTAH.—A franchise for an electric-light plant has been asked for by L. A. Jeffs.

## Canada

HAMILTON, ... [illegible] ... power solely for the electric pumps.

HAMILTON, ... [illegible] ... power that a ... power solely for the electric pumps.

## Miscellaneous

... [illegible] ... transmitted to the Bureau of Foreign and Domestic Commerce, Washington, D. C., specifications covering proposals for two duplicate centrifugal electrically driven pumps to handle surface drainage water, each pump to ... minute, with net head varying from 6 ft. to 14 ft. with the tide. Direct current (510 volts) is to be used. Controlling switchboards and accessories for complete units are to be included.

BELGRADE, SERVIA.—Tenders are invited by the Directorate of the Servian Telephones, Belgrade, Servia, for supplying telephone apparatus and instruments, including 225 common-battery wall telephones, 200 common-battery portable telephones and 200 table telephones. Address Direction des Telephones Serbe, Belgrade, from which further particulars may be obtained. Local representation is necessary.

## New Incorporations

SANTA ROSA, CAL.—The Griffith El. Co., of Berkeley, has been incorporated with a capital stock of $10,000 by D. T. Griffith, Thomas ... and M. Griffith.

GOLDSBORO, N. C.—The Falling Creek Tel. Co. has been chartered to construct, maintain and operate telephone and telegraph lines. Authorized capital, $10,000. Incorporators: J. B. Kennedy, G. E. Grantham, W. E. Blackman and E. A. Stevens, of Goldsboro, and R. A. Whitfield, Route 2, Princeton, N. C.

RICHMOND, VA.—The Imperial Power Corpn., incorporated with a maximum capital of $15,100,000 and a minimum of $1,000, has been granted a charter. G. W. Phillips, Jr., New York, treasurer. Other incorporators: T. B. Gay, H. H. Chalkley and Ernest Flippen, all of Richmond.

SPOKANE, WASH.—The Marshall Lake Pwr. Co. has been incorporated with a capital stock of $60,000 by W. H. Wright, Madison Street, Spokane, president, and N. E. Lindsay, of the Empire State Building, Spokane. The company has been organized for the development of a power project at Marshall Lake, Wash., near the Idaho line.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JULY 1, 1913

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,065,927. CONTROLLER REGULATOR; C. P. Ebersole, Philadelphia, Pa. App. filed Dec. 30, 1911. To prevent too rapid admission or cutting off of current to the motor.

1,065,940. ELECTRICAL PROTECTIVE DEVICE; J. O. Holton, Springfield, Mo. App. filed July 30, 1912. Fresh fuses automatically placed in circuit.

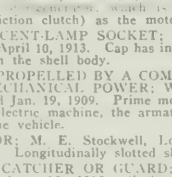
1,065,959. STARTING AND LIGHTING APPARATUS FOR MOTOR VEHICLES; M. Moskowitz, Montclair, N. J. App. filed Dec. 18, ... [illegible] ... shaft gradually (friction clutch) as the motor speeds up.

1,065,967. INCANDESCENT-LAMP SOCKET; F. Reutter, Waterbury, Conn. App. filed April 10, 1913. Cap has integral folded projections engaging in slots in the shell body.

1,065,982. VEHICLE PROPELLED BY A COMBINATION OF ELECTRICAL AND MECHANICAL POWER; W. N. Stewart, London, England. App. filed Jan. 19, 1909. Prime mover drives the rotatable field of a dynamo-electric machine, the armature of which is geared to the wheels of the vehicle.

1,065,983. INSULATOR; M. E. Stockwell, Los Angeles, Cal. App. filed May 31, 1910. Longitudinally slotted sheet-metal insulator pin.

1,066,008. TROLLEY CATCHER OR GUARD; A. W. Hart, Glencoe, Ohio. App. filed Aug. 26, 1912. Spring-pressed wire-embracing jaws pivoted on trolley pole in rear of the trolley wheel.



... [illegible] ... Instruments

1,066,016. AUTOMATICALLY DISPLAYED SYNCHRONIZER INDICATOR FOR CLOCKS; E. A. Hummel, St. Paul, Minn. App. filed Aug. 10, 1911. To indicate visually whether the clock was actually synchronized at the proper time.

1,066,051. ELECTRICAL SWITCHING APPARATUS; J. C. Rinker, New York, N. Y. App. filed Nov. 1, 1910. Ball bearings to hold the movable contact in any desired position; dust-proof and moisture-proof switch cover.

1,066,065. METHOD OF PRODUCING SO-CALLED OZONIZED AIR; J. Todd, Sewickley, Pa. App. filed Dec. 14, 1910. Reduces the amount of air passing to the ozonizer as the temperature rises.

1,066,081. RAILWAY SIGNAL RELAY; C. W. Coleman (deceased), Westfield, N. J. App. filed Sept. 2, 1908. Responsive only to periodic currents.

1,066,084. ELECTRIC MEASURING INSTRUMENT; W. W. Crawford, New York, N. Y. App. filed Feb. 8, 1909. Integrating wattmeter free from stray field effects.

1,066,147. ELECTROMECHANICAL TELEGRAPH SYSTEM; W. K. Queen and T. F. Pickett, Needham Heights, Mass. App. filed June 17, 1910. For signaling from pilothouse to engine room; engine-controlled return signal.

1,066,148. PRINTING TELEGRAPH SYSTEM; F. B. Rae, Glen Ridge, ... [illegible] ...

1,066,159. ELECTRICAL DEVICE FOR TRANSMITTING TO A DISTANCE CONTINUOUS OR INTERMITTENT ANGULAR MOVEMENTS; E. Spalazzi, Naples, Italy. App. filed Sept. 17, 1910. Uses a repeating motor.

1,066,175. DYNAMO-ELECTRIC MACHINE; J. C. Barry, Lynn, Mass. App. filed Oct. 13, 1911. Water-cooled brush support.

1,066,183. CARBON FOR ELECTRIC-ARC LAMPS; H. Caird, Chicago, Ill. App. filed Aug. 29, 1911. Double-coiled wire incased in longitudinal passage in the carbon.

1,066,209. TURBINE GENERATOR; F. Ljungstrom, Liljeholmen, Sweden. App. filed April 10, 1912. Turbine-generator casing supported yieldingly so as not to be affected by unequal expansion.

1,066,215. ELECTRIC BOX; M. Murray, Chicago, Ill. App. filed May 31, 1910. Sectional built-up box with tongue and groove connections.

1,066,216. METER-TESTING CUT-OUT; T. E. Murray, New York, N. Y. App. filed June 12, 1912. Gang plug construction.

1,066,272. CHEMICAL REACTION BY MEANS OF AN ELECTRIC ARC; J. L. R. Hayden, Schenectady, N. Y. App. filed May 8, 1908. Passes gaseous mixture through low-voltage high-current arc, withdraws products in direction of the arc stream and cools resulting compound.

1,066,290. JOINT; C. A. Kraus, Newton Highlands, Mass. App. filed Sept. 8, 1910. Gas-tight seal for electrode lead in vacuum apparatus, etc., composed of tubular members with intermediate vitreous material.

1,066,293. ALTERNATING-CURRENT ELECTROMAGNET; D. L. Lindquist, Yonkers, N. Y. App. filed Feb. 6, 1913. Has primary coil and a secondary conductor carried between the laminations of the core.

1,066,294. ALTERNATING-CURRENT ELECTROMAGNET; D. L. Lindquist, Yonkers, N. Y. App. filed Feb. 6, 1913. Primary coil, fixed secondary conductor disposed within said coil, and a movable laminated core having its polar end recessed to receive the secondary.

1,066,326. ELECTRIC INCANDESCENT LAMP; E. G. Royer, Paris, France. App. filed Feb. 4, 1911. Standard with annular supports and filaments extending vertically between the supports and transversely across the central plane of the standard.

1,066,329. CONDUIT FITTING FOR ELECTRICAL CONDUITS; G. H. Schwendler, Kansas City, Mo. App. filed Aug. 5, 1912. T-fitting provided with an interior curved guiding partition.

1,066,380. ELECTRIC SIGNAL SYSTEM; A. H. Caven, Youngwood, Pa. App. filed Nov. 28, 1911. Trolley pole carries a "sub-trolley" which establishes certain signal circuits.

1,066,385. TROLLEY ATTACHMENT; B. F. Dewees, Logan, W. Va. App. filed Jan. 4, 1911. Pivoted arms are deflected by a cross-wire to raise a pair of guiding fingers in advance of the trolley wheel.

1,066,388. SANITARY TELEPHONE ATTACHMENT; G. W. Downs, New York, N. Y. App. filed Oct. 31, 1912. Flexible sheet looped to hang over the telephone mouthpiece.

1,066,395. INSULATOR; O. J. Fisher, Walpole, Mass. App. filed April 30, 1912. For suspending a conductor from a tree.

1,066,410. ATTACHMENT FOR TELEGRAPH INSTRUMENTS; R. A. Grout, Davenport, Ia. App. filed Sept. 10, 1912. Diaphragm and amplifying horn adapted to be attached to a telegraph sounder.

1,066,429. ELECTRIC HIGH AND LOW ALARM FOR WATER COLUMNS; J. E. Gustin, Fort Dodge, Ia. App. filed Sept. 28, 1911. Separate floats for giving the high and low water alarms.

1,066,432. CONTROL FOR ELECTRIC-LIGHTING SYSTEMS; C. F. Kettering, Dayton, Ohio. App. filed Aug. 10, 1911. For temporarily cutting out the searchlamps and cutting in the side lamps of an automobile, for use when approaching pedestrians, etc.

13,589 (reissue). GROUND-JOINT CONNECTION FOR ELECTRIC CONDUCTORS; J. C. Vogel, Philadelphia, Pa. App. filed April 24 1912. (Original patent No. 907,543, dated Dec. 22, 1908.) Comprises ... [illegible] ... sible body member to which the opposite ends of a flexible metallic band are connected so that as body is compressed the band will be tightened about the pipe, etc.

# Electrical World

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**Co-operation with the Isolated Plant**

That the isolated plant can and should become the central station's most valuable off-season customer is no longer an untried theory. Progressive central-station managers know from experience that during the summer months when the lighting load on their systems is at its minimum, and when isolated plants operate at a disadvantage by reason of the absence of their steam-heating demand as well as the high cost of labor per kilowatt-hour generated, little difficulty is encountered in obtaining the isolated-plant load on a paying basis. Just why more isolated-plant owners and central-station managers do not enter into the above-mentioned co-operative scheme is not apparent, unless, perhaps, some central-station managers may hold the unenlightened selfish view that they would be giving valuable aid to competitors. The fact of the matter is that with the approach of the winter lighting peak the central station will have little to regret when relieved of the isolated-plant load, which would then be somewhat of a burden rather than wholly a benefit. During the summer months progressive central-station managers can help themselves by giving welcomed aid to isolated-plant owners without regard to any possibility of continuing the service throughout the winter.

**Pennsylvania Utilities Law**

The public utilities act very recently passed by the Pennsylvania Legislature and likely at any moment to be signed by Gov. Tener is unusually comprehensive in its phraseology, occupying about 100 pages and containing some 20,000 words. The control given the commission over municipal utilities is limited and relates to accounting and reports, to certificates of public convenience and necessity in the case of new municipal utilities, and to approval of contracts between public service companies and municipalities. In this respect the new law, although not ideal, at least protects the companies already serving the public from needless or wasteful competition and duplication of investment, which is more than can be said of the new Illinois law. On the other hand it leaves the public at the entire mercy of municipal authorities as regards the rates, regulations and service of such municipal utilities as now may be operating or in the future may be created. Nor does the law protect those companies now competing with municipal plants from the harmful and unfair competition of municipal rates so low as to be unremunerative, or from lower rates which are remunerative to the city only because the service rendered to the public is inferior. In common with some other recent laws of this kind the Pennsylvania act empowers public service companies: "To establish with the consent of the commission a scale of charges subject to automatic adjustment in relation to the dividends to be paid to the stockholders." This recognizes the plea advanced that capital will not be attracted to public utility investments by a return say, of 7 per cent, indefinitely, but demands a further increment of profit as a reward for progressive management and for introducing new economies as soon as the advances of the arts bring them forward. That is to say, capital asks the public to share with it the savings resulting from improved economy, as an incentive toward such economy. This brings up, of course, a proposition which is debatable from the standpoint of public policy. The real question is whether a public utility owes it to the public to give the most progressive and economical management obtainable, in return for a dividend of 7 or 8 per cent, for example, or whether it owes something less and may fairly ask for a further profit as a premium on maximum efficiency. So many variables enter this problem that space prevents elaboration of it here. Public opinion may be counted upon to decide the question ultimately, but in the meantime great interest attaches itself to the courses to be adopted by commissions. The Pennsylvania law is noteworthy in respect to the very strong control given the commission over railroad crossings, at grade, or above or below, and to the crossings of pole or transmission lines of every character, either at railroads or with reference to each other. Economy in state expenditure is promoted by abolishing the railroad commission, but the new commission is an unusually large body, comprising seven members. However, within the state there is much railroad property, including important trunk lines, besides numerous street and interurban railroads, pipe lines and a great number of public utility companies of diverse kinds.

**Utilization of Electrolytic Iron**

Many of the advantages attending the use of electrolytic iron as the active magnetic material for electrical machinery were set forth in a paper by Dr. Max Breslauer in a recent issue of the *Elektrotechnische Zeitschrift*, as noted elsewhere in our Digest. Chemically considered the characteristic feature of electrolytic iron is its freedom from carbon. Magnetically it possesses higher permeability and lower hysteresis loss than do the so-called alloy steel sheets used in transformer and dynamo-electric machinery. It is noteworthy in this connection that pure electrolytic iron is not a new product. It was produced on a relatively large scale by Prof. C. F. Burgess, of the University of Wisconsin, about ten years ago. Moreover, Professor Burgess is to be credited with extensive investigations of the properties of alloys of electrolytic iron and other metals.

## The Unqualified Commissioner

A capital illustration is furnished regarding the need of a public service commissioner brings to light adequate reasons for condemning the recent appointment to the New York Commission by Governor Sulzer of a man who has been a locomotive engineer for the past twenty years. Certainly no one can object to the appointment merely because the man is a locomotive engineer. It is a serious question, however, if one who has been doing little else than running an engine back and forth in a limited territory for anything like a period of twenty years can possibly have had a sufficient variety of experience to make a good commissioner. His moral qualifications may be of the best, his mentality may be of a high order, and, as a citizen, he may be everything that could be asked. These would make him merely fit to be a commissioner; they would not prepare him for the work.

The activities of a public service commissioner are very extensive and of great variety. He is not a judge controlled by technical rules of evidence, but must conduct hearings at which important evidence is often recorded; much harm may be done, or time wasted if he is unable to determine what is incompetent, immaterial and irrelevant. He is called upon to decide as to the reasonableness of demands made by the public, or of requirements insisted upon by corporations, and a broad general knowledge of affairs coupled with ripe judgment will be required to derive proper conclusions. Decisions of the public service commission involve questions of law, engineering, and business. No commissioner can be sufficiently informed in these divisions of the world's activity to enable him to be independent of other commissioners. He is dependent partly upon the opinions of subordinates, partly upon the statements of interested parties before him, and partly upon the opinions of his fellow commissioners, often very conflicting, or at least confusing. Again the value of his decision, not only as to the material submitted, but also as to the men submitting it, will depend largely upon the breadth of his experience.

We cannot assert that the appointee from a locomotive cab has not all the above qualifications, but we do submit that, as a rule, he could not be expected to have them. The very narrow groove in which he has worked so long has provided no opportunity for him to cultivate them. There are many lawyers, engineers, and business men who, on account of a narrow experience, we should consider just as unavailable as the present appointee. Nevertheless, as a rule, men of the last mentioned class have opportunities to view affairs at many angles and, therefore, can be expected to have the needed qualifications.

A practical railroad man was specified in the political platform, but it must be assumed that a practical man, in the general sense, was meant. If the appointee had started as a locomotive engineer, or even much lower, and had progressed through various departments, so that he could be expected to have some grasp of general railroad business, and especially of the intricate relations existing between a public service corporation and the public, we should be hopeful, in the highest degree, of his appointment. No matter what his standing as a man and as a citizen may be, we regard it as most unwise to permit him, or anyone else of his limited experience, to have a part in wielding the great power given by the public service commission law of New York State.

## A Vertical Trunk Line

In another column Mr. Charles E. Knox gives a most instructive account of the special problems encountered in providing the gigantic Woolworth Building with adequate elevator service. A modern office building is a metropolis quite by itself, and its efficiency as a place of doing business depends in no inconsiderable degree on the character of the elevator service. The Woolworth Building is not only of very exceptional size as regards office capacity, but its tower, the highest building in the world, involves difficulties all its own. As in the case of the suburban service of a great city, express trains to the further districts are necessary, and the whole transportation traffic must be managed with special regard to the convenience of the population.

From a mere mechanical standpoint the elevators in the Woolworth Building are rather in a class by themselves. In the first place their number, twenty-six, is unusually great, and their service, from the enormous height of the central tower, is altogether peculiar. They are of the electric type with the motor armature connected directly to the driving sheave. On the armature shaft is mounted a large brake pulley with a pair of brake shoes forced against it by powerful springs except when current to the motor energizes the brake magnets and releases the shoes. If anything happens to the motor, therefore, the brakes take hold automatically and stop the car. The drive is thus very simple and the actual moving force is supplied by two half-turns of the running rope between counterweight and car over the driving sheave by way of an idler sheave placed beneath it. This particular arrangement is especially safe against over travel of the car or the counterweight. The speed of the elevators in this building is 700 ft. per minute, the highest speed yet regularly used on passenger elevators, although curiously enough the top speed of the motor is only about 68 r.p.m., as extraordinary for an electric motor as is the rising speed for an elevator. The safety devices applied are most ingenious and effective.

The most interesting and novel feature of the whole equipment is the train-dispatching system. In ordinary elevator service a starter on the ground floor uses his judgment and tries to keep the equipment going to the best advantage, but inasmuch as he loses touch with the elevator when once it is on its way, the control, while good enough for a low building, is not sufficiently effective for dealing with the modern skyscraper, much less with the extremely high Woolworth Building. In this building the operation of the car is placed in the hands of a dispatcher with an office on the second floor overlooking the group of elevators. Each elevator is connected to a lamp indicator with a lamp for each floor lighted as the car passes that floor. Consequently a glance at the lamp indicator gives the dispatcher an im-

ate view of the position of each car of the entire em. He also knows when, where, and for how long, car stops. In case the schedule is violated a signal be immediately sent to the operator to omit stops at in floors. A set of switches enable the dispatcher to out or transfer the floor signals for any car so that if car gets behind its schedule it will not be signaled it has caught up, the floor signals being transferred nother car. In each car there is a telephone with a phone so that the dispatcher can deliver orders di- y to the operator and keep the system properly ng. These are only some of the many details of this ie train-dispatching system. By its use the dispatcher keep in closer touch with the operator than a train dis- ier can with the engineers on a suburban system. The t must be a great improvement in the orderly and tive carrying of passengers, which is indispensable in ll-served building.

## The Standardization of Head-Lamps

brief paper by Messrs. L. C. Porter and K. M. Mackall gs to the front the question of electrical head-lamps on notives, now of unusual importance on account of ation regarding the subject. Eight states have in laws regarding the head-lamps which shall be used n their territory, and bills are pending in several states. The whole question seems somewhat un- d on account of very grave doubts as to whether on whole electric head-lamps of great power are really ntageous. This question is one often discussed re- ing the head-lamps for automobiles and street cars. e is no doubt that for service on a perfectly clear and on a straight track use can be made of a lamp rful enough to illuminate distant objects on the track re they come within the dangerous space of the train. y moving vehicle may be conceived as carrying ahead a danger stretch equal to the distance required to a full stop. That dangerous space depends on the l and weight of the train and on the available brake r, but it is in nearly all cases much longer than would arily be supposed. Some recent accidents may very y be traced to the fact that the danger distance for a ern fast and heavy train is considerably longer than for which the signals actually in use are adopted. A -range signal lamp is of small avail on a curve unless beam is so wide that its radius will fully take up the nce between the tangent at the head-lamp and the measured at the extreme length of the danger dis- e. There is also chance of obliterating the light from present signal lamps which are of low power, by the e of the head-lamps. However this may be, the ques- is not one to be decided offhand; it is perfectly certain a mere specification of the candle-power of the bare ce used in the head-lamp such as appears in some of statutes is perfectly useless.

their article in this issue Messrs. Porter and Mackall est, very properly, that the average beam candle-power specific distance over a specific angle be made the rion of the effectiveness of the light. This is more to the point, but we are inclined to think that the further suggestion that the distance should be not less than 500 ft. and the spread 2.0 deg. is not altogether happy. What one really wants to know about the head-lamp is what the illumination produced is over the necessary area at a distance approximating the danger distance of the train. In other words, the problem is to supply enough light at a point beyond the danger distance to render objects on the track visible. The spread of the beam must be great enough at this distance to allow for curvature of the track, otherwise the beam will not fall upon the track until a point has been reached perhaps far within the danger distance. The matter needs standardization and ought to be taken up by some distinctively railway body. Specifications drawn up by petty-fogging legislators are of very little use in solving technical problems.

## Peace and Publicity

On the other side of the Canadian boundary there is in operation a simple and effective plan for bringing about settlements of labor disputes. When a controversy arises between employers and employed both are required to make a public statement of all the facts in the case. The interval gives time for angry spirits to subside and for the contestants to consider soberly whether the issues at stake are worth fighting for or not and to arrange a basis of agreement if such is possible. Meanwhile the public has an opportunity to review the facts and pass upon the merits of the case. This public inspection alone is likely to bring about a compromise, because neither side will wish to enter or continue a contest without public approval. So significant is this principle of full publicity in bringing about adjustment of controversies that Mr. Bryan, the Secretary of State, now even proposes to apply it on a world-scale by writing into our treaties with foreign nations the agreement that before any civilized warfare can be declared, a period of international investigation and conferences must first elapse.

In the distinguished examples just cited the various branches of the electrical industry should find a lesson for the settlement of their own disagreements. When due to trade disagreements, contractors, dealers and central station are engaged in a controversy of obstruction and attack, the most direct method of clearing up the situation is to have an honest statement prepared setting forth the claims of both sides. If such a review can be prepared by an outside, unbiased student of local conditions, and is of such a character when finished that it has the approval and respect of both sides as an honest statement of facts, surely a long step will have been taken toward settlement of the local misunderstanding. With the situation thus crystallized and held up to the view of the contestants and their friends in the industry and public, both sides will likely see where they have erred and will gain for the first time a conception of the other fellow's claims to justice. Most disputes have their birth in misunderstanding by each side of the facts as viewed by the other. Knowledge of the other side's viewpoint practically always means death to the controversy.

# The News of the Week

**Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.**

## High-Efficiency Incandescent Lamp

As a result of investigations made in the research laboratory of the General Electric Company at Schenectady, N. Y., for the past few years there has been produced a metallic-filament lamp which operates at the low specific consumption of 0.5 watt per candle—the efficiency being about twice that of the best incandescent lamps heretofore available. The new lamp contains a specially shaped tungsten filament and is filled with an inert gas, such as nitrogen, at a pressure of about an atmosphere. The types which it is expected to develop first are adapted to comparatively high current consumption, 6 amp. and above. The new lamps promise to be of particular value in a field not heretofore covered by incandescent lamps, and should greatly broaden the applications in which they can be used advantageously, particularly in the direction of very large candle-power units.

## I. E. S. Survey of Lighting Conditions

As president of the Illuminating Engineering Society, Mr. Preston S. Millar is submitting to the numerous industries in the lighting field a series of questions in order to obtain information regarding lighting practice as well as to making available comprehensive and accurate data to constitute a record of the status of the illuminating art in 1913. The questions asked occupy sixteen sheets and cover the practices of central stations, store keepers, sign makers, gas companies, manufacturers of lighting auxiliaries, school authorities, ophthalmologists and railway companies. The data compiled will be incorporated in a paper to be presented before the Illuminating Engineering Society and distributed to all those co-operating in its compilation.

## Research Bureau Established at Boston "Tech"

A division of electrical engineering research has been established at the Massachusetts Institute of Technology, following a grant of $10,000 per year for five years from the American Telephone & Telegraph Company. This award came through the initiative of President Vail, of the latter organization, who presented the Institute about a year ago with the Dering electrical library of more than 30,000 titles. Taking into account the value of the library itself, there are now available for electrical work gifts and pledges of more than $200,000. The laboratory of the division is already in commission under the direction of Dr. Harold Pender, who has been named as director of the bureau, Mr. H. F. Thomson being secretary and assistant to the former. The staff will be developed as becomes necessary, and an advisory committee has been named by the Institute, consisting of Prof. Dugald C. Jackson, head of the department of electrical engineering, and Professors F. A. Laws, R. R. Lawrence and W. E. Wickenden.

Among the problems which are to be undertaken this summer are a study of the clearness of speech in the telephone, investigating the phase relations of harmonics in sound waves, a study of skin effect in alternating-current transmission, and a determination of the distance to which a street-car passenger can be carried with reasonable profit on a 5-cent fare. The work of the bureau is in no sense contemplated as an outlet for the surplus energy of students, but it will conduct researches along liberal lines and in fields of industrial importance. In large measure the development of the organization is an outgrowth of the successful researches carried on in the past two years in the field of motor-vehicle transportation by the electrical engineering department.

## Winnipeg's Municipal Plant Shows $53,025 Deficit

The report for the first fiscal year of the Winnipeg municipal plant, ending April 30, 1913, has been filed with the local utilities commission and shows a deficit of $53,024.88 for the twelve months. It is pointed out, however, that the plant commenced actual earning only last September and that other delays occurred in connecting up offered business. The total operating earnings of the power department for the fiscal year amounted to $475,509.57 Total charges in the same year, including interest on stock and debentures, sinking fund and an allowance of $52,862 for depreciation, amount to $529,442.60. The revenue deficit for the year is therefore $53,024.88.

## Permit for Pacific Hydroelectric System

On July 16, Secretary Houston, of the Department o Agriculture, issued a permit to the Pacific Light & Powe Corporation, Los Angeles, Cal., to construct and operat a series of power plants in the Sierra National Forest The company plans to build four power houses, two reser voirs, and 25 miles of cement-lined tunnels. On account o the magnitude of the construction work and the amount o power to be disposed of, the permit provides for a construc tion extending over a period of twelve years. Under temporary permit the company has already nearly complete the first step of this development, known as the "Bi Creek Project," the work of construction being done by th Stone & Webster Engineering Corporation.

The ultimate development proposed is about 150,000 hp The greater part of the energy will be transmitted 240 mile into Los Angeles and vicinity and will probably be used i large part on further extensions of interurban railway sy tems. It is also expected that considerable quantities o energy will be utilized in pumping water for irrigation in th upper San Joaquin Valley. The energy will be transmitte over a double-steel-tower line strung with stranded alum num cables operated at a pressure of 150,000 volts.

This development of the Pacific Light & Power Corpor tion is one of several under way or projected upon nation forest lands in California. Among these are the projec of the Great Western Power Company on the north fo of the Feather River, where a reservoir of 43 sq. miles is be constructed and power plants with a total rating of abo 350,000 hp are to be built. The Southern California Edis Company is planning for the erection of four plants on t Kern River. The Pacific Gas & Electric Company is co structing on the South Yuba one of the highest mason dams in the world. The greatest water-power develo ment in the history of the state is now under way and m of the plants proposed or being constructed will occu national forest lands under permit from the Secretary Agriculture.

## hio Electric Light Association at Cedar Point

*(By Telegraph)*

Cedar Point, Ohio, on Lake Erie, served both as con-ntion headquarters and as a summer resort for the dele-ates who attended the nineteenth annual meeting of the hio Electric Light Association held at the Breakers Hotel, ly 15, 16, 17 and 18.

The first session was called to order Tuesday morning by r. J. C. Martin, of Wilmington, president of the associa-on. In the absence of Vice-president J. D. Lyon, Cincin-ti, who has assumed other duties, Mr. W. C. Anderson, Canton, a past-president, occupied the chair while Mr. artin delivered his presidential address.

### President Martin's Address

Mr. Martin spoke of the growth of the association, saying at at present its enrollment includes 102 active and 90 ssociate members, representing 65 per cent of the privately vned plants in Ohio. Among the many plants which suf-red from the floods recently, Dayton was probably the ost seriously affected, yet by the generous aid received om the New York and Chicago companies its central sta-ons were in operation furnishing energy within forty-ght hours after the water had receded. As a plan for ture flood protection, President Martin spoke of the proj-t of establishing large reservoirs near the headwaters the rivers of the State, thus holding the water in check ring rainy seasons and furnishing an opportunity for drodelectric development during dry seasons.

Calling attention to the various matters brought to the nsideration of the advisory committee during the last ssion of the Legislature, the president spoke of the work ne in causing a redraft of the Mills bill governing public ilities. The committee's labors did not cease here, but fficient opposition was instigated by its efforts so that the cts relating to the creation of local commissions, pre-enting the defense of contributory negligence, and cover-g workmen's compensation were all considerably modified

As the Ohio companies will soon meet the proposition of physical valuation of all properties in the state, Mr. Mar-n said that the advisory committee could be of consider-ble benefit to the members if sufficiently advised by the ngineering departments of the larger engineering com-anies. In future decisions affecting the public utilities, e authority will probably rest in the public-service com-ission so that mutual aid should be furnished by the com-anies in getting fundamental questions properly decided. or this reason legal matters should be regarded as asso-ation problems rather than as merely local matters.

With these purposes in view, Mr. Martin said that it is ow proposed that a monthly bulletin be published by the ssociation. During ten months of the year questions of ital importance to the members would be published, and uring the remaining two months information regarding ates and street-lighting contracts would be printed.

Mr. Martin also suggested that a legal body be appointed y the association to discuss matters jointly with the public-ervice commission. This body should receive advice from nd co-operate with the public-utility corporations in the tate.

### Discussion and Business Topics

In closing President Martin spoke in commendatory erms of the services rendered by the secretary-treasurer, Mr. D. L. Gaskill, Greenville, Ohio, and by the various com-nittees. Desiring that his address should express the senti-nent of the association he then called for a discussion.

Among those who spoke were: Messrs. W. Parsons, of Springfield; D. L. Gaskill, of Greenville; C. I. Crippen, of Youngstown; L. Beecher, of Hillsboro; W. C. Anderson, of Canton; J. E. Miller, of Cleveland, and Samuel Scovil, of Cleveland.

Mr. Gaskill moved that a committee of five be appointed o devise the best plan to handle legal affairs with the public-service commission and to report at the 1914 convention. Messrs. Crippen and Beecher raised the argument that the report should be made sooner. Mr. Martin then suggested that the executive committee prepare a report on the subject and be ready to submit it before the next convention, provided conditions require it. Revaluation of property appeals should have prompt attention. Mr. Miller amended the motion so as to place the duty on the executive committee, as proposed, and the amended motion was carried.

Following this discussion, the secretary-treasurer, Mr. Gaskill, presented his report, in which he gave the revenues and disbursements for the year. As the active membership dues have never been changed since 1895, although the benefits to be derived from the association have increased considerably since then, Mr. Gaskill proposed a revision in the dues to provide for increased expenses. At present the dues vary from $5 to $10 yearly, according to the size of the town represented. The proposed schedule provides for a range from $5 to $50 per year, assessed as before. The matter was referred to the finance committee.

The executive committee recommended the institution of a monthly bulletin to contain decisions on public utility questions, lighting rates and similar subjects. Action on this matter was deferred until a later session. The committee also recommended that companies operating in several cities or towns should have active members in each. In addition, it was suggested that men in the electrical engineering profession or in the position of instructors in the science should be eligible to membership.

### Report of Insurance Committee

The insurance committee next submitted a very comprehensive report, describing how its members had met with the Ohio Inspectors' Bureau and complained that fire-insurance rates were too high. The answer received was that any change would have to originate in the National Board of Fire Underwriters. In a subsequent investigation it was found that of sixty-five companies in Ohio, twenty-seven carried no insurance, and thirty-eight carried $2,373,250 insurance, on which they paid $23,382 in premiums annually. The total losses for these companies in five years aggregated $672, an amount barely one-half of one per cent of the premiums paid during that time. These figures show that central stations are very good risks.

At a meeting in Cincinnati, June 13, the committee suggested that the State of Ohio appoint an insurance commission which should review and correct rates by insurance companies on complaint or on its own initiative. Investigation also showed that inter-insurance with exchange of risk was a very satisfactory form.

In discussing the report Mr. Martin said that Ohio has three rating bureaus, one in each of the cities of Cleveland, Cincinnati and Columbus. One of these bureaus, it is asserted, is paid $70,000 annually for up-keep by the insurance companies, with the stipulation that a certain rate is to be maintained and that all insurance companies in the state are to abide by it. When attacked for high rates, the insurance companies refer the plaintiff to the rating bureau, saying that it sets the rates and they cannot be varied from.

Mr. M. E. Turner, Cleveland, reported that the committee on N. E. L. A. affiliation, of which he is a member, feels that the association is not yet ready to merge with the National Electric Light Association. The report was adopted.

In the evening a musicale and ball were held in the hotel lobby. During the intermission Mr. M. E. Turner, Cleveland, gave an address and demonstration of "Cooking by Unity-Load-Factor Electric Ranges," which was attended by a large audience of members and their wives.

On Wednesday morning at 10 o'clock the commercial session was opened with Mr. W. C. Anderson in the chair, the papers being presented in abstract by their authors.

In his paper entitled "The Retention of Business of Dissatisfied Customers," Mr. Thomas E. Kelley, sales manager for the Dayton Power & Light Company, urged above all else prompt and courteous attention to customers' grievances in order to prevent possible dissatisfaction. Especially should courtesy be insisted on from those employees who come in contact with the public. Where a complaint has been filed and the meter found correct, the case may be well turned over to some competent person to study the customer's conditions and determine whether changes cannot be made to reduce energy costs, thus transforming a dissatisfied complainant into a satisfied customer. A personal conversation is always preferable in explaining to the customer the inspector's finding. Poor lighting and delay in furnishing service are two other great sources of dissatisfaction. If the central-station man will only take the customer's viewpoint, the applicant will be very sure to receive more prompt attention. One cause of delay is the practice of requiring contracts and deposits in advance of supplying service. Such policies, declared Mr. Kelley, result in discomfiture of the customer and lost revenue for the company.

*Discussion*

Mr. Martin opened the discussion by saying that "Old business should be the best booster for new business."

Those who followed him in the discussion were Messrs. W. Parsons, of Springfield; C. C. Welch, of Columbus; W. C. Anderson, of Canton; S. M. Rust, of Greenville; J. M. Anderson, of Greenville; F. M. Tait, of Dayton; J. E. North, of Springfield; J. C. Martin, of Wilmington; Samuel Scovil, of Cleveland, and E. A. Bechstein, of Sandusky.

Mr. Parsons did not agree with Mr. Kelley in the matter of taking telephone messages as applications for service. In Springfield, he said, they have devised a system whereby a customer can be connected up twenty-four hours after application. He believes that credit is the mainstay of public utilities. Mr. Welch indorsed this opinion, saying that the credit of the applicant can best be judged by the solicitor, and other means should be devised to replace telephone applications, as they mean a distinct loss to business.

Mr. W. C. Anderson recommended that applications be taken by telephone, but that immediately thereafter a solicitor be sent to secure the application in writing so that no delay may result from lack of information on the status of the applicant.

Mr. Rust said that above all things favors should not be shown, as more will be offended by such practice than by a fixed rule requiring a guarantee or report with each application.

Mr. Parsons favored extending credit to those who have been in good standing in the past, in preference to any system requiring guarantees or deposits. He said that only about one-tenth of one per cent has to be charged off the books due to bad credits.

Mr. Martin recommended the system suggested at the N. E. L. A. convention in Chicago, whereby cities are divided into districts, each having a supervisor to look after the status of applicants. With such information and by not allowing back accounts to exceed the monthly bill the percentage of loss would be small.

Mr. Bechstein said that he believed in fixed rules and favored the payment of deposits with each application, interest on which can be paid at the rate of 6 per cent.

## New Business

Mr. J. E. North's paper described particularly the practices and policies obtaining in his own department at Springfield, Ohio, where commercial development is furthered through the three agencies of solicitation, advertising, and association of satisfied customers. The selection of competent salesmen has been a problem, but the best plan has seemed to be that of taking men with the requisite selling ability and teaching them the technical requirements of central-station work. Early in his commercial career the new solicitor must be impressed with the fact that people are more interested in saving dollars than in discussing kilowatt-hours or kilovolt-amperes. The customer's knowledge of electrical terms can well come later of his own natural curiosity after the contract is signed. Solicitors' reports should be made as brief as possible, to avoid burdening salesmen with office duties. Simple forms are used by the Springfield company for this purpose, but at the end of each week results are collected and totaled, ready for comparison. In authorizing extensions bona-fide applicants are assured by asking prospective customers to agree to pay $1.50 monthly for the interval between completion of the extension and their contract for service. An aggressive campaign for motor business in Springfield has netted good results. Several large jobs have been acquired as the result of prompt aid in gas-engine accidents. The cases of prospective motor-service users are recorded on special blank forms which make available a record of all essential facts in connection with future electrification. Every department of the company is required to co-operate in affording to customers prompt service and courteous attention. Mr. North advised adjustment of rates to meet competing conditions, depending upon quantity of business rather than return from high rates.

*Discussion*

In concluding the abstract of his paper Mr. North suggested appointing a committee on new business to compile data on industries having electrical applications in order that prospective customers might be taken to visit such installations.

In the discussion which followed Messrs. T. F. Kelley of Dayton, M. E. Turner of Cleveland, J. E. North of Springfield, E. A. Elliott of Mount Vernon, George Edgar of Coshocton, W. T. Edgenson, Jr., of Alliance, and Samuel Scovil of Cleveland took part.

Mr. Kelley favored holding morning meetings at which salesmen can discuss methods of securing new business. He also expressed belief that where forms are kept showing equipment of manufacturers on service lines it is advisable to record the customer's individual "hobby," since by consulting this record it would be an easy matter for the solicitor to obtain a hearing from the customer, opening the way with the customer's favorite subject.

Mr. Kelley made a motion, which was passed, that a committee be appointed to compile data on new business enterprises. Mr. Turner and others disagreed with him, however, concerning the idea of bringing up subjects foreign to business when soliciting applications for electricity.

Mr. Elliott heartily indorsed the point which Mr. Turner had disagreed with in Mr. Kelley's remarks, saying that while it might divert from business temporarily, a personal subject was harmful in gaining confidence.

## New Applications of Electricity

The paper by Prof. F. C. Caldwell, of Ohio State University, Columbus, described a number of lesser known uses of electricity, pointing out that the central-station man should welcome those which, even though involving small consumptions in themselves, contribute to the convenience of the customer, in this way adding to the attractiveness and indispensability of central-station service. In the field of electric cooking Professor Caldwell told of the development of improved stoves and ranges, application of thermostatic control, low-wattage fireless cookers, unity-load-factor ranges, etc. For the electric heating pad, the electrically heated garment, electric warming pan and other similar conveniences he predicted an increasing future usefulness. Electric sterilization of the household drinking supply is another new application. By using the hot, boiled water

rm the cold, raw water, one of these sterilizers treats ter at a cost of 1 cent per gallon, with energy at 10 cents r kw-hr. A new French sulphur-dioxide refrigerating chine produces refrigeration at a cost of 16 to 22 cents r 100 lb., with energy purchased at 6 cents per kw-hr. nong laundry uses may be mentioned the heating closet r drying clothes in which an electric fan supplies a blast air previously heated by electric or other means. Ozonrs are valuable in many ways, a new use suggested being connection with cold-storage plants where the preservae virtue of the ozone permits a higher temperature to be rried. In closing, the author urged either a reduction in ice of both appliances and energy, based on large-quantity oduction, or a redoubled educational campaign to bring out the greater use of electricity for other than lighting rposes.

*Discussion*

Mr. F. M. Tait, of Dayton, supported Mr. Martin in s statement that when electric service lines are installed e use of electricity for other purposes than for lighting ould be amplified. He described an artificial rainfall paratus which is used on one experimental farm near ayton, and also told of the work done in that vicinity in rtilizing a two-acre tract by electricity during the night nen there is not much demand on the central station. Dr. M. W. Franklin, Schenectady, N. Y., told of some teresting practical uses of ozone for purifying water, eaching cloth, sugar and flour, in cold storage warehouses, in breweries, and in destroying noxious organic ors.

As an extension of the subject treated by Professor aldwell, Mr. G. D. Smith, of Chicago, read a paper prered by Mr. H. W. Hillman, Long Island City, N. Y., titled "A Broad Principle Influencing Electric Truck ales." This paper commended the central station on the ork it has done in educating the public to the uses of ectricity and told of what has been accomplished in altimore and Hartford toward pushing electric commerial and pleasure vehicles.

On Thursday morning the report presented by the nomiating committee was accepted, the officers chosen for the suing year being: President, Mr. J. C. Martin, Wilmingn (re-elected); vice-president, Mr. C. V. Hard, Worcesr, and secretary-treasurer, Mr. D. L. Gaskill, Greenville. The concluding sessions of the convention will be reorted in the issue of next week.

## Thirteenth Convention of Missouri Electrical Contractors

In order that electrical contractors in Missouri who were ontemplating attending the convention of the National lectrical Contractors' Association in Chattanooga, July 15-8, might attend the State Section of that association and ravel in a body to Chattanooga, the convention of the Missouri Electrical Contractors' Association was held at t. Louis July 12. Visiting members en route to Chattanooga were met at the trains on the morning of July 12 nd entertained at a breakfast held at the Union Station Hotel, after which there was an executive meeting at the ity Club. This was followed by a luncheon at which bout fifty were present.

The remainder of the afternoon was occupied by a ball ame and by automobile rides around the city. As a final inding for the day dinner was served at the Sunset Country Club.

On Sunday similar entertainments were enjoyed and on Monday the delegates to the national convention left for Chattanooga, Messrs. E. S. Cowie, A. J. Burns, Charles Pierson of Kansas City, Mo., and F. B. Adam of St. Louis oing direct. Among those registered as going by way of Cincinnati were Messrs. C. J. Drees, Little Rock, Ark.; F. Bragg, Little Rock, Ark.; George Rush, Hot Springs, Ark.; G. G. Berkholder, Kansas City, Mo., and George Corrao, B. Koeneman, William Dennison, Charles J. Sutter, James Fenton and F. D. Phillips, all of St. Louis.

## Sociological and Industrial Aspects of Centralization of Energy Production

In a recent address at the University of Illinois Mr. Samuel Insull, of Chicago, spoke on the influence of engineering on modern civilization. In relation to the modern tendency toward unified operation of electric-service plants he said:

"The development of the business of the generation and distribution of electric energy will probably have within the next quarter of a century great influence on the development of our local communities, not alone the large cities but also the rural communities throughout our states, wherever there is any considerable density of population. Heretofore the business of producing and distributing energy on an economical basis has been confined very largely to our large cities, but the marvelous work of our engineers during the last two decades, the great changes that have taken place in connection with the development of the prime movers, the changes from the reciprocating engine to the steam turbine, the changes in the use of units of from 1000 hp to 5000 hp to units of from 20,000 hp to 40,000 hp, are producing changes in the cost of the energy which will lead to the centralization of production and distribution in the interests of economy. These changes, bringing about low cost to producer and low price to the consumer, must have a very great effect in the development of the industrial interests of such states as Illinois.

"It is to-day not only a possibility but an actuality that the same advantages that we enjoy in large communities can also be enjoyed by the farmer, by the rural community, by the people having large areas to drain; the same privileges of low cost of energy can be obtained for them as are obtained for the users of energy in the large centers of population.

"Suppose any very small community anywhere in the thickly populated territory of the Mississippi Valley is able to obtain energy for manufacturing purposes at low cost. Assuming that in those communities the manufacturer can obtain the necessary labor, it stands to reason that one of the great troubles of modern life will be solved by cheap energy. At the present time large manufacturing interests as a rule cluster around large centers of population. The reason for that is that power is relatively cheap where they have a large population to draw on for their labor.

"But as this State and other surrounding states become studded with manufacturing establishments the necessity which compels the workman to dwell in large centers of population, where living conditions are most unfavorable to him, will cease. He will be able to establish himself under conditions where he can get healthful environment for his family. Instead of living in a small, overheated, ill-ventilated tenement in the big city he will have the opportunity to establish himself practically amid the desirable conditions that those living in the country ordinarily enjoy.

"Surely if this can be accomplished, if the living conditions of our people can be improved, if their children can be brought up under circumstances which will give them the foundation of good health, which will give them the opportunity of association in our country schools with that portion of the population, the farming population, which is the very backbone of the country, it is reasonable to expect greater satisfaction on the part of the workmen with their conditions and better relationship, because of a closer community of interest with employers, and in general a better chance for the workman and his family."

## Pennsylvania Utilities Bill

The Legislature of [illegible] passed a public utilities bill which bears the title "The Public Service Company Law" and provides for the establishment of a public service commission, for the regulation of public utility companies, to a limited extent for the regulation of municipally owned utilities, for the regulation of railroad crossings, for the abolishment of the State Railroad Commission and for the repeal of any other inconsistent legislation.

### Powers of Public Service Companies

Every public service company may charge and collect reasonable tolls, rates, or fares; establish sliding scales after approval by the commission; adjust rates automatically in relation to dividends paid stockholders, upon approval of the commission; to participate as the commission may deem wise in the additional profits resulting from economies or improvements in service; to establish different classes of patrons or consumers upon any reasonable basis, such as nature of use, quantity used, time when demanded, bulk value, facility of handling, etc.; require payment of charges in advance under reasonable conditions; establish reasonable minimum payments, and require deposits to secure future payments; make cash discounts for prompt payment, or impose penalties for failure to pay promptly; to make complaint to the commission in like manner and with equal effect as any consumer or patron; and to pay to any patron or customer a reasonable sum for any service directly or indirectly rendered.

No public service company may be incorporated or created, obtain, exercise or renew its charter rights or privileges except after obtaining in due formal manner from the commission a certificate of public convenience and necessity; this applies as well to foreign public service companies and to consolidations or mergers within the state. It applies with equal force to municipalities desiring to acquire, construct or commence operating a public utility plant of the kind already operated by a company within the municipality, provided that this requirement shall not affect the right of a municipality to continue operating or to extend its plant when no private company is serving the same territory.

It shall be lawful for any company to issue securities only in the manner prescribed by statute, for money, labor done, or property actually received. Application to the commission may be made for a certificate of valuation to the effect that the provisions of law have been met. In the case of securities running for more than one year, every company shall file with the commission a certificate of notification, in the prescribed form, giving the total amount of issue, prior securities outstanding, details of the new issue, par value (in the case of stock), maturities, interest rate, and redemption. Such certificates shall be verified by affidavit of the fiscal head of the company. No act of the commission shall affect the validity of such issue.

Upon approval of the commission evidenced by a certificate of public convenience and necessity, and not otherwise, it shall be lawful for one railway to construct its tracks across another, or for one utility company to construct its facilities across those of another; and upon like approval to relocate or abolish such a crossing.

Capitalization of franchises or rights is forbidden in excess of the amount actually paid therefor to the commonwealth or one of its political subdivisions. It shall likewise be unlawful to capitalize any contract of sale or merger, or to issue by way of substitution any securities exceeding the aggregate value of the properties merged or consolidated plus any additional sum in cash, or any additional property or labor actually contributed, and the same applies to any reorganization effected under the act of 1861 regarding the sale of railroads, canals, etc.

Hereafter it shall be unlawful for any utility to acquire or hold a controlling interest in any other utility company without formal consent of the commission, but this shall not apply to holdings which do not amount to a controlling interest, and does not affect holdings previously acquired. After Jan. 1, 1914, it shall be unlawful for any company to give service if it has not posted its tariffs and schedules as required and previously described.

### Constitution of Commission

The commission will consist of a chairman at a salary of $10,500 and six members at $10,000, appointed by the Governor by and with the consent and advice of the Senate. There will be a secretary at a salary of $5,000 annually, a counsel at $7,500, an assistant counsel at $5,000, a marshal at $2,000, and an investigator of accidents at $5,000. The attorney-general will be ex-officio the general counsel of the commission, and the latter may employ such experts, engineers, statisticians, accountants, inspectors, clerks and other employees as it needs. The principal office of the commission will be at Harrisburg.

### Powers and Duties of Commission

The powers and duties of the commission are elaborately defined and in general cover the following: To inquire into and regulate service, rates, fares, tolls or charges, condition of plant, safety and convenience of patrons, and adequacy of facilities; hold hearings upon complaint or its own motion; order reasonable, safe, adequate and sufficient service, facilities and regulations, and reasonable maximum fares, rates, tolls and charges; upon notification of intended changes in service, rates or regulations to hold hearings and investigations and issue any order in relation thereto which the facts justify; to order reparation to patrons where an order of the commission has been disobeyed; to regulate the traffic arrangements of street railways; to enforce joint through routes, classifications, schedules, service and rates, and apportion the costs thereof and the revenues therefrom; to regulate railroad crossings and all matters involved therein; to establish and maintain standards of service; to require adequate service and facilities; to supervise the issuance of securities; to prescribe and enforce regulations respecting the keeping of records and accounts, and to examine the same as desired; to subpoena and examine witnesses, compel the production of books, papers and records, make physical examinations and valuations, and any related investigations; to determine the fair value of the property of every public service company, including consideration of original cost, security issues, earning capacity under rates fixed by statute, expenditures for obsolescence, reproduction cost, and going concern value; to make revaluations from time to time; and to determine amounts to be paid for franchise rights and privileges.

The act establishing the Railroad Commission is repealed as of July 1, and that commission was then required to hand over its records, files and cases pending to the new commission. The new act becomes effective on Jan. 1, 1914, although the commission shall be appointed and organized on or before Oct. 1 and in the interim may issue general orders and dispose of pending railroad cases.

## Underground-Contact System Proposed for Chicago Street Railways

By Section 4 of the "traction settlement" ordinances adopted in Chicago in 1907 it is provided that after three years from the date of acceptance of the ordinance the city shall have the power to cause the street-railway companies to operate by electrical energy "transmitted through working conductors carried in conduits below the surface of the street and between and underneath the rails, otherwise known as the underground trolley system, and shall there-

fter cease to operate the same by overhead trolley." Section 25 provides, however, that the companies shall not be equired to make the improvement if to do so would increase the total capital investment to such an extent that ie return thereon above the interest charge of 5 per cent uthorized by the ordinance would be reduced to an inadeuate or unreasonably small amount.

Acting under the ordinance Mayor Harrison sent a ommunication to the City Council on July 14 recommending iat the street-railway companies of the city be required to ut their contact wires beneath the surface in the area ounded by North Avenue on the north, Lake Michigan on ie east, Thirty-first Street on the south and Ashland Aveue on the west. The recommendation and proposed ordiances accompanying it were referred to the local transortation committee.

It is unlikely that the companies will submit to the change nless compelled to do so. New York and Washington are ie only cities in the United States where the sub-surface-ontact system of electric-railway operation is used. The nderground system is, of course, extremely expensive ompared with the overhead trolley and is more difficult maintain and operate.

## Public Use of Energy from Fort Snelling Development

Mr. John Lind, ex-governor of the State of Minnesota, ppeared before a recent meeting held at St. Paul to diss the granting of waterpower rights at lock and dam o. 1 on the Mississippi River between St. Paul and Minapolis, and pointed out that any step to dispose of the ydroelectric energy to the highest bidder would violate ie relationship existing between the state and the federal overnment. At the session, which was presided over by ol. C. L. Potter, corps of engineers, U. S. A., the rights ere offered to the state of Minnesota through the univerty and the cities of St. Paul and Minneapolis. The fedral government is also to obtain energy for use at the oldiers' Home, Fort Snelling, and in the federal buildgs at Minneapolis and St. Paul. Colonel Potter reuested that the dean of the College of Engineering, Uniersity of Minnesota, and the city engineers of Minneapolis id St. Paul form an engineering board to report before ec. 1 on the technical and financial features of the use f energy by the existing state corporation, as was authored by an enabling act two years ago.

## Louisville Merger Now Complete

On July 10, the Louisville Gas & Electric Company came nto full control of the gas and electric utility situation in ouisville, Ky., by purchasing from the stockholders of the entucky Electric Company all of the stock of that corporation. The Louisville utilities merger is now complete, ie companies which have been combined being the Louisille Gas Company, Louisville Lighting Company, Kenucky Heating Company, Kentucky Electric Company, Geo. . Fetter Lighting Company and the Campbell Electric ompany, as reported in our issue of last week.

In accordance with agreement with the city, work will e started at once upon the natural gas pipe line from West irginia, and it is thought possible that natural gas will be istributed in Louisville some time during the winter. Anther possibility in connection with the merger is the xpansion and unification of the steam-heating systems of ie various utilities to serve additional territory.

Stockholders in the new company have authorized the ssuance of $7,500,000 five-year 6 per cent bonds, all of hich have been sold. The controlling interest in the new ompany is held by the Standard Gas & Electric Company, one of the Byllesby companies. The property will be under the management and operation of H. M. Byllesby & Company.

## Registration of Electrical Contractors in Chicago

By an ordinance just passed by the City Council of Chicago all persons or corporations desiring to install wires or other electrical apparatus in that city must obtain a permit from the city electrician before commencing electrical construction work. Any person or corporation making application for a permit must file an affidavit stating that the work to be done will be under the supervision of a person not less than twenty-one years of age who has a thorough knowledge of electrical construction and who has had not less than four years of practical experience in wiring and electrical construction work. The affidavit must contain the name and signature of the person under whose supervision the work is to be done. It must also bear the indorsements of two responsible citizens. Upon the filing of this affidavit, if found proper, and upon the payment of a fee of $25, the city electrician shall issue a certificate of registration to the applicant. This certificate entitles the contractor to obtain permits to install electrical apparatus for the period of one year. Renewals of the certificate of registration will be at the rate of $10 a year. The ordinance is designed to put a check on the operations of incompetent and inexperienced men posing as electrical contractors.

## Regulation of Water-Power Development in Wisconsin

The Legislature of Wisconsin is considering a bill for the regulation of water-power development in that state which is receiving much attention from capitalists interested in the subject. It will be recalled that a very drastic bill on this subject passed the Legislature of Wisconsin about two years ago and was nullified by the courts as unconstitutional. The committee of the state Senate has taken the position that the bill now under consideration safeguards the rights of the public and is liberal enough to encourage the investment of capital for the legitimate development of water-powers. However, the men interested in hydraulic development are opposed to several features of the bill, notably the provision giving to the state the right to take over water-powers at the expiration of the thirty-year period of the franchises to be granted. It is contended that the proposed law allows the state to confiscate the property of water-power companies without just compensation. The water-power men do not object to the principle of conservation of natural resources, but say that the greatest waste is due to the non-use of these resources.

## Separate Company to Build Cincinnati Plant

With the exchange of minority stock of the Union Gas & Electric Company for 5 per cent debenture bonds of the Columbia Gas & Electric Company now completed, many operating economies are expected to result from the complete ownership by the Columbia company, although it is likely that the corporate existence of the Union company will still be maintained as a leasing company.

The present plan will facilitate the arrangements for building a new generating station on the river front, to take the place of the company's Plum Street plant. This new station, it is now understood, will be erected by a separate power-house company to be incorporated in Ohio, and as at present contemplated the underlying corporation, the Cincinnati Gas & Electric Company, will donate the site. Nearly $5,000,000 will be expended on this station.

The power [illegible] the plant through the sale of bonds at 90, half of the issue (the whole not to exceed [illegible] to be taken by each company. The power house company is to lease the plant to the Union company for a term coextensive with the present lease of the Cincinnati properties to the Union.

It is proposed that the Cincinnati company shall provide its half of the power house bonds by an issue of 5 per cent forty-year sinking-fund bonds, secured by mortgage on its properties, one-half of the power house bonds to be deposited thereunder. There is to be a stipulation in the mortgage for the retirement of the $1,500,000 Edison bonds and the Cincinnati company to be protected by a lien on the power house property. The other half of the power house bonds are to be taken by the Union and Columbia companies.

## Missouri Commission Complete

Mr. William F. Woerner, a St. Louis attorney, has been appointed the fifth member of the Missouri State Public Service Commission. Previous to his appointment two other lawyers, a civil engineer and a railroad engineer were appointed, thus making three lawyers in all. Mr. Woerner introduced into the St. Louis City Council in 1903 the railway tax ordinance, the validity of which is being so vigorously contested at the present time by the United Railways Company of St. Louis. Mr. C. B. Bee of Oklahoma City, who was formerly rate expert for the Oklahoma Public Utility Commission has been appointed to a similar position for the Missouri commission.

## Electric-Rate Discussion in Chicago

At the meeting of the committee on gas, oil and electric light of the Chicago City Council on July 9 the reading of the rate-investigation report of Mr. Ray Palmer, city electrician, was resumed. Parts of the report relating to intangible values, working capital and revenue were taken up. Alderman Merriam questioned the item of $3,224,256 allowed in the report as an addition to capital value for intangible values in connection with the acquisition of competing properties. Mr. C. B. Willard, expert accountant for the city comptroller, who assisted in the preparation of the report, explained that the money was expended in good faith. Mr. A. C. King, an engineer of the department of electricity, who also assisted in preparing the report, said that in cities where there are several competing electric-service companies experience has shown that the condition is unfavorable to the interests of the consumers. In Chicago, block-lighting plants, which are not subject to city control, usually charge higher rates than the Edison company. Mr. W. J. Norton, of the Commonwealth Edison Company, declared that the allowance made for old properties in the Byllesby appraisal (which was in the main followed in the Palmer report in this particular) is a conservative one. He said that this allowance has been referred to as a "nuisance value" in Wisconsin. Alderman Merriam also questioned the allowance of $575,700 for free wiring. He thought that this allowance (based on a practice followed several years ago but which has since been discontinued), should be considered in the nature of a reduction of rates and not charged to capital account.

At the following day's session Mr. Palmer explained the $3,224,256 item as the excess cost of the intangible value of acquired properties. He said it was true that this item showed that the company had paid for something it could not use, but in the modern economic tendency toward monopoly and regulation this procedure seemed to be inevitable. The company should be entitled to the allowance, figuring on original-cost basis; otherwise the valuation would be on a reproduction basis, which would be inconsistent with the method followed in making the whole valuation. Alderman Merriam declared that similar excess cost of acquiring competing plants (aside from an allowance for the physical value of such competing plants) had been thrown out by the city in the gas-rate case; the city ought to be consistent, he thought. Mr. Palmer quoted Mr. Halford Erickson, a member of the Railroad Commission of Wisconsin, in support of his position. The city electrician expressed his belief that the company has acted in good faith in the matter of acquiring competing companies and should be entitled to the allowance for the intangible values involved in the transaction.

The reading of the report was then resumed, and the portions relating to expenses for the year 1911, purchased energy, other expense, and depreciation allowance, were taken up. The rather striking coincidence was brought out that, in independent studies and by different methods of computation, Messrs. King and Willard arrived at almost the same allowance for depreciation as is made in the accounting system of the Commonwealth Edison Company.

## Long Acre Electric Light & Power Decision

As recorded in the March 8 issue of the ELECTRICAL WORLD, an order was made by the Public Service Commission of New York State, First District, approving the construction of an electric light plant by the Long Acre Electric Light & Power Company. Since 1908, when application for permission to issue $50,000,000 in bonds and $10,000,000 stock was denied by the Commission, the Long Acre company has passed through a series of legal actions, resulting in turn both favorably and unfavorably. In September, 1912, another complication was introduced by the acquisition of a major portion of the company's outstanding bonds by New York Edison Company interests, the latter concern having opposed from the start the formation of a competing electric light and power company in New York City.

On a writ of certiorari, the order of the Public Service Commission, dated March 5, was reviewed by the Appellate Division of the Supreme Court, First Department, and a decision has just been rendered sustaining this order. The only opinion given was that of Judge Ingraham, dissenting. An appeal is to be taken by the Edison company and the case will probably come up before the Court of Appeals some time this fall. The Long Acre Company is controlled at present by A. B. Leach & Company and allied interests

## Petition Against Colorado Commission Bill

The Colorado public utilities commission bill, passed by the last legislature and signed by Governor Ammons, has been "referred" under the state referendum law, by the presentation of a petition to the Secretary of State, signed by over 18,000 persons and asking for a referendum on the entire bill. This petition was circulated by Mr. D. A. Camfield, an irrigation and power project promoter. The usual method of circulating the petition by means of canvassers paid ten cents per signature was followed.

N. D. Smith, who is promoting an automatic telephone company for Denver, has also filed a petition of over 18,000 names, similarly obtained, for referendum on sections 35, 36 and 37 of the bill. The latter two sections give control over stock issues, mergers and financial management. Section 35 grants indeterminate franchises and sustains regulated monopolies.

Governor Ammons is very much opposed to receiving the petitions, feeling that a defect in the initiative and referendum law is being taken advantage of through a reg-

lar organization which obtains signatures at a certain price. He has threatened to call a special session of the legislature to pass a utilities law with no saving clause by which it may be referred. Counsel has, however, advised that the standing of such a law might be questioned should the statute now referred be again passed by the referendum vote.

The law is largely modeled after the California law and is somewhat defective in not providing definitely for regulation of municipally owned utilities nor specifically exempting them. The question of home rule under existing charters is also not determined.

After July 15 a law passed by the last legislature will become effective, providing for inquiry into legality of petitions filed under the referendum law and this law may be taken advantage of by the governor. The findings of the Secretary of State are final, subject to review by the courts.

If an extra session is called the Governor declares that a bill will be passed making it a penal offense to circulate petitions of this kind for pay. Business men are backed by the Secretary of State in opposing an extra session on account of the great unrest and business depression attendant upon consideration of radical changes in legislation by the state.

### Intangible Values in Rate Making

The Supreme Court of New Jersey on July 7, 1913, sustained the validity of the order of the Board of Public Utility Commissioners of New Jersey in requiring the Public Service Gas Company, a subsidiary of the Public Service Corporation of New Jersey, Newark, to establish a 90-cent gas rate within the district which embraces Passaic. The decision of the board was published in the *Electrical World* of Jan. 4, page 36. The principal question at issue was the valuation of the intangible property of the company, and in this matter the court upheld the ruling of the commission. To determine the correctness of the decision on which the order of the Board of Public Utility Commissioners was based, the company, with the knowledge and the approval of the commission, decided to obey the order and sue out a writ of certiorari in the Supreme Court of the State. The company has now announced that it will appeal the case to the Court of Errors and Appeals.

### Probable Franchise Compromise at Lexington, Ky.

It now appears probable that a compromise will be reached in the franchise controversy between the city of Lexington, Ky., and the Lexington Utilities Company, the local subsidiary of the Kentucky Traction & Terminal Company. The city attorney has ruled that the referendum by which the franchise awarded the company was canceled, was valid. The city officials are desirous of reaching an agreement with the company, however, and a new franchise has been drawn up and probably will be adopted.

### Public Service Commission News

#### Maine Commission

Petitions bearing the signatures of more than 10,000 voters have been filed at the office of the Secretary of State at Augusta asking for a referendum on the recent Maine public utilities act. This action will prevent the act's becoming operative ninety days after the adjournment of the recent Legislature. A special election may be called by Governor Haines to determine the acceptance of the act, or, if desirable, he may designate the general election in September, 1914, as the time when the voters shall approve or disapprove the law. As recently announced in these columns, the act provides for the creation of a commission of three members to have general supervision of all public utilities within the State.

#### Ohio Commission

The Sandusky City Council has asked the Public Service Commission to issue an order to allow the city to examine the books of the Sandusky Gas & Electric Company for the past ten years, in order that the city may be better prepared to make an offer for the property, when it decides upon municipal ownership. The company refused to grant the city's request to examine its accounts.

#### New York Commissions

A reduction in the price of gas from $1 to 95 cents per 1000 cu. ft. has been ordered by the Public Service Commission for the First District in the Thirty-first Ward of Brooklyn, supplied by the Brooklyn Borough Gas Company. The new rate will take effect Oct. 1, and continue in effect until Dec. 31, 1914. The original complaint against the Brooklyn Borough Gas Company was filed in October, 1910, but after hearings it was dismissed by the Commission, with the statement that conditions at that time did not warrant a reduction. On the second complaint the Commission made a careful examination and appraisal of the company's plant and property. The commissioner found that the company's sales of gas have increased from 213,817,000 cu. ft. in 1910 to 273,253,000 cu. ft. in 1912; and that its operating income has increased from $76,566.26 in 1910 to $98,479.76 in 1912. While the sales have increased the operating expenses have decreased, the manufacturing cost, which was 31.29 cents per 1000 cu. ft. in 1909, having fallen to 21.26 cents in 1912. The commissioner finds that a return of 7½ per cent would justify a rate of about 92 cents for 1913 and about 89 cents for 1914; and a return of 8 per cent would justify a rate of about 94 cents for 1913 and 91 cents for 1914. Allowing for possible increases in the cost of production, etc., the Commission found that 95 cents per 1000 cu. ft. would be a reasonable rate for the remainder of 1913 and all of the year 1914. If conditions continue to improve another reduction in the price will be possible in 1915.

## Current News Notes

Annual Meeting of the Jovian Order.—The Jovian Order will hold its annual meeting at the Hotel Astor, New York, Oct. 14, 15 and 16. Mr. E. C. Bennett, 1412 Syndicate Building, St. Louis, Mo., is secretary of the order.

* * *

Cleveland's New Charter.—By a vote of 24,037 to 12,077 the electors of Cleveland adopted a new charter on July 1. It is drawn in accordance with the "home-rule" amendment to the state constitution. The city is empowered to institute municipal ownership by condemning the property of public-service corporations. Cleveland newspapers speak of the charter as an embodiment of the ideas of the late Tom L. Johnson.

* * *

The Lineman's Bed.—From Paterson, N. J., comes the latest story of the antics of the central-station lineman. This particular gentleman, it would appear, stopped at too many places on the way home, as linemen (and others) will, and finally, bethought himself of a place of refuge—a pole line. His slumbers were sound while they lasted, at least judging by the snores. Successfully resisting all efforts to awaken him by usual methods, he compelled the fire department finally to escort him back to the channels of surface traffic, and incidentally the "wagon." And the story goes that the magistrate discharged him—probably because he was "clearing trouble."

[illegible] at the Lake Geneva Country Club, on the Chicago course of the Electric Vehicle Association of America, will enjoy their first annual picnic and field day at Cedar Lake, Ind., on July 25. A special train on the Monon Railroad will leave the Polk Street station at 10:30 a. m. Tickets may be obtained from Mr. E. D. Kelly, Metropole Hotel, Chicago.

* * *

Mining Exposition and Practice.—A mining exposition will be held at Philadelphia during the week of Oct. 20 in connection with the forthcoming American Mining Congress scheduled for the same dates. Manufacturers of mining machinery and rescue, first-aid and safety apparatus are invited to display their products at the exposition, which will be the first of its kind in the country. Mr. J. T. Callbreath, Munsey Building, Washington, D. C., is secretary of the American Mining Congress.

* * *

Colorado Electrical Statistics.—Colorado has $80,000,000 invested in electric lighting and power properties, according to a statement just issued by the Colorado Electric Club. The state has 6000 miles of electric-light and power wires, 222,000 miles of telephone wire, 4790 miles of telegraph wire, 400 miles of street railways and 800 street cars. About 100,000 acres of land have already been reclaimed by electric pumping. Colorado has more irrigated land than any other state, although hardly one-fifth of it is in farms.

* * *

Civil Service Examination for Electrical Machinist.—Applications will be received until Aug. 4 for the Civil Service examination for electrical machinist, for a vacancy in the Signal Service at Large, Fort Wood, N. Y., at $1,000 per annum. Applicants should be practical machinists with three years or more experience in the repair of telephones, telegraph instruments, radio apparatus and other small electrical instruments. Persons desiring to take the examination should write for Form 1312, United States Civil Service Commission, Washington, D. C.

* * *

Telephone Complaint Bureau in Chicago.—Steps are being taken by the Chicago City Council to establish the telephone complaint bureau provided by the Chicago telephone-rate ordinance of May 26. It is proposed to employ a telephone commissioner at a salary of $3,000 a year and an investigator at $1,500 a year with a stenographer at $840 a year. At a recent meeting of the Council committee on gas, oil and electric light City Electrician Palmer suggested that the scope of the bureau might be broadened to include complaints relating to gas, electric and water service.

* * *

To Lease Additional Water-Power Rights at "Soo."—The Michigan-Lake Superior Power Company has filed with the International Joint Commission at Washington, a proposed lease for water and the constructing of compensating works across St. Mary's River at Saulte Ste. Marie, Mich. Terms of the lease provide for a continuous flow of 25,000 cu. ft. of water a second, with a possible increase of 5000. A yearly toll of $2.50 a cubic foot a second, and $1 a cubic foot a second for all water in excess of 25,000 cu. ft. will be paid the government by the company.

* * *

Ideas of Spanish Singletaxers.—The first Spanish Singletax Congress was held at Ronda, Spain, on May 26-28. The following platform of the Congress in relation to utilities may be of some interest: "Municipal or state ownership of public utilities. Each state or locality to select its own time for making change from private ownership. In accordance with this principle, a law should at once be passed prohibiting governments from extensions or renewals of franchises. Until the state assumes ownership of railroads, they should be taxed on the values of the land and monopolies they enjoy. This method should be employed with telephone, water, electricity and gas companies, in fact, all those who exploit public service, and with which free competition is impossible."

* * *

British Electrical Statistics.—The aggregate capital issued by the electric companies and municipal plants of the United Kingdom during the last year was $2,120,000,000, according to the 1913-1914 volume of Garcke's "Manual of Electrical Undertakings." For 1912 the figure was $2,050,000,000 and for 1911 $1,980,000,000. The amount of capital belonging to the companies is $1,425,000,000, on which sum dividends averaging 4.6 per cent were paid last year, as compared with 4.28 per cent on $1,340,000,000 in 1912. Companies and municipalities sold 1,317,734,150 kw-hr. during 1913 as compared with 1,235,512,163 in the previous year; the kilowatt capacity of plant installed was 1,119,617, against 1,070,851, and the lamps connected equaled 67,020,086 8-cp equivalents, compared with 64,222,086. Although the kw-hr. sales by the municipalities have risen during the last two years from 811.6 millions to 896.8 millions, the business of the companies fell from 423.8 millions to 420.8 millions. The total capacity of plant installed rose from 696.673 kw to 736,236 kw in the case of municipalities, and from 374,178 kw to 383,381 kw in the case of the companies. Again, in lamps connected municipalities showed an increase from 34.5 millions to 37.5 millions, and the companies a decline from 29.7 millions to 29.4 millions.

* * *

## SOCIETY MEETINGS

Maine Electric Association Outing.—The annual outing of the Maine Electric Association will be held at Portland on July 24 and 25. An attractive program is being arranged. Mr. W. S. Wyman, Augusta, is secretary.

* * *

Milwaukee N. E. L. A. Section Banquet.—At the banquet of the Milwaukee Section, National Electric Light Association, held at the Hotel Pfister, Milwaukee, July 8, Mr. John Andersen presided as toastmaster, and addresses were given by Messrs. J. D. Mortimer, S. B. Way, R. B. Stearns, George C. Post and others.

* * *

American Mine Safety Association.—The annual meeting of the American Mine Safety Association, composed of leading coal and metal-mine operators, mining engineers mine-safety engineers, and mine surgeons, will be held in Pittsburgh, Pa., September 22 to 24. The program will include a mine-rescue and first-aid contest at Arsenal Park, an explosion in the experimental mine of the Bureau of Mines at Bruceton, Pa., and a visit to the Bureau's experiment station.

* * *

Chicago Convention of Electric Vehicle Association.—The Chicago convention of the Electric Vehicle Association of America will be held in the Hotel La Salle on Oct. 27 and 28. Sessions will be held on the nineteenth floor and exhibits will be displayed on the eighteenth floor. Mr. H. E. Niesz, chairman of the Chicago section, has appointed chairmen of the local committees as follows: Reception and entertainment, Mr. Louis E. Wagner; finance, Mr. George H. Jones; papers, Mr. D. C. Arlington.

* * *

Jovian Lunch Club Formed in Galveston.—There are forty members of the Jovian Order in Galveston, Tex., and at a meeting held on June 26 twenty-seven of them were present and formed a lunch club. This club will meet on the third Monday of each month. Officers were elected as follows: President, Mr. C. W. Matthews, Galveston Electric Company; first vice-president, Mr. W. D. Masterson, city electrician; second vice-president, Mr. K. E. Mason, Brush Electric Company; treasurer, Mr. A. D. McLellan, McLellan Electric Company; secretary, Mr. W. J. Weber, Tschumny Electric Company; press agent, Mr. A. K. Young, Brush Electric Company.

# The World's Highest Office Building

**Elevator equipment, safety features, generating plant and wiring of the Woolworth Building, New York City. By Charles E. Knox**



IN view of its unequaled height, the Woolworth Building, in New York City, has much of interest for the general public, and on account of the serious engineering problems involved it possesses features of particular interest to the engineer. The description below will give some of the details of the elevator installation and the electrical equipment, which were designed by the writer.

It is needless to say that without the modern high-rise elevator the Woolworth Building could not have been erected. The tall building depends very largely on the proper solution of the various problems which arise in the consideration of the elevator installation. It is essential that the elevator service be adequate, that the upper floors be served approximately as well as the lower floors, that every reasonable safety appliance be provided to safeguard the passengers, that proper means of signaling and controlling the cars be provided, and that the acceleration and retardation be as rapid as smooth and efficient operation will permit. While adequate service is essential, on the other hand, if more elevators are provided than necessary to afford good service, the rentable area of the building, and consequently the revenue, are greatly reduced.

It is obvious that the upper stories of the building must be served by through elevators, running from the bottom to the top without change of cars, and consequently some of the elevators in this building have an extremely high rise. The accompanying schedule gives the number and rise of the various elevators. It shows a total of twenty-eight elevators besides one sidewalk lift.

NUMBER AND RISE OF ELEVATORS

| Main Group, No. | Runs | | Rise, Feet |
|---|---|---|---|
| | From Floor | To Floor | |
| 11, 12, 13, 14, 4, 5, 6, 7, 9, 10, 15, 16, 18, 19, 20, 21 | First | Twelfth | 145 |
| | Basement | Twenty-seventh | 358 |
| 8, 17 | Sub-basement | Twenty-seventh | 372 |
| 3, 22 | Basement | Forty-first | 530 |
| 1, 2 | First | Forty-sixth | 606 |
| 23, 24 | First | Fifty-first | 689 |
| *Service elevators* 25, 26 | Basement | Twenty-eighth | 375 |
| *Shuttle elevator:* 27 | Fifty-first | Fifty-fourth | 47 |
| *Bank elevator* 28 | Basement | Third | 56 |
| *Sidewalk lift* 29 | Sub-basement | First | 39 |

From the table it is apparent that there is a wide variation in the travel of the elevators. On account of this difference in the rise, the writer became convinced that special means would be required to maintain a reasonably uniform schedule for the various groups of elevators and designed a dispatcher's system for starting and controlling the elevators

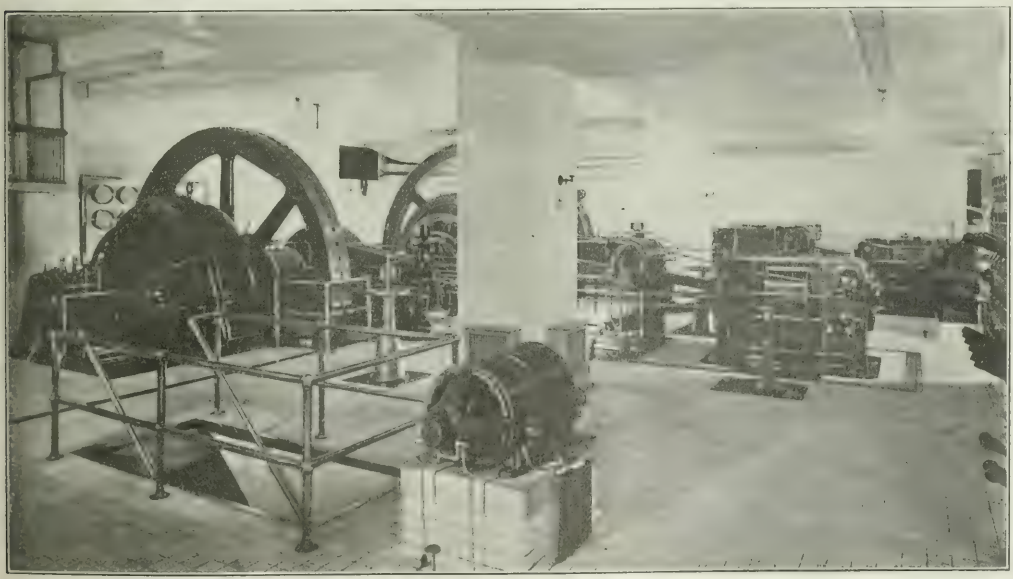


FIG. 1—ENGINE ROOM, SHOWING TWO OF THE FOUR GENERATING UNITS

similar to [illegible] work, which system will be described briefly a little later.

The elevators are designed to run at a speed of 700 ft. per minute, this being the first case where an elevator equipment has been designed for a speed of over 600 ft., the city building rules having been modified recently to permit this higher speed. Of course, the average speed of the



FIG. 2—FRAMING OF ELEVATOR AIR CUSHION

elevator depends upon the distance traveled and the number of stops. It takes approximately 20 ft. for the elevator to accelerate to full speed, and it is obvious that it must be gradually retarded to make good stops at the various landings.

The type of elevator which the writer specified for the Woolworth Building is that known as the gearless one-to-one electric traction type of elevator. The general scheme of this type of elevator is shown in Figs. 5 and 8. The elevator winding machine is located on beams placed at the top of the elevator hatchway. It will be noticed that one end of each hoisting rope is attached to the counterweight and the other end attached to the car. The driving torque is obtained from a motor the armature of which is mounted on a shaft which also carries the driving sheave, the torque being transmitted directly from the armature to the driving sheave. The ropes pass over the driving sheave, thence around the idler sheave placed underneath the driving sheave, back again over the driving sheave, and thence to the counterweight. The object of the idler sheave is to obtain an additional half wrap or turn of the hoisting ropes around the driving sheave, so as to obtain additional tractive force, as one half wrap around the driving sheave would not afford sufficient hoisting torque. The coefficient of traction obtained by this method of drive is approximately two. In other words, under ordinary conditions, a load of approximately twice the weight of the counterweight can be placed at the car end before the ropes begin to slip through the driving sheave.

On the same shaft with the armature and the driving sheave is mounted a large brake pulley, inclosed with a pair of powerful spring-actuated, electrically released brakeshoes. The brakeshoes always grip the brake pulley unless current is applied to the armature, in which case the brake magnets are magnetized and the brakeshoes pulled away, thereby allowing the motor to drive the traction sheave. In case of failure of the electric current from any cause whatever, the brake therefore operates to stop the car. The direct application of the torque from the motor to the driving sheave and the absence of gearing results in an elevator machine of the highest efficiency as well as the greatest simplicity.

While the motor runs at a very low speed (the maximum speed being approximately 68 r. p. m.), it is especially designed for the purpose and its efficiency is very high. The elevators are of the Otis manufacture.

### Safety Features

Probably the greatest feature of this type of elevator is the inherent safety which the elevators possess, owing to the peculiar form of drive used. As already stated, the driving force consists of the tractive effort of the ropes on the driving sheave. This tractive effort is obtained by means of the counterweight at one end of the ropes and the weight of the car at the other end. In case the counterweight is at the bottom of the shaft resting on the buffer and the car is at the top, it is apparent that the weight of the counterbalance is removed from the driving ropes and the car cannot be driven any further. In such a case, even if the motor continued revolving, the driving sheave would slip through the driving ropes and the car could not be driven into the overhead work.

Over-travel of the car and counterweight is one of the frequent causes of elevator accidents, and consequently this

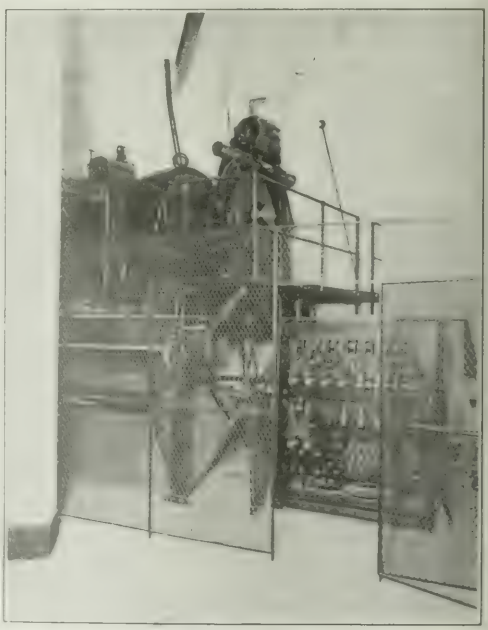


FIG. 3—ELEVATOR MACHINERY ON FIFTY-SECOND FLOOR

safety feature, which is an inherent part of this method of drive, has a very great advantage from the standpoint of safety. In other words, neither the car nor the counterweight can go more than a short distance beyond the limits of travel, because the tractive force decreases or disappears entirely. Of course, the car would have a certain amount of momentum in the event of its tending to travel beyond

ne top landing, and to overcome this momentum and stop ne car a safety device known as the "retarding and latching afety" is provided for both the car and the counterweight t the top of the hatchway. This device consists of a numer of steel wires strongly secured in position at each side f the upper end of the hatchway. These wires pass between airs of steel plates, and between these plates steel pins are laced, staggered or so located that the wires between the lates pass around and between the pins in such a manner that the plates cannot be moved without deforming or inking the wire. To move the plates, therefore, a conideralble constant force is required, as the wires are tretched somewhat tightly and therefore tend to prevent he movement of the plate. At the top of the car there s provided a projecting bar, or dog, which presses against hese plates in case the car or counterweight goes above the op landing. If, for any reason, the other safety devices hould fail and the motor continue to run, the car would e quickly brought to rest after it had passed the top landng by the retarding effect of these plates. Latches are lso attached to the car, which would rest on the top of hese plates in case of over-travel and thereby prevent the ar from dropping back. If, therefore, the car should pass he top landing, not only would the force tending to drive it e removed, as already explained, but the further movement f the car would be retarded by this security retarding levice.

The usual wedge type of safety has been provided under oth the car and the counterweight to stop either the car r the counterweight in case the ropes should break. This afety device is shown in Fig. 8. In consists of a fly-ball

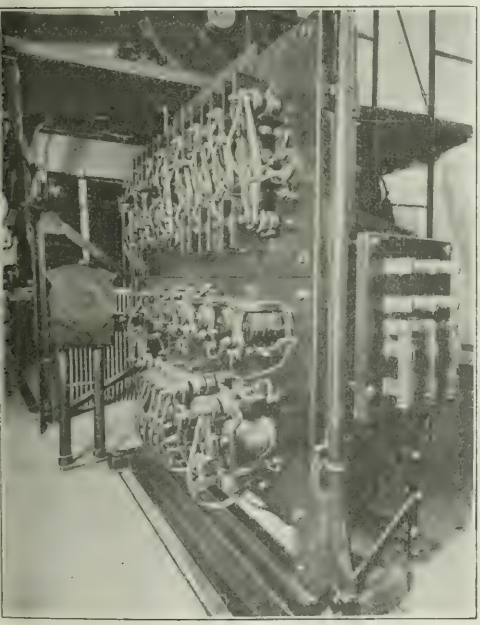


FIG. 4—ELEVATOR-MOTOR CONTROL PANEL

governor placed overhead, driven by a sheave, around which he governor rope passes. This governor rope is attached o a second rope passing around a drum underneath the car. As the elevator car travels the governor rope travels with it, driving the sheave and rotating the balls on the governor at the top of the hatchway. In case the car speed exceeds 800 ft. per minute, the balls are raised by centrifugal force to such a point that two jaws are thrown in action and grip the governor rope. The governor rope is now stopped, and as the car proceeds to travel the drum on the safety plank underneath the car starts to rotate, being driven by the rope passing on its outer grooved surface. The inside of the hub on this drum is threaded, and this thread engages with two shafts, one of which is threaded with a right-hand



FIG. 5—INTERIOR OF ELEVATOR, SHOWING CONTROL LEVERS AND TELEPHONE EQUIPMENT

and the other with a left-hand screw. The continued rotation of the drum drives these shafts in an outward direction. The outer end of each of these shafts is equipped with a wedge which tends to press two very heavy jaws against the guide rails.

These wedges are so shaped that at the beginning of the movement of the drum the clearance between the jaws and the guide rails is rapidly taken up, but gradually the movement becomes less. By this means the car is gradually but surely brought to rest. Of course, the action of the governor and the rotation of the drum and the application of the jaws to the rails are entirely automatic, and the action takes place when the car exceeds a speed of 800 ft. per minute. Before accepting the elevators which were installed in the Metropolitan Life tower the writer made approximately eighty tests of this particular safety device. This device is very seldom called into operation because a number of electric governing and controlling devices which act automatically tend to prevent the car from overspeeding and thereby avoid the necessity of the governor going into operation.

At the bottom of Fig. 8 is shown an oil buffer, another one of the safety devices used on the Woolworth elevators. This buffer is installed so that in case the car should go beyond the limits of travel it would strike the buffer and bring the car to rest without injury to the passengers. This device consists of a large cylinder containing a second inner cylinder. In this latter cylinder is placed a small piston connecting with a piston rod, at the upper end of which is attached a rubber buffer. The cylinder is prac-

tically filled with oil and a spring holds the piston and piston rod at the upper end of the cylinder. The inside cylinder is perforated and has large holes at the top and smaller holes at the bottom. As the striking plate under the car hits the buffer the oil is driven from the inner cylinder into the outer cylinder, and as the piston travels further down, the holes becoming smaller, the continued retarding force brings the car quickly but gradually to rest. The buffers in the high-rise cars in this building have a stroke of 5.0 ft. The writer made tests on the elevators, running the car into the buffer at a speed of nearly 1000 feet per minute, and found the stop perfectly safe and, in fact, not unpleasant.

At the bottom and top of the hatchway provision is made for a series of limit switches which first tend to reduce the amount of current and thereby slow down the car, and finally to shut off the current entirely and bring the car to rest. These switches operate slow-down switches on the con-

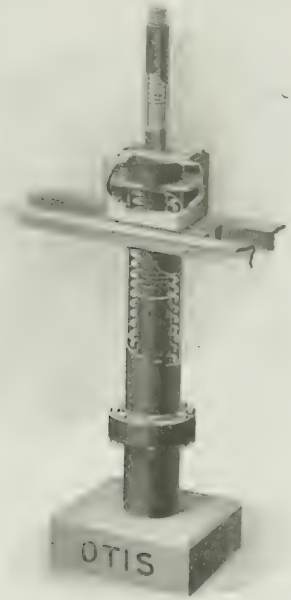


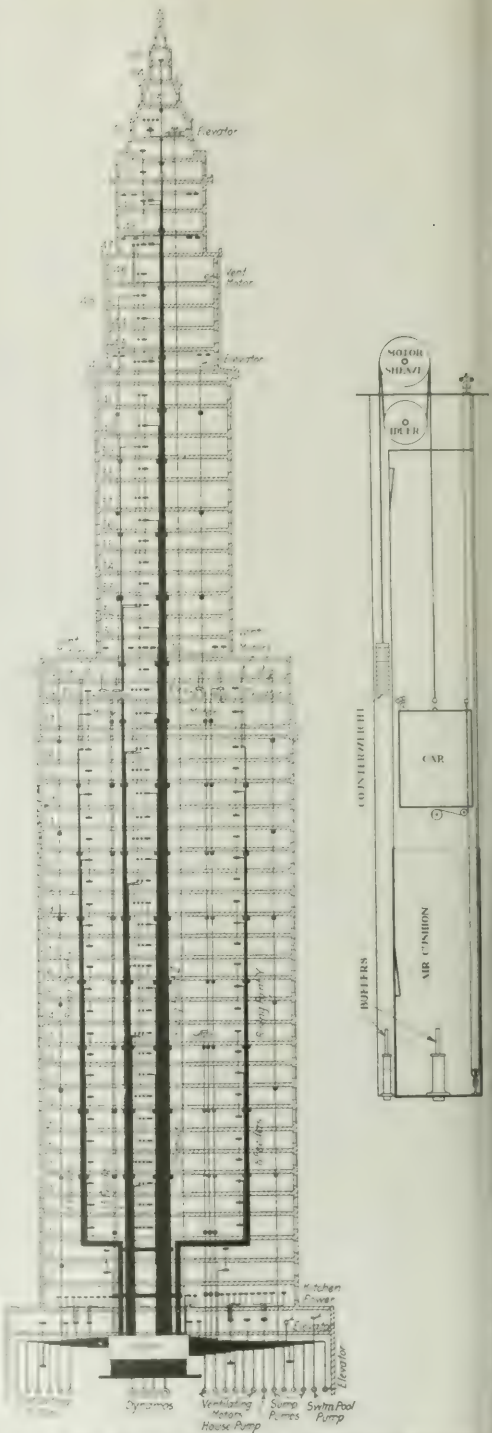

FIG. 6—DETAILS AND PARTIAL SECTION OF OIL BUFFER USED AT BOTTOM OF ELEVATOR SHAFT

troller board and finally cut in the reversing switch, the brake and the potential switch. In the event, therefore, that the operator failed to stop the car, the limit switches would automatically accomplish this purpose.

A small knife switch, known as the safety switch, is installed in each car to open the potential switch and put in operation both the electrical and the mechanical braking devices. On the governor at the top of the hatchway are mounted two switches, the first of which strengthens the field of the motor and reduces the speed in case the car tends to over-speed, and the second of which opens the circuit and applies the electrical and mechanical brakes.

In case the current should fail, or in case the voltage across the line should increase by more than 20 per cent above the normal, the main circuit would be opened and all the emergency stopping devices would be put in operation to prevent the fall of the car.

The car is equipped with an emergency lever which the operator can use to apply the jaws under the car against the guide rails, independently of the automatic governor

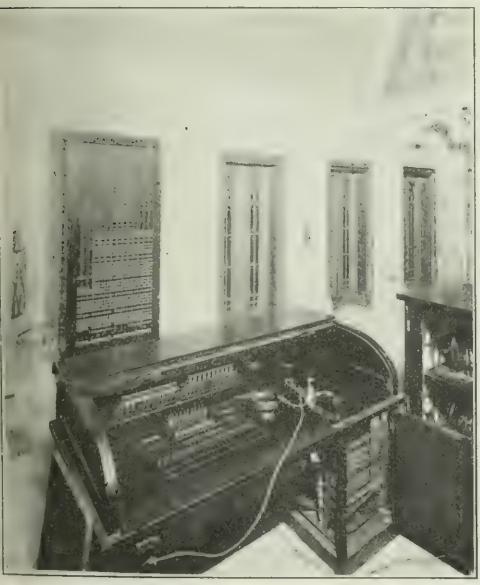



FIGS. 7 AND 8—DIAGRAM OF FEEDER RISERS AND DETAILS OF ELEVATOR SAFETY DEVICES

verhead. The operator can, by working this lever back nd forth four or five times, apply the undercar safety de- ice and bring the car quickly to rest.

In order to guard against the most frequent cause of ele- ator accidents—namely, those known as hatchway acci- ents—the writer specified an equipment of door contact evices so arranged that the operating circuit would not e closed when any of the hatchway doors were open. A ery large percentage of accidents are caused through care- essness of the operator, and sometimes through carelessness n the part of the passenger in getting on or off the car. These accidents have become so common that bills are now ending in the Legislature in New York to compel owners o provide a device which will prevent the car from moving ntil the door is closed.

In addition to the above safety devices, Mr. Woolworth nsisted on the installation of air cushions in all of the ele- ators. These air cushions consist of a wall surrounding he lower portion of each hatchway, extending upward for pproximately 20 per cent of the rise of the elevator. These valls are very substantially and heavily built of steel and oncrete, and the hatchway doors within the zone of the ir cushion are built to withstand the maximum air pressure hat would be obtained in case of the car falling from the op. Fig. 2 shows the steel work for one of the air cushions n the course of construction. The clearance between the ar and the air cushion has been made as small as practicable o as to prevent too great an escape of air between the sides f the car and the hatchway. If one of the high-rise ele- ators should fall from the top of the tower, it would attain



IG. 9—DISPATCHER'S STATION AND TELEPHONE SWITCHBOARD FACING A FLASHING DIAGRAM OF CAR TRAVEL

a speed of approximately 140 miles an hour at the time it reached the top of the air cushion.

### Dispatcher's System

As already stated, the differences in the heights of rise f the various cars and the grouping of the elevators neces- itated special means for starting and controlling the ele- ators. To accomplish these results the writer designed a pecial dispatching system which will be used in this build- ing for the first time. The usual method of controlling the elevators is to place at the ground floor a starter who signals the operator and starts each car on its trip. Ordi- narily this starter has no further control over the car until it reaches the ground floor again. In some cases in the past the writer made telephone connection to the various cars, sometimes from the starter's position at the ground floor, and sometimes from the engine room, and also used lamp

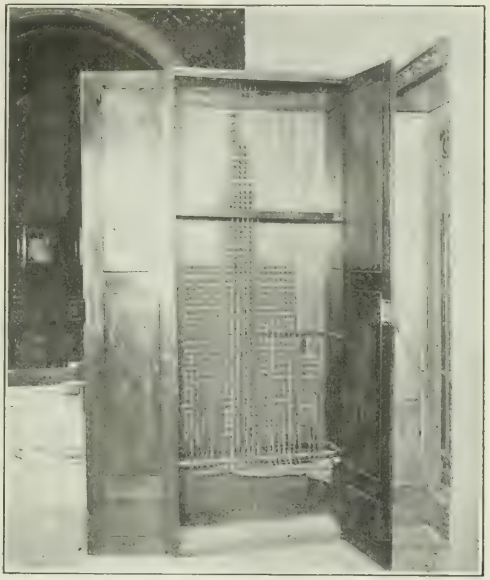


FIG. 10—REAR OF CAR-TRAVEL INDICATOR, SHOWING WIRING TO MINIATURE LAMPS

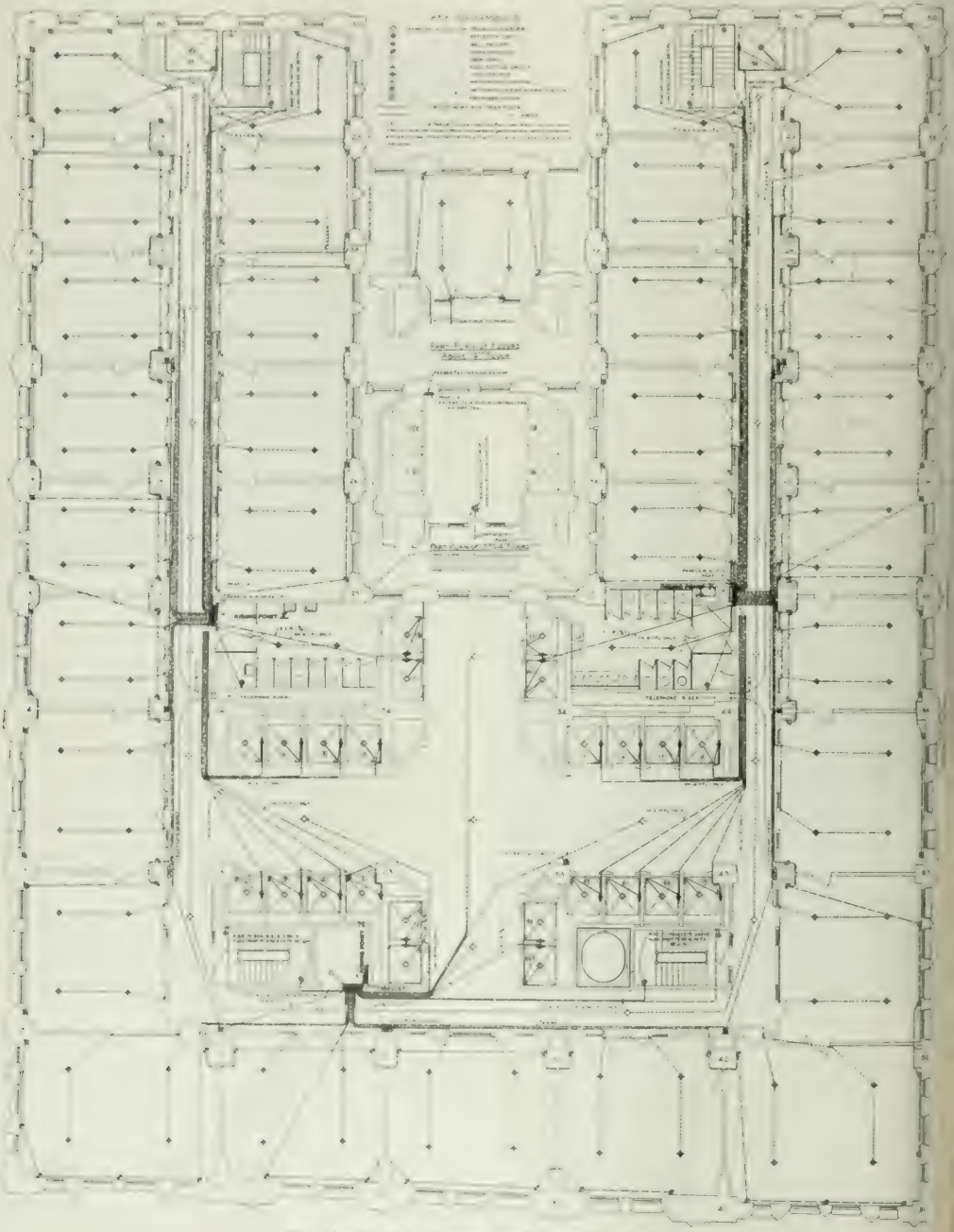
annunciators showing the position of the cars. Neither of these systems went far enough, and in the Woolworth Building the starting and signaling of the cars will be entirely in the hands of a dispatcher instead of a starter.

The dispatcher's system is located on the second floor overlooking the main group of elevators. Near the dispatcher's desk is placed a lamp indicator, each lamp corresponding to one floor for each of the elevators within its limits of travel. As an elevator passes a floor a lamp on the indicator is momentarily lighted, corresponding to that particular elevator and the floor passed. By glancing at this indicator the dispatcher knows immediately the location of each elevator. He also knows when an elevator stops at any given floor and for what length of time. Furthermore, the indicator shows him whether the elevators are keeping in proper step, that is, whether they are the proper distance apart and maintaining their predetermined schedule. In case an elevator gets behind the schedule, he can send a signal to the operator to skip a certain number of floors and thereby "catch up" to his schedule.

On the dispatcher's desk are also mounted a number of double-push switches which the dispatcher uses to cut out or transfer the signal on any car, so that when an operator falls behind his schedule he would not receive a signal to stop, and it would be transferred to the next car. For the purposes of signaling, the dispatcher has located on his desk a push-button connecting with a buzzer in each car, and also a telephone switchboard connecting with megaphones in the car, by means of which he may communicate orders to the operators, in addition to the code of signals used by means of the push-button and buzzer. The operator can

hear the dispatcher's orders by means of the megaphone without holding a receiver to his ear. In case of necessity the operator in the car may also communicate by means of a separate telephone with the dispatcher, but ordinarily it is intended that he shall receive orders only and not use the telephone.

Ordinarily when a car drops behind its schedule it retards all of the other cars following, because they lag behind in order to have the first car reach the ground floor ahead of them. In other words, the system usually employed tends to retard the entire service. With the system used in the Woolworth Building, if a car falls behind it is forced to catch up with the schedule by the dispatcher directing it to proceed to the ground floor, thereby distributing the



PLAN OF A TYPICAL FLOOR

assengers among the cars following. In this way the operators are forced to use every effort to have the cars maintain he predetermined schedule, instead of permitting them to ag behind. It is a matter of common observation that an perator will frequently stop his car at a floor and wait until he car preceding gets ahead of him by four or five floors. By unnecessarily stopping in this manner additional electrical energy is consumed and the number of cars leaving he ground floor in a given time is decreased, the elevator ervice being therefore correspondingly reduced.

Near the dispatcher's desk is also placed an automatic tarting device which sends a signal to all of the cars at oth the bottom and top of the hatchway. This timing device can be arranged so as to send a signal every twenty econds, thirty seconds, or at any other interval desired. The dispatcher may also cut this timing device out of service

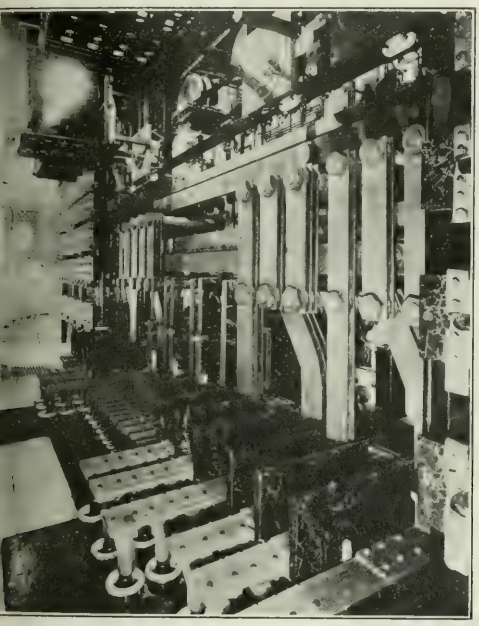


FIG. 12—REAR OF MAIN SWITCHBOARD

or any particular car or group of cars and send the signal imself.

A system of signals has been provided for use at night or two of the high-rise elevators.

The above dispatcher's system has been worked out very ompletely, and it is believed will increase the efficiency of he elevator service very materially and will bring about marked change in the method of operation of elevators in all office buildings.

## Electric Generating Plant

The electrical energy for the building is derived from an lectric generating plant located in the sub-basement. The otal rating of the plant is 1500 kw, consisting of two oo-kw units, one 300-kw unit and one 200-kw unit.

The engines are all of the tandem compound, non-condensing type, having releasing Corliss valve gear. The ngines are designed to operate at an initial steam pressure f 150 lb., with practically no back pressure, and run at oo r.p.m. Fig. 1 shows a view of the engine room.

The generators are wound for a potential of 250 volts nd three balancer units are provided for the three-wire system. Each of two of these balancer sets is designed for a total unbalance of 30 kw, and the third set for 10 kw.

The engines were manufactured by the Providence Engineering Works and the generators by the General Electric Company.

Figs. 13 and 12 show front and rear views respectively of the main switchboard. The central panel of the switch-

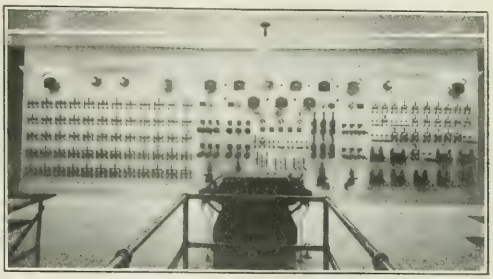


FIG. 13—LIGHTING SCHEME OF MAIN SWITCHBOARD

board is equipped with the various controlling and protecting devices for the balancer sets. The two panels on each side of the central panel serve for the generators. The right-hand panels are equipped with the switches and circuit-breakers for controlling the various motor feeders, and the left-hand panels are equipped with the knife switches for the lighting feeders. The two photographs show clearly the various features of the switchboard without further explanation.

## Wiring

Fig. 7 shows the various feeders and centers of distribution for the lighting and motor-service wiring of the entire building. The lighting system is of the three-wire, 125-250-volt type, and the motor service is of the two-wire, 250-volt type. Fig. 11 shows a wiring plant of a typical floor. These two views show generally

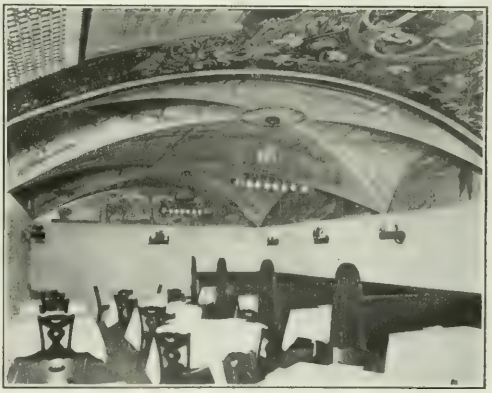


FIG. 14—ILLUMINATION IN RATHSKELLER OF WOOLWORTH BUILDING

the principal features of the wiring system. The total number of outlets installed in the building is in the neighborhood of 12,000 and the installed lighting load is approximately 450 kw. The offices are lighted principally with reflector units, the sizes of the lamps varying from 25 watts to 60 watts. Including the elevator motors, the installed motor load is over 1400 kw.

## Phase Compensation—III.

By Val A. Lyss

Below is given the concluding portion of the article entitled Phase Compensation, the first and second instalments of which appeared in the *Electrical World* July 5 and July 12.

The method of varying the phase of the exciting emf $e_3$ shown in Fig. 30 is most effective, but, obviously, not always

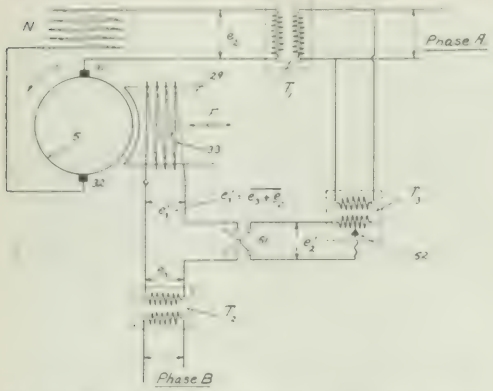


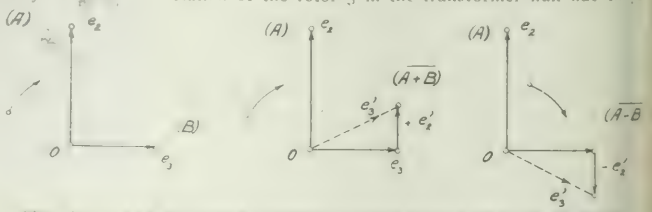

FIG. 33—COMPENSATED CONDUCTION ALTERNATING-CURRENT MOTOR OPERATED FROM A TWO-PHASE SUPPLY

practical. However, the method shown in Fig. 33 can be readily employed, for instance, wherever a two-phase distribution is available. In this figure the motor is supposed to be constituted exactly in the same manner as that shown in Figs. 17, 19 and 30. The emf $e_2$ impressed on the armature circuit is derived from phase $A$ by means of the transformer $T_1$, while the exciting winding 33 is fed from phase $B$ by means of the transformer $T_2$. If the field winding 33 were directly connected to the secondary of $T_2$, then the phase relation between $e_2$ and the exciting emf $e_3$ would be correctly shown in Fig. 34. These two emfs, being derived from different phases of a two-phase supply, must necessarily be in time-quadrature, as shown in that figure, and it is known that under these conditions the motor would operate with a "lagging" power-factor.

The phase of the resultant emf impressed on the exciting winding 33 may be easily changed by impressing on that winding two emfs differing in phase and connected in series. One way of achieving this in practice is shown in Fig. 33, where an emf $e_3$ derived from phase $B$ is connected in series with an emf $e_3'$ derived from phase $A$ and impressed on the field winding 33. The direction of $e_3'$ relatively to $e_3$ can be changed by means of the reversing switch 51, and the magnitude of $e_3'$ can be controlled by means of the regulating switch 52 of the transformer $T_3$. Thus for a position of the reversing switch 51 for which $e_3'$ is of the same direction as $e_3$, the phase and magnitude of the resultant exciting emf $e_3'$ may be represented in the diagram shown in Fig. 35. The component $e_3$ of Fig. 35 is of the same phase as the component $e_3$ of Fig. 34, because both are derived from phase $B$. The component $e_3'$ is of the same phase as $e_2$ because both are derived from phase $A$. The resultant exciting emf must therefore be correctly represented as to phase and magnitude by the diagonal $e_3'$ of the parallelogram, two sides of which equal $e_3$ and two other sides of which equal $e_3'$. If the connections of Fig. 33 correspond to the assumptions underlying the diagram shown in Fig. 35, then, according to former deductions, the power-factor of the machine will be improved and will continue to improve as the magnitude of the component $e_3'$, to which it is customary to refer as the "compensating emf," is increased. It is easy to see that as $e_3'$ increases, so does the lead of $e_3'$ over $e_3$ diminish. Similarly, if the direction of $e_3'$ is reversed, by reversing switch 51, then the diagram shown in Fig. 36 will correctly represent the conditions, and it will be seen that the lead of $e_3'$ over $e_3$ must increase with increasing $e_3'$, thus lowering the power-factor.

The method of varying the phase of the resultant exciting emf described in connection with Fig. 33 is the one made use of by the Wagner Electric Manufacturing Company in its constant-speed so-called "unity-power-factor" motor, but this motor differs somewhat from the one shown in Fig. 33. While the latter is what is known as a conduction machine—that is, one in which the energy required by the rotor is conducted to it—the Wagner machine is an induction motor—that is, a machine in which the energy required by the rotor is conveyed to it by induction without making it necessary to have a conductive connection between the rotor and the source of supply. Another difference between the motor shown in Fig. 39 and the Wagner machines resides in the fact that an exciting emf generated outside the motor by some independent source of supply must be impressed on the exciting winding 33 of the machine shown in Fig. 33 in order to produce any exciting flux at all, while in the Wagner motors a quadrature exciting emf is generated in the machine itself, thus enabling these motors to operate without separate excitation.

The primary form of motor from which the unity-power-factor machine has been derived is shown in Fig. 37, where 52 is the main stator winding adapted to be connected to the mains, while the rotor is short-circuited by means of the brushes 31, 32 along the axis of 52 and by means of other brushes 53, 54 along an axis displaced from that of 52. It has been shown elsewhere, and it is clearly apparent, that the winding 52 is simply the primary of a transformer the secondary of which is the rotor winding 5, closed coaxially with 52 by means of the interconnected brushes 31, 32. As long as the machine is standing still it corresponds exactly to a short-circuited transformer. The fact that the windings of the secondary 5 of this transformer may be revolved is immaterial. The primary 52 will produce a transformer flux $TF$ in line with the axis of 52. This flux will induce in the rotor 5 a working emf $e_2$, which appears at the brushes 31, 32, causing a current $i_2$ to flow in the working circuit comprising the brushes 31, 32. If the rotor is brought up to synchronous speed by any desired means, it will be found, as has also been elsewhere explained at some length, that an exciting emf of proper phase is generated at the exciting brushes 53, 54, by the rotation of the rotor 5 in the transformer flux due to 52

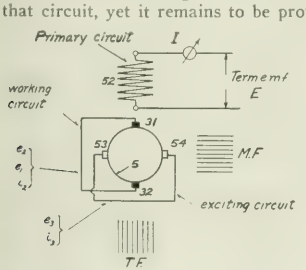



FIGS. 34, 35 AND 36—PHASE DIAGRAMS ILLUSTRATING OPERATION OF MOTOR SHOWN IN FIG. 33

This exciting emf $e_3$ will produce a current $i_3$ in the exciting circuit and this current will set up the exciting or motor field $MF$. It is found that when such a machine operates near synchronism the working emf $e_2$ induced in the working circuit is of opposite phase to the terminal emf $E$, and that the exciting emf $e_3$ acting on the exciting circuit is in phase-quadrature with the working emf

e foregoing discussion immediately leads to the con-sion that, owing to this quadrature relation of $e_2$ and $e_3$, back emf $e_1$ appearing in the working circuit and oppos- the working emf $e_2$ induced therein from 52 will be prac-ally of opposite phase to $e_2$ and that the machine will erate with a "lagging" power-factor—the more so be-se of the lagging magnetizing current required by the in stator winding in order to produce the all-important nsformer flux $TF$, on the presence of which the entire eration of the machine depends. It has been shown that is only necessary to alter the phase of the exciting emf the correct direction in order to cause the power-factor the working circuit of any motor to be raised to any ired extent or even to be converted into a "leading" wer-factor. That being the case, it is only necessary, in nection with the motor shown in Fig. 37 to introduce o the exciting circuit comprising the brushes 53 and 54 l in which an exciting emf $e_3$ in phase-quadrature with working emf $e_2$, and therefore with the terminal emf $E$, already present, another emf differing in phase from the iting emf and of such magnitude and direction as will ieve the end in view. Since the exciting emf $e_3$, acting the exciting circuit of this motor, is in phase-quadrature h the terminal emf $E$, then it is necessary merely to ect into this exciting circuit an emf of the same phase $E$ and to select correctly the direction and magnitude of s compensating emf $e_2'$. This result can be readily ieved in the manner shown in Fig. 38 by means of the nsformer $T_2$. The secondary emf of such a transformer st necessarily be of practically opposite phase to the minal emf $E$, while its direction relatively to the self-duced exciting emf $e_3$ generated within the rotor 5 can ays be adjusted by means of a reversing switch, such 51. The magnitude of $e_2'$ can be controlled by means of regulating switch 52. A comparison of Fig. 38 with . 33 immediately discloses the fact that the methods of npensation employed in the two figures are identical, the npensating emf $e_2'$ in each case being derived from that ise which feeds energy to the working circuit. In Fig. 33 working circuit is fed conductively; in Fig. 38 this cuit is fed inductively. In Fig. 38 the motor itself pro-es the emf $e_3$ required for its excitation; in Fig. 33 this iting emf is not produced in the motor and is conse-ently derived from an outside source, such as phase $B$ the supply.

There remains just one question to settle in connection h Fig. 38. While it is true that by means of the connec-ns shown it is possible to control the phase relation be-en the current in the working circuit and the emf im-ssed on that circuit, yet it remains to be proved that by




. 37—SELF-EXCITED, SINGLE-PHASE INDUCTION COMMUTATOR MOTOR WITH SHUNT CHARACTERISTIC

doing it is possible to control also the phase relation the current $I$ taken by the main stator winding with pect to the terminal emf $E$. If it be remembered that rotor along the axis 31, 32 is simply the secondary of a nsformer the primary of which is represented by the in inducing winding 52, then it is clear that phase varia-ns between current and emf in the rotor along the axis 31, 32 will be almost exactly reflected in the main inducing winding of the machine. These phase relations would be quite accurately reflected if it were not for the magnetizing current required by 52 in order to uphold the transformer field, which is essential to the operation of the machine. Owing to this magnetizing current in 52, the primary current $I$ will not only always lag more behind the terminal

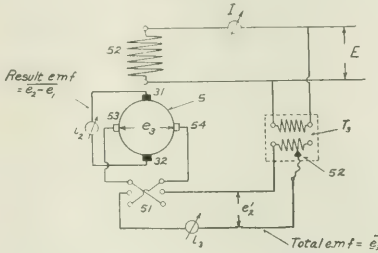



FIG. 38—SELF-EXCITED SINGLE-PHASE INDUCTION COMMUTATOR MOTOR WITH SHUNT CHARACTERISTIC AND ARTIFICIAL PHASE COMPENSATION

emf $E$ than the working current $i_2$ lags behind the working emf $e_2$, but it will also lead $E$ by less than $i_2$ leads $e_2$. For this reason it will be necessary to cause the rotor current along the axis 31, 32 to lead slightly the working emf along that axis in order to secure phase coincidence between $I$ and $E$ in the primary circuit of the motor. The reason why the phase relations between secondary current and secondary emf are always almost exactly reflected in the primary is that as long as the terminal voltage on the primary of a transformer remains constant it is necessary for the transformer flux, and therefore for the magnetizing current, to remain practically constant. At no load there is no current in the secondary and only the magnetizing current $i_0$ in the primary. As soon as a current $i_2$, be it lagging or leading, flows through the secondary, an equal and opposite current $-i_2$ must flow in the primary, in order to counteract all the magnetizing effects due to $i_2$ and thus retain a constant transformer flux. This condition is very clearly illustrated in the diagrams of Figs. 39 and 40, the first of which indicates the conditions for a secondary curent $i_2$ lagging by an angle $\gamma$ behind the secondary emf $e_2$, while the second shows the conditions obtaining for a lead of $i_2$ over $e_2$ amounting to $\delta$ degrees. It is seen that in the first instance the primary current $I$ lags behind the primary emf $E$ by more than the angle $\gamma$, while in the second instance the primary current $I$ leads the primary emf $E$ by less than the angle $\delta$. This fact leads to the conclusion that the compensating scheme used in Fig. 38 for the purpose of controlling the phase relation in the working circuit of the rotor will also control the phase relations in the primary winding 52 of the machine, or in that winding of the motor which is directly connected to the mains.

While it is quite possible to derive the compensating emf $e_2'$ from the mains in the manner shown in Fig. 38, it is neither the cheapest nor the most convenient manner of doing so. A handier way is shown in Fig. 41, in which the transformer $T_2$ is practically built into the motor itself, the main winding 52 being made use of as the primary of such transformer, an auxiliary or compensating winding 55 being used as the secondary thereof. It is then necessary only to connect this winding 55 properly to the exciting brushes 53, 54. If desired, the compensating winding 55 may be provided with taps, as shown in Fig. 41, with the help of which taps the magnitude of the compensating emf, and with it the power-factor of the motor, can be adjusted.

It is well known and has already been pointed out that it is possible to cause a synchronous motor to operate with almost any desired power-factor simply by altering the magnitude of the direct-current excitation of the machine. It

is thought that [illegible] point of [illegible] about is secured in [illegible] machines that must be very advantageously viewed from a somewhat different standpoint. It will be easy to see that the principle involved is exactly the same as that set forth in connection with asynchronous motors, although the necessary phase alterations

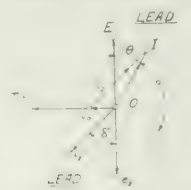



[illegible] 39.—[illegible]STOEMER PHASE DIAGRAM FOR LAGGING SECONDARY CURRENT

are brought about in a somewhat different manner; that is, mechanically instead of electrically.

Consider a single-phase generator and an identical single-phase synchronous motor, such as shown in Fig. 42. Let the field magnet 42 of the generator be provided with the field winding 20 and be excited by means of direct current, and let 42 be revolved at a uniform speed of 500 r.p.m. in the direction indicated by the curved arrow, then an emf $e_2$ will be generated in the armature winding 41 of this generator and may be represented by the vector $e_2$ of Fig. 43. Let the field magnet 3 of the motor be brought up to the same speed of 500 r.p.m. while excited with direct current by means of the field winding 5, connect the motor armature 58 to that of the generator at the proper time and in the manner shown, and adjust the excitation of the motor until it operates at unity power-factor; that is, until the current $I$ taken by the machine coincides in phase with the working emf $e_2$ impressed on same from the generator winding 41. Assuming that the generator winding 41 and the motor winding 58 are entirely devoid of local inductance—an assumption which holds true only in the case of an ideal machine—and that the direct-current excitation has been adjusted for unity power-factor, then it will be found that the corresponding relative position of the field magnets 3 and 42 is that shown in Fig. 42. This relative position of the two field magnets is preserved throughout each revolution as long as the machines remain in step; that is, in operation. This condition may be described by saying that the two field magnets are in phase but are oppositely directed, or by saying that they are of opposite phase. This is true since at the instant for which Fig. 42 holds good the north pole of the generator field magnet is directed upward and that of the motor is directed downward, and these magnets retain their parallelism at all times.

Since the instantaneous magnitude of the emf $e_2$ gener-




[illegible] 40.—[illegible] PHASE DIAGRAM FOR LEADING [illegible]

ated in 41 depends at any instant on the position of the field magnet 42 relatively to the points 60 and 61 at which $e_2$ is measured, then it is clear that the emf $e_1$ generated in 58 will likewise depend on the position of the field magnet 3 relatively to the points 62, 63 at which $e_1$ appears. Referring to Fig. 42, it is noted that when the north pole of 42 stands opposite point 60 the south pole of 3 stands opposite point 62; thus if the emf $e_2$ generated in 41 reaches a positive maximum when the north pole 42 stands opposite point 60, then the emf $e_1$ must clearly reach a negative maximum at the same instant. It follows that the emf $e_1$ generated in the motor winding 58 and which is the back of the machine will, for the relative positions of 3 and 42 shown in Fig. 42, oppose at every instant the working emf $e_2$ generated in 41 and impressed on 58. This condition of things may be represented by means of vectors, in the manner shown in Fig. 43, in which the vector representing the back emf $e_1$ is shown as being exactly opposed to the vector $e_2$ representing the terminal or working emf of the motor. It is known that $e_2$ must be sufficiently greater than $e_1$ in order to enable the motor to receive enough current to allow it to deal with its load. The resultant responsible for that current in the armature winding 58 of the motor will therefore coincide in direction with the vector $e_2$ and may be represented by the vector $R$. On the assumption that the motor is an ideal one, the current $I$ due to $R$ will not lag slightly behind this resultant but will coincide with it, as shown in Fig. 43, and the motor will operate at unity power-factor. The same thing is also indicated in Fig. 42 by means of the arrows marked $e_2$, $R$, $I$ and $e$. The first three are all in line one below the other, thus indicating that they coincide in time and direction; the last is of opposite direction to the first and is so shown.

Now let the direct-current excitation of the motor be weakened. This will immediately reduce the magnitude of the back emf $e_1$ and cause the current $I$ taken by the motor

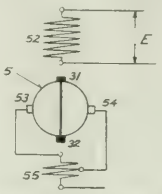



FIG. 41.—SELF-EXCITED SINGLE-PHASE INDUCTION COMMUTATOR MOTOR WITH SHUNT CHARACTERISTIC AND ARTIFICIAL PHASE COMPENSATION

to rise momentarily, thus supplying more energy to the machine than is called for by the load with which it dealing, with the result that the field magnet will momentarily accelerate its speed in an attempt to reduce the current $I$ by increasing the back emf $e_1$. Assume that the momentary acceleration of the field 3 alters its relative position to the field 42 by the angle $\alpha$ indicated in Fig. 4 If the field magnet 3 continues to revolve synchronous with the field magnet 42 after having altered its positi relatively to the latter in the manner indicated, then it clear that the back emf $e_1$ generated in the motor armatu 58 will retain its original periodicity, as is imperative, b will reach its maxima ahead of the maxima reached by The time elapsing between the instant at which $e_1$ reach its maxima and the instant at which $e_2$ reaches correspon ing maxima will be proportional to the angle $\alpha$ of Fig. and will represent the phase difference between $e_1$ and This phase difference may, therefore, be expressed in t usual way by displacing the vector $e_1$ of Fig. 43 by t angle $(+\alpha)$; that is, by an angle $\alpha$ measured in the dir tion of rotation. This displacement of the vector $e_1$ shown in the vector diagram of Fig. 45 and immediat indicates that the resultant $R$, responsible for the current the motor armature 58, for the new relative positions the field magnets 3 and 42, shown in Fig. 44, will no m coincide with $e_2$ as was the case in Fig. 43, but will behind $e_2$ by the angle $\theta$ indicated in Fig. 45, causing current $I$ in the motor also to lag behind its terminal e by this same angle $\theta$.

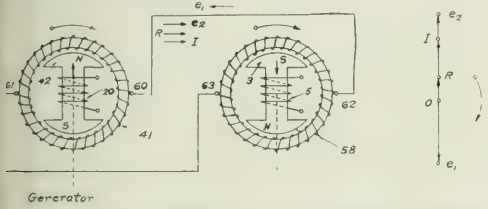
When previously discussing the behavior of synchronous notors it was shown:

(1) That the armature reaction of a synchronous alternating-current motor operating with unity power-factor can merely cross-magnetize the field magnet of such a machine and cannot directly oppose or help the magnetization produced by the field magnet.

(2) That the armature reaction of a synchronous motor operating with "lagging" power-factor produces a magnetization which helps that due to the field magnet of the machine.

(3) That the armature reaction of a synchronous motor operating with "leading" power-factor produces a magnetization which opposes that due to the field magnet of the machine.

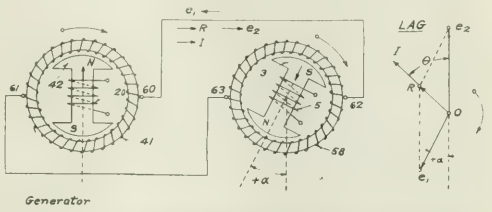
In the case of Fig. 44 it has been seen, with the help of the diagram in Fig. 45, that the weakening of the direct-current excitation of a synchronous motor tends to accelerate the field magnet of the latter, and that the resultant permanent space displacement of the field magnet of the motor with respect to the field magnet of the generator (compare Figs. 42 and 44) so alters the phase of the back emf of the motor as to cause the latter to take a lagging current. This lagging current will help the magnetization produced by the field magnet of the motor and will, therefore, be in a position to bring the total useful magnetization of the machine back to a value at which the back emf will be of such magnitude as sufficiently to reduce the motor current $I$, even if the motor speed remains constant; that is, even if the machine continues to revolve synchronously.




FIGS. 42 AND 43—GENERATOR AND SYNCHRONOUS MOTOR OPERATING AT UNITY POWER-FACTOR

follows that as soon as the direct-current excitation of a synchronous motor is weakened, its field magnet will swing forward through an angle $\alpha$ of such magnitude as will enable the lagging current thereby drawn from the generator to increase the useful magnetization of the machine by about that amount by which it was reduced owing to the weakening of the direct-current excitation. This adjustment of the magnetization having taken place, the motor may and will continue, after the above-mentioned momentary deviation, to run at a strictly synchronous speed. A strictly synchronous speed is necessary because the frequency of the back emf of a synchronous motor depends on the speed of that machine and must remain equal to the frequency of the terminal emf.

Similarly, if the excitation of a synchronous motor be suddenly increased, then the magnitude of its back emf will be increased, will reduce the current taken by the machine, thus reducing its torque, and will cause the field magnet 3 to be retarded momentarily. This retardation may, for instance, amount to the angle $(-\alpha)$ shown in Fig. 46, causing the back emf $e_1$ to reach its maxima some time after the working emf $e_2$ has reached its corresponding maxima. This time-difference, or phase difference, between $e_2$ and $e_1$ will be proportional to the angle $(-\alpha)$ and may be represented, as shown in Fig. 47, by displacing the vector $e_1$ of Fig. 43 against the direction of rotation through that same angle $(-\alpha)$. A glance at Fig. 47 shows that this new displacement of the field magnet 3 of the motor relatively to the field magnet 42 of the generator causes the motor to take a leading current, and since a leading current taken by a synchronous motor tends to demagnetize the field magnet of the latter, it will be apparent at once that an increase of excitation will cause the field magnet of a synchronous motor so to change its position relatively to the field magnet of the generator feeding the latter as to cause the now

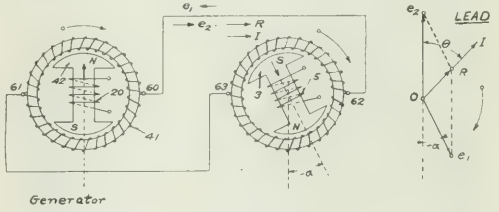



FIGS. 44 AND 45—GENERATOR AND SYNCHRONOUS MOTOR OPERATED WITH LAGGING POWER-FACTOR (MOTOR UNDEREXCITED)

leading armature reaction of the motor to oppose the magnetization produced by the field magnet of the machine to that extent which will allow a back emf of the correct magnitude to be generated by the machine even though it continues to run at a synchronous speed and with an excessive direct-current excitation.

In discussing Figs. 42, 44 and 46, the changes in the position of the field magnet 3 of the synchronous motor have always been referred to the field magnet 42 of the generator driving it, and it has been shown that the space displacement of the field magnet 3, indicated by the angle $\alpha$, is simply a phase displacement of the exciting flux of the motor relatively to the exciting flux of the generator. Since it has also been shown that the phase of the working emf $e_2$ produced in the generator always bears the same phase relation to the exciting flux of the latter, then it would clearly be just as accurate to refer the various positions of the field magnet 3 to the phase of this working or terminal emf $e_2$, instead of to that of the field magnet 42 of the generator. Such a course was followed in previous sections of this paper.

The same conditions may be expressed in many other ways by taking into account the phase relations between the motor flux, the motor back emf and so on, but enough has been said to show that the power-factor of a synchronous motor is controlled exactly in the same manner as that of the non-synchronous motors shown in Figs. 30, 33, or 38 and 41, namely, by altering the phase relation between the working or terminal emf and the exciting or motor flux. In the synchronous machine this change in phase is brought about mechanically by an automatic attempt of the motor




FIGS. 46 AND 47—GENERATOR AND SYNCHRONOUS MOTOR OPERATED WITH LEADING POWER-FACTOR (MOTOR OVEREXCITED)

itself to correct the magnitude of its excitation so as to enable it to deal with any desired load within its range of power while preserving a strictly synchronous speed. Not only does this automatic adjustment take place every time the operator changes the magnitude of the direct-current excitation of the machine but it is also induced by every

change of [illegible] that causing the power-factor of a synchronous motor to vary with the load. In the [illegible] there is no occasion for any such automatic adjustment on the part of the machine itself, and none takes place, because of the fact that these motors need not preserve a strictly synchronous speed, a fact already indicated by the word "asynchronous" used in connection with these motors. Asynchronous machines therefore always operate with "lagging" power-factor unless artificial means are provided for the purpose of shifting the phase of the exciting or motor field relatively to the phase of the working emf. Such artificial means have been shown, for instance, in Figs. 33, 38 and 41. In Figs. 33 and 38 they comprise a compensating emf $e_3'$ differing in phase from the exciting emf $e_3$ and derived from a transformer $T_3$. In Fig. 41 they comprise a compensating emf ($e_3'$) derived from the compensating winding 55 disposed on the stator of the motor itself.

## The Close Measurement of Speed

By Neil Monroe Hopkins

In the precise measurement of electrical and mechanical values probably no factor has received less serious consideration until recently than what may be termed the precise simultaneous indication of angular velocity or the general subject of scientific tachometry. In the various branches of engineering many refinements have been developed for closely measuring and showing time, temperature, mass, heat units, candle-power, wave-form frequency, volts, etc., and our laboratory textbooks are filled with clever methods of dealing accurately with various familiar electrical and mechanical measurements; but up to the present time refinements in instruments for measuring speed and their calibration have been very much neglected.

Several years ago the writer set out to produce a scientifically accurate tachometer, using as a basis for calibrating a shaft of constant angular velocity operated by a small ten-pole synchronous motor controlled by the vibrations of an electrically driven tuning fork kept carefully at constant temperature, and driving the tachometers under study, within a double-walled temperature cabinet fitted with means for heating and cooling and for indicating the temperature not only of the voltmeter movement but of the magneto and connecting leads as well. With this synchronous motor drive and tuning-fork control a progressive increase of load upon the motor will not progressively slow down the shaft. The writer's first problem consisted in the design of a small direct-current magneto capable of giving a straight line rise of emf when operated with the indicating instrument, which was of low resistance and low millivolt full-scale deflection, allowing for a large percentage of manganin to be included in the circuit.

In order to secure permanence of the magneto magnet, long life of operation when subjected to conditions of moisture, dirt and grit, and perfect commutation at all speeds up to 25,000 r.p.m. and higher if desired, a very special design of magneto became necessary. The machine, as finally constructed, consisted of a laminated magnet of thin tungsten steel of the highest grade, with the pole pieces stamped as an integral part of the laminations to avoid any joint which might rust or produce a variable in the magnetic circuit, an armature running within an exceedingly close air-gap, for the sake of permanence, and the armature shaft running upon internal ball bearings entirely separate from those of the main driving shaft. Reduction gears within a water-tight and dust-tight cast-iron shielding case greatly reduced the speed of the main shaft, thereby keeping the armature and commutator within the bounds of smooth commutation at the highest speeds. It will be seen that any wear of the main bearings whose shaft passes through the cast-iron case will not affect the true and close running of the armature and commutator mounted upon the second shaft. It will also be seen that any undue vibrations or end play of the main shaft will not be communicated to the armature and commutator shaft because of the intermediate gear drive. By designing a very long commutator and constructing the commutator bars of platinum or gold, and by supplying several pairs of platinum or gold brushes, connected in parallel, upon each side of the commutator, no variable in resistance is introduced into the circuit as a result of variable brush tension, salt formation or oxidation, as would be the case with copper or bronze, etc.

## The Measurement of Peak Voltage

By Henry A. Morss

There appears to be considerable misconception concerning the high-voltage testing of wires and cables. This may be due to the fact that these tests are usually made on open circuit, and, therefore, engineers take it for granted that there are no difficulties because practically no current is required. Such is not the case, however. Owing to the electrostatic capacity of cables of commercial lengths, considerable current is required to maintain the test voltage, and this current by its action on the generator so distorts the wave-form as to render the ordinary voltmeter practically useless.

Of course, the ideal wave-form for high-voltage testing is the sine wave, and if this can be maintained the ordinary voltmeter is sufficient, but when the wave is distorted and the voltmeter still reads only the "square-root of the mean square," it gives very little indication of what is actually happening as regards a breakdown test, for the peak of the wave is what counts so far as the breaking down of insulation is concerned. It follows, therefore, that the strain may actually be much larger than indicated by the voltmeter if the wave is distorted into a high peak, or the strain may be less than indicated if the wave has become flattened.

Experience has shown that under certain circumstances the real strain, which is due to the highest point of the wave, is not indicated at all by the ordinary voltmeter.

The Standardization Rules of the A. I. E. E. require in voltage testing that use be made of an alternating voltage with an effective value equal to the square root of the mean square referred to a sine wave.

In the case of a sine wave, the effective voltage is about 70 per cent of the maximum voltage. Therefore, in cable testing a maximum voltage about one and four-tenths times the required voltage should be used, and the question arises how to determine this under all conditions of testing.

The maximum voltage may be ascertained by means of an oscillograph, but an oscillograph is a delicate and cumbersome instrument for factory use where a large number of tests are made every day. As a result of his study of the problem, the writer concluded that an instrument might be made on the principle of the oscillograph, but with the vibration confined to a straight line, so as to show the limits of oscillation, and thus to indicate the peak of the wave at the end of the line. Such an instrument would be extremely simple to calibrate at any time by applying a known value of unidirectional voltage. This proposition was laid before Prof. F. A. Laws, of the Massachusetts Institute of Technology, and Mr. Chester L. Dawes, of Harvard University. They built an instrument which, although somewhat crude, has achieved the desired result and demonstrated the feasibility of the scheme by a test of three months' use under factory conditions. It would seem that such a peak-voltage-measuring instrument, which is now being developed for commercial service, should have varied uses, for many engineers must be interested not only in the voltage as shown by the ordinary meter, but also in the actual maximum voltage present in generators, transformers, motors or transmission lines.

# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Employees' Relations with the Public

The Narragansett Electric Lighting Company, of Provi-nce, R. I., recently posted the following notice to em-oyees, with the object of cultivating the best possible rela-ons with the public:

TO OUR EMPLOYEES

Do not forget that you are in the service of the public.
Treat all customers politely and courteously.
Do not try to be smart.
Do not misrepresent anything.
Do not think you are doing the company any favor by beating a cus-ier on a deal.
The motto of this company is "A square deal to the public."
See that you live up to it.

## A Woman's Private Electric-Car Livery Service

A lady living at an Eastern summer resort recently un-rwent financial reverses which threatened to deprive her her electric automobile, but rather than sacrifice the car a small price she determined to convert it into a revenue oducer. First she had tasteful little folders printed an-uncing that her car was for hire for shopping trips, etc., d these she distributed at the local hotels.

"My private electric car is at your service," reads the nouncement, "for a morning's shopping to the exclusive ops; for a ride out of town; for church-going; for an ting for convalescents; for trips to the theater; for ncheons, etc."

"This electric car," continues the folder, "is ideal for e élite and refined, because it is safe, quiet, clean, com-rtable, conservative, luxurious and commodious." The r seats four persons comfortably, including the driver, io is usually the woman owner herself. The rate is .50 per hour, with a slightly lower price per hour if the r is hired by the day or half-day.

## wo Years' Commercial Effort at Steubenville, Ohio

Since the inauguration of a commercial department at eubenville, Ohio, May 1, 1911, a remarkable central-ation growth has resulted there as indicated by the in-

RESULTS OF COMMERCIAL EFFORT AT STEUBENVILLE, OHIO

| | 1911 | | 1913 | |
|---|---|---|---|---|
| | No. | Kw | No. | Kw |
| tor connections | 3 | 32 | 76 | 1200 |
| mmercial connections | 260 | 520 | 604 | 1208 |
| sidential connections | 240 | 120 | 402 | 201 |
| t-rate connections | 0 | . | 194 | 19.4 |
| n connections | 0 | . | 61 | 41 |
| ngsten clusters | 0 | . | 120 | 12 |
| hite Way" posts | 0 | . | 59 | 23.6 |
| ns | 25 | 12.5 | 300 | 70 |
| Total | | 684.5 | | 2775 |

ease in motor load from 40 hp to 1500 hp, scattered nong a number of small customers ranging from 1 hp 100 hp each. This work was accomplished in spite of the ct that 95 per cent of the motor-service users were for-merly operating gas engines for which the fuel supply cost only 25 to 15 cents per 1000 cu. ft.

Among the lighting customers maximum-demand indicators were employed with success, a rate of $4.50 per room being obtained from local contractors for wiring old houses complete with fixtures, lamps and pull-chain sockets. In the accompanying table is reproduced the comparison of central-station data presented by Mr. H. E. Armstrong, of the Tri-State Railway & Electric Company, before the convention of the Ohio Electric Light Association at Cedar Point, July 16, 1913. The company considers Steubenville's "White Way lighting" its most notable achievement. The local business district is lighted by fifty-nine ornamental standards, each carrying five 100-watt tungsten lamps.

But, adds Mr. Armstrong, "the commercial department of any company cannot be a success unless it has every man in the company working for it."

## The "Movies" as a Central-Station Load

Realizing that a load of from 35 amp to 60 amp at 110 volts is demanded continuously from early afternoon to late into the evening by the picture mechanism alone of a moving-picture show, the new business department of the United Electric Light & Power Company, under the management of Mr. J. Becker, is making a strong bid for this class of business in New York City. The energy which is required to produce the arc in the lantern is, in an up-to-date picture theater, but a small portion of the load if the appliance and electrical auxiliary salesmen of the central-station company have been attending to their duties.



BOOTH OF THE UNITED ELECTRIC LIGHT & POWER COMPANY

At the booth of the United Electric Light & Power Company which was erected at the first International Exposition of the Moving Picture Art, held at the Grand Central Palace in New York City from July 7 to July 12, the picture show electrical necessities and helpful auxiliaries were tactfully displayed. A standard fireproof booth containing an up-to-date lantern wired to receive energy from

small rotary converter formed the basis of the exhibit, and pictures of a beautiful young lady demonstrating toasting stoves and other electrical appliances served, when upon the screen, to make the booth a stopping place for every passer-by.

In addition to these necessary adjuncts to the picture show, fans, musical bells, ozonators, sign flashers, electric radiators and motor-driven ventilating equipment and household appliances were displayed in conspicuous positions. At times when the picture camera was not in operation the art-glass doors seen in the background of the illustration were closed, hiding the white screen from view. The illuminated sign above the arch was lighted with 5-watt tungsten lamps, which periodically flashed the words "The United Electric Light & Power Company," while the smaller letters at each end of the sign were in service continuously, spelling the words of the slogan of the Society for Electrical Development, "Do It Electrically."

## Service Extensions to Bona-Fide Customers

Most companies have had experience with supposed prospective customers who make application for a service extension and then, after the extension is run, are not themselves ready to contract for service. In many cases it is found that such supposed "prospects" had merely signed

APPLICATION FOR LINE EXTENSION

*Agreement* made this . . . day of . . . . . , by and between the Springfield Light, Heat & Power Company, hereinafter called "Company" and, hereinafter called "Applicant."

In consideration of the Company making investment to supply Applicant with electricity, the Applicant agrees to have building located at ..... wired ready for Company's meter. If building is not ready for service on date that Company's line is completed, Applicant agrees to pay to the Company, one and one-half ($1.50) dollars each month from date line is completed until Applicant is ready for service.

Service will then be supplied at rates as specified on attached application.

The Springfield Light, Heat & Power Company.

*By* . . . . . .

*By* . . . . . .

Owner of Above Property.

FACSIMILE OF APPLICATION FORM

the application to oblige a neighbor in getting electric light, and that they themselves had no serious intention of taking service. Unless some form of obligation is involved on the part of the applicant, considerable outlay may be made in service-extension investments without resulting business to justify it. To single out the people who are actually sincere in their requests for service, Mr. J. D. North, commercial manager for the Springfield Light, Heat & Power Company, Springfield, Ohio, arranged the accompanying form, by the terms of which the intended customer agrees to pay the company $1.50 per month during the interval from the time service is available until the applicant is ready to use it.

## Electricity in a Colorado Hospital

Electricity performs important service in the Red Cross Hospital of Salida, Cal., a town well known to transcontinental travelers via the central Rocky Mountain region as a railroad center and junction point. About 400 incandescent lamps are in use in the establishment, service being supplied by the local central-station company. The operating room is one of the best in the State from the standpoint of electrical equipment and is about 20 ft. by 12 ft. in plan, containing twelve service outlets, an electrically warmed operating table and an instrument cabinet 5 ft. by 5.5 ft. by 1.5 ft. in dimensions, with six glass shelves, two 4-cp lamps being kept lighted constantly to maintain the proper conditions of dryness. Four 100-watt lamps are installed directly above the operating table, and ventilation is facilitated by an 18-in. fan driven by a ⅛-hp, 110-volt motor. In the diagnosis rooms and laboratories electric reflector lamps attached to head bands are in service, and electrically heated instrument sterilizers are in use. A large examination table is provided with four 60-watt lamps, two of which may be cut off at a time. A full line of rheostatic equipment is available for use in connection with cautery apparatus, endoscopes and cystoscopes. An electric stove is employed in heating broth in the kitchen, and an electric toaster is constantly used on the premises. An electric clock system and a complete set of interior telephones, floor bells, corridor, pilot and night lamps are in service, and the nurses' croquet ground is illuminated for evening games by incandescent lamps of 16-cp rating scattered at convenient intervals.

## The Meter Tester and His Duties

Of equal importance with the standard used for testing meters is the selection of the tester himself, declared Mr. C. B. Stelle, of the Springfield (Ohio) Light, Heat & Power Company, in a recent paper before a metermen's conference of the Ohio Electric Light Association. Mr. Stelle continued:

"Take the young man who has had a fair education, the one who is building an induction coil or motor, the one who is more interested in the electrical journals than the daily papers and periodicals, even though he did shut down the whole plant on a Saturday evening by trying to electrocute a rat! If there is no one around the plant who is familiar enough with ordinary methods of testing to instruct him, it might be advisable to send him for a month or two to one of the larger companies to act as an assistant and thereby learn to test meters. Then let him test what meters there are in the place usually set aside for this purpose, until you are satisfied that he is familiar with the necessary adjustments and is competent to test any meters he may find on the lines. Even then it will be advisable for him to test the meters of smaller capacity first and gradually work up to the larger ones."

Among the rules which the tester should observe from the start and which from the experience of other companies are most important are:

Notify the customer of the test.

Politeness and good appearance, showing little or no interest in anything but the meter.

Approach the meter as quickly, carefully and quietly as possible.

Ascertain first if the current is on—in small towns the lineman may have that side of the town cut off.

Enter the data, such as "company number," "maker's number," reading, size and type of meter, etc., on suitable card. While getting these data it is well to see if the meter is sealed, and if there is any movement of the meter due to creeping; if so, the time of one revolution should be taken or if the creep is very small, a quarter or half revolution from which can be calculated readily the watts represented. If this, however, is due to a bell-ringing transformer or lamp burning in some part of the house, the meter should be jumped so as not to inconvenience the customer.

Wipe dust and dirt carefully from cover before removing for failure to do this may show the meter as found "not running" where the trouble was due to some foreign particle having just fallen into the meter.

As there are two adjustments for correctly altering the meter's accuracy, a test under both light-load and full-load conditions is necessary. The light-load condition should be taken first as the meter might not start on light load, while a full load at first might remove the cause of meter not running on light load.

Just about the time the test has been made and results entered, the customer will usually appear on the scene with an exclamation of "How is she?" This is the most critical part of the test, for if the tester says it is slow, he will probably be subjected to a torrent of abuse. If he says "It's fast," the customer will get to the office before he does and things will be mightly uncomfortable for everybody for a while. If the tester says he doesn't know, or that he will have to wait until he gets back to the office to make the calculation, the customer knows he is falsifying.

The best and common practice, declared Mr. Stelle, is to say that instructions are not to give out any information but to refer the inquires to the proper individual in the office. This official, from long dealing with the public in general, is more qualified to handle the situation.

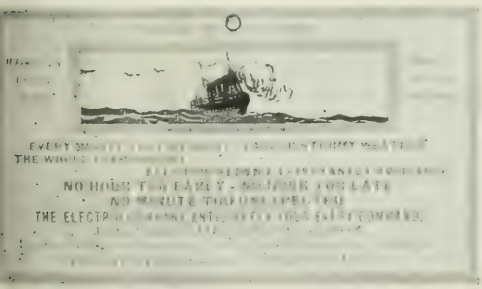
After reconnecting meter, check the readings, replace cover carefully (after cleaning dial glass) and seal meter. Try at least one lamp to see that the circuit has not been left open.

Gather up all apparatus carefully, for it is burdensome for the consumer to let the tester go up to the meter again for a forgotten pair of pliers. "On the way out notify the person in charge that you are through, thank him for some imaginary kindness like showing you to the meter or something similar, and wish him good day. It doesn't cost anything to be polite, but it paves the way to your success as a meter tester. Then go on to the next test."

## A Central-Station Barometer

Subsidiary companies of the Federal Light & Traction Company of New York are distributing to present and prospective customers a new advertising novelty which has proved to be one of the most popular publicity "stunts" the company has put out. The card measures 6.25 in. by 3.5 in. and frames a picture on chemically sensitized paper entitled "The Playground of the Storm" and showing a big ocean liner on the high seas. When exposed to dry air the sky of the ocean scene assumes a blue color, changing to pink when the air becomes humid, indicating the approach of rain.

The lower part of the card bears the appropriate re-



BAROMETER USED AS AN ADVERTISING NOVELTY

minder: "Every minute—day or night—fair or stormy weather—the whole year around, electric service is instantly available. No hour too early—no hour too late—no minute too unexpected—the Electric Company anticipates your every command. Just a twitch of the switch for comfort. Electric service—convenient—safe—clean—economical—healthful." Then follows the name of the company.

## A "Living-Picture" Window Display

The Lexington Street and Park Avenue show windows of the Baltimore Gas & Electric Company have been attracting much attention during the last few weeks by the alternating exhibition of a wax dummy figure of "Liberty" and by a living imitation of the wax dummy. The human figure held his position immovably for fifteen minutes at a



WINDOW DISPLAY AT BALTIMORE

time, arousing the greatest of curiosity on the part of the public outside, who wagered among themselves whether they were looking on flesh or waxwork. Only when the poser stepped from his position and his place was taken by the inanimate dummy were all of the people convinced. A 500-watt lamp was held in the figure's hand, and the idea of "the Goddess of Liberty enlightening the world" rapidly "caught on" in the public's mind.

Besides the tungsten-lamp exhibit illustrated, the company has also been using the mechanical doll in connection with displays of electric irons, fans, vacuum cleaners and washing machines. These never failed to draw crowds, as the demonstrator cleverly imitated the mechanical movements of an automaton. At other times both the real dummy and its living prototype appeared in the window, it being quite impossible to tell which was which, especially as their positions were changed from time to time. Mr. Dorsey R. Smith devised the displays described.

## Electric Operation of Household Drying Closets

An application of electric power which is highly appreciated by housekeepers is the drying closet, used in connection with the laundry.

Such a closet, as described by Prof. F. C. Caldwell, of Ohio State University, Columbus, in his paper on electrical applications before the Ohio Electric Light Association convention, July 16, makes use of an electric fan to blow heated air through the closet. The heating is usually done with gas, though in the matters of both safety and convenience and in the dryness of the air electrical heat would be much to be preferred. Such drying closets built of steel can be purchased, but very good results can be obtained from an ordinary closet properly fitted up. Professor Caldwell has had one in his own home for several years, he said, and it has proved most satisfactory.

The mangle, or ironing machine, motor-driven and electrically heated, is another laundry helper that deserves more consideration than it has so far received, he said. Here again it is a problem of demonstrating its applicability to the ordinary household.

# Illumination and Wiring

## Work of Electrical Department, Sanitary District of Chicago

Some interesting points were brought out in an address before the City Club of Chicago on July 11 by Mr. A. B. Gates, testing engineer of the Sanitary District of Chicago, who gave a brief account of the hydroelectric development of the District in a symposium on street lighting. The speaker said that the hydroelectric development of the Chicago Drainage Canal was put in service in 1907, with a connected load of 165 hp in the town of Cicero. A year later the connected load was 15,278 hp, and it has grown steadily since until at the close of 1912 it amounted to 51,846 hp. This connected load is about equally divided between municipal and commercial users.

Mr. Gates called attention to the fact that the Electrical Department of the Sanitary District, co-operating with the Department of Electricity of the city of Chicago, is entitled to credit for a number of important changes in electric street-lighting practice. Perhaps the most important of these was the development of the long-life, series, alternating-current 10-amp flame-arc lamp. When this lamp was first considered for Chicago there was no lamp of the type on the market and it was only after considerable experimental work in which the engineers of the Sanitary District were actively engaged, that such a lamp was produced. Another interesting feature of the present lighting system of Chicago was the adoption of the series-tungsten lighting for residential districts, converting old gas-lamp posts into standards for tungsten lamps enclosed in opalescent spherical globes. A third feature is the special raising and lowering device for arc lamps, which saves time and expense in trimming and repairing lamps, and insures the men against possibility of electric shock.

## Lighting the Park-Like Streets of Washington, D. C.

Mr. Walter C. Allen, district electrical engineer of Washington, D. C., gave an illustrated luncheon address before the City Club of Chicago on July 10. His subject was "The Lighting of the National Capital." Prof. Harry McCormack, of the Armour Institute of Technology, presided and in a few opening remarks said that the chemist, as well as the electrical engineer, is entitled to credit for the modern advancement of illuminating engineering. To prove this he cited the use of the Welsbach mantle and the tungsten filament.

Mr. Allen said that all street-lighting service in Washington, D. C., is purchased from three companies—two gas companies and one electric-service company. The outstanding characteristic of the illumination of the streets in the national capital is the use of 100-watt tungsten lamps enclosed in opalescent glass balls mounted singly on slender fluted iron posts of graceful design. This low-intensity street-lighting service has given most satisfactory results. It was adopted largely on account of the fact that almost every street in Washington is generously provided with shade trees. In some cases there are four rows of trees in a single street or avenue, giving the beautiful park-like character to the streets of Washington which is so well known. The 100-watt lamp units are usually staggered, and in that case are 66 ft. apart, measuring in a straight line along the axis of the roadway. Occasionally, however, they are arranged in parallel fashion, with the lamps on each side of the street opposite each other, and in this case the longitudinal distance between lamps is 75 ft. Two heights are provided, one bringing the center of the globe 12 ft. above the surface of the street and the other 10 ft. 3 in. The posts are utilized for street signs.

About 18 miles of streets are now lighted by these single-lamp 100-watt units. There is, however, considerable arc lighting. In the case of the tungsten-lamp standards the lamps are mounted in upright positions in the globes, as tests made by the Bureau of Standards showed that there is practically no difference in efficiency between this position and the downward mounting. Energy is conveyed to the tungsten street lamps by single-conductor lead-covered underground cables laid at the curb and practically at the surface, being protected by strips of wood. Tile ducts are used only at street crossings and other exposed places. The cost of installing these 100-watt tungsten-lamp units is $45 per unit, exclusive of the post and globe, the figure named covering the lamp, fittings, cable, and labor. The maintenance cost varies from 25 cents to 40 cents a front-foot per year.

Pennsylvania Avenue, from the Capitol to the White House, is to be lighted with luminous-arc lamps mounted on specially designed standards having globes consisting of spherical frames with glass in segments. Lamps taking 6.6 amp each will be used, and they will be placed about 100 ft. apart on each curb. The initial cost will be about $70 each and the maintenance cost about $92.10 a year. Luminous arcs, with posts and globes of similar design, will also be used in the plaza about the union railroad station. The numerous bridges in and about Washington receive special treatment from the lighting point of view. For instance, Nernst lamps are used on the handsome concrete bridge over Rock Creek in line with Connecticut Avenue. The standards employed are very elaborate and cost $500 each. It is an interesting fact that in Rock Creek Park, a 1600-acre tract left largely in its natural state, there is no artificial lighting of any kind.

## High-Pressure Gas Lighting in Europe and America

In the course of an address on "Street Lighting by Gas Here and Abroad," before the City Club of Chicago on July 11, Mr. F. Victor Westermaier, consulting gas engineer, of Philadelphia, stated that a large area of the Panama-Pacific International Exposition, San Francisco, 1915, will be lighted by high-pressure gas. Mr. Westermaier argued for an abundance of light for city streets, and cited the example of Berlin, which, he said, is the most modern city in the world. He described the 4500-cp three-mantle high-pressure gas street lamps used in some of the streets of Berlin and said that lamps of similar type are used in London and Paris. The gas used by the municipality in Berlin costs about 40 cents a thousand, but is not of very good quality. As a rough measure of comparison he said that 2000-cp high-pressure gas lamps, on the operating basis used in Berlin (that is, two mantles burning from dusk until 1 a.m. and one mantle burning from 1 a.m. until dawn) cost 325 marks or about $81.25 a year. This includes operation and maintenance. He compared with this the 12-amp twin arc lamp on all-night service as used in Berlin and said the latter cost 575 marks ($143.75) a year for operation and maintenance, with electricity at 2.5 cents a kw-hr. Mr. Ray Palmer, city electrician of Chicago, said that in that city, with 80-cent gas and electricity obtained from the Sanitary District at an approximate of 0.5 cent a kw-hour, it was found that gas for a 50-cp gas lamp cost $10 a year and that electricity for an 80-cp series tungsten lamp cost $2.11 a year. Under the Chicago conditions, therefore the comparison was greatly in favor of electricity.

Mr. A. B. Gates, testing engineer for the Sanitary District of Chicago, pointed out that it is not fair to compare the cost of operation of the multiple direct-current arc lamps used in Berlin with the series alternating-current flame-arc lamps in Chicago, for the reason that the latter are of the long-burning type and therefore cut down the cost of maintenance; furthermore, they are more efficient

than the direct-current multiple lamps. For this reason, it does not follow that a saving could be effected in Chicago, under local conditions, by using high-pressure gas lamp in place of the present long-hour series alternating-current flame-arc lamps supplied with energy from a municipal waterpower plant.

## Fundamental Principles of Head-Lamp Illumination

By L. C. Porter and K. W. Mackall

There is at present considerable agitation throughout the country in regard to the use of the locomotive head-lamp. The question of whether a locomotive shall carry a head-



FIG. 1—DIFFERENT SIZES OF FILAMENTS, EACH OF 32 CP

lamp throwing a beam powerful enough to illuminate the track a long way ahead or one merely powerful enough to serve as a marker is very largely under discussion at this time and has occasioned the expression of varied opinions on the relative merits of the two methods.

Each class of lamps has its drawbacks and also its advantages. Where single-track roads are in use the powerful head-lamp seems to be advantageous; on double-track roads, equipped with extensive block signals, a powerful head-lamp may momentarily blind an engineer on an approaching locomotive. Tests have also shown that under certain conditions a powerful head-lamp may distort the colors of signals, owing to reflection from the glass roundels. It is probable that a head-lamp of intermediate power would be desirable—a head-lamp which would avoid the glare and reflection of the extremely powerful electric units and yet throw a stronger beam than the present oil lamps.

For the purpose of assuring greater safety to the traveling public, certain states have passed legislation (pending in others) regarding the use of head-lamps on locomotives passing through those states. This is an excellent move. However, as there is relatively little reliable information at present on this subject, great care should be exercised in securing such legislation as will accomplish the desired object. The question of how the law shall read is of vital importance.

At present such legislation is in force in the states of North Carolina, Montana, Indiana, Iowa, Oklahoma, South Dakota, Texas and Arizona. Bills on the subject have been presented and defeated in the states of Colorado, Kentucky and Illinois. Legislation is pending in California, Nevada and Pennsylvania. In several instances the law reads that the locomotive shall carry a head-lamp of at least 1500 unreflected candle-power.

The primary object of a head-lamp is, of course, to illuminate the track ahead of the locomotive. It makes little difference what the candle-power of the light source itself may be, so long as that ultimate result is accomplished. It is the desire of the authors to show that this may be done by the use of proper reflectors or lenses, or a combination of the two, with light sources far below 1500 cp; also that so powerful a light source, if backed by reflectors, may be detrimental to railroad operation, as suggested above. It is also intended to point out in this article the fallacy of the law, as worded, from the standpoint of track illumination.

The beam obtained from any head-lamp depends on three things, namely, (1) concentration of the light source into the focal point of a reflector or lens; (2) shape and condition of reflector or lens; (3) candle-power of the light source. These three conditions are placed in the order of their relative importance.

RATIO OF THE BEAM INTENSITIES OF VARIOUS INCANDESCENT LAMPS

| Kind of Lamp | Relative Beam Candle-power |
|---|---|
| No. 1—Carbon regular | 1.0 |
| No. 2—Carbon stereopticon | 2.0 |
| No. 3—Carbon stereopticon | 5.2 |
| No. 4—Tungsten stereopticon | 12.4 |
| No. 5—Tungsten concentric helix | 13.4 |

A head-lamp beam varies in two ways—in intensity and in spread. One beam may throw an extremely narrow yet very powerful pencil of light. Obviously such a beam would not be so serviceable as one not quite so intense but spreading over a greater area of the track.

In order to study the effect upon the resultant beam of concentration of the light source, special incandescent lamps were made up having filaments of varying concentrations, as illustrated herewith, but each of 32 cp. Each lamp was backed by the same reflector and the beam candle-power of the combination measured. The ratio of the beam intensities was as shown in the accompanying table. From this it will be seen that the beam candle-power, and consequently the track illumination, varies with the degree of concentration of the light source, and the more nearly the light source approaches the ideal point source of light, the more powerful the beam will be.

However, as the light approaches a point source, the spread also decreases. As a light source must have an appreciable size, there will be two rays of light striking each point of the reflector, coming from the extreme edges of this source; and since the angles of incidence and reflection must be equal, the angle between these two rays will determine the extreme spread of the beam. Hence neither an actual point source nor one of no concentration would produce the best head-lamp arrangement, but rather a source somewhere between these two extremes.

To study the effect of a reflector on the resultant beam,

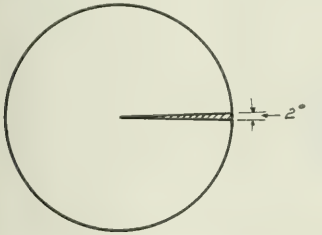



FIG. 2—RESULTANT BEAM WITHOUT REFLECTOR

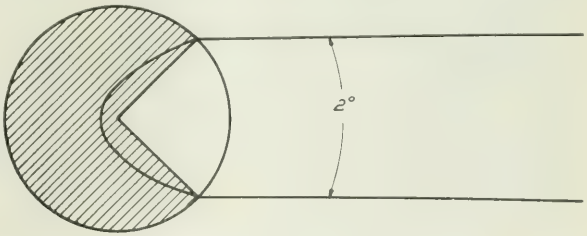



FIG. 3—RESULTANT BEAM WITH REFLECTOR

assume that a beam [illegible] by using a light [illegible] it is seen that only a very small portion of the total light flux generated would be utilized. On the other hand, suppose that in back of this light source there be placed a reflector that will give a beam of 2 deg. spread, a very much greater percentage of the total light flux will be utilized, and consequently a more powerful beam will be obtained. In each case the light utilized is represented by the shaded portion of the circle. The diameter and focal length of the reflector also determine, to a large degree, the percentage of total light used and spread of the beam.

The collection and effective projection, or redirection, of rays which are emitted from the light source in all directions produce the powerful beam; thus the selection of the proper lens or reflector is all-important. It is also important that the lens or reflector be kept highly polished and free from dirt.

At a distance of several hundred feet the diameter of a head-lamp becomes negligible in comparison with the distance; hence the whole head-lamp may be considered as a point source of light. Now, the intensity of light from a point source varies inversely as the square of the distance from that source. From all this it is seen that a light of 1500 unreflected cp (horizontal) will give an intensity at 1000 ft. of $\frac{1500}{(1000)^2} = 0.0015$ ft.-candle, which is far too low to enable a motorman or engineer to see an object the size of a man.

Tests made by several railroads seem to indicate that it is necessary to throw an intensity of from 0.05 to 0.1 ft.-candle on a man in dark clothes to make him visible at from 800 ft. to 1000 ft. on a railroad track, the actual intensity required depending somewhat on both atmospheric conditions and the color contrast between the object and the background against which it is viewed.

A 4-amp magnetite head-lamp, consuming 320 watts at the arc, gives from 550 to 650 unreflected cp. This light source backed by a polished parabolic aluminum reflector gives a beam candle-power of 70,000 candles, and at 1000 ft., the intensity will be $\frac{70,000}{(1000)^2} = 0.07$ ft.-candle. This same light source placed behind a semaphore lens 12 in. in diameter and of 7-in. focus gives approximately 125,000 cp. At 1000 ft. the intensity will be $\frac{125,000}{(1000)^2} = 0.125$ ft.-candle. Head-lamps having concentrated filament tungsten lamps for light sources have been made and have easily accomplished similar results.

Summarizing, it appears that laws requiring 1500 unreflected cp are misleading and really mean nothing where track illumination is concerned. A better specification for a head-lamp would be one which should have an average beam candle-power of not less than 100,000 measured at a distance of not less than 500 ft. over a 2-deg. spread. This is a concrete figure and one that can be met by head-lamp manufacturers. A law so worded would permit of perfect safety at high speeds.

## Recent Telephone Patents

The problem of designing a repeater circuit that will be equally efficient when operating in either direction is difficult because of the mutual reaction of repeaters so connected resulting in line noises. A patent recently granted to Messrs. E. W. Preston and G. L. Nickerson, of Sioux City, Ia., describes a means of overcoming this difficulty by arranging a single repeater for use in both directions. By means of relays the relation of the receiving and transmitting parts to the line is adjusted in accordance with the direction in which transmission is proceeding at any particular instant. The relays must be sensitive to the small impressed currents on either section of the line. In order that these weak currents may be effective in operating an electromagnetic relay, one-way repeaters are associated with each section of the line so that each of these may cause a sufficient magnification of received currents to effect the operation of the relay controlling the main-line repeater.

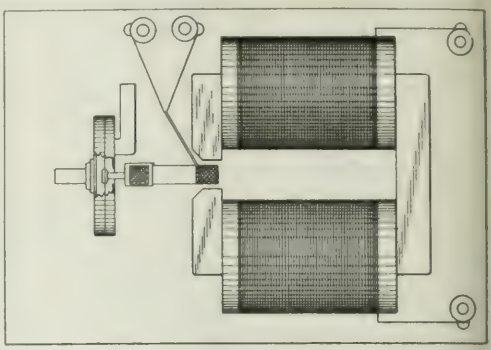


FIG. 1—REPEATING APPARATUS

In Fig. 1 is shown a repeating apparatus patented by Messrs. P. L. Jensen and E. S. Pridham. It will be seen that there is a circular coil disposed within the magnetic field of two co-operating field magnets and attached to the microphonic button. The pull exerted by the moving coil is not only a function of the field created by the received current but also of the strength of the permanent magnetic field. It is also a function of the length of conductor perpendicular to the lines of force. Weak telephone currents in the moving coil may effect a considerable pull on the microphone button.

### Exchange Systems

With automatic systems it is usually necessary for a subscriber to go through a complete manipulation of the dial of the instrument before obtaining talking connection with any party on the system. This becomes a disadvantage in case of emergency. To overcome this, Mr. A. E. Keith, of Hinsdale, Ill., has invented an arrangement by means of which, as soon as the receiver is removed from the switch hook of the automatic instrument, a talking circuit is established with an employee of the telephone company whose duty it is to respond to any demands made at this time. The system is arranged so that as soon as the dials are moved for the purpose of establishing a regular exchange connection the connection with the special employee is cut off. The patent for this system has been assigned to the Automatic Electric Company.

Mr. C. L. Johnson, of Chicago, has obtained two patents relating to the use of party lines in connection with automatic systems, the particular feature sought being the removal of any possibility of one station on the line inadvertently interfering with the establishment of switches from the other station. According to one of the patents the operation of any station is dependent upon the response of a polarized magnet of high resistance. If any station is using the line, its low resistance shunts the control magnets of all the other stations. The second patent describes a system whereby the mutual control between the stations of the party line is effected by means of an additional circuit parallel to and independent of the talking circuit. The circuit is arranged so that no station can interfere wi[illegible]

nother. Both of these patents are assigned to the Corwin elephone Manufacturing Company.

Another patent granted to Mr. Johnson and assigned to he Corwin company relates to ringing on party lines perating on automatic systems. This patent provides a runk circuit such that the calling subscriber may control he ringing by opening his circuit. As the ringing takes

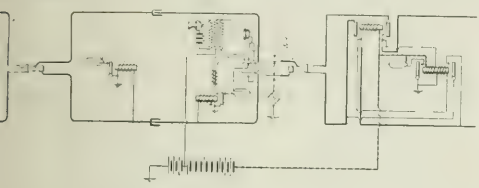


FIG. 2—CIRCUIT SYSTEM

lace when the calling party's circuit is open, the calling tation has no effect in shunting the line.

A switchboard circuit system invented by Mr. E. R. Hobbs, of Buhl, Idaho, is of the two-wire, common-battery ype, it having been the designer's endeavor to arrange uch a circuit system so that the line will be free from licks upon the response of the operator and further so hat there will be no chattering of the cut-off relay during inging. Fig. 2 shows how this is accomplished by making he cut-off relay close the connections to the jacks before evering the line relay connections, and by associating the ut-off relays between the tip side of the line and ground, hile all ringing currents are applied upon the ring side f the line. A further feature of the system is the establishment of the "busy" condition upon the jack sleeves as soon s a calling subscriber lifts his receiver. This is accomlished through an auxiliary contact of the line relay.

Another circuit system for common-battery multiple witchboards has been patented by Messrs. D. L. Temple, f Chicago, and C. L. Goodrum, of Atlantic City, and is ssigned to the American Electric Company. In this system two-wire plugs and cords are used, but the jack wiring s of the three-conductor type. The line relay is doubly ound, one of the windings alone being inserted during the alling condition. This winding energizes the relay and ghts the line lamp. Upon the insertion of a plug in the ack two of the jack springs become short-circuited, thus lacing the two windings of the line relay in parallel and eleasing the armature through differential action. The upervisory relays are three in number. The single controlelay circuit is completed through a retardation coil placed etween the subscriber's line and battery, while individual upervisory relays are associated with the plugs on the tip ide of the line. The control relay closes both supervisory amp circuits, while each supervisory relay serves to open he corresponding lamp circuit.

A combined fire-alarm and telephone system is the subect of a patent granted to Mr. W. W. Dean, of Chicago. The usual code-wheel fire-alarm apparatus is located upon he subscriber's premises, the moving code wheel serving o introduce current impulses upon one side of the telehone line. The telephone line is carried through a triplewound induction coil at the central office. Two of the windings are connected into the respective limbs of the ine in differential relation. The third winding is inductive o that one of the line winding which carries the codewheel impulses. These code-wheel impulses therefore beome induced in this tertiary winding, the terminals of which are connected to a relay sensitive to such impulses. The contacts of this relay in turn control the circuit of the larm bell and Morse recorder.

A party-line system designed by Mr. E. R. Corwin is rranged so that if any station is using the line a relay of ny other station attempting to do so will open both transnitter and receiver circuits of the offending station.

# Letter to the Editors

## Progress of the Jovian Order—The Electrical Fraternity

*To the Editors of the Electrical World:*

SIRS: The elecrical fraternity now known as the Jovian Order was formed at Austin, Tex., May 20, 1899, having a charter membership of forty-four, with the name "The Order of Rejuvenated Sons of Jove," and as an emblem a representation ot Lucifer in scarlet upon a white field. At the annual meeting held in Pittsburgh in October, 1912, the name was changed to the "Jovian Order," and a representation of the classical head of Jove surrounded by a circle, with the words "The Jovian Order" and "Co-operation," was adopted as an alternate emblem.

Statistics are at best but barren reading, yet it is believed that the figures in the accompanying table are not entirely devoid of interest to men associated with the electrical industry. They have at least the merit of being given in this manner for the first time. They show in concrete form the progress of the order in gaining candidates and emphasize clearly the struggles of its early days.

DATA ON JOVIAN MEMBERSHIP

| Jovian Period, Year | DATE | | NUMERICAL DESIGNATION OF NEW MEMBERS | | |
|---|---|---|---|---|---|
| | From | To | Potentials | | Number Admitted |
| First..... | 5-20-99 | 10-15-99 | 1 to | 44 | 44 |
| Second.... | 10-16-99 | 10-15-00 | 45 to | 56 | 12 |
| Third..... | 10-16-00 | 10-15-01 | 57 to | 66 | 10 |
| Fourth.... | 10-16-01 | 10-15-02 | 67 to | 103 | 37 |
| Fifth..... | 10-16-02 | 10-15-03 | 104 to | 116 | 13 |
| Sixth..... | 10-16-03 | 10-15-04 | 117 to | 178 | 62 |
| Seventh... | 10-16-04 | 10-15-05 | 179 to | 219 | 41 |
| Eighth.... | 10-16-05 | 10-15-06 | 220 to | 578 | 359 |
| Ninth..... | 10-16-06 | 10-15-07 | 579 to | 1,128 | 550 |
| Tenth..... | 10-16-07 | 10-15-08 | 1,129 to | 1,812 | 684 |
| Eleventh.. | 10-16-08 | 10-15-09 | 1,813 to | 2,490 | 678 |
| Twelfth... | 10-16-09 | 10-15-10 | 2,491 to | 3,548 | 1,058 |
| Thirteenth | 10-16-10 | 10-15-11 | 3,549 to | 4,865 | 1,317 |
| Fourteenth | 10-17-11 | 10-15-12 | 4,866 to | 8,400 | 3,535 |
| Fifteenth.. | (6½ months | expired) | 8,401 to | 10,407 | 2,007 |

The Jovian Order is not on trial, with need to justify its existence, and it requires no defense. However, individuals who have not had opportunity to perfect their knowledge of its aims and work may question its right to expect their cooperation and support. To any doubt felt by these the record as indicated in the table should be more than sufficient reply. When ten thousand men of one industry support a cause that has survived the test of fourteen years, the doubter may safely embrace it without strict examination. If, however, numbers alone fail to convince, an investigation of the personnel of this vast membership would surely do so, revealing as it would that included in the roll are not alone those of humble position and influence but numerous influential and learned men active in making history in the electrical industry to-day. All the men in the profession having national and international fame, with few exceptions, are Jovians. The Jovian roster in each city includes the men of large achievement there, the executives of central stations, street railways, telephone, manufacturing and jobbing companies, all meeting upon common ground under the mantle of Jovianism.

Concerning the serious purposes of Jovianism for the enlightenment of those who still have the erroneous impression that it plays a part no deeper than that of first comedian in the drama of electrical development, no more convincing argument of the earnestness and sterling character of Jovian tenets can be found than the slogan of the order: "All together, all the time, for everything electrical,"

and its broad purposes as expressed in its constitution, as follows:

"The foundation of the Jovian Order was inspired by a desire to bring the devotees of the science of electricity and of its kindred schools into a closer communication and companionship, so that the information and learning might be more generally and effectually diffused; that love and pride of profession might be instilled in every heart, brotherly feeling engendered, and that ties and links be forged at the anvil of Vulcan which shall lengthen until the chain encircles the globe, thus cementing forever its membership in a common bond of interest, which shall include the loftiest savant and the humblest aspirant.

"The object of this order is the cultivation of the spirit of fraternity and good-fellowship, from which may be evolved practical plans of commercial co-operation for the promotion and popularization of electricity in the world's work."

Surely the above is broad enough to satisfy the most ambitious of commercial Don Juans.

As stated in that part of the Jovian constitution just quoted, the prime object of the order is to bring together upon common ground the men engaged in electrical and kindred industries; to bring them together in such a manner and amid such surroundings that the too frequent suspicions and animosities which impede and embitter much of our commercial intercourse may be forgotten, that the path to profitable industrial co-operation will be opened by social commingling and made easy to traverse to the ultimate goal of pleasure and profit in the labor of every worthy man.

The most efficient agent for the realization of this object, at one time considered merely a Utopian dream, is the "Jovian league" or "Jovian luncheon club." There are today in active operation fifty-one of the leagues, avowedly Jovian, in nearly all the large cities in United States and Canada, and probably six or seven "electrical clubs" not including the word "Jovian" in their names but owing their existence to the order, with their officers, committees and members largely Jovian. The roster of the leagues vary from 50 to 500, a conservative average being slightly more than 100.

These clubs are not of a "hit or miss" character, with no more worthy object than an excuse to assemble men occasionally at luncheon, but all have definite schemes and concerted action and thorough organization. In a majority of the clubs the local Jovian statesman is the presiding officer, although this practice is not made obligatory by the rules of the order. The executive management is undertaken by a president, a vice-president, a secretary-treasurer and an executive committee of five. The work outlined by them is accomplished usually by entertainment, reception, publicity, public affairs and other committees appointed by the president and made up of the most influential and active men of the local electrical industry.

Without exception in every city where these leagues have been put in active operation there has been evident at once a marked improvement in electrical trade conditions. They have proved the value of, generated and fostered the "get-together" doctrine, have stopped or at least abated destructive competition and price-cutting, and by bringing men of the same industry together socially to discuss their affairs in a friendly spirit have eliminated much bitterness and antagonism. Specific examples could be cited where these clubs have been the direct cause of a funeral ceremony over the hatchet that had for years ruthlessly chopped the pleasure and profit from the relations between the central station, the contractor and the dealer.

At meetings of the Jovian leagues, held weekly or bi-weekly, educational possibilities are not overlooked, it being the duty of the entertainment committees to furnish speakers for thirty-minute after-luncheon talks on subjects of interest to the members. These talks have resulted in the dissemination of much useful information and have served as a clearing house for the exchange of ideas and the discussion of problems of the profession or of local conditions.

In several cities the leagues through their public affairs committees have originated and are pushing to consummation legislation which will greatly benefit the electrical industry locally. In other cities the leagues are co-operating with local civic bodies in campaigns for the advancement of movements conducive to the public good, thus in a broad manner furthering their own interests and bringing the whole electrical industry into even higher repute. The committees have been successful in securing much desirable publicity in the daily press throughout the United States and Canada, as well as in the technical electrical publications, the latter being exceedingly generous in recording the efforts of the order.

Conceding the advantages of affiliation with the order, a number of the most powerful electrical leagues, not originally organized as Jovian bodies, have adopted new constitutions making them such or have reached the same result by consolidation with the local Jovian club. Notable examples of this condition are to be found in Pittsburgh, St. Louis, Cleveland and San Francisco. In some cities there still exist separate organizations, but it is hoped and believed that they too will eventually realize the greater strength of one concrete body supported by an international order more than ten thousand strong.

The past and present officers of the Jovian Order are fully cognizant of the tremendous possibilities for practical benefit to the electrical industry inherent in the Jovian luncheon leagues and feel that in the further development and rounding out of the present system of operating them lies the assured realization of Jovian doctrines. Every possible effort is being made to foster and encourage the existing clubs and others are being organized wherever the Jovian membership is sufficiently large. There will be not fewer than sixty-five active clubs reporting to the order at the expiration of this Jovian year.

If a contingency should ever arise where it would be beneficial to the electrical industry to put into effect a gigantic educational campaign or powerful concerted effort for certain national legislation, the trained and efficient artillery of these clubs can be simultaneously brought into action with a resultant cannonade that will prove irresistible.

At first limited to the confines of Texas, then spreading over the entire United States, the Jovian Order continues to press onward and, although often spoken of as a "national" body, has long since graduated into the international class through its Canadian and Mexican chapters.

The order publishes a monthly magazine, known as *The Jovian Bulletin*, of from thirty-two to fifty-two pages printed upon good paper, profusely illustrated with half tone engravings, containing a complete record of all the happenings within the order and all news which can be gathered concerning the activities of Jovians in Jovian work or otherwise. Data concerning conventions, a free employment bureau, an "exchange" for the interchange of ideas and text matter of general interest are also included. This magazine is mailed without charge of any kind to each member of the order on the twenty-fifth of each month.

Now to sum up, and it shall be but a brief conclusion:

First, the Jovian Order has a well-defined purpose, big and broad and sincere, and practical enough with relation to the betterment of trade conditions in the electrical industry amply to justify its existence and the steadfast support of every man having the welfare of that industry at heart.

Second, its methods of accomplishing this purpose have improved and strengthened, its membership has increased and its organization has been better perfected with each succeeding year, until now beyond any doubt it is a staff sturdy enough to support him who will use it honestly to his coveted goal and to a better understanding of himself and his fellow-man.

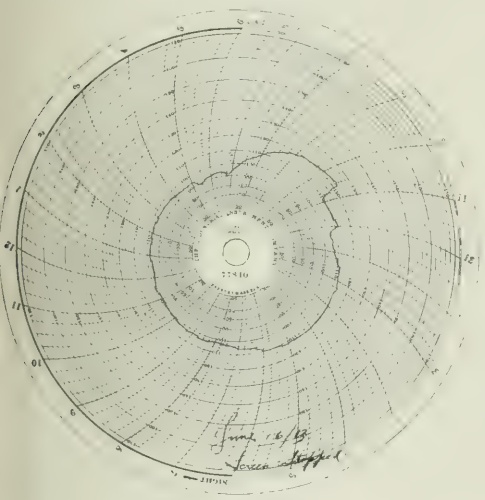
*St. Louis, Mo.* ELL C. BENNETT

# Field of the Operating Engineer

**A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers**

## Locating Defective Turbine Ventilation Graphically

The accompanying chart taken from a Foxboro recording thermometer installed in the power plant of the Jenckes Spinning Company at Pawtucket, R. I., illustrates how by close observation of such records serious troubles in operation may be forecast and often prevented. The thermometer is installed in the field of a 1000-kw turbo-generator. On the day shown an abnormal increase in temperature occurred between 8 a. m. and 9 a. m., soon attracting the attention of the operating force. Search for the trouble disclosed that the screen on the turbine fresh-air intake outside the power plant building was clogged with lint. As soon as the latter was removed the temperature dropped 12 deg. and after a second cleaning a further 6-deg. drop was obtained. On account of the increased load the tem-



THERMOMETER CHART

perature rose to 112 deg. at about 2 p. m., later falling to the normal as the output was reduced, the plant being operated day and night. By the use of this recorder, which was built by the Industrial Instrument Company, Foxboro, Mass., the textile plant was saved a possible interruption of a costly character.

## Requirements for Efficient Burning of Oil Fuel

BY R. T. STROHM

The first essential for the successful burning of crude oil or fuel oil is that it must be atomized or broken up into a fine spray or mist; next, it must be thoroughly mixed with a sufficient amount of air to insure its complete combustion, and, finally, the combustion must take place in a furnace of suitable size and shape. These three requirements must be met in every power plant in which liquid fuel is to be used.

When crude oil was first tried as a fuel for steam boilers, attempts were made to burn it by running it into shallow pans and igniting its surface. This was simply following the old methods applied in the case of coal. For, as the coal was spread out in the form of a bed of fairly uniform thickness on the grates, so was the oil spread out in a shallow sheet. This method, however, was wholly unsatisfactory and unsuccessful and was soon abandoned. The reason for its failure was that oil differs so greatly from coal.

With coal the effect of the heat is to drive off the volatile matter in the form of gases, which, mixing with the air passing through the bed of fuel, burn and generate sufficient heat to ignite the solid carbon remaining on the grates. This bed of burning carbon then furnishes the heat required to ignite succeeding charges of fresh fuel.

With oil, there is no incandescent bed of fuel. The oil does not burn in the liquid form. Before it can burn it must be changed to a vapor, or volatilized, and this is done by the action of heat. The action may be illustrated by the burning of a common wax candle.

When the wick of a candle is lighted the heat due to the burning melts some of the wax just below the flame, and the melted wax is at once carried up the wick by capillary action. As it comes closer to the flame it grows hotter and hotter, until at length it reaches the boiling point and passes into vapor. This vapor mixes with the air and thus forms a combustible mixture, which burns above the tip of the wick. Part of the heat due to its burning is used to melt and vaporize more of the wax, and the burning is thus rendered a continuous process.




FLAME OF WAX CANDLE

It will be observed that the flame of a candle varies in color. Just around the tip of the wick there is nothing to be seen. This transparent section *a* is the vaporized wax, before it has had a chance to mix with air and burn. Around this is another transparent section *b* that has a bluish tinge. Here the vapor has mixed with some air and is being partly burned. Farther up, there is more opportunity for the mixing of a sufficient quantity of air, and the flame there becomes yellow or yellowish white.

That part of the flame that is tinged with blue indicates incomplete combustion, because the supply of oxygen in the air that mixes with the vapor is not sufficient to burn the carbon to dioxide. This portion of the flame does not have so high a temperature as the yellowish portion where the combustion is complete.

As a further experiment to show that the crude oil will not burn in the liquid form, a live coal or a blazing stick may be dropped or thrust into a vessel containing the oil. Instead of firing the oil, the live coal will be quenched or the flame of the stick will be extinguished by the oil, for the simple reason that the oil is vaporized so slowly that the inflammable gas produced is not sufficient to support continuous combustion.

The object of atomizing the oil, or dividing it into a fine mist or spray, can now be understood. By separating the body of oil into a great number of fine particles, each particle will have its surface exposed to the heat and will be

the mist or spray, the more easily will the vaporizing occur.

the ratio of the surface area to the volume of each drop is sixty to one. But if the drops are 0.01 in. in diameter, the ratio of area to volume is 600 to 1. That is, a drop of oil 0.01 in. in diameter will expose ten times as much surface per unit volume as a drop 0.1 in. in diameter. The finer the particles, therefore, the greater will be the amount of external surface per unit volume exposed to the action

When the oil has been properly vaporized, it must be thoroughly mixed with air in the correct proportion to produce complete combustion. This may be done by allowing the air to enter the furnace through openings in the floor or the ash-pit, somewhat after the manner in which it is admitted to the furnace of a coal-burning boiler. Again, it may be admitted through the same opening as those through which the burners are introduced, in which case the air sweeps over the burners. But it is more than probable that both methods will be used at one time, so that part of the necessary air will be admitted by each.

The third requirement for the efficient use of oil fuel is a furnace of suitable design and construction in which the combustion may take place. The common furnace used for solid fuel will not ordinarily answer the purpose without

The coal-burning furnace can be fired intermittently, for there is always a bed of incandescent fuel on the grates, so that when the fresh coal is added the incandescent portion will fire the green fuel. But the injection of the liquid fuel is continuous, and the conversion of the freshly admitted oil from the liquid to the gaseous state must be accomplished by a part of the heat of the oil that was burned just before. As there is no fuel bed, the heat must be stored in the lining of the furnace. In other words, the furnace is lined with firebrick, which becomes highly heated and acts as a heat reservoir and equalizer.

The chamber in which the combustion of the liquid fuel takes place should not be bounded by cold metal surfaces. For if the partly burned gases strike such surfaces they will be chilled, combustion will be checked, and there will be a loss of heat and probably the formation of smoke. By having the combustion occur in a firebrick furnace, however, the chilling is prevented, and when the gases have been burned completely they may be led against the boiler tubes and surfaces without danger of producing smoke.

## Safety Screen Protection Against Moving Belt

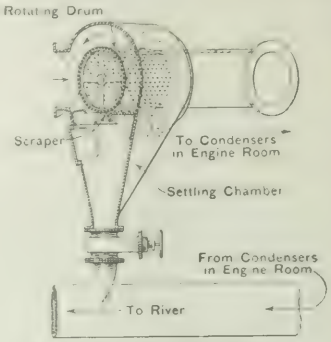
In the older plants of the country there exist no more dangerous conditions than those about the moving belts so generally employed in stations designed twenty years ago.



There are attendants to-day who will reach into these man-killers and wipe off the pulley surfaces while belts and pulleys are running at full speed. A little lapse or carelessness, and the man's sleeve, or his rag and hand, may be drawn between pulley and belt, tearing the arm from its socket and probably killing the man. The best rule, of course, is the positive one of handling the pulley only when it is shut down. A screen like that shown in the sketch should be installed on the approach side of every large high-speed pulley in which a limb is likely to get caught. Such a screen will arrest the member before it can be crushed between belt and wheel.

## Rotating Strainer for Condensing-Water Intake

An unusual form of rotary strainer-screen is employed in the condenser-intake lines of the famous Deptford central station, London, the design having been made by the engineers of the London Electric Supply Corporation, which operates the plant. The strainer proper consists of a drum, perforated with many small holes, which rotates in a cast-iron housing at the rate of about 3 r.p.m., being driven from the centrifugal-pump shaft through reduction gearing. Leaves, straw or other débris entering with the water adhere to the outside of the drum, and are removed by a fixed scraper, the position of which is seen in the figure. This is adjusted so as to have a "shaving" action on the drum surface, so that any solid matter may also be effectively removed. Thence it gravitates through a duct




ROTATING STRAINER-SCREEN

at the back of the scraper into the lower part of the housing which acts as a settling chamber. From this it is returned to the river through a sludge valve, connected to the return pipe from the condensers, and opened either automatically or by hand.

These rotating screens were built in the corporation's own shop and represent the fruit of many experiments. They have given satisfactory results and in initial cost represent about one-third of the investment required for other strainers.

## Where Step-up Transformation Would Not Pay

[illegible] a prospective 160 kw load in 60-cycle three-phase induction [illegible] 440 volts from our plant which generates at 480 volts. What size cable will we have to install to carry this load, or would it pay to [illegible] The [illegible] per cent to the 440-volt motor terminals. C. E. F.

To deliver 160 kw at 440 volts requires 210 amp per phase at unity power-factor; or 263 amp per phase allowing 80 per cent power-factor for inductive load. With 8 per cent power loss allowed for the entire line, the loss per phase wire would be 4267 watts. With a current of 263 amp this loss will result from a resistance of 0.0625 ohms, represented by each 3300-ft. line conductor. Hence our conductor should have a resistance of 0.019895 ohms per 1000 ft. of length. Now 600,000-circ. mil cable has a resistance of 0.0175 ohms per 1000 ft. and will therefore fulfil the conditions. The cost of such a 440-volt cable would be less than that of installing transformers alone, not including the cost of the high-tension line.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*Electrolytic Iron in the Construction of Electric Ma-ines.*—MAX BRESLAUER.—The conclusion of his paper in hich the author figures the saving in material which can e obtained by the use of electrolytic sheet iron instead of loy steel sheets in the construction of transformers and ynamo-electric machines. This saving is due rather to the gher permeability of the electrolytic iron than to its lower ysteresis losses. It is shown that in transformer design e utilization of the material may be increased by from to 40 per cent. Attention is called to the fact that losses electrolytic iron are influenced considerably by the tem-erature because the temperature coefficient of electrolytic on is higher by 50 per cent than with special alloy steel eets. During overload machines built of electrolytic iron e less liable to be damaged than the other machines since ith increased temperature the iron losses decrease. In e construction of direct-current machines electrolytic eet iron may be used advantageously in the yoke only; it thought, however, that it might be employed advan-geously also for the commutation poles.—*Elek. Zeit.*, ne 19, 1913.

*Three-Phase Commutator Motors.*—SCHOENBURG.—An rticle on the use of the three-phase commutation motor r driving intermittently operating machines in steel mills, c., especially for rolling mill motors and crane motors.—*lek. Zeit.*, June 19, 1913.

*Phase-Advancing.*—An account of the discussion which llowed the reading at Birmingham of the paper by Kapp, tely mentioned in the *Digest*.—London *Electrician*, June . 1913.

### Lamps and Lighting

*Fluctuations of Candle-Power of Alternating-Current amps.*—G. W. MEYER.—A brief article on the fluctuation f the candle-power during one period of an alternating-rrent incandescent lamp. The fluctuation effect depends ot only on the frequency but also on the wave-form of the ternating current. To suppress the flicker effect the fila-ent should be made of sufficiently high heat capacity or eactance may be connected in series. Some references to terature on the subject are given.—*Elek. und Masch.* Vienna), June 15, 1913.

*Ductile Tungsten Filaments.*—A note on three recent ritish patent (5026, 5027 and 5028 of 1912), of J. Hubers nd Julius Pintsch, A.-G. The first specification describes process in which a compound of tungsten is mixed with etween 1 per cent and 5 per cent of an oxide or an equiva-nt proportion of a compound of thorium or other rare arth metal, an alkaline earth metal or magnesium or zir-onium, or a mixture. The mass is squirted and reduced in ydrogen, so as to avoid the formation of crystalline par-cles. The metals are finally alloyed together. Likewise olloidal tungsten may be used. In the second specification rocesses are covered for compressing the preliminary duc-le filament, obtained as above described, by passing it rough drawstones or rollers and subjecting it to drawing r rolling. According to the third specification, a thick ire or rod is formed from the paste, as in specification 926, 1912, and is drawn or rolled.—London *Elec. Eng'ing*, ne 26, 1913.

*Ductile Tungsten Filaments.*—A note on a recent British tent (12,752, 1912) of M. M. Hubers, executrix of the late J. Hubers, and Julius Pintsch A.-G. The carbonization and decarbonization of the filaments, produced as above in a reducing atmosphere, is effected with filaments of long aggregate length, and is carried out in one step. The filaments are cut to length after ductile filaments are obtained.—London *Elec. Eng'ing*, June 26, 1913.

*Drawn Tungsten Filaments.*—A note on two recent British patents (12,244 and 12,469, 1912) of C. Gladitz. In the first specification a construction of press molds which permits of pressing the bar in such a way as to avoid the possibility of cracking, is described. The tungsten powder used is of a fluffy character, and the press mold simultaneously releases the compressed air in all three directions, so that it can expand unrestrictedly. The second specification deals with a method of preparing the end of the wire so that it can easily be inserted into the draw-plate, for drawing into filaments, without twisting taking place. A long tapering of the wire at the end is effected by treatment in an electrolytic bath containing a strongly oxidizing electrolyte. The end to be treated is stretched and hangs vertically in the electrolyte; it is connected as the cathode, and is gradually withdrawn upwards.—London *Elec. Eng'ing*, June 26, 1913.

### Generation, Transmission and Distribution

*Capacity of Transmission Line.*—G. P. MARKOVITCH.—The first part of a long mathematical paper in which, after a general introduction on the capacity of transmission lines and the definition of partial capacities, the author first discusses a three-phase line with the three conductors symmetrically arranged and then passes over to a three-phase line with the three conductors non-symmetrically arranged. The vector diagrams and formulas in these cases are given. The article is to be continued.—*Elek. und Masch.* (Vienna), June 22, 1913.

*Electric Distribution for Mines.*—J. W. ANSON.—A long abstract of a paper read before the South African Institute of Electrical Engineers giving a description of the conditions likely to be encountered when installing an electrical plant in the South African mines, and advises on the class of plant which is best able to fulfill these conditions.—London *Electrician*, June 27, 1913.

*Preventing Corrosion in Boilers.*—An illustrated article on the Cumberland process in which iron anodes are suspended in the water contained in the vessel to be protected and a small current is caused to flow from these anodes to the metal work to be protected as cathode.—London *Electrician*, June 27, 1913.

### Traction

*London.*—A. J. LAWSON.—An article giving statistical data of London passenger traffic in the past year and former years on the London County Council tramways, the Metropolitan electric railways, and motor omnibuses. A comparison of fares is given as well as some data of cost of operation of motor omnibuses.—London *Electrician*, June 27, 1913.

### Installations, Systems and Appliances

*Austria-Hungary.*—EMIL HONIGMANN.—Continuation and conclusion of his long statistical article containing many tables on the condition of the electrical industries in

### Wires, Wiring and Conduits

[illegible] the mechanical, physical and electrical properties of aluminum [illegible] various systems of electrical transmission. In a table is given a comparison of the physical, mechanical and electrical properties of aluminum and copper. It is stated that so far aluminum cables have not been used in British mines. From a table giving a comparison of prices of medium-presssure three-core copper and aluminum cables with paper insulation and lead sheath for three-phase currents it appears that the aluminum cable is the cheaper (a) in plain lead-sheathed cables whenever aluminum wire bars are less than $110 per ton above the price of copper bars; (b) in single-wire armored cables whenever aluminum wire bars are less than $50 per ton above the price of copper bars; (c) in double-wire armored cables whenever aluminum wire bars are lower in price than copper bars. Another table gives a comparison of prices of medium-pressure single-core copper and aluminum cables with paper insulation and lead sheath, and it is shown that for plain lead-sheathed cables aluminum cables are less expensive than copper cables if the aluminum wire bars cost less than $210 per ton above the price of copper wire bars. A similar comparison is given for analogous cables with bitumen insulation. Another comparison is made between 0.20 sq. in. paper-insulated three-core 3000-volt copper conductor, lead-sheathed and double-wire armored cable 470 yd. long with its equivalent aluminum cable and it is found that in this case the aluminum cable cannot compete either in price or in weight. Finally overhead lines are discussed. The first cost of overhead transmission lines of stranded aluminum conductors of 0.10 sq. in. sectional area and upwards, [illegible] the maximum usually employed in the United Kingdom), is less than for lines of copper conductors. A comparison of the cost of a 6600-volt, three-phase, 25-cycle line to carry 1000 kw for ten miles under British conditions, constructed of copper and aluminum, is given. This shows an approximate saving of 16.5 per cent in favor of aluminum. An account of the discussion which followed the paper is also given.—London *Electrician*, June 20, 1913.

*Impregnated Poles.*—R. Nowotny.—An article on the behavior of different kinds of wood when subjected to impregnating processes and on the modification of impregnating processes required to get equally good poles from different kinds of wood.—*Elek. und Masch.* (Vienna), June 15, 1913.

### Electrophysics and Magnetism

*Multiple Reflection of Short Electric Waves from Screens [illegible] Resonators.*—W. L. Severinghaus and W. Nelms.—The results of multiple reflection of electric waves from selective resonator screens are very similar to those of multiple or selective reflection in the infra-red. Multiple reflection affords a practicable and easy method of obtaining short electric waves having a very definite period, less damped than the oscillator and free from "mirror action" and other disturbing influences. The damping coefficient for resonators, whose width was negligible compared to their length, was found to be about 0.15, which agrees with the theoretical value, whereas the experimentally determined coefficient is about 1.4 for the Righi vibrator. Resonators can be made to oscillate in their first overtone; that is, with a frequency twice that of the [illegible]

[illegible]

flected" from crystals have the general properties of ordinary X-rays. The radiation from an X-ray tube with platinum target is of two kinds, (A) radiation of indefinite wave-length, analogous to white light, and (B) five types of monochromatic radiation, probably characteristic of the platinum. The radiation (A) is reflected at all angles of incidence. The reflection has been studied at different angles, and the results have been interpreted. Each of the radiations (B) is reflected only at special angles. These angles have been measured with three crystals, and the results are in good agreement with the simple theory deduced from the principle of interference. An attempt is made to estimate the distribution of energy in the wave-lengths for the general X-rays.—*Philos. Mag.*, July, 1913.

### Electrochemistry and Batteries

*Constitution of Atoms and Molecules.*—Albert C. [illegible] hore.—A long and very elaborate paper on the formation of the molecules of the elements and their compounds, with atoms as constituted on the corpuscular-ring theory. The author starts from J. J. Thomson's hypothesis of the constitution of an atom of a mass of positive electrification within which negative electrons are revolving. According to the number of electrons in an atom there are more or less rings of electrons in an atom. The various configuration for 1 to 100 electrons are given in a table. The author then describes experiments in which he tried to imitate the forces acting between the electrons in an atom and studied their resulting configuration. In his model the electrons were represented by spheres charged electrostatically and each sphere was suspended as a pendulum from a common point by long conducting fibers or wires. If the deflection is small compared with the length of the pendulum, so that the value of the angle does not differ appreciably from its sine, the force of gravity tends to return each sphere to the center or lowest point with a force proportional to the deflection, and by this means the positive electrostatic sphere in the atom is simulated by the weight of the spheres. If the spheres are equally charged with electricity of the same kind and the distance between adjacent spheres is large compared with their radii [illegible] the force of repulsion between any two of them [illegible] versely proportional to the square of the distance between them. This meets the second required condition, and such an arrangement should give the required equilibrium figures. Details are given of the arrangement of the experiments and some modifications, which permit one to vary the configuration of the electron spheres. He finally succeeds in producing experimentally exactly such configurations as are required theoretically from Thomson's hypothesis. From these experimental results he then finds the relative radii of the orbits of the various electrons and their exact positions for equilibrium in an atom. [illegible] are then used to deduce the constitution of molecules [illegible] shows that atoms come to definite positions of stable equilibrium with each other at fixed distances, thus forming the molecules of compounds. The diatomic molecules consist of two atoms rigidly held at fixed distances apart resembling the well-known dumb-bell molecule which has been deduced from the theory of heat. The reason that carbon may unite with more hydrogen atoms than nitrogen, and nitrogen with more than oxygen, and oxygen with more than fluorine becomes apparent. The last part of the paper contains a mathematical theory of the subject.—*Philos. Mag.*, July, 1913.

*Constitution of Atoms.*—N. Bohr.—According to Rutherford's theory an atom consists of a positively charged nucleus surrounded by a system of electrons kept together by attractive forces from the nucleus; the total negative charge of the electrons is equal to the positive charge of the nucleus. According to J. J. Thomson's theory an atom consists of a sphere of uniform positive electrification, inside which the electrons move in circular orbits. The pri

ipal difference between these two atom-models consists n the circumstance that the forces acting on the elec-rons in the atom-model of Thomson allow of certain con-gurations and motions of the electrons for which the sys-em is in a stable equilibrium; such configurations, how-ver, apparently do not exist for the Rutherford atom-nodel. The present author shows that the application of Planck's radiation theory (principle of elementary quanta f action) to Rutherford's atom-model affords a basis for theory of the constitution of atoms. The mechanism of he binding electrons by a positive nucleus is discussed in elation to Planck's theory. It is possible from this point of iew to account in a simple way for the law of the line pectrum of hydrogen.—*Philos. Mag.*, July, 1913.

*Specific Inductive Capacity and Atomic Charges.*—FERNANDO SANFORD.—The author has called attention to the act that if the mobilities of ions, calculated from elec-rolysis, be multiplied by their respective ionic masses num-ers are obtained which are closely related to many of the hysical and chemical properties of the ions. Among these re all the properties of bodies which depend on cohesion r affinity. In the present paper their relation to specific nductive capacity, refractive power and magnetic rotatory ower are shown in some cases.—*Phys. Review*, June, 1913.

*Electric Tube Furnace.*—R. E. SLADE.—An illustrated oyal Society paper describing an electric platinum tube urnace for experiments in vacuo at temperatures up to 500 deg. C.—London *Electrician*, June 27, 1913.

### Units, Measurements and Instruments

*National Physical Laboratory.*—The conclusion of last ear's report of the work of the British National Physical aboratory relating especially to the investigations on the nit of light, visibility of light, metallic-filament lamps, lternating-current power measurements, heating of lamp ockets, insulating materials, testing work, primary bat-eries, and electric cables.—London *Electrician*, June 27, 913.

*Torsion Dynamometer.*—H. GOERGES AND P. WEIDIG.—he first part of an illustrated description of a simple mir-or dynamometer which combines convenience of measure-ients with accuracy. The principle is shown in Fig. 1. *B* s a concave mirror and *C* a plain mirror, both *B* and *C* eing mounted on the rotating axle. $D_1$ and $D_2$ are two lain mirrors stationary in space. The lamp *A* sends rays o *B* which are reflected to $D_1$, $D_2$, *C* and finally are re-ected by *C* into the telescope. If the focus of the con-ave mirror *B* is so chosen that the point *E* where the real

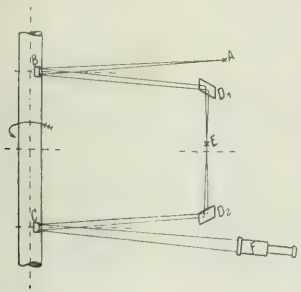



FIG. 1—PRINCIPLE OF TORSION DYNAMOMETER

mage appears is about the central point in the path of the ays between *B* and *C*, a sharp stationary image of the ource of light is obtained in the telescope, independently of he fact whether the axle is rotating and with what speed t is rotating. If it rotates slowly the image appears at egular intervals, always at the same point, while with apid rotation the impression in the eye is that of a quiet permanent image. If now the two cross-sections where the mirrors *B* and *C* are mounted are distorted against each other (as in the case of the torsion dynamometer) the image is displaced in the telescope and soon disappears from the field of vision. It may be rendered visible again by displacing either the lamp *A* or the telescope *F*. From the amount of this displacement, the torque can be easily

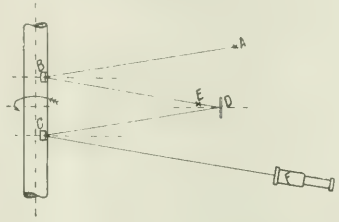



FIG. 2—SCHEME FOR USING SINGLE STATIONARY MIRROR

determined. If the two rotating mirrors *B* and *C* are not too far distant from each other, a single mirror, *D*, stationary in space may be used instead of the two mirrors $D_1$ and $D_2$. In this case, which is shown in Fig. 2, the real image should be near the mirror *D*. If *C* is replaced by a concave mirror it is possible to produce a real image of *E* and project it on a scale which then replaces the telescope *F*. On the other hand the mirror *B* may be replaced by a plain mirror and a lens. The construction of the instrument and its theory are discussed at some length. The article is to be concluded.—*Elek. Zeit.*, June 19, 1913.

*Resistors.*—In last year's report of the (British) National Physical Laboratory it is stated that the 10-megohm "resistance box" has now been completed. The resistor is built up out of 100 coils, each having a resistance of 100,000 ohms. The coils are mounted in sets of five on brass rods, every two such sets constituting one megohm, being brought out to separate terminals. The general arrangement of the coils and the terminal pillars is shown in Fig. 3. The ebonite terminal pillars are continued some distance below the ebonite base in order to increase the leakage path between the terminals. The joint between the ebonite pillar and the amberite washer placed above it was sealed with paraffin wax in order to prevent any acid products of the

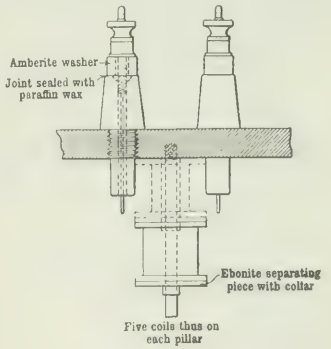



FIG. 3—GENERAL ARRANGEMENT OF TERMINALS AND COILS

exposed ebonite creeping between the two surfaces. The upper portion of the terminal screws is turned smooth to enable connection to be made at any point by means of an insulated split tube contact piece. The bobbins on which the coils are wound are of porcelain. Previous to winding, these were boiled in paraffin wax at a temperature of 150 deg. C. The wire used is constantan, No. 46, S. W. G.,

[illegible] direction of the winding being reversed about ten times in order to reduce the self-inductance. The coils were boiled in [illegible] C. After their resistance had been measured and roughly adjusted they were kept under observation for several months. During this period the change in resistance was generally not more than 2 parts in 10,000. The coils were then finally adjusted, copper ends were soldered on to the ends of the resistor wire, and after again being boiled in wax, final determinations of the resistance were made.—London *Electrician*, June 27, 1913.

*Measurement of the Carey Foster Method of Comparing Resistances.*—Frank Wenner.—An abstract of an American Physical Society paper. The method was developed for use in the measurement of the resistances of a number of similar conductors connected in series, such, for example, as the coils of a low-resistance potentiometer. In such measurements it is not possible to put a slide wire between the resistor being tested and the standard of resistance, so it is necessary to provide some other means of making and reading the small changes neccessary to balance the bridge. This is accomplished by using a variable-ratio coil set of the direct reading type instead of fixed-ratio coils such as are regularly used in Carey-Foster bridges. The ratio set used has a range of 1 per cent, and while designed for other work has been found to be very satisfactory for this

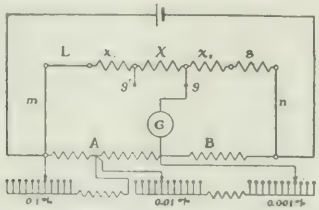



Fig. 4.—Circuit for comparing resistances

purpose. The method will be understood by reference to Fig. 4, in which $X$ represents the conductor whose resistance is to be compared with that of the standard $S$, while $L$ is a connecting link interchangeable with $S$. The conductors, $x_1$ and $x_2$, are permanently connected to $X$, $m$ and $n$ are connecting leads, $A$ and $B$ the two sides of the ratio set, and $g$ and $g'$ terminals of the conductor $X$. In general the same characters are used to represent the value of the resistances. The ratio of $A$ to $B$ may be represented by $1 + r + c$, where $r$ is the reading and $c$ the correction to the reading of the ratio set. The bridge is balanced first with the arrangement shown in the figure, then with the link and standard interchanged and the galvanometer connected at $g'$. From the two relations it follows that

$$X = S + (r - r')(x_1 + S + x_2 + L + n)$$

where $r'$ is the second reading of the ratio set. If the correction $c$ is the same for both readings and $r + c$, $r' + c$, and $L$ are all small in comparison with $X$ and $S$, then $x_1 + S + n$ is very nearly equal to $X + x_2 + L + n$, and hence approximately

$$X = S + \frac{r - r'}{2}(x_1 + x_2 + L + n).$$

In case several similar conductors are being compared, $x_1$ and $x_2$ are of the same nominal value as $X$ and $S$, while $m$ and $n$ are small, in comparison, and hence the latter equation may be put in the form

$$X = S + \frac{1}{2}(r - r')N.$$

Where $N$ is the nominal value of the resistances $X$ and $S$, $s$ the excess in proportional parts of the resistance of the standard above its nominal value, $l$ the ratio of the resistance of the link to the resistance of the standard, and $r$ and $r'$ the two readings of the ratio set.—*Phys. Review*, June, 1913.

*Self-Recording Electrometer.*—J. Patterson.—Benndorf has designed an electrometer which gives a continuous record by mechanical registration, and a British company has a self-recording galvanometer on the same principle, called the thread-recorder. In the Benndorf instrument the apparatus for producing the registration is operated by an electromagnet worked by clockwork, while in the thread-recorder it is all done by clockwork. It occurred to the author that the recording mechanism of the thread-recorder could also be used for a self-recording electrometer as well as for a galvanometer. In these instruments a boom with a counterpoise is attached to the axis of the needle, and the excursions of the end of the boom are registered at stated intervals by a bar dropping and nipping an inked thread or ribbon between the boom and the recording paper, thus leaving a dot, which gives the deflexion of the needle at the moment of registration. In this way all mechanical friction is avoided. The construction of the electrometer is given in some detail together with the results of experiments. The advantages claimed for the instrument are simplicity of construction; little attention required when in working condition; high degree of sensibility enabling the potential of the air to be measured with a battery of only a few volts; and fair uniformity of scale over the range of the recording paper.—*Philos. Mag.*, July, 1913.

### Miscellaneous

*Resistance Welding.*—Otto Fuchs.—A profusely illustrated article giving the results of an investigation of the electric resistance welding of sheets. The primary and secondary current, the power and the temperature were measured and the strength of the welds were tested. Micro-photographs are given of the structure of the welds. Besides iron and steel the welding of other metals is also considered. It is important that the welding process should be done as quickly as possible. Electric welding seems to be more convenient and rapid than autogenous gas welding.—*Elek. und Masch.* (Vienna), June 8, 1913.

## Book Review

The Practical Electrician's Pocket Book for 1913. Edited by H. T. Crewe. London: S. Rentell & Company, Ltd. 440 pages and diary. Illus. Cloth, price, 1 shilling.

This useful little book contains information of a character even more extensive than might be guessed from an interpretation of its title in the American vernacular, for a number of its pages are devoted to central-station subjects, prime-mover apparatus, steam and internal-combustion engines, water-wheel equipment, switchboard construction, etc. Street-railway and telephone topics are also given attention, and there are chapters on repair methods, test schemes for locating faults in machines and wiring circuits, measurements, etc. Under the division of applications of electricity will be found a new chapter on the use of electric coal-cutting machines, and there are many pages descriptive of practical wiring methods, plans for direct and indirect illumination, operation of household appliances, construction of vacuum cleaners, control of circuits, wireless stations, Home Office mining rules, Board of Trade rules for electrical construction, etc. Tables of practical electrical reference data, reports of British central stations, instructions for resuscitation from electrical shock and a number of blank memoranda pages complete the practical usefulness of this convenient and brief compilation.

# New Apparatus and Appliances

**An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers**

## Fuseless Rosettes

Two types of fuseless rosettes or outlet box covers re-tly placed upon the market by Pass & Seymour, Inc., of vay, N. Y., are illustrated herewith. The smaller of the

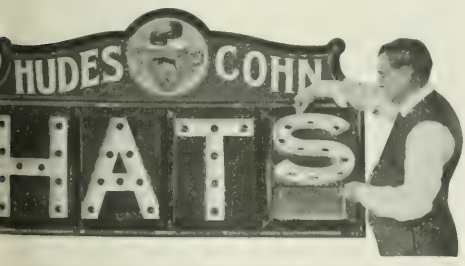



OUTLET BOX COVERS

o illustrations portrays the type of cover which is in-ded for use with 3-in and 3.25-in. outlet boxes, while larger cover is made for use on 4-in. boxes. To facili-e handling the rosettes, which are of porcelain, are ked for shipment in pasteboard boxes containing the uisite number of screws for their installation.

## Interchangeable Electric Sign

Electric signs which have come to be regarded as a potent tor in augmenting the central-station load are found in igns varying from the crude home-made affair to the ssive steel structure which often weighs more than 20 s. One of the most recent additions to this already lely varying category of advertising media is the inter-ngeable sign which is being put on the market by the & W. Electric Sign Company, of Cleveland, Ohio. This n is built up of a number of separate panels each of ich is equipped with a sufficient number of wired outlets allow any letter of the alphabet to be placed upon it. nen the letter is in position special receptacles furnished h the sign are pushed into place through the holes left the purpose in the letter. With the single pair of out-wires connected to the lighting circuit the sign is ready




ELECTRIC SIGN WITH INTERCHANGEABLE LETTERS

operation as soon as the lamp receptacles are pushed me.

The body of the sign is constructed so that any number of ter panels may be used. The accompanying illustration ows a man in the act of placing a letter on a four-panel n. The wired outlets which are to receive the lamp re-otacles are shown below the tilted letter. The ornamental legend at the top of the sign which bears the name of the company is also detachable. It is stated that even a person with no knowledge of electric wiring can effect a change in a large theater sign in a remarkably short space of time.

## Meter Testing Table

An electrical meter testing table at which eight men can be accommodated simultaneously with each man handling four meters has recently been installed for the Municipal Gas Company, of Albany, N. Y., by the H. W. Johns-Manville Company, Madison Avenue and Forty-first Street, New York City. The table is constructed of a fireproof product known as ebony asbestos wood and is arranged in two sections, the dimensions of which are 15 ft. long by 5 ft. 4 in. wide by 6 ft. high over all. The rack or upright board is 3 ft. in height and the shelf or table is 20 in. wide. The rack and the shelf are 1 in. thick, and the space be-

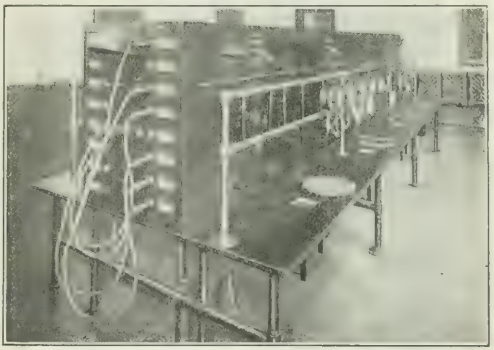


TABLE FOR TESTING ELECTRIC METERS

tween the racks at the top is covered with 0.25-in. asbestos wood.

Immediately in front of each tester are a set of binding posts, three load switches and a potential switch providing emfs from 110 volts to 220 volts. The wiring is arranged so that the power-factor of the test circuit can be varied from zero to 100 per cent by small steps and any load from zero to 800 amp can be obtained. The circuits for each tester's position are independent from those of any other so that if eight men are working at the table each may be using a different load from the others without interference with his co-workers. The plugging arrangement and ammeter shown at the end of the table are used in obtaining the approximate load desired. Where meters of different types are being tested either alternating current or direct current may be obtained at both sides of the table simultaneously, or the table may be divided with direct current on one side and alternating current on the other. The rotating standards are placed under the table and are read through an opening which has been cut in the bench for this purpose. The table is constructed so that additional units may be added from time to time without interfering with the original wiring.

## Improved Primary Wet Cell

A liquid battery [illegible] under various conditions has given results well worthy of notice. This type of cell, which is a product of the Burns-Boston Battery & Manufacturing Company of Boston, Mass., purports to possess all of the good qualities of the dry battery and yet to be free from most of the bad fea-

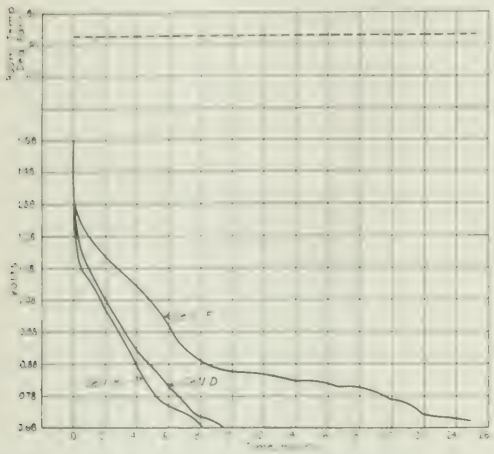


FIG. 1—CURVES SHOWING RESULTS OF CONTINUOUS DISCHARGE TEST AGAINST A RESISTANCE OF 1 OHM

tures of the dry cell. The square moisture-proof case of this battery encloses a zinc shell which contains a balance of active elements, zinc, carbon, and salt solution. Except for a pin-hole vent, the cell is tightly sealed to avoid leakage. The electrolyte is a non-freezing liquid and is said to give off no fumes. To reduce the chance of a wrong connection the zinc terminal is made a flexible wire perma-

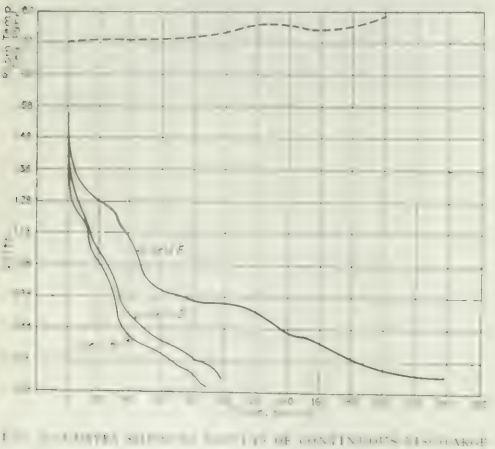


FIG. 2—CURVES SHOWING RESULTS OF CONTINUOUS DISCHARGE TEST AGAINST A RESISTANCE OF 5 OHMS

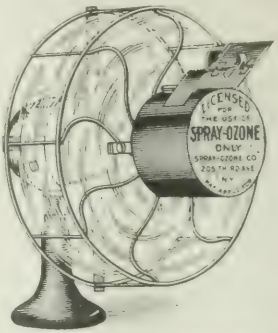
nently soldered to the electrode while the carbon terminal is provided with a lock nut. A single cell measures 7.5 in. high by 2.6875 in. square, occupying the same space as a dry cell. These cells also give the same potential as a new dry cell, namely, 1.5 volts per cell.

The United States war department made a comparative test on these liquid batteries and upon ten dry cells for shelf life (charged). After six months' storage at boiler-room temperature the wet cells showed no decrease in amperage whatever while the nearest competing dry cell when tested showed 40.4 per cent depreciation. This test shows that one of the worst defects of the dry cell, deterioration in storage, has been overcome by the new cell.

The accompanying curves which were prepared by the Electrical Testing Laboratories, New York City, show clearly the remarkable performance of these liquid cells upon continuous discharge test. Fig. 1 shows the result of a simultaneous continuous discharge test made through a resistance of 1 ohm upon one liquid battery (cell F) and two dry cells (cells K and D). This curve sheet shows that twenty-four hours were required to deplete the wet cell to the state which was reached by the dry cells in from eight hours to nine hours. A similar test of three cells of the same make as previously used against a resistance of 5 ohms showed practically the same proportion of advantage for the liquid battery. That is, the emf of the wet cell at the end of 240 hours continuous operation was 0.69 volt while cells C and D were reduced to a potential of 0.69 volt in 80 hours and 100 hours respectively.

## Electric Fans Used for Disinfectant

A device which may be attached to any electric fan for the purpose of automatically disinfecting the room in which the fan is operating is now being manufactured by



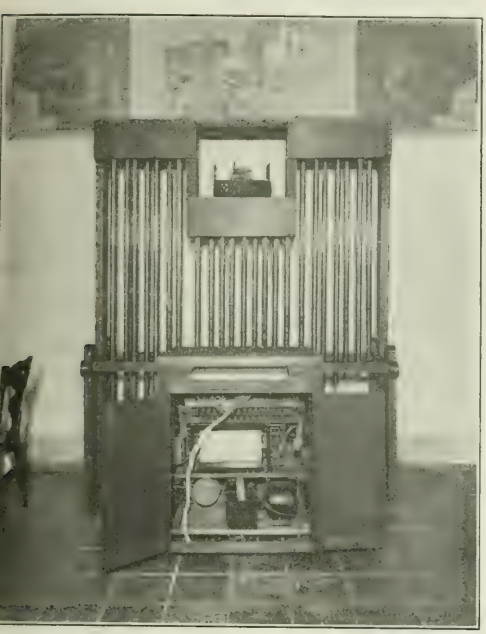

ATTACHMENT FOR ELECTRIC FAN

the Spray Ozone Company, Inc., of 205-211 Third Avenue, New York City. As is shown in the illustration the attachment consists of a brass container for the liquid disinfectant from which projects a wide mouthed spout. The lower end of a wick projecting from this spout is in the liquid; due to the process of capillary attraction a fresh quantity of the disinfectant is always found available at the top of the wick. The blast of the fan over the wick picks up particles of the disinfecting liquid and distributes them in the various parts of the room visited by the fan's air currents. It is said that this device is finding ready application in moving picture shows, department stores, hospitals, railway cars and many other public places.

## Electric Temple Bells and Chimes

Among the many unique and pleasing features which make the Woolworth Building more than a massive pile of architecture with a claim to interest only on account of its sheer size are the electrically operated bells and chimes found in the "rathskeller" of the building. The temple bell outfit consists of twenty resonator bells ranging in chromatic intervals from low C to high G. The bells are

mounted upon felt-covered oak disks, and each bell is fitted with a resonator which is bolted to the supporting frame of the bell. Upon the same wooden disk with each bell is mounted a direct-current magnet. The wires from the magnets are led through the piano keyboard, beneath which are arranged a number of contacts. By wiring these contact points in series with the source of energy and the bell, pres-



ELECTRICALLY OPERATED CHIMES IN RATHSKELLER OF WOOLWORTH BUILDING

ure on the keyboard completes the circuit and rings the bell corresponding to the note of the key depressed. For striking the twenty-three bell-metal chimes shown in the background of the illustration single-stroke direct-current magnets are used. As it is desirable at times to play either the bells or the chimes separately, a switch is provided making it possible to connect each into the circuit separately or to connect them so that bells and chimes can be played simultaneously.

Ordinarily these bell and chime outfits are driven by a Geisgler storage battery, but the set in the Woolworth Building is equipped with a motor-driven pneumatic player attachment supplied with electrical energy from the direct-current lighting circuit. The automatic player is actuated by a clockwork mechanism which operates the chimes every half hour.

The entire bell and chime outfit was supplied by the Verkes Sound-Effects Company, 202 East Eighty-eighth Street, New York City.

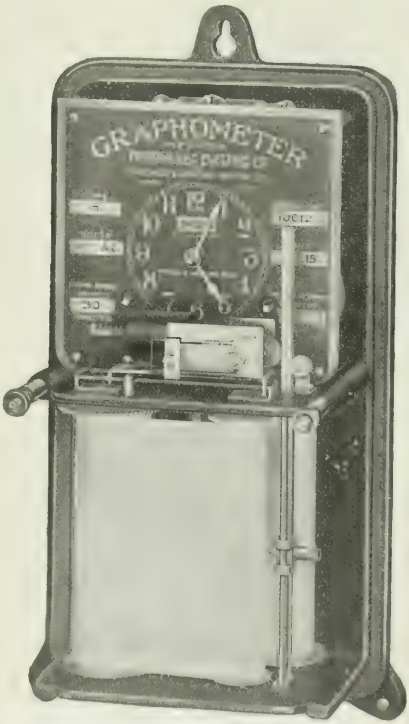
## The Graphometer

The Chicago Electric Meter Company has developed a device, based upon inventions of Charles H. Merz, Simon B. Storer and others, that will give a record based like those of the printometer and maxicator, on the modern principle of measuring the demand, that is, the average demand during a definite time interval; but, instead of printing or indicating, this new instrument records the demand on a chart, so that it will be possible to see at a glance the maximum demand, the time it occurs and its relation to other load conditions during the month. This is the form of record obtained by the graphometer, the instrument which is illustrated herewith.

Other forms of graphical records are instantaneous and show extreme peaks and rapid variations of load. With instantaneous records it is necessary to apprroximate the average consumption for each interval and then use this average in figuring the bill. The graphometer gives this average automatically and draws the record ready for immediate use.

The graphometer is connected to the watt-hour meter by means of three small wires which lead to a contact-making device on the register of the watt-hour meter. This device closes the circuit on a solenoid connected to a rack carrying a stylus on the graphometer. Each operation of the solenoid moves the stylus forward on the graphometer.

This stylus while advancing is in contact with a treated paper chart, which is being driven forward at right angle to the stylus, at a definite speed, by means of a high-power clock contained within the graphometer. The stylus will, therefore, continue to be driven upward for each operation of the contact-making device on the watt-hour meter register, the height of this line representing kilowatt-hours, and the paper will move forward steadily at right




DEVICE FOR GRAPHICALLY RECORDING MONTHLY DEMAND CHARTS

angle thereto, the base line of this portion of the chart representing the time. Then at the end of the interval for which the demand is to be taken, say, for instance, thirty minutes—the carriage holding the solenoid will become disengaged from the rack carrying the stylus and will allow it to return to the bottom of the chart, or the zero position, where the same series of operations will begin for the next

interv... [illegible] on the chart by the stylus during the month will, therefore, be the maximum demand for the month and may be read directly in kilowatts. Since the total consumption is obtained from the watthour-meter dials, the combination of the graphometer with the watt-hour meter will give both the total consumption and maximum demand for the month and will show the time it occurs.

The graphometer is simple in construction. There is no pen-and-ink arrangement used, as it has been found that these attachments often give trouble. The solenoid which is used to advance the stylus may be operated from any one of the following sources: 100-volt alternating current, 220-volt alternating current, 18-volt direct current, 110-volt direct-current. The instrument can be set for demand intervals at five, ten, fifteen, twenty, thirty and sixty minutes.

The chart used with the graphometer are 6 in. wide and are advanced 0.25 in. per hour, so that a one week's record will be approximately 3.5 ft. long.

The graphometer may be applied to any watt-hour meter regardless of the make, type or capacity, permitting the use of the present watt-hour meters and also one type of maximum-demand device with any watt-hour meter on the sytem.

Records obtained with the graphometer must be accurate, since the device is electrically interlocked with the watt-hour meter and depends solely on the calibration of the watt-hour meter for its accuracy; and the time is also acccurate, since this element of the device is mechanically interlocked with a high-grade clock and differs from other curve-drawing devices in that the time is not dependent upon the speed of travel of the paper but only upon the length of time between each return of the stylus to the base line or zero point. This gives a definite time interval. The manufacturer says that the graphometer is protected by patents which are issued or are pending.

## Illuminated Danger Sign

Following the general adoption of the "Safety first idea" by many railways, mining and power companies, the Electric Service Supplies Company of Chicago has placed on the market a new type of illuminated sign consisting of a steel frame joined at the top in the shape of a hood under which is placed a weatherproof socket and one incandescent lamp.



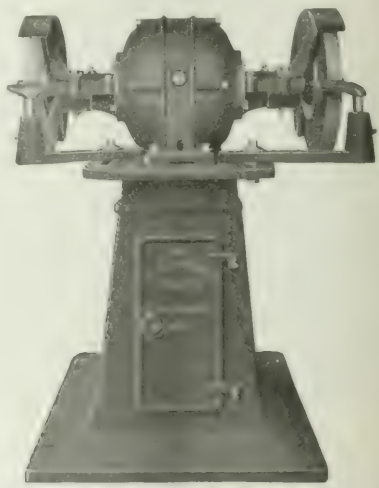

The hood is given a coat of aluminum paint on the inside and acts as a reflector as well as a protection to the lamp. Standard enamel steel signs are attached to this frame by means of six machine screws, the standard size of the sign proper being 10 in. by 12 in.

These signs may be made to read in several different languages, as the one shown herewith, which portrays the message in English, Italian, Lithuanian, Polish and Slavok. In mines where an illuminated sign is essential this type of warning is used extensively to warn the workman of the danger of gases, falling timbers and electric wires. For railway companies their use at stations and cross-overs to inform the public of possible danger is advantageous in view of the low cost of operation and maintenance.

## Double-Disk Grinder Electrically Driven

Every step away from belt drive is in general a step toward increased economy, reliability and convenience, and, not least important, toward increased safety of operation of machines and machine tools. The lower first cost of the belt drive as compared to individual electric motor drive is, in the main, the only real argument in its favor, although there are undoubtedly occasional instances where it possesses other advantages. Not the least of the disadvantages of belt drive is the fact that it cuts off light and the extra cost of artificial illumination is often a considerable item.

In the accompanying cut is shown a front view of the new double-disk grinding and buffing machine recently put on the market by the United States Electrical Tool Company, of Cincinnati, Ohio, and designed to include the qualities of compactness, simplicity and efficiency. Westinghouse motors of 3 hp or 5 hp furnish the drive and are supplied for 110-220 volts, direct current, or 220-440 volts, alternating current, 25 or 60 cycles, two-phase or three-phase. The motor is totally inclosed and is equipped with an especially heavy shaft. Bearings are large and dust-proof, being ring-oiled and self-lubricating. No starting box is required.



DOUBLE-DISK GRINDER

One who has worked with the old belt-driven grinder with its jerky, uneven and uncertain action, its slapping, irritating noise and its excessive bearing wear, will appreciate the improvements effected in the newer type above illustrated.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Cable Making Record.**—During the week of June 9-16, the Hawthorne Cable Shops of the Western Electric Company turned out lead-covered cable containing 256,000,000 conductor feet of wire, or in the neighborhood of 48,500 miles, breaking all previous records for this plant.

**Search-Lamp Sales.**—Twenty-two electric search-lamps, varying in size from 7 in. to 24 in., have been shipped out during the past few weeks by the Carlisle & Finch Company, Cincinnati, Ohio. Of these, three were sent to Canada and the rest were scattered pretty well through the United States.

**Electric Companies Buying Economizer Equipment.**—At the present time electric lighting and traction companies are the heaviest buyers of economizer equipment, according to recent advices from the Green Fuel Economizer Company, of 90 West Street, New York. Large orders have lately been placed for this class of apparatus by the Philadelphia (Pa.) Traction Company and by the Alton Gas & Electric Company, of Alton, Ill.

**Boot and Shoe Factory Installs Electric Drive.**—The F. Mayer Boot & Shoe Company, of Milwaukee, Wis., has ordered from the Mechanical Appliance Company, of the same city, motor equipment for the new section of its plant. There will be supplied five 2 hp motors and nineteen 3 hp motors, all of the Watson slow speed type, operating on direct current at 220 volts. The motors will run at a speed of 420 rpm and will be directly connected to the sewing machine shafts.

**Mercury Lamp Situation.**—It is understood that the Cooper Hewitt Company, of Hoboken, N. J., is viewing present conditions in its lines with entire satisfaction. A large proportion of its sales are to manufacturing firms, and even at this early date there has been noticed a decided and well-distributed tendency to prepare lighting equipment for shorter days and overtime work. At the present time the company is enjoying, in addition to its regular business of supplying lamps for industrial lighting, a period of decided activity in sales of lamps for use by photographers.

**Pushing Mexican Power Project.**—The Mexican Northern Power Company is pushing work on its generating plant and transmission line at La Boquilla, Chihuahua, Mexico. Four Escher-Weiss water turbines, directly connected to 10,000-kw General Electric alternators, are to be installed in the generating station when completed, and the auxiliary apparatus at this station will all be of General Electric make. A 47-mile steel tower 110,000-volt transmission line will carry the energy to Parral, where it is to be used for operating mining machinery. At the step-down station at Parral the transformers are to be of General Electric make and the rest of the equipment will be supplied by the Westinghouse Electric & Manufacturing Company.

**Refrigerating Machines Going Fast.**—Cheerful reading for the recent hot weather is furnished by the report of the York Manufacturing Company, York, Pa., on the sales of refrigerating machines between May 21 and June 23. Eighty-eight machines were disposed of with an aggregate output rating of 1641 tons, and these were placed all over the United States and adjoining territory. The largest installation was for Standard-Waygood, Ltd., Sydney, Australia, consisting of three 90-ton units, arranged for electric motor drive, to be used in the municipal market at that place. Other large buyers were Conron Brothers Company, of New York, 150-ton machine, and J. M. Horton Ice Cream Company, also of New York, 125-ton machine. Among the installations outside the United States were two for the E. Weise Company, in Alaska, three for Agar Cross & Company, in Buenos Aires, Argentine Republic, one for Mora & Majo, in Santiago de Cuba, and one for James M. Motley, in San Pedro, Honduras. Three machines went to Canada, all of them for the Province of Ontario. In addition to the above-mentioned machines there was sold a large amount of auxiliary equipment for ice-making and cold-storage systems.

**Nordberg Hoisting Installation.**—An order has just been placed by the Inspiration Copper Company for two double-drum mine hoists, to be built by the Nordberg Manufacturing Company, of Milwaukee, Wis. Each hoist will be designed to lift 18 tons (exclusive of the cable) from the present working depth of 650 ft. at an operating speed of 750 ft. per minute. The two drums on each hoist will have a diameter of 10 ft. and a face of 65 in., grooved for 1000 ft. of 1¾ in. rope. The braking and control mechanism is of special design. A normal hoisting rate of 30 trips per hour is anticipated, enabling each hoist to handle about 5000 tons of ore in a 14-hour day. General Electric direct current motors will be used to drive the hoists and the installation will include an Ilgner motor-generator set.

**Sign Company Selling Plan.**—The A. & W. Electric Sign Company has recently announced that it is about to put into effect a selling plan which it is thought will be of value to the central stations in securing electric sign business. According to the proposed scheme the interchangeable electric signs manufactured by the above company will be sold to the central stations with the understanding that the station salesmen shall resell them to customers on a thirty-six monthly-payment plan. In case the company receiving the sign fails to make all of the payments, or for some reason wishes to discontinue the service, the central station will be permitted to return the sign to the A. & W. Electric Sign Company and will be credited with the cost price of the sign less one thirty-sixth of the cost price for each month that the sign has been in service. In view of the interchangeable feature of the sign few redemptions are anticipated by the sign company.

**Boiler Sales Still Active.**—In spite of a pretty general slowing up of business, reflecting a combination of the usual summer dullness and the present tight money market, the sales of boiler equipment reported by the Babcock & Wilcox Company, of 85 Liberty Street, New York, show that their product is enjoying a wide demand. Public utility companies have been the largest buyers of boilers and auxiliary equipment, aggregating in the neighborhood of 13,700 hp, since the last report was received, but industrial companies with a total of 11,200 hp, bought during the same period, are not far behind. The larger purchasers among utility companies were the Public Service Company of Northern Illinois, Blue Island, Ill., with 3048 hp, and the Public Service Electric Company, of Marion, N. J., with 3000 hp. Of the industrial concerns the Toledo Furnace Company, of Toledo, Ohio, with 4137 hp, and the National Biscuit Company, of New York, with 2080 hp, were the heaviest buyers of boiler equipment.

**Southern Hydroelectric Developments.**—H. A. Lewis, manager of the New York office of the Hot Point Electric Heating Company, 46 West Street, who has just recently returned from a trip through the South, states that progress is being made in hydroelectric development work in that section of the country, especially in Tennessee, Georgia and Alabama, and that a number of the smaller stations in each location are being tied together in a large unified system. Speaking of the outlook for the company he represents, Mr. Lewis says that the report printed in the June 21 issue of the *Electrical World*, to the effect that the main office of the company is to be moved from the Pacific Coast to Chicago, was in error, the only change at the

latter place being an extension of the factory. The business of the company in this country has been satisfactory recently, and the export business has been particularly pleasing, large numbers of heating appliances being shipped to England, France, South America, Australia and New Zealand.

**Old Firm Incorporates.**—The firm of Charles Cory & Son, of 286 Spring Street, New York, which has been controlled by the Cory family for the past seventy-five years, has recently been incorporated, ownership and management being retained by Messrs. Charles and John M. Cory. No change will be made in the company's office and factory address, which continues as above indicated. This company specializes in electric and mechanical signaling and communicating equipment for war vessels and supplies all this sort of equipment for the ships of the United States Navy. At the present time installations of this nature are being made in the battleships *New York, Texas, Pennsylvania, Oklahoma* and *Nevada*, the gunboat *Sacramento* and in a number of destroyers now under construction in the several navy yards. As no two battleships are built exactly alike, and as the changes in design of this class of vessels are extremely rapid, the design of signaling and communicating equipment for each ship is almost a distinct problem. This is probably one of the most highly specialized branches of the electrical industry.

**Proposed Extensions to Municipal Plant in Jamestown, N. Y.**—The Board of Electric Lighting Commissioners of Jamestown, N. Y., has recommended to the Common Council of that city that bonds of the city to the amount of $40,000 be issued, if approved at a taxpayers' election. The proceeds of these bonds are to be used to extend the municipal electric-light plant. The commissioners declare that the surplus earnings of the plant, together with the moneys raised by the Common Council for street-lighting purposes and all other moneys on hand, are insufficient to meet the cost of the desired extensions and improvements. It is desired to purchase 1000-kw turbo-generator to cost about $21,000; two 75-light street-lighting sets and 150 luminous-arc lamps to cost about $7000; three mechanical stokers and the rehabilitation of the old blower system, to cost about $4000; a new street-lighting circuit to cost about $2000; a new storage building and repair shop to cost about $5500, and incidentals, $500. The output of the 1000-kw unit is desired for additional commercial service. Mr. Clement B. Jones is secretary of the Board of Electric Lighting Commissioners.

**Electrical Energy for Large Chicago Tannery.**—Along with the construction of its new eight-story tannery, which measures 240 ft. by 130 ft. on the ground floor, the Griess-Pfleger Tanning Company, Chicago, is building an electrical plant which will generate all of the energy which is used in the building. One 150-kw and two 500-kw Westinghouse 440-volt, three-phase alternating-current generators driven by reciprocating steam engines are being installed in a separate building near the tannery proper. Each generator carries its individual exciter mounted on the same shaft. A twelve-panel switchboard measuring about 7.5 ft. high from the floor is to be installed by Kohler Brothers of Chicago. The motor-feeder panels on this board are asserted to be the largest ever made and are constructed by the States Electric Company, Chicago. Energy for the operation of the motors used in this tannery will be supplied at 440 volts, while that for lighting will be stepped down to 110 volts, three-phase, at the switchboard. Lead cables will be run from the switchboard to a junction box in the tannery, from which double-braided cables will be run to various cutout cabinets throughout the building. Wiring of tanneries is somewhat different from that in other buildings because acid fumes have to be contended with after the work is completed. To safeguard against the fumes special conduit manufactured by the Safety Armorite Conduit Company has been used throughout the building. All of the conduit is run exposed so that additional motors can be installed at the most convenient points after the building is completed without having to run feeders a long distance to some motor outlet. The motors range in size from 5 hp to 50 hp, most of them being installed on the ceilings. There will be about 1300 hp in motors installed in the building for drying, pressing, dipping, etc. Outlets capable of supplying twelve lamps each are installed in the building, and at present about 1000 lamps will be connected. If the labor trouble in Chicago is settled soon, it is expected that the entire electrical equipment will be ready for operation by the latter part of August. The entire wiring contract is held by the Freeman-Sweet Company, Chicago.

**Northern Illinois Company Sells Short-Term Notes.**—The Public Service Company of Northern Illinois announces the sale of $2,500,000 worth of three-year 6 per cent gold notes secured by $3,125,000 of the company's 5 per cent bonds. A syndicate composed of Lee, Higginson & Co., N. W. Halsey & Co. and Russell, Brewster & Co. purchased the notes, and it is said that the issue will be offered to investors on a basis to yield a 7 per cent return. Out of the proceeds the company will redeem the $1,500,000 note due on Oct. 3 and given in part payment for the Northwestern Gas Company.

**Proposed Electric Bus Service in New York City.**—During the past week or ten days there has come to light an interesting situation in the electric vehicle field which is worthy of close attention, both on account of the actual present importance of the movement and because of the latent possibilities for future development opened up by it. Four concerns have appealed to the Board of Estimate and Apportionment for franchises to operate bus lines in the city streets, namely: the Fifth Avenue Coach Company, the New York Motor Bus Company, the Manhattan Motor Bus Company, and the People's Five Cent Bus Line. The first-named line has been in operation for some time, and until last winter was in virtual control of the situation in New York City, but at that time the Legislature passed some measures which destroyed this monopoly. The company is now trying to strengthen its position by adding new routes to those already in operation under its earlier franchise. Of the two next mentioned companies there is not a great deal known at present, but it is suspected that one of them at least is aiming to secure routes which will take some of the traffic now controlled by the Interborough and New York Railways companies. The People's Five Cent Bus Line, which is controlled by George W. Loft and a half dozen or more prominent bankers, proposes to inaugurate a novelty in this class of service by charging, as the name implies, only a nickel a ride in place of the ten-cent fare long exacted by the Fifth Avenue Coach Company. About twenty routes have been laid out and applied for by the People's Line and these seem to be so placed as to give service in sections of the city which have long been difficult of access by the regular street-car lines. At present transportation facilities are notably poor in both the lower east and west sides, and especially along the water fronts, and routes have been requested by the People's company to cover these sections. Central Park has always been an effective barrier to traffic across town, there being only a single line, namely the Eighty-sixth Street Cross-town car, connecting the east and west sides of the Park. It is proposed to run two or three bus lines across the Park and one line up through it, if the necessary franchises can be obtained, and the People's Line, which is also applying for these routes, claims that by the use of electric drive the offensive noises and odors common to the gasoline cars can be eliminated and the main objections to bus service in the Park removed. The same company is also trying to obtain routes down through the business and financial sections and through the residential sections well uptown. If it succeeds in securing any of the franchises sought this company will probably put in service a fleet of single-deck storage battery cars of the four-motor four-wheel-drive type which has been used with some success in trucking service in Philadelphia and elsewhere. The patents covering this type of car are owned by the Imperial Electric Motor Company, a German concern, and the American rights are controlled by the Electro-Coach Corporation, of New York. These trucks are made at the plant of the Commercial Truck Company, in Philadelphia, Pa. An economic if not an engineering point in connection with the proposed service on the People's Five Cent Line is the plan, said to be under consideration, for the use of lady conductors to collect fares and manipulate the bell on its electric busses.

**Public Service Company of Oklahoma.**—The Public Service Company of Oklahoma has been organized as a state company subsidiary to the Middle West Utilities Company of Chicago. The operating headquarters of the new company will be in Oklahoma City and it will control properties in Guthrie, Tulsa, Colgate, Vinita, Lehigh and Utoka.

## Industrial Securities

| Security | Capital Stock Listed | DIVIDEND Per Cent | DIVIDEND Period | QUOTATION July 9 | QUOTATION July 16 |
|---|---|---|---|---|---|
| Allis-Chalmers, t.r., 5th pd | $19,800,000 | ..... | ..... | 5⅞ | 5⅞ |
| Allis-Chal., pf.,t.r.,5th pd.. | 16,050,000 | ..... | ..... | 14* | 14⅛ |
| Amalgamated Copper..... | 153,887,900 | 1½ | Q | 63⅜ | 66⅛ |
| American Tel. & Tel..... | 344,471,400 | 2 | Q | 126⅜ | 127½ |
| Electric Storage Battery,c. | 16,074,425 | 1 | Q | 45½ | 46⅛ |
| General Electric..... | 101,363,600 | 2 | Q | 137 | 139½ |
| Mackay Cos., c..... | 41,380,400 | 1½ | Q | 89* | 77½ |
| Mackay Cos., pf..... | 50,000,000 | 1 | Q | 68* | 68 |
| Western Union Tel..... | 99,747,600 | ¾ | Q | 60 | 61¼ |
| Westinghouse, E. & M., c. | 34,496,400 | 1 | Q | 57 | 59 |
| Westinghouse, E. & M., pf. | 3,998,700 | 1¾ | Q | 109* | 109 |

*Last price quoted.

### NEW YORK METAL MARKET PRICES

| | July 8 Bid. | July 8 Asked. | July 15 Bid | July 15 Asked. |
|---|---|---|---|---|
| Copper: | | | | |
| Standard, spot*..... | 13.75 | to 14.30 | 13.25 | ..... |
| | Selling Prices | | Selling Prices | |
| | £ s d | | £ s d | |
| London, standard, spot*..... | 63 3 9 | | 62 8 9 | |
| Prime Lake..... | 14.75 | to 14.85 | 14.50 | ..... |
| Electrolytic..... | 14.50 | to 14.60 | 14.15 | to 14.25 |
| Casting..... | 14.35 | to 14.40 | 14.05 | to 14.15 |
| Copper wire base..... | .... | 15.75 | 15.50 | ..... |
| Lead..... | | 4.35 | | 4.35 |
| Nickel..... | 40.00 | to 45.00 | 40.00 | to 45.00 |
| Sheet zinc, f. o. b. smelter..... | | 7.00 | | 7.00 |
| Spelter, spot..... | 5.40 | to 5.50 | 5.30 | to 5.35 |
| Tin, spot*..... | 39.20 | to 39.50 | 39.70 | to 40.00 |
| Aluminum: | | | | |
| Prompt delivery..... | 23.00 | to 24.00 | 23.00 | to 23.50 |
| Future..... | 22.00 | to 23.00 | 21.00 | to 22.00 |

### *OLD METALS

| | | |
|---|---|---|
| Heavy copper and wire..... | 13.25 | 13.25 |
| Brass, heavy ..... | 8.12½ | 8.12½ |
| Brass, light..... | 7.25 | 7.25 |
| Lead, heavy..... | 4.25 | 4.25 |
| Zinc, scrap..... | 4.37½ | 4.37½ |

### *COPPER EXPORTS

Total tons to July 15..... 10,000

*From daily market report of the New York Metal Exchange.

## Business Notes

**Massachusetts Chemical Company.**—The Boston office of the Massachusetts Chemical Company has been moved from 185 Summer Street to 757 Boylston Street.

**The Bryant Electric Company and the Perkins Electric Switch Manufacturing Company,** Bridgeport, Conn., have opened New York sales offices in the Vanderbilt Avenue Building, 51 East Forty-second Street, in charge of Messrs. Frank Stout and Robert Abbott.

**The Electric Controller & Manufacturing Company.**—Mr. W. H. Williams, formerly in the Pittsburgh office of the Electric Controller & Manufacturing Company, has been made district manager for the company in the Chicago territory.

**The Line Material Company,** of South Milwaukee, Wis., maker of insulator brackets, outdoor lighting brackets and other line construction material, have established offices at 114 Liberty Street, New York; 229 Sherlock Building, Portland, Ore., and 915 Olive Street, St. Louis, Mo.

**The Arrow Electric Company,** Hartford, Conn., manufacturers of sockets, switches and electrical supplies, held a sales conference, July 15 to 17, which was attended by about twenty of its salesmen from all parts of the United States and Canada. Business sessions occupied a part of each day, the balance being given over to various forms of amusement and entertainment provided by the company.

## New Industrial Companies

**The Farkas Lamp & Wire Company,** of Hoboken, N. J., has been incorporated with a capital stock of $125,000 to manufacture incandescent lamps, etc. The incorporators are: M. H. Breen, W. H. McTigue and D. Lubash, of Hoboken, N. J.

**The Hammesfahr Glass & Insulation Company,** of Brooklyn, N. Y., has been incorporated by H. Hammesfahr, E. Hammesfahr and H. Hammesfahr, Jr., of Brooklyn. The company is capitalized at $100,000 and proposes to manufacture and deal in insulation.

**The Electric Specialty Company,** of Baltimore, Md., has been incorporated by Julius H. Wyman, Fidelity Building, Baltimore, Md.; John M. Wright, of Baltimore, and William M. Pyle, of Wilmington, Del. The company is capitalized at $10,000 and proposes to manufacture electrical machinery.

## Trade Publications

**Wire.**—The American Electrical Works, Phillipsdale, R. I., has recently distributed a price list of wires and cables.

**Direct Current Motors.**—Bulletin No. A4121, of the General Electric Company, is a revision of the company's bulletin on direct current motors of the commutating-pole design.

**Refillable Fuses.**—A cardboard poster, 7 in. by 11 in., is being mailed by the A. F. Daum Company, Pittsburgh, Pa., showing cross-sectional views of refillable fuses for electric circuits.

**Lamps.**—A new price list, effective July 1, on Eastern tungsten lamps is being sent out by the Eastern Electric Lamp Co., Division of the Franklin Elec. Mfg. Co., Hartford, Conn.

**Chandeliers.**—Illustrations of some of the new designs added recently to its line of chandeliers have been published in leaflet form by the Beardslee Chandelier Mfg. Co. for inclusion with its loose-leaf literature.

**Time Switches.**—Various types of time switches, transformers for tungsten lamps, spot-lamps, search-lamps and other specialties are briefly referred to and illustrated in a leaflet issued by the Campbell Electric Co., Lynn, Mass.

**Switches.**—"Diamond H" push button switches, rotary-flush and rotary-surface switches, remote-control switches, automatic door switches, flush receptacles, steel wall cases and ground clamps are described and illustrated in Catalog E recently issued by the Hart Mfg. Co., Hartford, Conn. A number of wiring diagrams are included.

**Feeder Voltage Regulators.**—The General Electric Company has issued Bulletin No. A4129, which illustrates and describes in detail small feeder regulators. This regulator is of the pole type and is built for use on single-phase feeders only. It is made in two designs, one for outdoor installation and automatically operated, and the other for hand operation, and to be installed indoors only. The bulletin contains internal and external views and connection and dimension diagrams.

**"Buckeye-Mobile."**—The Buckeye Engine Co., Salem, Ohio, in its Bulletin No. 10-B gives detailed information in regard to its "Buckeye-Mobile." This apparatus is a complete self-contained superheated steam power plant composed of internally fired boiler, tandem compound engine, superheater, reheater, feed-water heater and pump, with or without condenser, for belted service or with flexible coupling for direct connection to generator. Some useful test data are given. The bulletin is fully illustrated.

**Insulators.**—A revised and enlarged edition of "The Insulator Book" has recently been published by the Locke Insulator Manufacturing Co., Victor, N. Y. The "Notes" which form the opening pages are full of interest and value, telling just the things that the prospective user of insulator would like to know. The many types of insulators and some special applications are graphically shown. The book is arranged in the modern "loose-leaf" form, making it possible always to keep the book up to date.

# Personal Mention

**Mr. Joseph S. Lovering** has resigned as president of the Eastern Connecticut Power Company of Eastern, Conn.

**Mr. W. R. Tasker** has succeeded Mr. F. S. Freemole as superintendent of the [illegible] plant at Trenton, N. S.

**Mr. A. T. McDonald** has resigned his position as general sales manager of the Louisville (Ky.) Lighting Company.

**Mr. S. G. Reque** has recently been made general superintendent of the Northumberland County Gas & Electric Co., Sunbury, Pa.

**Mr. F. H. Miller**, of Toledo, Ohio, has become local manager of the Lebanon, Ind. plant of the Interstate Public Service Company.

**Mr. G. A. Forgnier**, formerly of Racine, Wis., has become associated as superintendent with the lighting and water system of Gladstone, Mich.

**Mr. E. J. Nally**, vice-president of the Postal Telegraph Company, returned this week from a vacation trip to Europe, his time abroad having been spent largely in London.

**Mr. Alex Macauley**, superintendent of the electrical department of the Beverly (Mass.) Gas & Electric Company, is this month celebrating the twenty-fifth anniversary of his service with the company.

**Mr. R. P. Stevens** has been elected president of the Eastern Consolidated Electric Company which has been taken over by the Lehigh Valley Transit Company of which Mr. Stevens is also president.

**Mr. W. H. Blood, Jr.**, of Stone & Webster, Boston, Mass., and insurance expert for the National Electric Light Association, has sailed for Europe, where he will spend a vacation touring with his family in an automobile.

**Mr. S. F. Messer**, formerly with the Warren Water & Light Company and the Trumbull Public Service Company, both of Warren, Ohio, is now superintendent of the Kent Water, Light & Power Company, having succeeded Mr. A. B. Young, deceased.

**Mr. F. A. Tennant** has resigned as Assistant Commissioner of Patents to enter the practice of patent law at Boston. Mr. Tennant entered the United States Patent Office in 1895 and after a number of promotions was made Assistant Commissioner in 1909.

**Mr. Howard Maxwell**, formerly connected with the engineering department of the General Electric Company, has been appointed superintendent of the motor department as successor to Mr. J. A. Smith, who has been appointed general superintendent of the works.

**Prof. Henry H. Norris** has resigned his position as head of the electrical engineering department at Cornell University and will devote a part of his time to editorial work on this paper. He will have the title of associate editor and at present will make his headquarters at Ithaca, N. Y.

**Mr. Zenas W. Carter**, secretary of the Electric Development Association, Boston, Mass., sailed for Europe on July 13 from Montreal on the steamer "Ionian" of the Allan Line. He was accompanied by Mrs. Carter. They expect to spend about two months in England, France, Belgium and Scotland.

**Mr. M. J. Curran**, who succeeds Mr. Waldemar Michaelsen as city electrician of Omaha, Neb., was formerly connected with the Omaha Electric Light & Power Company, resigning after eight years' service to become superintendent of the Standard Electric Company. Since 1909 Mr. Curran has conducted an electrical contracting business in Omaha.

**Mr. J. Martin**, who has been associated with the United States Navy in electrical work for the past twenty years has joined the staff of the Marconi Wireless Telegraph Company of America. His first duties will involve the completion of a chain of 50-kw stations at New Orleans, Swan Island and Santa Marta for the service of the United Fruit Company.

**Mr. Waldemar Michaelsen**, for ten years city electrician of Omaha, Neb., has been succeeded in that position by Mr M. J. Curran. Mr. Michaelsen served the city under three mayoralty administrations. He is a past-president of the Western Society of Electrical Inspectors, and is well known among electrical men of the west as an engaging speaker and humorist.

**Mr. James A. Smith** has been appointed general superintendent of the Schenectady works of the General Electric Company. Mr. Smith was formerly superintendent of the motor department and his present post has been newly created in order to relieve Mr. G. E. Emmons, who has been placed in general executive charge of all manufacturing operations of the company.

**Mr. W. J. Canada**, engineer of the Rocky Mountain Fire Underwriters' Association, has resigned to become associate physicist with the Bureau of Standards, Department of Commerce, Washington, D. C., where he will take up an investigation of the electrical life hazard, of which he has made a special study. Mr. Canada is past-president of the Western Association of Electrical Inspectors.

**Gen. George H. Harries**, president of the American Electric Railway Association, and an officer of several public utility properties controlled by H. M. Byllesby & Company, has been elected president of the Louisville Gas & Electric Company, chartered in Kentucky as a consolidation of the Louisville (Ky.) Gas Company and four other utility companies. Mr. H. H. Byllesby is chairman of the board of the new company.

**Mr. Francis C. Pratt**, who was assistant to Mr. E. W. Rice, Jr., when he was vice-president of the General Electric Company, has been appointed assistant to the president, so that Mr. Rice will not be deprived of his services. Mr. Pratt has also been placed in executive charge of engineering. He has been with the General Electric Company about eight years, coming to Schenectady from the Pratt & Whitney Company of Hartford. Mr. Pratt is a graduate from the Sheffield Scientific School, Yale University.

**Mr. William T. Taylor**, consulting engineer, Santiago, Chile, is visiting the United States in the interest of certain hydroelectric undertakings in South America. Mr. Taylor served for a time as general superintendent of the Jhelum Power Installation, Baramulla Kashmir, India, and later was associated with the Central Mexico Light & Power Company, San Luis Potosi, Mexico. More recently he has been president of Taylor & Company, Sao Paulo, Brazil. He is a member of the (British) Institution of Electrical Engineers and a fellow of the American Institute of Electrical Engineers.

**Mr. George E. Emmons**, for many years general manager of the Schenectady works of the General Electric Company, has been placed in general executive charge of all manufacturing operations of the company. Mr. Emmons has been with the General Electric Company for twenty-eight years. He entered the employ of the Thomson-Houston Company as cost clerk and served through various grades and positions until in 1895, one year after going to Schenectady, he was made general manager of the combined works. The new position is one of the highest in the gift of the company and has been won by a long record of successful achievements.

# Obituary

**Burton E. Baker**, inventor and manufacturer of X-ray apparatus, died at his home at Hartford, Conn., July 10, of a malady superinduced by his continuous exposure to X-rays in connection with his work. A number of prominent physicians operated upon Mr. Baker in an attempt to stay the disease, but without result. He was 43 years of age, and was head of the Baker Electric Company and the Baker X-ray Tube Company of Hartford.

**R. M. Ferris**, chief engineer of the New York Telephone Company, was drowned July 13 while bathing at Siasconsett Beach, Nantucket, Mass. Mr. Ferris was 38 years of age and had served the telephone company for 15 years. He was a graduate of the Massachusetts Institute of Technology and the Riverview Military Academy. His home was at Montclair, N. J. Mr. Ferris was an associate member of the American Institute of Electrical Engineers.

# Construction

## New England

FORT KENT, MAINE.—A new electric-light plant is being built in Fort Kent, plans for which were prepared by Green & Wilson. Harry F. Green, of Waterville, has charge of the work.

NEWPORT, N. H.—The Public Service Commission has approved of an issue of $35,000 in capital stock by the Newport El. Lt. Co.

MORRISVILLE, VT.—A new 1000-hp James Leffel waterwheel has been installed at the Cadys Falls plant of the Morrisville municipal lighting and water plant.

BOSTON, MASS.—Bids will be received by the Schoolhouse Commissioners of the city of Boston, 120 Boylston Street, Boston, until July 22, for installing vacuum cleaning system in the Practical Arts High School, Greenville and Winthrop Streets, Boston, Mass. Charles Logue, John F. Kennedy and Charles B. Perkins are commissioners.

FITCHBURG, MASS.—Additions to the power station of the Fitchburg Gas & Elec. Co., to accommodate ultimately three 2500-kw turbines will be made within a short time. The equipment has been contracted for. C. R. Hayes, manager.

HOLYOKE, MASS.—The Holyoke St. Ry. Co. is reported to be preparing plans for improvements to its power plant. Louis D. Pellissier is general manager.

MILFORD, MASS.—The Milford El. Lt. & Pwr. Co., it is reported, contemplates extensions and improvements to its gas and electric systems to cost about $22,000. About $9,000 will be expended for improvements to the electric service.

TURNERS FALLS, MASS.—The Franklin El. Lt. Co. expects to purchase within the next three months additional street-lighting equipment. The company has recently closed a 10-year street-lighting contract with an increase in the number of street lamps. M. H. Mahoney is superintendent.

WESTFIELD, MASS.—The municipal light board is considering the proposition submitted by the Amherst Pwr. Co. of Greenfield, offering to furnish electricity to operate the municipal electric-light system. In case the department should decide to secure energy from the Amherst company an appropriation of from $10,000 to $15,000 will be asked for the erection of transmission line, transformers, etc. The transmission line will be extended from the West Springfield line, a distance of about 3 miles.

WEST SPRINGFIELD, MASS.—The City Council has given permission to the Amherst Pwr. Co. to erect a transmission line across the land to Bear Hole. This is considered the initial step in the plan of the board to use electric energy at Bear Hole in place of using energy derived from a gas engine, but it is planned to retain the latter for an emergency.

## Middle Atlantic

ALBANY, N. Y.—Bids will be received by Duncan W. Peck, superintendent of public works, Capitol, Albany, until Aug. 5 as follows: Contract No. 93, Erie Canal, sections 5, 6 and 7; Oswego Canal, section 1—Power plants, electrical equipment and machinery for operating and lighting locks as follows: Erie Canal, locks 20, 21, 22, 23, 25 and junction lock at New London; Oswego Canal, locks 3, 5 and 6. Sheets 1 to 33 inclusive. Plans may be seen and detailed specifications, engineer's estimate of quantities, proposal blanks, form of contract and bonds required and other information for bidders may be obtained at the office of the superintendent of public works at Albany; at the office of the assistant superintendent of public works for the middle division at Syracuse; at the office of the assistant superintendent of the western division at Rochester, and at the canal office, Spaulding's Exchange, Buffalo. Copies of detailed plans or drawings may be obtained from the state engineer and surveyor at Albany, upon payment to him of the cost of producing same.

BROOKLYN, N. Y.—Bids will be received by the Department of Public Charities, foot of East Twenty-sixth Street, New York, until July 23, for furnishing material and labor necessary to reset 12 horizontal tubular boilers in the power house of the Kings County Hospital, Borough of Brooklyn. Blank forms and further information may be obtained at the office of the chief engineer of the department, foot of East Twenty-sixth Street, where plans and specifications may be seen. Michael J. Drummond is commissioner.

FULTON, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 14 for construction, complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Fulton. Drawings and specifications may be obtained from the above office or from the custodian of site at Fulton. O. Wenderoth is supervising architect.

JAMESTOWN, N. Y.—The Niagara & Lake Erie Pwr. Co., of Buffalo, is planning to extend its transmission line from Portland to Mayville and thence to Jamestown. The company has applied to the Public Service Commission for permission to issue $50,000 in bonds for the erection of a line from Portland to Mayville.

JAMESTOWN, N. Y.—Bids will be received by the Board of Electric Lighting Commissioners of Jamestown, until July 30, for furnishing one and two 75-lamp series luminous or flaming arc rectifiers sets and also 75 and 150 series luminous or flaming arc lamps in accordance with specifications on file at the office of the board. Specifications may be obtained at the office of the Board of Lighting Commissioners, City Hall, Jamestown.

LANCASTER, N. Y.—The Depew & Lancaster Lt., Pwr. & Conduit Co., of Lancaster, expects to install within the next three months three 200-kw transformers for 11,000-volt primary, 2200-volt secondary, 25 cycles; it also expects to purchase one 11,000-volt, three-phase, 25-cycle oil breaker; poles, wire, cross-arms and hardware for approximately 5 miles of arc lamp and low-tension wires; incandescent-lamp regulators for street service with reflectors, etc., within the next three months. A. R. Tremaine is superintendent.

LESTERSHIRE, N. Y.—The Board of Trustees is considering the installation of an ornamental street-lighting system in Lestershire.

NORWOOD, N. Y.—The Norwood El. Lt. & Pwr. Co. expects in the near future to install a water wheel governor, build a new concrete flume (500 ft. long), enlarge its raceway and change the position of the 350-hp engine. The cost of proposed improvements is estimated at $15,000. C. F. Vance is superintendent.

NUNDA, N. Y.—The Nunda Casket Co. expects to purchase within the next four months one 125-hp boiler, one 150-hp Corliss engine and two generators for its electric-light plant.

ONEONTA, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 21, for construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Oneonta, N. Y. Drawings and specifications may be obtained from the custodian of site at Oneonta or at the above office. O. Wenderoth is supervising architect.

OWEGO, N. Y.—The Owego Lt. & Pwr. Co. expects to purchase within the next month one 150-hp water turbine. The company installed last year two 300-kva De Laval steam turbines, new condensers, pumps, oiler, new switchboard, instruments, transformers, meters, etc. D. C. Newton is superintendent.

SCHENECTADY, N. Y.—Bids will be received by the Board of Contract and Supply, City Hall Annex, until July 23, for the general construction, including electrical work, for three new schools. Plans and specifications may be secured from W. T. Wooley, city engineer and architect, 447 Franklin Street, Schenectady. Fred E. Johnson is secretary of Board of Contract and Supply.

SPENCER, N. Y.—The Seely El. Co., of Spencer, expects to erect within the next two months 3 miles of transmission line, with distribution system at end, and to purchase switchboard and instruments for same, and material for street-lighting system, including hoods, brackets, etc.

CANTON, PA.—The Canton Illg. Co. expects to erect within the next three months a new brick and concrete power house (30 ft. by 80 ft.) and to install two 150-hp boilers (150 lb. pressure), two 160-hp Skinner engines connected to two 125-kva General Electric, 60-cycle, 2500-volt generators. Contracts have been placed for all machinery. The company is changing its system from direct to alternating-current and will establish a 24-hour service. H. L. Clark is treasurer.

COATESVILLE, PA.—The Chester Valley El. Co., of Coatesville, has recently closed a five-year contract with the borough of Coatesville for street-lighting and is considering the installation of metallic or luminous-arc lamps. The company is erecting a 7-mile high-tension transmission line to Parkersburg, material for which has been purchased. F. W. Harris is superintendent.

DUNBAR, PA.—The Dunbar El. Co. expects to purchase within the next month about 130 poles and crossarms and some incidentals for ordinary upkeep of distribution system. Stuart B. Marshall is general superintendent.

ERIE, PA.—The Erie County El. Co. expects to erect within the next two months additional three-phase transmission lines and to purchase within the next 30 days three 500-kva transformers and also to purchase within the next six months one 5000-kva turbine. The company has bought within the last four months two 550-hp Babcock & Wilcox boilers. T. J. O'Dea is superintendent.

HAMBURG, PA.—The Hamburg Gas & El. Co. expects to purchase within the next three months two 150 or 200-hp boilers. The company has just completed the erection of six miles of 4400-volt transmission line to supply electricity to two boroughs and three villages. A. J. Althouse is superintendent.

HOLTWOOD, PA.—The Pennsylvania Wtr. & Lt. Co., of Holtwood, expects to erect within the next six months a second transmission to Baltimore, Md., consisting of three-phase circuits and to extend the Baltimore substation 44 ft. The company also expects to purchase unit No. 8, consisting of a 17,000-hp water turbine directly connected to a 12,000-kw generator, governor and necessary lubricating system for new unit; switching equipment for new unit at Holtwood station, the two new circuits to Baltimore, one 10,000-kw transformer for Baltimore station for the two new circuits, one 10,000-kw transformer and three 13,000-volt feeders; three 10,000-kw transformers, of which two are for Holtwood station and one for the Baltimore substation, and all material for No. 2 Baltimore transmission line, such as towers, cables, insulators, lightning

NORTH WARREN, PA.—Work will begin in the near future on the construction of a large power plant at the State Hospital for the Insane

PHILADELPHIA, PA.—The United El. Construction Co., of Philadelphia, was recently awarded the contract for electric-lighting equipment, including engines, generators, pumps, wiring, telephones, etc., for the Kenilworth apartment house, at Nineteenth Street and Rittenhouse Square, at a cost of $60,000, also the contract for the entire electrical equipment for the new building being erected for the National Biscuit

SUNBURY, PA.—The Northumberland County Gas & El. Co., of Sunbury, is erecting a 6-mile extension to its 16,500-volt transmission line from Milton to Watsontown, to supply electricity to brick manufacturing plants there. Material for the above has been purchased. The company expects to purchase within the next 30 days high-tension disconnecting switches for outdoor service (33,000 volts). S. G. Reque is superintendent.

YORK HAVEN, PA.—The York Haven Wtr. & Pwr. Co. expects to erect within the next three months a 4500-volt transmission line to Mount Wolf, Pa., and a 2200-volt line to Royalton, and also expects to purchase three 200-kw transformers within the next month. W. L. Mann is general manager.

TRENTON, N. J.—The merchants of this city are reported to be interested in a proposition to start an independent lighting plant. The proposed plant will be built by Ogden D. Wilkinson, of Philadelphia, Pa., one of the large property owners in this city.

CLARKSBURG, W. VA.—The Clarksburg Gas & El. Co., it is stated, is having plans prepared for a central power plant of brick and steel construction, 75 ft. by 85 ft., to cost about $500,000.

WASHINGTON, D. C.—An American consul in Central America has transmitted the name of a person in his district who is interested in electric-light supplies and telephones and who has been requested to submit estimates of cost on an electric-light outfit for two towns. For further information, address No. 11,287, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C.

WASHINGTON, D. C.—An American consular officer in the Far East has transmitted the names of two electric-light companies in his district which are preparing to construct electric railway lines about 20 miles in length. Correspondence may be in English. Further information may be obtained by addressing No. 11,283, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C.

WASHINGTON, D. C.—A report from an American consul in England states that a firm in his district desires particulars, including illustrations, prices, etc., from American manufacturers of wireless telegraphy apparatus. The firm is in touch with several ship and trawler owners who own at least 550 vessels. For further information address No. 11,292, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 22 for furnishing at the navy yard, Brooklyn, N. Y., supplies as follows: Schedule 5637, one 30-kw motor generator, 15 5-kw radio sets for ship installation. Bids will also be received until Aug. 5 as follows: Boston, Mass., Schedule 5644, for one three-motor electric traveling crane; Philadelphia, Pa., Schedule 5646, one motor-driven flange facing machine; Norfolk, Va., Schedule 5643, 16 blower ventilating sets; Schedule 5641, rewiring quarters at navy yard; Puget Sound, Wash., Schedule 5623, six heavy pattern, motor-driven engine lathes; Washington, D. C., Schedule 5639, 15 sets transmitting and receiving, etc., radio sets. Applications for schedules should designate the schedule desired by number.

## North Central

ALBION, MICH.—The Commonwealth Pwr. Co. will rebuild its local plant, recently destroyed by fire, at once. The city will be without street-lighting service until the plant is rebuilt.

DETROIT, MICH.—The Edison El. Illg. Co. is reported to have awarded contract for the erection of substation building, 40 ft. by 75 ft., one story, at Bellevue and Waterloo Streets. Plans are now being prepared for a substation 40 ft. by 100 ft., to be located at the corner of Beech and First Streets.

DETROIT, MICH.—All bids for the 5000-kw turbo-generator unit for the municipal electric-light plant have been rejected by the Public Lighting Commission and new bids will be asked for. Under the new specifications the lighting commission will lay the foundations. An appropriation of $119,500 has been made for the equipment.

FRANKFORT, MICH.—The new dam of the Benzie County Pwr. Co., on the Betsey River, will be completed early in August, and will develop 1200 hp. This energy will be used for lighting and industrial purposes in the town of Frankfort, Elberta, Benzonia and perhaps other places. S. B. Wiggins, whose address is the Engineering Building, Ann Arbor, is engineer in charge.

[illegible] has been awarded by the [illegible] for a period of five years at $[illegible] per year. [illegible] tungsten lamps are to be installed on the bridge.

BRYAN, OHIO.—The installation of a new street-lighting system to cost approximately $5,000 is under consideration. The plans provide for the erection of 70 standards on Main Street surrounding the [illegible]

CINCINNATI, OHIO.—Bids will be received at the office of the [illegible] of Board of Education, City Hall, Cincinnati, until Aug. 4 for furnishing material and installing electric-lighting systems in the Whittier and Hyde Park public schools, in accordance with plans and specifications on file in the office of C. W. Handman, business manager.

CLEVELAND, OHIO.—Bids will be received at the office of the secretary to the director of public service, 104 City Hall, Cleveland, until July 25, for transformers for the municipal electric light department of Cleveland. Bids will also be received at the same time and place for [illegible] the Municipal Electric Light Department of Cleveland. Plans and specifications may be obtained at the office of the engineer of construction, room 319, City Hall. W. J. Springborn is director of public service and W. H. Kirby secretary.

KENTON, OHIO.—The Hardin-Wyandot Ltg. Co. is building 12 miles of transmission line between Forest and Upper Sandusky, which is expected to be complete within thirty days. P. M. Magly, manager.

MASSILLON, OHIO.—The Massillon El. & Gas Co. expects to increase its transformer capacity on the 11,000-volt transmission line to Canal Fulton by 300 kw, and in Canal Fulton by 100 kw, to care for increased load. The company also expects to purchase within the next month 1000 or 1500-hp feed water heater and feed pump, Lea Vacuum recorder for boiler feed water. Generating and street-lighting equipment has not yet been decided upon. J. B. Johnson is superintendent.

TOLEDO, OHIO.—A petition has been presented to the City Council asking for the installation of boulevard lamps on Jefferson Street between Eleventh and Fourteenth Streets. J. R. Crowell is director of public service.

WEST MILTON, OHIO.—L. A. Pearson, owner of the Stillwater Valley electric-light plant, expects to purchase within the next two months one 150-kw alternator and to erect a 5-mile transmission line to a neighboring village within the next six months.

LOUISVILLE, KY.—The Louisville Gas & El. Co., which recently took over the control of all public utilities of Louisville, is reported to be considering plans for the establishment of a central steam heating station. The George G. Fetter Lt., Ht. & Pwr. Co., one of the companies taken over, has a steam heating franchise covering a few of the downtown streets, and some buildings are now being served under it. Additional franchises will be asked in the near future. George H. Harris is president of the Louisville Gas & El. Co.

PINEVILLE, KY.—The Kentucky Utilities Co., of Lexington, is reported to have made arrangements to enlarge its plant at Pineville so [illegible] to furnish electrical service to the coal mines in this section.

BATESVILLE, IND.—The Batesville El. Lt. & Pwr. Co. expects to install within the next two months one 600-hp Heine boiler, one 250-hp Erie City boiler and one 150-hp Tudor boiler and one Heine brick stack (175 ft. high); one Roney-Westinghouse stoker and Cochran heater, and one 500-kw Westinghouse generator, complete with switchboard, the generator to be direct-connected to Hamilton Corliss engine. A. W. Romweber is secretary.

DANVILLE, IND.—Bids will be received until Aug. 1 for heating apparatus, plumbing and wiring of the new court house in Danville. For further particulars address Lewis W. Borders, auditor.

DANVILLE, IND.—The Danville Lt., Ht. & Pwr. Co. expects to erect within the next three months a pole transmission line to Clayton and Pittsboro and to install a post lighting system within the next three months in Danville and Plainfield, provided that in both cases the towns purchase the standards. Harry C. Kahlo is secretary.

GARY, IND.—The Gary Ht., Lt. & Wtr. Co. is installing a 75-lamp mercury-arc rectifier, 6600 volts, and is also extending the ornamental series incandescent lighting system, adding 15 three-lamp and five-lamp posts. Leonard Fitzgerald, superintendent.

GOSHEN, IND.—Contracts will be awarded by the city of Goshen on [illegible] the ornamental street-lighting system. W. W. Barnes is clerk.

HAUBSTADT, IND.—The Zillick & Schaefer Milling Co. now runs its 250-bbl. mill with electricity and furnishes energy for lighting in about 70 residences for which 200 or 300 lamps a year are required.

JASPER, IND.—Recent improvements in the municipal lighting plant have called for the purchase of the following material: One 150-kw and one 250-kw directly connected two-phase, 2300-volt generator with directly connected exciter, one 170-hp and one 300-hp four-valve engine, one seven-panel switchboard, line material and incandescent lamps. By Nov. 1 the plant contemplates installing 24-hour service and will then be in the market for all kinds of heating and cooking apparatus and household labor-saving devices. J. P. Kunkel, superintendent.

MENTONE, IND.—Messrs. Hollands and Davis, owners of the [illegible] electric-light plant, expect to purchase within the next two months [illegible] lamp standards.

OOLITIC, IND.—The local electric-light plant is reported to have been damaged by fire recently, causing a loss of about $5,000.

BARRY, ILL.—The City Council has refused two franchises offered by the Central Illinois Pub. Ser. Co., and it is said that the construction of a municipal electric-light plant is under consideration.

CHICAGO, ILL.—Bids will be received by John McGillen, clerk of the Sanitary of the District of Chicago, until July 24, Room 700, South Michigan Avenue, Chicago, Ill., for furnishing series, alternating-current, enclosed arc lamps, in accordance with specifications, which may be obtained at the above office. Thomas A. Smyth is president of board of trustees, Sanitary District of Chicago.

CLINTON, ILL.—The City Council is contemplating the installation of a municipal electric-light plant at the water works station. Charles Dickerson, commissioner of the Water Works Department, is interested.

LA SALLE, ILL.—The Western Cloak Co. is reported to be contemplating the construction of a power house in La Salle, to cost about $25,000.

LEWISTOWN, ILL.—The Lewistown El. Co. is reported to be considering the question of furnishing electricity to operate the pumps at the municipal water works plant.

MONMOUTH, ILL.—The Commercial Club, in co-operation with the Monmouth Public Serv. Co., expects to establish a boulevard lighting system.

MORRIS, ILL.—The installation of a new street-lighting system in Morris is under consideration by the City Council.

O'FALLON, ILL.—The Southern Illinois Lt. & Pwr. Co., of Hillsboro, has purchased the plant of the O'Fallon El. Lt., Ht. & Wtr. Co. The local plant, it is said, will be dismantled and electricity to operate the local system will be furnished by a transmission line from Collinsville.

DEPERE, WIS.—Material for the installation of the new street-lighting system (mentioned June 21) has been purchased and includes 204 100-watt tungsten and 18 arc lamps. L. L. Tessier, superintendent.

GRAFTON, WIS.—Earlier in the year at Grafton a new series tungsten street-lighting system was put in operation, and the Grafton Lt., Ht. & Pwr. Co. is now furnishing for the city a total of 29 lamps, six being 200-cp, 15 100-cp and 8 80-cp, all 6.6-amp units. August Kroehuke, secretary.

LUCK, WIS.—The local electric-light plant and saw mill, owned by P. M. C. Pederson, is reported to have been destroyed by fire recently, causing a loss of about $8,000.

MARSHFIELD, WIS.—The Water and Light Commission has been authorized to procure estimates of cost for the necessary improvements to the water and light systems.

SEYMOUR, WIS.—S. D. Newell, owner of the local electric-light plant, expects to erect within the next three months a new concrete power house (40 ft. by 66 ft.) and install a new 150-hp boiler and a Bates Corliss engine.

BRAINERD, MINN.—The Minnesota Central Ry. Co., recently incorporated, contemplates the construction of a street railway in this city, in central Minnesota, and the erection of a high-tension transmission line to connect this city with Ironton and other towns on the north Cuyuna Range. R. M. Hughes, Alworth Building, Duluth, is counsel for the company; Joseph Ferrier, of Duluth, William F. Henry and John H. Hill, of Ironton, are incorporators.

NEW PRAGUE, MINN.—The managers of the municipal electric-light plant and water-works system expect to erect within the next four months either a brick or concrete chimney, 80 ft. high, and to purchase one fire-tube boiler, 18 ft. by 66 in., for 130-lb. pressure. Joseph T. Ryan is superintendent.

ROCHESTER, MINN.—The City Utility Board, it is reported, is about to award a contract for the installation of an ornamental street-lighting system. The plans provide for 60 lamps, to cost about $8,000.

ST. JOSEPH, MINN.—The local electric-light plant is reported to have been damaged by a storm recently, causing a loss of about $5,000.

ST. PAUL, MINN.—The State Board of Investment has voted to loan the village of North St. Paul $8,000 to enlarge its water and light plant.

WILMAR, MINN.—The lines of the electric-light plant are being rebuilt throughout the city this summer. A constant-current transformer will be installed within the next month on the series street-lighting system and about 40 ornamental lamp-posts. Clarence C. Haskell is superintendent.

WINDOM, MINN.—The citizens have voted $15,000 bonds for day service. Up to the present time the municipal plant has furnished only night service.

HAWARDEN, IA.—The city of Hawarden is now installing two boilers, two engines, three generators and a complete switchboard and series street-lighting equipment. T. J. Reeves, city clerk.

LAKE MILLS, IA.—J. B. Conley, owner of the local electric-light plant, expects to purchase within the next few months some electrical appliances, including heating and cooking apparatus, vacuum cleaners, etc. A day service was established June 24, 1913.

MARSHALLTOWN, IA.—The Lennox Furnace and the Quick Action Range Companies, it is reported, will use electrically operated machinery in new factories to be erected.

ROCK RAPIDS, IA.—Within the next year two boliers, an engine and a generator will be purchased for the city lighting plant. E. G. Ging, manager.

SIGOURNEY, IA.—The new power house at Sigourney is almost complete and a 350-hp Hamilton heavy-duty Corliss engine and a 300-kva three-phase generator have been purchased. R. L. Van Meter is superintendent and manager.

JOPLIN, MO.—The City Council is reported to have passed an ordinance calling a special election July 22 to submit a proposition to issue $75,000 in bonds for improvements and extensions to the municipal electric-light plant.

MARYVILLE, MO.—The Maryville El. Lt. & Pwr. Co. has just completed the installation of an ornamental street lighting system, consisting of 72 lamp standards, carrying one 100-watt and four 40-watt Mazda lamps. The company has entered into a contract with the city whereby all arc lamps are to be taken out and 100-wat Mazda lamps installed throughout the city where both arc and 40-watt series Mazda lamps have been used. About 180 of the new lamps will be erected. C. C. Hellmers is secretary and manager.

ST. LOUIS, MO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 29, for a vacuum cleaning apparatus in the United States post office building at St. Louis, Mo., in accordance with plans and specifications, copies of which may be obtained at the office of the custodian, or at the above office. O. Wenderoth is supervising architect.

NELSON, NEB.—The Nelson Lt. & Pwr. Co. expects to purchase within the next two months two oil engines with a rating of from 65 hp to 70 hp.

OMAHA, NEB.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 28 for furnishing air washers and humidifiers, heating and temperature coils for the United States court house, custom house and post office building at Omaha. Specifications may be secured from the custodian of building at Omaha or at the above office. O. Wenderoth is supervising architect.

TECUMSEH, NEB.—The managers of the municipal electric-light plant expect to erect within the next three months 12 miles of transmission lines and will purchase equipment for same; also to purchase within the next two months coal-conveying machinery for 250 ft., and within the next month to purchase 1000 lb. No. 886 weatherproof wire. The management of the plant has just started to handle electrical appliances, including heating and cooking apparatus, vacuum cleaners, washing machines, etc. The village of Cook is contemplating erecting a transmission line from that village to Tecumseh.

VALLEY, NEB.—The municipal electric light commissioners expect to purchase within the next two months two 10-kw transformers and 24 lightning arresters, fifty 100-watt series street lamps and forty 100-watt multiple lamps. Albert P. Hedberg is village clerk.

ATCHISON, KAN.—Bids will be received at the office of W. P. Waggener, for the Atchison Hospital Association, until July 28, for general plumbing, heating and electric wiring contracts for a hospital in Atchison. Plans and specifications may be secured from Sayler & Sedden, architects, Gumbel Building, Kansas City, Mo.

HOLTON, KAN.—Bids for electrical equipment, it is reported, were rejected July 5. Proposals for engine and generator will be received July 25; bids for other equipment will be opened later. Worley & Black, Reliance Building, Kansas City, Mo., are consulting engineers.

JETMORE, KAN.—It is reported that bonds have been voted for the installation of a municipal electric-light plant and water works system.

## Southern States

BLACK MOUNTAIN, N. C.—The Black Mountain Tel. Corpn., it is reported, will erect a steam-driven electric generating plant in connection with Dickey-Campbell Lumber Co. The proposed plant will have an output of about 100 hp. F. B. Braid is general manager.

ROCKY MOUNT, N. C.—The Public Works Department expects to purchase within the next two months one 500-kw, 60-cycle, 2300-volt, alternating current turbo-generator, one exciter and one switchboard panel with instruments for above unit. A. S. Lyon is superintendent.

McCOLL, S. C.—Bids will be received by the Public Works Commission and the Sewerage Commission until July 29 for furnishing material and constructing water-works, electric-lighting and sewerage systems, in accordance with plans and specifications on file in the office of the town clerk. Copies of specifications may be secured upon application to J. Newton Johnson, engineer. T. B. Gibson is chairman board of public works.

LAKELAND, FLA.—The municipality is considering issuing bonds for enlarging the electric light plant. H. D. Bassett, chairman water and light commission.

LAKE CITY, FLA.—It is reported that bonds to the amount of $7,500 have been voted for the installation of a new electric-lighting system.

MILTON, FLA. [illegible] J. Harvey, president of Council, until July 29, for furnishing material and constructing water-w[illegible] as follows: (1) Water-works system, consisting of two 1,000,000-gal. (per day) pumps; two 125-hp boilers with appurtenances; 100,000-gal. tank, minimum head 100 ft.; approximately 3½ miles of cast-iron mains 4 to 10 in. in diameter; one 8-in. deep-well, one clear-water well, 40 fire hydrants, valves and boxes. (2) Sewer system, consisting of 4/5 mile of pipe line 8 in. to 10 in. in diameter, with manholes and flush tanks. (3) Electric-light system, consisting of one 100-hp simple engine, directly connected to a 50-kva, 60-cycle, three-phase, 2300-volt generator; suitable switchboard and transmission line with necessary transformers, lighting arresters and series lamps. Proposals will be received as follows: First—for furnishing material and constructing three systems complete; second—for furnishing labor and constructing the systems. The city to furnish material for the entire work or any subdivisions scheduled under the bidding sheet. Plans and specifications are on file at the office of the town clerk of Milton, and at the office of Solomon-Norcross Co., engineers, 1622 Candler Building, Atlanta, Ga. Copies of plans and specifications may be obtained upon application to the engineers, for which a deposit of $10 will be required, to be refunded upon return of plans.

MEMPHIS, TENN.—The Memphis Consol. Gas & El. Co., it is reported, will erect an electric 6600-volt transmission line that will completely encircle the city, in conjunction with the Belt Ry. Co., to furnish electricity for manufacturing plants. The first section (9 miles) will be erected at once, and the remaining 18 miles will be built as soon as business demands it.

SHELBYVILLE, TENN.—The Duck River Pwr. Co., of Shelbyville, expects to install within the next three months two 44-in. Trump water turbines. The company is completing a three-phase transmission line for its power house 3 miles distant. All machinery, including turbines for proposed improvements, has been purchased. A. F. Trimble is general manager.

BIRMINGHAM, ALA.—The Republic Iron & Steel Co., of Birmingham, contemplates the construction of a large electric generating plant at East Thomas, to cost about $100,000. The proposed plant will furnish electricity for the furnaces at Thomas and to operate the machinery at the Sayreton mines and also for three other openings. A high-tension transmission line will be erected between Thomas and Sayreton. Martin J. Lide, of Birmingham, consulting engineer, it is understood, will have charge of the erection of the plant.

BREWTON, ALA.—The installation of an electric-lighting system at the Downing Industrial School is reported to be under consideration.

MERIDIAN, MISS.—The Meridian Lt. & Ry. Co. expects to erect an extension to its power house and put in a concrete steel floor within the next four months and to purchase a 2000-kw General Electric turbine within the next three months. The company has just completed the installation of Murphy stokers under 1500-hp boilers, putting in ash-carrying equipment and new stack. A. B. Paterson is general manager.

NEW ORLEANS, LA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 6, for an electric elevator plant in the United States post office and court house at New Orleans, La., in accordance with drawings and specifications, copies of which may be obtained at the above office or at the office of Hale & Rogers, 11 East Twenty-fourth Street, New York, N. Y., architects. O. Wenderoth is supervising architect.

BAY CITY, TEX.—The Texas Pub. Ser. Co., recently incorporated, is reported to be contemplating improvements to its local plant. The company is controlled by the Albert Emanuel Co., of Dayton, Ohio.

HICO, TEX.—The Hico El. Lt. & Pwr. Co. expects to erect within the next two months about 22 miles of transmission lines and has purchased a 100-kva Curtis turbine and General Electric generator, a Wheeler condenser and Christy vacuum pump, switchboard equipment and transformers, poles, lightning arresters and wire for distribution system. H. Gleason is manager.

## Pacific States

ARLINGTON, WASH.—The Jim Creek Wtr., Lt. & Pwr. Co., of Arlington, Wash., has recently erected a substation at its hydroelectric plant for step-up transformers to transform the voltage from 2000 volts to 11,000 volts and will install step-down transformers in Arlington. E. G. Robinson is manager.

BELLINGHAM, WASH.—The City Council has voted in favor of the construction of a municipal electric-light plant, to be built on the Nooksack River. A committee from the City Council, headed by City Engineer North, has been instructed to investigate the proposition.

COLFAX, WASH.—The Washington Wtr. Pwr. Co., it is reported, contemplates extending its transmission lines from Colfax in Whitman County during the summer. The first extension will be from Colfax to St. John, thence to Endicott, via Diamond. The company has been granted a franchise in Endicott.

SEATTLE, WASH.—The Puget Sound Trac., Lt. & Pwr. Co., Seattle, is reported to have applied for franchises in North Seattle, Kirkland and Redmond.

TACOMA, WASH.—The City Council has instructed Nicholas Lawson, commissioner of light and water, to prepare an estimate of the cost of a cluster lighting system to be installed on Pacific Avenue, Commerce Street and C Street, the three principal business streets of the city. Plans are also being prepared for lighting the residence section with cluster lamps.

FOSTER, ORE.—F. B. Knapp, manager of the Hotel Foster, it is said, will install an electric-light plant here. The equipment will [illegible] 1[illegible]-volt exciter and [illegible]-kw, 600 r.p.m. motor.

LEBANON, ORE.—The City Council has adopted a resolution whereby the city will enter into a contract with the Lebanon El. Lt. & Wtr. Co. for electrical power. A lighting system will be installed on Main, Sherman and Grant Street, for which bids will soon be received for fixtures and installation.

BERKELEY, CAL.—The Great Western Pwr. Co. of San Francisco is reported to have applied to the City Council for a 35-year franchise to furnish electricity throughout the city. The company now has a franchise in West Berkeley. Guy C. Earl, of San Francisco, is vice-president.

CLOVERDALE, CAL.—The State Railroad Commission has granted the California Tel. & Lt. Co. permission to issue $350,000 in bonds, the proceeds to be used for paying off existing indebtedness and for additions to its system. The commission also authorized the company to purchase the property of the Cloverdale Lt. & Pwr. Co., and to pay $75,000 in cash and $50,000 in preferred stock for same.

ELSINORE, CAL.—The Southern Sierras Pwr. Co., of San Bernardino, will begin work at once on construction of a one-story reinforced concrete transformer building (135 ft. by 50 ft.) to be located on Main Street.

IMPERIAL, CAL.—The City Council is preparing estimates of cost and detail plans for an electric-light plant and distribution system. I. B. Funk and H. N. Dake are carrying on the preliminary work.

KITTERICK, CAL.—The San Joaquin Lt. & Pwr. Co.'s recent proposed extensions to its plants at Kitterick and Taft will nearly double the rating of these plants.

SALIDA, CAL.—E. M. Gilbert informs us that the Salida Lt., Pwr. & Utility Co. is now building a 500-kw steam-standby station. The old station contained a 120-hp Corliss engine, and there will be added one 500-kw condensing vertical Curtis turbine and 800 hp in B. & W. boilers, complete with necessary auxiliaries. Most of the equipment was moved from the old steam plant at Leadville, nothing new except the exciters being purchaed. The water-power plants are also being overhauled in all details. A new line from the hydroelectric plant at Garfield is being constructed to replace the old line.

SAN DIEGO, CAL.—The San Diego Consolidated Gas & El. Co. has been granted permission by the State Railroad Commission to issue $639,000 in bonds, the proceeds to be used for additions to its plant in San Diego.

SAN FRANCISCO, CAL.—The State Railroad Commission has granted the Great Western Pwr. Co., of San Francisco, permission to operate under franchises previously given in Contra Costa County, particularly in the vicinity of Antioch.

SPRINGVILLE, CAL.—The work of excavating for the power house of the San Joaquin Lt. & Pwr. Co. on the Tule River plant is about to commence. The equipment of the Tule plant will include two 3000-kw Allis-Chalmers generators, with water wheel of sufficient rating to carry a 25 per cent overload working under a head of 1500 ft. There will be four transformers which will step up the voltage to 60,000 to deliver energy to the 60,000-volt line of the San Joaquin loop system.

BOISE, IDAHO.—Bids will be received at the office of the United States Reclamation Service, Los Angeles, Cal., until July 23, for furnishing electrical equipment for the Boise and Minidoka projects, Idaho, including wattmeters, transformers, oil switches, air-brake switch, lightning arresters, etc. For further information address United States Reclamation Service, 605 Federal Building, Los Angeles, Cal., or Washington, D. C. O. H. Ensign is consulting engineer.

COEUR D'ALENE, IDAHO.—A proposition will be put before the tax payers [illegible] for the city either to [illegible] the existing electric lighting plant or to build a new one.

TWIN FALLS, IDAHO.—The City Council has adopted a resolution calling for the installation of cluster lamps to be erected in the central part of the city.

TUCSON, ARIZ.—The Federal Lt. & Pwr. Co., New York, holding company of the Tucson Gas, El. Lt. & Pwr. Co. and the Tucson Rapid Transit Co., is making a tentative offer to spend about $150,000 in extensions and improvements in the lighting and street railway systems in Tucson, provided the City Council will grant a new contract to the company for lighting at a rate no higher than at present. W. A. Haller, general superintendent and chief engineer of the Federal Company, at 60 Broadway, New York, has outlined these plans.

RAWLINS, WYO.—The Rawlins El. Lt. & Fuel Co. expects to install within the next three months an elevated track on which coal cars (pulled by motor or capstan) will be unloaded from the bottom instead of by hand. The company also expects to install within the next six months one 100-hp, 2300-volt, 60-cycle alternator (directly connected) as relay unit for use in case of emergency. J. H. Jacobucci is engineer of power station.

## Canada

CALGARY, ALTA.—A by-law was recently passed authorizing additions to the power house equipment, including gas-fired boilers and turbo-generators with a rating of 6600 hp.

MEDICINE HAT, ALTA.—The City Council, it is reported, has authorized City Engineer Grimmer to place contracts for six 500-kw transformers.

KAMLOOPS, B. C.—The city of Kamloops expects to build a power house on the Barriere River and to erect a transmission line from the power plant to Kamloops, a distance of 40 miles, within the next nine months; it also expects to purchase within the next nine months two waterwheels and two generators with a rating of 1000 hp each, equipment for high-tension line, including step-up and step-down transformers for 44,000 volts), aluminum cable, high-tension insulators, etc. C. L. Main is superintendent.

MERRITT, B. C.—Within the next year the city of Merritt will install a second 125-kw, three-phase, 60-cycle, 2300-volt generating unit in the municipal electric plant.

VANCOUVER, B. C.—The Bridge River Co., recently incorporated, it is reported, is contemplating the development of at least 200,000 hp in the Lillooet district, involving an expenditure of about $8,000,000. The plans provide for the construction of a large dam on Bridge River and a tunnel 1¾ miles long through a mountain to an outlet on Seaton Lake. The transmission line will be about 150 miles long and will follow the route of the Pacific Great Eastern Ry. Co. The proposed power house will be located at Lytton, less than 40 miles from the main line of the Canadian Pacific Railroad and the Canadian Northern railways, and the company hopes to supply motive power to both lines. Application for water rights aggregating 100,000 acre-ft. have been made to the Provincial Government. W. R. Bonnycastle is engineer for the power company.

VERNON, B. C.—The City Council is considering the question of installing an electric-lighting system on Barnard Avenue, between Mission Street and Railroad Avenue, at a cost of about $10,000. The Council has also approved the proposition of extending the system to the Pleasant Valley Road.

WINNIPEG, MAN.—Tenders will be received by the city of Winnipeg until Aug. 9 for furnishing and installing one 1000-kw motor generator, plans and specifications for which may be obtained from the Board of Control. M. Peterson is secretary.

AMHERST, N. S.—The Maritime Coal & Ry. Co., of Amherst, is reported to be preparing plans for a transformer station, to cost about $5,000. The power house of the company was recently destroyed by fire.

DUNDAS, ONT.—The water and light committee of the Town Council is considering a proposition to illuminate all the approaches to the town. It has been suggested that the Town Council co-operate with the councils of the surrounding municipalities with a view of lighting the rural highways for some distance out.

TORONTO, ONT.—In order to secure an uninterrupted service the Toronto Hydroelectric Power Commissioners have about decided that the city must have an auxiliary steam plant, which will cost approximately $1,000,000. The proposed plant will probably be located on the water front.

WINDSOR, ONT.—R. T. Jefferies, engineer of the Hydro-Electric Power Commission of Ontario, has submitted plans for the ornamental lighting system to the City Council.

DESCHAMBAULT, QUE.—The Deschambault El. Co. expects to erect within the next five months complete equipment for a 3000-hp plant and to purchase wire insulators for a 50-mile transmission system; also to purchase within the next three months three 1000-hp turbines and switchboard equipment for a 3000-hp plant.

CARLYLE, SASK.—Tenders will be received by F. J. Stent, secretary and treasurer, until Aug. 1 for the construction of water works system and electric-light plant as follows: (1) Construction of brick power house and concrete reservoir, and laying approximately 800 lineal ft. of pipe in trenches and relative works; (2) air-lift pumping system; (3) duplex steam pump; (4) furnishing and installing two horizontal return tubular boilers and stack; (5) compound vertical steam engine; (6) generator, exciter and switchboard; (7) poles, arms, hardware, copper wire, transformers and meters; (8) furnishing series tungsten street-lighting apparatus; (9) erection of pole line. Plans and other information may be obtained at the offices of the John Galt Engineering Co., Ltd., at Winnipeg and Calgary. A deposit of $25 will be required on plans for contract No. 1, which will be refunded upon return of same.

GRENFELL, SASK.—The Town Council is contemplating the installation of a municipal electric-light plant. The British Canadian Engineering & Supply Co., Ltd., 122 Phoenix Building, Winnipeg, Man., is consulting engineer.

## New Incorporations

OAKES, N. D.—The Oakes Lt. & Pwr. Co. has been incorporated with a capital stock of $50,000 by F. A. Blakeslee, A. P. White, both of Bemidji, Minn., and C. F. Blakeslee, of Oakes.

JOHNSTON, PA.—The Jenner Township Pub. Ser. Co. has been incorporated with a capital stock of $5,000. Headquarters of the company are located in Johnstown.

LEBANON, PA.—The South Annville El. Lt. & Pwr. Co. has been granted a charter with a capital stock of $5,000. The office of the company is located in Lebanon.

HOUSTON, TEX.—The Public Service Co. has been incorporated with a capital stock of $500,000, to construct and operate electric-light and power plants and water works systems in a number of towns in Matagorda, Upshur, Titus and Wilbarger Counties. The incorporators are: Albert Manuel, of Dayton, Ohio; H. A. Van Eaton, Raymond Neilson, C. H. Wilson, R. C. Patterson and W. A. Parish, all of Houston.

ALDERSON, W. VA.—The Alderson Lt. & Pwr. Co. has been incorporated with a capital stock of $25,000 by W. C. Beard, G. K. Gwinn, L. E. Johnson and others.

CHARLESTON, W. VA.—The Gauley Pwr. Co. has been incorporated by J. H. Gaines, R. Kemp Morton, F. R. Hurlburt, G. G. Todd and A. B. Koontz, all of Charleston. The company is capitalized at $250,000 and proposes to construct five dams in connection with proposed hydroelectric plant; dams are to be located at Wood's and Carnifax ferries on Gauley River and near Carnifax Ferry, Shawni's Bridge and Riverside on Meadow River.

WEBSTER SPRINGS, W. VA.—The Webster Springs Pwr. Co. has been incorporated with a capital stock of $50,000 by C. L. Benedum, J. W. White and E. R. Randolph, of Webster Springs; J. S. Rex, of Monongah, and H. Shaw, of Fairmont.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JULY 8, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,066,468. PROCESS AND APPARATUS FOR ELECTRIC WELDING; L. W. Chubb, Edgewood Park, Pa. App. filed Feb. 16, 1912. Welds unlike metals by effecting percussive engagement of the surfaces to be welded and simultaneously applying heat of great intensity.

1,066,475. ELECTRIC-LAMP CUT-OUT; H. S. Dunning, East Orange, N. J. App. filed Aug. 6, 1910. Lamp terminals are separated by thin films of insulating material which are punctured to automatically short circuit the lamps when the filament is broken.

1,066,476. LIGHTNING ARRESTER; W. H. Elliott, Albany, N. Y. App. filed Feb. 18, 1911. For railway signaling circuits; selective plates separated by spark gaps.

1,066,479. ALARM ATTACHMENT FOR REFRIGERATOR DRIP-PANS; A. J. Fiala, Omaha, Neb. App. filed Sept. 12, 1912. Adjustable float to sound alarm at various heights of water.

1,066,484. OZONE GENERATOR; W. O. Freet, Hackensack, N. J. App. filed Jan. 23, 1912. Of small capacity for use in apartments, etc., has hollow perforated electrodes separated by dielectric plates having openings in their centers.

1,066,493. ILLUMINATED ADVERTISING DEVICE; H. Harrold, Chicago, Ill. App. filed July 12, 1912. Cylindrical transparent or translucent shell surrounding a lamp is given rotative movement by the uprising currents of heated air.

1,066,499. INSULATING COMPOUND; G. A. Jacobs, Cleveland, Ohio. App. filed Apr. 8, 1907. Manila gum, asphaltum gum and linseed oil.

1,066,504. ELECTRODE-LEAD FOR VAPOR ELECTRIC APPARATUS; C. A. Kraus & R. D. Mailey, Newton Highlands, and Lynn, Mass. App. filed June 30, 1910. Screen of insulating material surrounds the anode and is in contact with the mercury of which the cathode is composed.

1,066,505. ANODE-SHIELD FOR VAPOR ELECTRIC APPARATUS; C. A. Kraus & R. D. Mailey, Newton Highlands and Lynn, Mass. App. filed Apr. 5, 1912. Has a plurality of perforated partitions.

1,066,507. SYSTEM OF CONTROL FOR ELECTRIC MOTORS; B. G. Lamme, Pittsburgh, Pa. App. filed Sept. 26, 1910. For starting induction motors of large capacity and relatively low voltage.

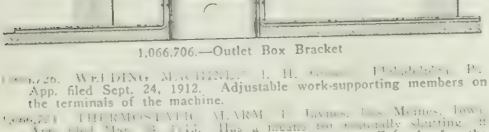
1,066,513. ELECTRICAL REGULATION FOR ELECTRIC MOTORS; B. McInnerney, Council Bluffs, Iowa. App. filed Aug. 26, 1911. Automatically reduces speed of an induction motor either when acting against or with the load.

1,066,538. AUTOMATIC RAILWAY SIGNAL AND STOP; A. T. Smith, Sioux City, Iowa. App. filed Feb. 11, 1909. Combination of mechanical trip and electrical circuits.

1,066,554. SYSTEM OF ELECTRICAL DISTRIBUTION; H. G. Thompson, Glen Ridge, N. J. App. filed Oct. 20, 1909. Generator supplies given current to charge storage battery and then when charged to predetermined voltage the charging current is automatically decreased.

1,066,570. APPARATUS FOR THE PURIFICATION OF WATER AND OTHER LIQUIDS; M. D. Avery, Kansas City, Mo. App. filed June 1, 1912. Insulating post rotatably mounted in tank and carrying the electrodes.

1,066,580. SPEED REGULATOR FOR ELECTRIC MOTORS; L. Bradley, Milwaukee, Wis. App. filed Mar. 3, 1913. Compressible resistance column and compressing means.



1,066,706.—Outlet Box Bracket

1,066,520. WELDING MACHINE; J. H. [illegible], Pittsburgh, Pa. App. filed Sept. 24, 1912. Adjustable work-supporting members on the terminals of the machine.

1,066,521. THERMOSTATIC ALARM; J. Eames, Des Moines, Iowa. App. filed May 9, 1912. Has a means to manually shorting it the alarm before the temperature has subsided sufficiently for the alarm to open half break the alarm circuit.

1,066,522. ALTERNATING CURRENT MOTOR CONTROL; D. Harrison, Yonkers, N. Y. App. filed Aug. 11, 1908. For elevators, has mechanism for successively short-circuiting the sections of resistance when the controller is started from any position.

1,066,541. SYSTEM OF MOTOR CONTROL; D. L. Lindquist, Yonkers, N. Y. App. filed Aug. 15, 1910. For elevators to prevent motor attaining unsafe speed and to prevent reverse current in motor field when motor is being driven by the load.

1,066,542. ELECTROMAGNETIC BRAKE; W. D. Lee, Montclair, N. J. App. filed Feb. 23, 1910. For elevators; automatically effects a slow application of the brake.

1,066,[illegible]. POTENTIAL REGULATOR; P. Müller, Charlottenburg, Germany. App. filed Nov. 11, 1912. Rotor with auxiliary coil winding, stator with two windings at an angle and tap of variable potential at junction of stator windings.

1,066,[illegible]. [illegible]. App. filed July 1, 1912. Contact rail system.

1,066,[illegible]. [illegible] DRIVING MOTOR ARMATURE; W. W. [illegible], Manchester, England. App. filed Oct. 1, 1912. Insulated conductor reeled upon the machine and a bare grounded conductor lying on the ground and connected with machine through movable contacts.

1,066,783. ELECTRIC SWITCH; F. Barr, New York, N. Y. App. filed Apr. 26, 1911. Double pole, double break rotary snap switch.

1,066,[illegible]. [illegible] TELEPHONES; C. C. Bellamy, [illegible]. App. filed [illegible]. [illegible].

1,066,[illegible]. PROCESS OF PRECIPITATING IRON FROM BLUE POWDER; W. F. Bleecker, Canonsburg, Pa. App. filed Jan. 22, 1913. Consists in treating a solution of blue powder by electrolysis in a fused bath.

1,066,805. ADJUSTABLE IRON CABINET-BOX FOR ELECTRIC-LIGHT-WIRING CUT-OUTS; J. C. Fisher, Denver, Colo. App. filed Nov. 10, 1911. Face of the box is adjustably clamped to the open body position of the box.

1,066,810. THERMAL TREATMENT OF METAL IN ELECTRICALLY HEATED FURNACES; P. Girod, Ugines, France. App. filed Aug. [illegible], 1912. Causes compact metal in an electric steel furnace, cools to a temperature as low as incipient red heat and then remelts by electrically generated heat.

1,066,[illegible]. [illegible] WIRES IN [illegible]; [illegible]. App. filed Oct. 16, 1911. Pivoted interchangeable rod sections with [illegible].

1,066,[illegible]. ELECTRIC DISTRIBUTION; R. C. Leake, Baldwinsville, N. Y. App. filed May 19, 1909. Selective call telephone [illegible].

1,066,[illegible]. [illegible] CURRENT MOTOR; A. S. McAllister, [illegible], N. Y. App. filed Oct. 26, 1909. High power-factor, single-phase commutator motor.

1,066,[illegible]. PROCESS OF SMELTING IRON ORES; F. M. McClenahan, Knoxville, Tenn. App. filed Apr. 17, 1913. Fluxes aluminous materials by smelting in the presence of sodium chloride.

1,066,[illegible]. LIGHTING ATTACHMENT FOR GAS BURNERS; I. K. [illegible], [illegible], N. Y. App. filed Sept. 22, 1910. Adapted to be [illegible] ordinary gas burner.

1,066,[illegible]. PROCESS OF EXTRACTING METALS FROM THEIR ORES; E. B. Slater, Riverside, Cal. App. filed Mar. 13, 1912. Produces a deposit by electrolytic means.

1,066,[illegible]. THEFT DETECTOR FOR ELECTRIC METERS; I. T. Swan and A. G. English, Wichita, Kan. App. filed Aug. 31, 1912. Swan and A. G. English, Wichita, Kan. App. filed Aug. 31, 1912. Prevents current from being interrupted by a stolen lamp by shunting the meter, a wire connected across the live wires which results in blowing fuses and service being cut off.

1,066,[illegible]. HEATING APPARATUS FOR METALLIC TIRES; W. H. [illegible], Sandusky, Ohio. App. filed Apr. 9, 1913. Uses gas fuel.

1,066,853. COLLAPSIBLE CABINET; F. F. Burdick, Chicago, Ill. App. filed Nov. 6, 1912. Folding electric light bath-cabinet.

1,066,[illegible]. COLLAPSIBLE CABINET; F. F. Burdick, Chicago, Ill. App. filed Feb. 4, 1913. Folding construction of electric light bath-cabinet.

1,066,[illegible]. WINDING FOR DYNAMO ELECTRIC MACHINES; C. J. [illegible], Cincinnati, Ohio. App. filed Dec. 11, 1907. Two-layer winding for slotted core, the different layers having unequal number of conductors.

1,066,[illegible]. FUSE; J. Keefe, Boston, Mass. App. filed Aug. 2, 1912. Has exceptionally long fuse strip; holds window in place by porcelain plate.

1,066,[illegible]. ELECTRIC BELL OR ALARM; A. Langen, New York, N. Y. App. filed Dec. 24, 1910. A single spring cushions the armature in either direction.

1,066,[illegible]. AUTOMATIC CUT-OUT FOR CLOCK SYNCHRONIZING MECHANISM; E. A. Hummel, St. Paul, Minnesota. App. filed Aug. 18, 1911. Automatically cuts out the relay from the local circuit which energizes the synchronizing mechanism the moment the synchronizing impulse has been communicated to it.

1,066,[illegible]. CASE FOR INCANDESCENT ELECTRIC-LAMP SOCKETS; A. Weber, Sr., and J. Weber, Schenectady, N. Y. App. filed Jan. 26, 1911. Multiple-lock-socket shell.

1,066,[illegible]. CASE FOR INCANDESCENT ELECTRIC-LAMP SOCKETS; A. Weber, Sr., and J. Weber, Schenectady, N. Y. App. filed June 12, 1905. Separates in edge if one member hold the two parts of a socket shell against relative rotation.

1,066,[illegible]. CIRCUIT CONTROLLING DEVICE; F. T. West and H. W. Darby, Winnipeg, Manitoba, Canada. App. filed July 8, 1912. Mercury contact circuit controller for a number of distant tools, such as electrical riveters.

1,066,[illegible]. APPARATUS FOR RECOVERING COPPER FROM ITS ORES; H. M. Wilcox, Chicago, Ill. App. filed Aug. 28, 1909. Absorption tank, containing measuring tank for a chemical agent, connections between the tops and bottoms of the tanks and valves in the conduits.

1,066,[illegible]. MELTING METALLURGICAL FURNACE; W. W. Case, Jr., Denver, Col. App. filed Mar. 15, 1913. Periphery of crucible is [illegible] closely spaced refractory projections.

1,066,[illegible]. PROCESS OF MAKING ELECTRICAL CONDUCTORS; W. Hoops and C. Scott, Yonkers, N. Y. App. filed Aug. 16, 1909. Mixes oxid, pulverized carbon and substantially powdered metallic [illegible], molds the mixture into blocks, subjects it to pressure, and then bakes, for conversion into carbon, [illegible], etc.

1,066,[illegible]. CONNECTION FOR LAMPS OR OTHER ELECTRIC APPARATUS; A. Isenegger, Montreux, Switzerland. App. filed Oct. 5, 1909. Screwable plug connector.

1,066,[illegible]. SOLDER FOR ALUMINUM; C. H. Frantz, New Orleans, La. App. filed Apr. 26, 1913. Made of zinc, tin, lead and aluminum, [illegible] zinc in excess of the lead and aluminum.

1,066,[illegible]. EXTRACTION OF PRECIOUS METALS; W. W. Crest, Alameda, Cal. App. filed Oct. 15, 1910. Gives amalgamating results of ores in a solution of the nitrates, [illegible] chlorides or ores in a solution of the nitrates. Dissolves precious metals and hypochlorites of the alkaline metals and subsequently amalgamates by agitation and circulating slimes containing said salts in contact with [illegible] cathode.

1,066,[illegible]. INTERCHANGEABLE ELECTRIC SIGN AND LAMP THEREFOR; F. P. Hall and J. O. Sharpe, Newark, N. J. App. filed Oct. 15, 1912. Lamps carry circuit making points which may be pushed into contact at any point with two wire mesh screens forming the terminals of the circuit.

1,066,[illegible]. ELECTRODE FOR USE IN ELECTROTHERMAL PROCESSES; E. F. Lowell, Clarksburg, W. Va. App. filed Feb. 14, 1912. [illegible] separated by a refractory core and having the [illegible] the space between relatively large particles of carbon a core material.

1,066,[illegible]. WIRELESS TELEPHONY; A. H. Lewellen, Detroit, Mich. App. filed [illegible]. Transmitting apparatus.

1,066,[illegible]. DYNAMO-ELECTRIC MACHINE; N. Perrine, Birmingham, [illegible]. App. filed Apr. 24, 1913. Relays converter, regulates [illegible] speed.

1,066,[illegible]. WIRING FOR ELECTRIC CALL BELL CIRCUITS; G. A. [illegible], Pa. App. filed Mar. 24, 1910. Arranged so [illegible] that operative circuit is completed through receiving station.

1,066,[illegible]. CONTROLLING APPARATUS; W. H. Gaulke, Milwaukee, Wis. App. filed Sept. 26, 1911. Improved switch arm construction for controlling speed, etc.

1,066,[illegible]. APPARATUS FOR GOVERNING THE PASSAGE OF [illegible] VEHICLES ALONG A RAILWAY AND THE LIKE; H. [illegible]. App. filed [illegible]. [illegible] switches, [illegible].

1,066,[illegible]. ROTOR WINDINGS FOR ALTERNATING-CURRENT DYNAMO-ELECTRIC MACHINES; L. J. Hunt, Sandycroft, [illegible]. App. filed [illegible]. Original Patent 1,057,061, Mar. [illegible], 1913. Divided and delta connected windings.

1,066,[illegible]. ALARM CLOCK; M. Shearer, New York, N. Y. App. filed June 5, 1912. (Original Patent 1,042,542, June 6, 1911.) Sounds an alarm when lock is tampered with.

# Electrical World

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**Co-operation for Business Expansion**

Companies normally competitive have learned from experience that they can well afford to co-operate in many ways for the good of their particular line of business as a whole while maintaining sharp competition for individual shares of that business. Non-competitive companies engaged in the same line of business, such as central stations in different communities, have accomplished many excellent results by co-operation along innumerable lines. Co-operation in the expenditure of a part of the money now spent competitively or separately in increasing the electrical business of the country is the keynote of an article in this issue by Mr. J. Robert Crouse, who has preached co-operation to electrical audiences for many years. Even the most skeptical will admit that the objects to be accomplished by the Society for Electrical Development, the principles of which he sets forth strikingly, are well worth while, and that all persons asked to contribute to it will be benefited by the results. To a much greater extent than is justified by the facts, many central station managers have assumed that subscription to the society would mean merely additional expense without proportionate return therefrom. The fact is that it should involve merely the transfer of a portion of present expense to the column of co-operative expenditure. Doubtless, the amount needed to bring the pledges up to $200,000 will be subscribed, but it is appropriate at this time to urge those companies now hesitating to join in the co-operative movement to cast in their lot without delay in order that the co-operative electrical business expansion plan may quickly be given the trial it so well merits.

**The Parcel Post and Electric Delivery**

With the establishment of the parcel post, and now the decision to extend this service and to inaugurate reduced rates, the amount of fourth-class matter carried by the United States Post Office Department has been very greatly increased. Even the first estimate of 300,000,000 parcels now seems likely to be far exceeded, the official statements putting the probable first year's business at 600,000,000 packages. It is thus very apparent that it will soon be impracticable to deliver this enormous amount of package mail in cities by the present method of using horse-drawn wagons, or even, perhaps, by supplanting these wagons with motor vehicles. It is believed that the government is considering seriously the establishment of a greatly extended pneumatic-tube system in cities, or else some underground light railway system to be electrically operated between the central post office and branch post offices. Private concerns have already designed automatically controlled electrical railways to have a much greater carrying capacity than any pneumatic-tube system. The government is undoubtedly familiar with the experiments which have been made in this direction, and if an electrical system of this kind should be adopted it would be another demonstration of the adaptability, convenience and flexibility of electrical energy in connection with the requirements of modern life.

**Convention of Electrical Contractors**

The convention of the National Electrical Contractors' Association of the United States, at Chattanooga, showed that the organization is growing in wisdom as well as in strength. The chip has disappeared from its shoulder; suspicion has given place to partial confidence at least, and altogether the outlook is very promising indeed. Recognition of the necessity for maintaining a high standard of work and overcoming the abuses which exist in the wiring and contracting trade has brought with it breadth of vision and the determination to meet the obligations squarely. Time was when the contractor imagined the central station, manufacturer, jobber, inspector and dealer were all pitted against him, and he threw up breastworks for defense only to find that his foe was largely of his own imagination. It has taken a little time and persuasion for him to appreciate their rights and their points of view, and to learn that it is possible for him to promote friendly and profitable relations with them all; but the lesson has been taught and the electrical contractor has now become an ardent advocate of co-operation. This was one prominent feature of the convention at Chattanooga. A crying need was also met there in the adoption of an adequate system of bookkeeping and an accurate record for material used on jobs and job costs. The electrical contracting business has long lacked stability owing to the absence of a proper accounting system. Perhaps the most important subject brought before the convention was the proposition to guarantee wiring, and the reception with which the scheme was received augurs well for the organization. For a non-professional body the plan is equivalent to the adoption of a code of ethics, and if brought to fruition will do much to enhance the dignity of the contractors' association as a national and responsible body and to further the use of electricity. The country has long suffered from the effects of poor wiring which has hurt not only the central stations but the contractors and the industry as well. It has also destroyed the confidence of the public in electric service and has created uneasiness in the minds of many as to the safety of electricity. What is needed to offset this baneful condition of affairs is a determination on the part of the National Electrical Contractors' Association that only first-class work shall be done; and this can be brought about by

the adoption of some guaranteed wiring plan. A national standard for wiring already exists in the shape of the National Electrical Code. First-class wiremen are also plentiful. When the latter work according to the former the job is safe to guarantee. The plan is simple, straightforward and honorable. It is certainly worthy of adoption.

## Free Tungsten Renewals

The gradual reduction in price and improvement in quality of the tungsten lamp bring forward for serious consideration by central station managers the question of supplying renewals of tungsten lamps free. As long as tungsten lamps were costly and fragile, this question was not pressing, although some able central-station managers, even in the early days of the tungsten lamp, proceeded on the theory that the central station must in some way control tungsten lamp renewals for the same reason that most of the large central stations have controlled carbon lamp renewals; namely, to prevent inferior lamps being used to the detriment of the company's service. The necessity for such control has not yet appeared in connection with tungsten lamps, as it did with carbon lamps. This is due chiefly to the fact that tungsten lamp manufacture in this country is a monopoly at present as compared to carbon lamp manufacture in the earlier days of the incandescent lamp industry. Then lamps were sold to the general public either on the ground of cheapness or long life, and in order to secure the latter salesmen usually sold lamps of low efficiency to the uninformed customer with the result that the customer had to pay bills out of all proportion to the amount of light he obtained. Now, conditions have almost reversed, and it is usually the central station man who urges customers to take tungsten lamps of such voltage as to give a long life on a given circuit while the avowed efforts of the manufacturers is in the other direction, namely to persuade central stations and consumers that lamps should be operated at high efficiency in order to secure the lowest cost of lighting, including both electrical energy and lamp renewals. Such a policy is obviously more to the interest of lamp manufacturers than the old policy of selling low-efficiency long-lived lamps, because it means more lamp renewals and greater lamp sales per year. Until such time as central station consumers attempt false economy by operating tungsten lamps at low efficiency, there appears to be no necessity for central station interference or guidance as to renewals of tungsten lamps. However, control of the tungsten lamp output to consumers has been effected by the policy adopted by some central stations of selling tungsten lamps at a cost below that at which dealers can sell them. This precludes any possibilities of tungsten lamps being purchased by consumers from other than the central station company. Such central stations just as truly control the kind of tungsten lamps used on their circuits as they do the carbon lamps on which they furnish free renewals.

Recently the question has come up whether it would not be cheaper for a central station company giving free renewals of carbon lamps to substitute tungsten lamps and operate them at [illegible] now is common

so that the total cost of lamp renewals per kw-hr. would be less than for the carbon lamps. One of the objections offered to this plan is that if the tungsten lamp is operated at sufficiently low efficiency to bring its renewal cost per kw-hr. below that of the carbon lamp it would have such a very long life that the danger from accidental breakage would increase in importance, especially in view of the fact that tungsten lamps become brittle with age. It is nevertheless interesting to know that tungsten quality and price have now reached a stage where such a policy on the part of central stations can be seriously considered. Already many of the larger Edison companies have adopted the policy of furnishing tungsten lamps of 100-watt rating and over free, while at the same time offering the 60-watt and 40-watt lamps at prices far below cost.

## An Iowa Central-Station System

On that future day when some electrical Homer lifts an inspired pen to write the epic of the central-station industry his scenario will not be laid in a Fisk or Waterside station or his chorus summoned from the peaceful army of employees of some great metropolitan electric-service undertaking. Broad and diverse as are the problems confronting these admirable organizations which have the serving of populations of hundreds of thousands, it is in the achievements of the far more numerous cities of medium size that the real progress of the industry must, after all, be measured. Here expertness can not be devoted to specialization but to generalization, and in his time each man must be prepared to play many parts.

Representative of best practice in those smaller systems which make up the great bulk of the industry is the central-station plant supplying service to Waterloo and Cedar Falls, Iowa, a detailed description of which is given on a following page. In the Waterloo situation special attention is called to the subservience to the modern tendency to distribute from substations instead of from the central power house as was the practice of a decade ago. The development of alternating-current motors and other apparatus is also attested in the use of alternating current for distribution purposes even in the downtown business section. Most of our older medium-sized cities, especially in the East, have been unable to free themselves from the direct-current systems of early days, and fortunate indeed are those newer communities in which modern practice is possible throughout, without respect to the trammeling inheritances of a past electrical generation. An ingenious combination of lighting and motor-supply circuits is also shown in the underground distribution scheme, which is designed to prevent pressure variations on the motor circuits from being felt on the lighting lines. Notice is also directed to the very complete record form devised for the Citizens' Gas & Electric Company which presents a detailed report of all instrument and meter readings, for units, plant and circuits, in addition to showing the periods of service of each boiler, machine and employee, and the variation in plant load.

Referring to the broader aspects of the local situation who can view even casually the rising output curves kept

during the last ten years without having his imagination fired? Beginning almost at datum, that significant slope denoting thousands of kw-hours of monthly output has struggled always upward until a maximum of 600,000 units was attained during the dark month of last October. And after a glance at this mounting progress who can predict or deny Himalayan heights to which another decade or two will carry "the thin red line" of Mr. Burt's recording wattmeter charts; for in this—history reversing itself—is the peaceful victory of the twentieth-century Waterloo!

## The Sterilization of Water

The paper by Dr. Max von Recklinghausen on the use of the ultra-violet radiation from quartz-tube mercury-vapor lamps in the sterilization of water gives a strong impression that the method has passed far beyond the experimental stage into a very practical form of effective sterilization. Rays of wave-length less than 300 μμ are exceedingly effective in the destruction of bacilli, even the most resistant succumbing after a very short exposure. The quartz-tube lamp is by no means the most convenient powerful source of such radiation because the proportion of energy in the region of very short wave-lengths is exceptionally large. Even with the ordinary commercial lamp about one-half of the total ultra-violet light has a wave-length of less than 300 μμ and hence is effective for sterilizing purposes. One-half of the energy is completely cut off by the ordinary inclosing globe of such a lamp, but when the bare tube is brought close to the water to be sterilized these very rays can freely get through the quartz and penetrate filtered water remarkably well. It is interesting to note in this connection that the mercury arc gives out very little radiation having wave-lengths so short that it is stopped by the quartz tube, so that nearly all the energy of extremely short wave-length is readily utilized.

For sterilization purposes, the ordinary commercial quartz-tube mercury-vapor lamp is not sufficiently powerful to be conveniently worked on a large scale, and hence the special type of lamp described by Dr. von Recklinghausen has been developed to operate on a 500-volt circuit with about 375 volts effective at the electrodes. This lamp is operated intensively at a high temperature and gives very much greater efficiency of production of the useful rays than does the lamp ordinarily used for illuminating purposes. It is a curious fact that preliminary filtering to remove suspended matter of every kind is necessary for the effective working of the apparatus, although the ultra-violet rays penetrate filtered water with great readiness yet they are stopped very effectively by matter carried in suspension, much more readily than are ordinary light rays. Whether the effect is due to the extremely small size of many of the suspended particles which scatter the ultra-violet light, and whether it is chiefly due to organic or inorganic matter in suspension is not yet clear, but it is certain that the operation of an ordinary filter permits the necessary penetration of the ultra-violet rays to secure rapid sterilization. The beauty of the process is its absolute cleanliness, leaving the water entirely suitable for use. Various chemical agents used for water purification are, perhaps, equally effective in killing bacteria, but are not quite pleasant to have in drinking water. The plant mentioned by Dr. von Recklinghausen in which from 7500 to 8000 tons of water per day is sterilized is an admirable example of the practical application of the process. From pretty thorough tests of the process the sterilization is genuinely complete. No guilty microbe escapes after passing under the rays of the battery of lamps.

## Construction Contracts

In connection with the recent contract between the city of New York and the Interborough Rapid Transit Company for the so-called dual subway system, there is a provision for third-tracking and extending the elevated systems, upon which it is estimated some $25,000,000 will be expended. The company now proposes to award the contract for the work, without competitive bidding, to a former chief engineer of the Panama Canal, on the basis of cost plus a percentage profit. This proposal, as pointed out by Borough President McAneny, is improper in several respects, two of the chief points being that such an arrangement places a direct premium upon waste and extravagance and that the contractor is directly relieved of financial responsibility in the matter. A further objection lay in the fact that the proposed contract was in blanket form and the actual percentage of profit was left to be determined later, at the pleasure of the contracting parties.

Quite aside from the obvious impropriety of letting such a large piece of work, in which the city is strongly interested, without competitive bidding, there is raised an interesting question as to construction contracts in general. It was once the general custom, and still prevails, to award contracts to the lowest responsible bidder for a lump sum, making him fully responsible for his own profit. A decade or more ago a certain much-advertised contractor gave considerable publicity to his plan of cost plus a profit, arguing among other things that in the end it insured the best job for the lowest price. The plan has admitted advantages, if the profit is a stipulated flat sum, instead of a percentage of the total cost. Nevertheless it is open to the objection that there is no direct incentive to economy, and the owner, unless he has very competent disinterested advice, may become the victim of an unscrupulous contractor.

It seems obviously feasible, however, to draw a form of contract based primarily on cost plus a profit which shall have the desirable safeguards and incentives for economy. For example, let the bids be prepared in the form of an estimate of maximum cost, based on the specifications, plus a provisional lump-sum profit, subject to a percentage bonus profit on savings in cost under the estimate and a corresponding penalty for excess of cost over the estimate, with the owner's maximum outlay limited in any case to the estimated cost plus the provisional lump-sum profit. In order to insure bona-fide bids under such a plan, the basis of letting the contract would be the estimated cost plus the provisional or base profit. This scheme has the great advantage of placing a premium on economy and a penalty on extravagance, besides disclosing in detail the bare cost of the work in labor and materials.

# The News of the Week

**Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.**

## Canadian Water-Power Commission

A water-power commission, to be known as the St. Lawrence and Great Lakes Commission, is to be appointed by the Canadian government for the purpose of studying the whole field of water-power development from the head of the lakes at Montreal. It is expected that the commissioners will be Messrs. Prof. McLeod, of McGill University; Arthur Seymour, of Montreal, and C. R. Coutlee, of the engineering staff of the Department of Public Works. The intention to appoint a commission to deal with water-power questions in the Montreal district was expressed prior to the change of government in connection with the settlement of certain questions at issue among the power companies of Montreal. The commission was never appointed, but it is now proposed that the scope of its operations be extended to include the Great Lakes. Another commission is already at work studying the St. Lawrence River waterpowers below Montreal, and will report to the Department of Marine and Fisheries. The work of the St. Lawrence and Great Lakes Commission will extend over a number of years and may result in the establishment of a permanent water-power bureau to which the government can go for expert information in connection with water-power applications. The commission will prepare reports which can be available in connection with the work of the Canadian section of the International Joint Commission. The latter body is constantly called upon to deal with important technical questions upon which there is little reliable information from the Canadian standpoint.

## Anglo-American Exposition, 1914

The Philadelphia Commercial Museum, of which Mr. W. P. Wilson is director, has arranged to organize the American Industrial Section of the Anglo-American Exposition to be held in London from May to October, 1914. The time has been selected to celebrate 100 years of peace and progress of the English-speaking people since the Treaty of Ghent in 1814. The buildings for the exposition at Shepherd's Bush are now ready for the reception of American and British exhibits, practically one year before the opening of the exposition on May 1, 1914.

## Status of Wisconsin Water Power Bill

After a lengthy debate in which several amendments were incorporated into the water power bill by the water power interests of the state, the Water Power bill has passed the Wisconsin State Senate. The bill, in substance, provides for the complete public control of water power by the Railroad Commission. The franchises must be given to utility corporations and therefore can be controlled as other utility corporations in which rates can be fixed and service ordered by the commission. The franchise is indeterminate, but the State can purchase at any time by paying full value. The bill provides for the taking over of any property by the State at the end of thirty years and the State will pay for the improvements, minus a certain amount for depreciation, for the value of the land and the riparian rights, but is not bound to pay for water rights. Following a previous court decision, the committee has not recognized the value of a franchise or water power right. An amendment to the bill provides, however, that riparian property, previously acquired, may be taken into account when the State takes over the property provided the price for such property was paid in good faith by the grantor of the franchise. This excludes the possibility of an unearned increment and confines the value to the price actually paid. There is one point still in dispute which will probably be the subject of an amendment before the bill passes the Assembly. The question at issue concerns the value of future franchises and the water power interests are making strenous efforts to amend the bill in some way so as to recognize the market value of these franchises.

## Illuminating Engineering Society Convention

Coincident with the dates of the Pittsburgh (Pa.) convention of the Illuminating Engineering Society, Sept. 22 to 26, the city will be celebrating the one hundred and twenty-fifth anniversary of Allegheny County. There will be elaborate decorations by day and illumination features by night, making the occasion one of great interest to visitors.

Among the papers to be presented at the sessions are the following: "The Use of the Photo-Electrical Cell in Photometry," by Prof. T. R. Richtmeyer, Cornell University, Ithaca, N. Y.; "Characteristics of Enclosing Glassware," by Mr. V. R. Lansingh, New York; "The Quartz Mercury-Vapor Lamp and Its Applications," by Mr. W. A. D. Evans, New York; "The Fortune Lamp as a Working Standard," by Messrs. E. G. Crittenden and A. H. Taylor, Bureau of Standards, Washington, D. C., and "The Neon-Tube Lamp," by Mr. Georges Claude, Boulogne, France. Mr. Roscoe Scott, Cleveland, Ohio, will also deliver a lecture on "The Evolution of Illuminants."

The Philadelphia Section of the society is planning to present an historic gavel to the presiding officer of the convention. Mr. Robert Ely is chairman of the gavel committee.

## San Francisco 1915 Congresses

Following the meeting of the International Electrotechnical Commission to be held in San Francisco during the week beginning Sept. 6, 1915, the International Electrical Congress will be held during the week of Sept. 13 in accordance with the plans outlined in their tentative form on page 230 of our issue dated Aug. 3, 1912. A comparison of the final with the tentative plans shows that the former two sections on wireless and wire communication have been combined as one while a new section on electrophysics has been created. Thus the total number of sections is twelve, as formerly provided for. The secretary of the committee on organization is Dr. E. B. Rosa, Bureau of Standards, Washington, D. C., who is also secretary of the congress. The president is Dr. C. P. Steinmetz, Schenectady, N. Y.

For the convenience of the manufacturers of minor devices special arrangements have been made by the department of machinery exhibits of the Panama-Pacific International Exposition to be held in San Francisco from Feb.

20 to Dec. 4, 1915. Several such manufacturers will be permitted to club together in applying for and utilizing exhibition space. An exhibit might consist, for example, of circuit-breakers, switches, fuses, porcelain goods and other supplies, although made by different manufacturers. Mr. A. M. Hunt, Exposition Building, San Francisco, is the chief of the department of machinery exhibits.

## Colorado Convention of the American Electrochemical Society

The twenty-fourth annual meeting of the American Electrochemical Society will be held at Denver, Colo., Sept. 9, 10 and 11, with headquarters at the Hotel Shirley. For the second day's session, Wednesday, the delegates will go by electric car to the University of Colorado at Boulder, and Thursday's meeting will be held at the Colorado School of Mines, Golden. The concluding session of the convention will be held on Friday on the summit of Pike's Peak, following a pleasure trip to Manitou and the Garden of the Gods.

Among the entertainment features scheduled are automobile rides through the Denver park system, and up Boulder canyon to the plant of the Central Colorado Power Company at the entrance to the Boulder tungsten district. On Thursday evening there will be a picnic dinner on Lookout Mountain, near Golden. Besides Friday's Pike's Peak trip, the delegates will on Saturday journey to Cripple Creek via the famous "Short Line." Other special trips have been arranged for the ladies.

The Colorado convention will be marked by the first "Electrochemical Special" train, which is scheduled to leave the Grand Central Terminal, New York, at 10:30 a. m., Saturday, Sept. 6, and Chicago, Sunday, 9:45 a. m., reaching Denver, Monday, Sept. 8, at 1:15 p. m. The returning train will leave Colorado Springs, Saturday, Sept. 13, at 10:30 p. m., reaching Chicago at 9:15 Monday, and New York at 9:11 a. m. Tuesday. The trip from New York to Denver will be made over the New York Central and Burlington routes, returning via the Santa Fé. The highest grade all-steel Pullman equipment, electrically lighted, will make up the special train. Requests for railroad reservations should be made to the chairman of the transportation committee, Mr. J. M. Muir, 239 West Thirty-ninth Street, New York City. Dr. J. W. Richards, Lehigh University, South Bethlehem, Pa., is the secretary of the American Electrochemical Society.

## Practice of Indiana Public Service Commission

The recently organized Public Service Commission of Indiana has adopted rules of practice and uniform classification of accounts for electric utilities as well as uniform classification of accounts for electric railways. An order has been issued directing all utilities to keep their accounts in conformity with the classifications of the commission. It is required that each public utility shall show in itemized detail (1) the depreciation per unit, (2) the salaries and wages separately per unit, (3) legal expense per unit, (4) taxes and rentals separately per unit, (5) quantity and value of material used per unit, (6) receipts from residuals, by-products, services or other sales separately per unit, (7) total and net cost per unit, (8) gross and net profit per unit, (9) dividends and interest per unit, (10) surplus or reserve per unit, and (11) prices per unit paid by consumers. In addition other items may be required as the commission may prescribe in order to show completely and in detail the entire operation of the utility in furnishing the unit of product or service to the public. Two separate schedules have been prepared. In general electric utilities operating in cities of 10,000 population or over will keep the accounts prescribed in Class A classification, while utilities in smaller cities will use the Class B classification; but this arrangement may be varied abitrarily if sufficient cause is shown to the commission.

The official address of the commission is Public Service Commission of Indiana, Indianapolis, Ind. Mr. Thomas Duncan is chairman of the commission, and Mr. J. L. Reiley is secretary.

## J. Robert Crouse on the Society for Electrical Development

There are always some underlying, basic principles governing all change and progress, whether in the field of research, engineering, manufacturing or merchandizing. These principles are of the same essential quality as the axioms in mathematics or refined statements of particular relations, such as $I = \frac{E}{R}$ in our electrical business. Such principles do not depend for their truth upon minority or majority assent, and when once fairly stated, are assured of final acceptance since essential progress must be made in harmony with them.

Progress in our electrical business during thirty years (notwithstanding that less than 30 per cent of the population is electrically served) has been one of the wonders of the world; its contribution to the comfort, happiness and efficiency of our modern life are so great that we wonder how a preceding generation did without electricity. We may justly feel proud of such a magnificent business which in every department of its development is so worthy of our best thought and effort.

The efforts of those engaged in the fields of research, engineering and manufacturing have shown the most marked results, since, while enjoying the stimulus of the friendly rivalry of other men and organizations, they have been free from the sort of competition which makes the accomplishment of useful results expensive and difficult. It is a matter of common observation that rapid progress has been made in discovery and research, in efficient engineering adaptation of discovery to practical manufacture, and improved products tending to better conditions of generation, construction and distributing systems.

However, in the field of selling and distribution we are challenged by the cold fact that no essential progress—meaning by this a decreasing ratio of sales expense to sales—has been generally accomplished. Not only this, but there is a prevailing opinion among the manufacturers, jobbers, dealers and contractors that the ratio of sales expense to sales tends to increase. The annual reports of some of the largest electrical manufacturers makes specific mention of this tendency as a fact in their operation. Among central stations this is doubtless less true, since by common consent they are properly monopolistic for the best results and competitive only with other methods of furnishing service for light, heat, power and other useful purposes.

Our electrical business, technical in its very nature, has doubtless for that reason placed less emphasis in the past on aggressive selling and distributing effort—witness the fact that the first commercial papers in the National Electric Light Association appeared only so recently as 1905, and national advertising by individual companies began about 1907, 1908.

It is estimated that the gross sales, ratio of sales expense and sales expense for 1912, in the electrical business, were approximately as indicated in the following table.

The $80,000,000 of sales effort (which is equal to one-fifth of the gross sales of all the central stations) is incurred by approximately 5000 central stations, 500 manufacturers, 200 jobbers, 5000 dealers and contractors—a total of 10,700 organizations. It is of special importance

to note that [illegible] sales effort is incurred by the [illegible] dealers and contractors who operate under complete competitive conditions, at a sales expense ratio of at least 15 per cent, and tending to increase.

While this table and the above comments are broad generalizations, the reader is asked to check the principle and its application in his own particular case.

| [illegible] | [illegible] | Per Cent Ratio Sales Expense to Sales | Sales Expense |
|---|---|---|---|
| [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] |
| Total | $800,000,000 | | $80,000,000 |

These facts in themselves are a challenge to commercial men, which cannot be avoided. They justify the most careful search for causes and investigation of plans for improvement.

Whatever minor causes may be contributory to this failure in more efficient merchandising, the major one, which experience and the facts disclose, is competition among these thousands of companies, resulting in expensive duplication of all kinds of sales efforts and failure to co-operate in a definite organized plan in those kinds of endeavor which supplement legitimate competition.

This competition is to a very great extent to secure the business held by others or of natural growth—which we may characterize as the existing market. A very large part of the selling effort is exerted on this existing market and dissipated in commercial friction and lost motion, with resulting decrease in its creative effect.

The fact is frequently overlooked that the energy-consuming devices for light, heat, motor service and other useful purposes are the only aspects of our business in which the public are or can be interested, while they constitute only a small part of the resulting business from the boilers to the devices the public uses. We are therefore all, without conscious organization, joint sellers of the final service.

The age of business (in which someone has said we live to do business, instead of doing business to live, in the best sense) is in the order of social development the successor of the period when war—the extreme of competition—was the principal occupation. Business has inherited from this prototype many habits of enmity, antagonism and waste, which only the persistent cultivation of good fellowship, harmony and economy will gradually supplant. The most successful organizations which I have observed have given the greatest attention to the cultivation of harmony among their men, and the spirit of progressive, constructive effort. This same result must measurably follow similar conscious effort by an entire industry.

The Society for Electrical Development proposes a broad, common organization of our entire industry: central stations, manufacturers, jobbers, dealers and contractors (controlled by a balanced representation from each), through which a part of this $80,000,000 of unorganized and competitive sales effort can be more effectively exerted through organized and co-operative effort in promoting and popularizing electrical service. These plans to teach the public to "Do it electrically"—many more than can at once be undertaken—have been worked out and endorsed as entirely practical by many prominent men in our business.

The Society proposes at the start that a minimum of $200,000 or only one-fourth of 1 per cent of this $80,000,000 of competitive sales expense, be co-operatively expended. The basis of subscription is for manufacturers, and central stations, one-fifteenth of 1 per cent of gross sales, and for jobbers, dealers and contracters one-twentieth of 1 per cent, amounting, for illustration, in the case of the former to $[illegible] of gross [illegible], and in the latter case to [illegible] of gross [illegible]. [illegible] This [illegible] in the case of a company having a 15 per cent sales expense account, only one-three-hundredth of its sales appropriations. There are few organizations which cannot locate competitive expenses of doubtful value equal to the society's subscription. While individual subscriptions are comparatively small and in no sense burdensome, yet general co-operation in the movement will make a fund of $500,000 per annum available for progressive and aggressive market cultivation along these new lines.

This society creates the organization and the fund through which some of our dollars can co-operate with the good will of us all in broad effective activity for the expansion of the market, while we continue with the most of our dollars to compete for our fair share.

This plan means real progress in the direction of more efficient distribution of electrical service through joint cultivation of our common market—the great pre-occupied, incredulous, money-spending public—a result which our present systems neither accomplish nor promise ever to achieve on the old lines.

The plan presents a new kind of consolidation for sales efficiency through a better balance of competitive and co-operative effort to which the popular thought will not now nor in future take exception.

The plan means that men identified with the most wonderful of all businesses will demonstrate for themselves and by example for others the true principles which underly progress in more efficient sales distribution, through the creative cultivation of the market. The plan lends dignity to the art of selling—synonymous in the best sense with service—and marks a further point in the age now happily passing, when the selling spirit was symbolized in the economist's expression *caveat emptor*—"Let the buyer beware."

## Building Trades Strike Settled in Chicago

Following a basis of settlement reached by a joint conference committee, the men affected by the general strike and lockout in the building trades of Chicago returned to work on July 21. The dispute had nothing to do primarily with wages, hours of work, or recognition of the union. The employers objected to the employment of "maintenance men" on jobs of electrical construction work and to the vexatious clashes of the unions themselves as to jurisdiction over certain classes of work. The original strike, followed by a general lockout, was begun on June 12. Over 20,000 men were involved, and work on all large buildings under construction was stopped for over a month.

The joint conference committee represented the Building Construction Employers' Association and the Building Trades Council. After numerous sessions it decided to create a permanent joint arbitration board, to which any future disputes may be referred. It also reached decisions on many of the points involved. In relation to the use of maintenance men in electrical work, the conference committee adopted the following resolution:

"Resolved, That in view of the statement of Mr. Cleary, representing the Electrical Workers' Union, local No. 134, that no contractor shall be compelled to employ so-called maintenance men, it is mutually agreed by the joint committee that where men are required to do electrical work it shall be at the option of the employer and that union electricians shall be employed."

This upholds the employers' contention. The claim of the hoisting engineers for the use of maintenance men was referred to the arbitration board when formed.

The jurisdictional claim of the ornamental iron-setter and electric-fixture workers in reference to the erection of ornamental and monumental bronze fixtures was decided as follows: "That all ornamental and monumental iron and bronze lamp standards which are a part of ornamental iron and bronze contract and manufactured by members of the

Iron League of Chicago, or by manufacturers engaged in a similar line of business, shall be erected solely by members of the Architectural Iron Workers' Union, as has always been the custom."

Field work necessary for the erection of coal and ash conveyors and package conveyors, claimed by the machinists, was awarded to the millwrights.

Boiler makers are conceded the work of assembling and erecting water-tube boilers, machinery movers to deliver boilers or parts to their foundations.

Other stipulations of this kind are made in relation to the jurisdiction of structural iron workers, lathers, building laborers, cement finishers, carpenters, glaziers, sheet-metal workers, asbestos workers, machinists, steam fitters, and others.

Where disputes are referred to the board of arbitration in the future there shall be no cessation of work during arbitration. The work of the conference committee was conducted in a friendly spirit, and there is a hopeful feeling that a way has been found to do away with the almost constant strikes and bickerings that have characterized building operations in Chicago in the last few years.

The Building Construction Employers' Association of Chicago represents the prominent building contractors. The electrical contractors on the executive board are Messrs. John Cuthbert, Ernest Freeman and G. A. E. Kohler. Mr. Kohler is third vice-president of the association and is a member of the joint conference committee.

## Convention of the National Electrical Contractors' Association

The thirteenth annual convention of the National Electrical Contractors' Association was held in the Hotel Patten, Chattanooga, Tenn., July 16, 17, 18 and 19. The registered attendance was 214, 115 of whom were members, the remainder being guests and ladies. On the day preceding the convention the contractors traveling on special cars from New York, Chicago and St. Louis were entertained at the Sinton Hotel, Cincinnati, by the electrical contractors of that city. A tour of Cincinnati was made on special trolley cars which ended with a visit to the zoological garden, where dinner was served, Mr. L. T. Milnor acting as toastmaster. Speeches were made by the Hon. H. T. Hunt, mayor of the city, Mr. J. C. Hatzel of New York City, second vice-president of the National Electrical Contractors' Association; Mr. W. E. Robertson, electrical jobber of Buffalo, N. Y.; Mr. J. M. Wakeman of the Society for Electrical Development, Inc.; Mr. Victor Price, director of public service; Mr. G. W. Sullivan of Cincinnati, and Mr. F. D. Lawrence, manager of the General Electric Company's Cincinnati office. A cabaret performance was given in the course of the dinner and special cars left the zoological garden at a quarter to nine for the Central Union station. A special train in charge of Mr. V. C. Gilpin, master of transportation, left Cincinnati at 10 o'clock, arriving in Chattanooga the following morning.

The first official session of the association was held on the morning of July 16 when the visitors were welcomed formally to the city. The first speaker was Mr. Joseph A. Fowler of the Tennessee State Association, who made a short talk and introduced President Ernest Freeman, who made the opening address. Mr. Freeman paid many glowing tributes to Chattanooga, and was followed by Commissioner H. Clay Evans, who welcomed the visitors on behalf of the State of Tennessee. Mr. Evans detailed the possibilities of Chattanooga for the future and told of some of the wonderful developments that are now under way. Mr. T. C. Betterton, on behalf of the city of Chattanooga, also welcomed the visitors, and in a speech calling attention to the hydroelectric developments on the Ocoee River and on the Tennessee River predicted a broad future for the electrical business of Chattanooga saying that within a very short time over 125,000 hp would be available for manufacturing purposes in that historic city. The last speaker of the session was Mr. A. M. Schoen of Atlanta, Ga., who represented the Southeastern Underwriters' Association. Mr. Schoen spoke of the National Electrical Code and dwelt upon the relations that should exist between the electrical contractor and the underwriters' inspector.

### Business Sessions

The remaining sessions were open to members only. On the afternoon of July 16 reports were read by the President Ernest Freeman of Chicago, Mr. John R. Galloway of Washington, D. C., treasurer, and Mr. W. H. Morton of Utica, N. Y., secretary. Mr. Freeman's report was quite optimistic in tone and in it he dwelt on the relations existing between the jobbers and contractors. He also made a plea for closer co-operation between the various electrical interests, closing with a resumé of the general work conducted by the association. According to the report of the treasurer the National Electrical Contractors' Association was never in a better condition financially and Secretary Morton's report revealed the fact that on June 1, 1913, the total membership of the association was 1268. During the session a telegram was received from Mr. J. Robert Crouse of the National Quality Lamp Division of the General Electric Company, Cleveland, Ohio, bearing expressions of good cheer and stating that the contractors' association was worthy of congratulation for the progressiveness displayed during the year and for the co-operative work done by it in creating harmonious relationships with other national bodies engaged in the electrical business.

During the afternoon session Mr. Morton tendered his resignation effective Sept. 1 as secretary, stating that he was going to leave within a short time for Porto Rico, where he has organized a large company to exploit grape fruit plantations. Inasmuch as Mr. Morton has been connected with the organization ever since its formation thirteen years ago, his resignation was received with much regret, and President Freeman appointed as a committee on resolutions all of the past presidents of the association present, comprising Messrs. Ernest McCleary of Detroit, James R. Strong of New York; Gerry M. Sanborn of Indianapolis, and Marshall L. Barnes of Troy, N. Y. This committee introduced a set of resolutions thanking Mr. Morton for the work he had done while secretary of the National Electrical Contractors' Association, recalling his valuable services and concluding with well wishes in his new undertaking. The resolution was unanimously adopted by the convention.

The rules of the National Electrical Code were brought up by Mr. Ernest McCleary of Detroit, the committee on that subject, during the afternoon and the greater part of the session was allotted to the speaker, who explained the recent changes made in the rules at the biennial meeting held in New York City last March. He also answered questions relative to Underwriters' decisions.

### Guaranteed Wiring

At the afternoon session Mr. McCleary also read the editorial appearing in the *Electrical World* of July 5, in which it was suggested that the National Electrical Contractors' Association guarantee the work of its members. The scheme proposed was that every member of the association should undertake to carry out interior wiring contracts in strict conformity to the rules in force, the association to stand back of the guarantee by agreeing to indemnify the employer of any of its members against bad workmanship or materials, and that any member failing to remedy defective work after being notified by the association to do so should be dropped from the organization. The scheme suggested called forth a very general discussion and it was felt that its adoption would redound to the credit of the association as a whole, and give it and its members a

better standing with the central-stations and with the communities in which the contractors were engaged in business. On motion the suggestion was referred to the executive committee of the association with instructions to investigate the proposition in all its details and to report its findings at a subsequent meeting.

The reports of the various standing committees were also presented at the afternoon session, discussion on them coming up during the other days of the convention.

### Co-operative Movement

During the Thursday session Mr. J. M. Wakeman of New York City, general manager of the Society for Electrical Development, Inc., made an interesting address on the purpose and scope of that society. He dwelt at length on the plan of the organization to bring about better conditions both for the contractors and for the consumers, and his talk was strongly endorsed by a number of contractors present who told of the good they themselves had experienced from membership in the Society for Electrical Development, Inc. As a result of the discussion which followed, twenty-four contractors made applications of membership in the society.

### Segregated Contracts

The committee reports read at the session on Wednesday were taken up and discussed at some length and other executive matters were also taken up. The contractors expressed themselves freely on the policy followed by architects of making a general contract to cover all work so that the successful general contractor in sub-contracting the electrical work used one contractor against another to the detriment of the entire trade. It was the sense of the meeting that the National Electrical Contractors' Association suggest to the American Institute of Architects the segregation of contracts so that this practice of using one contractor against the other might be stopped. Attention was also called to a law recently passed by the Pennsylvania Legislature enacting that in the preparation of specifications for the erection, construction and alteration of any public building when the entire cost of such work should exceed $1,000 it shall be the duty of the erecting engineer or other person preparing such specifications to prepare separate specifications for the plumbing, heating, ventilating and electrical work, and it shall be the duty of the person or persons authorized to enter contracts for the erection, construction or alteration of such public buildings to receive separate bids upon each of the said branches of work and to award the contract for the same to the lowest responsible bidder for each of said branches.

The sessions on Friday were devoted chiefly to matters of business and during the morning addresses were delivered on subjects pertinent to progress and policy of the organization.

### Cost Keeping for Contractors

Mr. F. L. Decker explained the bookkeeping system adopted by the National Electrical Contractors' Association, which is sold to members for $15, and to non-members for $20. An instruction book goes with the system. It was felt that the plan which has been devised for handling a job from beginning of construction to completion and which forms a part of the bookkeeping scheme is worth in itself many times the cost of the system. Investigations showed that the cause of a large majority of failures on the part of the contractor are due to lack of proper accounting methods and ignorance of true financial conditions. In the hope of improving this feature of the business the National Electrical Contractors' Association set about to find a remedy, and the report of Mr. Decker on the bookkeeping system is the result. The two important features of the system are that it shows first how much money has been made or lost on every job no matter how large or how small, and secondly, the true status of the business at the end of every month. In order to make the system, which in itself is very simple, more comprehensive a book of explanation setting forth step by step how every item or transaction is to be handled, has been made a part of the system.

### Standardization of Finishes

One of the other important reports taken up during the morning session was made by Mr. G. M. Sanborn, of Indianapolis, on the standardization of finishes. The association hopes to induce manufacturers to adopt standard finishes of fixtures, sockets, wall plates, etc., by distributing to its members numbered samples and requesting them to order from manufacturers by number, thus compelling the latter in filling the order to adopt or refer to the standards of the contractors. For instance, if a contractor desired a brush brass finish on fixtures, wall plates, etc., and his samples designated the finish as No. 18 he would merely note on his order to the manufacturer that he desired No. 18 finish.

### Standard Conduit for Wiring Installations

Another movement toward standardization comprises a set of six charts of standard sizes of conduit for the installation of wires and cables adopted by the National Electrical Contractors' Association and explained in detail during the meeting. The disposition in the past has been to use conduits of too small interior diameter and in the preparation of the charts care has been taken to recommend conduits of sufficient size to cover all work, bearing in mind at the same time that economy in installation should be considered and extravagant sizes in conduits discouraged. The charts adopted were prepared after careful study of the actual conditions encountered in making installations and show the conduit and conductors' full size so as to give a visual representation of the actual condition, in addition to showing the size of conduit needed for each combination of wires. The charts gave the actual diameter of the conduit and the current carrying capacity of the wire used in accordance with the changes made in the National Electrical Code. The complete set comprises six charts which show the proper size of conduit for one, two, three, four and convertible three-wire systems combinations of duplex wires in sizes of Nos. 10, 12 and 14; single wire combinations of No. 14 wires up to No. 90 wires; combinations of No. 16 and No. 18 fixture wires up to 150 wires and combination of telephone wires up to 50 pairs. The charts are substantially framed, hinged together and provided with a backing for convenient hanging, two charts being mounted on each sheet so that there are only three frames in the set.

### Universal Data and Sales Book

Mr. Sanborn in his report on a universal data and sales book issued by the National Electrical Contractors' Association to its members under lease, drew attention to many of the clauses appearing on the title page of the book, to the effect that there is no understanding or agreement on the part of the National Electrical Contractors' Association or among its members or otherwise, fixing or in any way effecting the price of the material listed in the book, such listing being made only for the convenience of members. Moreover, there is no understanding or agreement on the part of the association or among its members or otherwise that purchases shall be limited to the material so listed. Members are entirely free to buy where they please and sell at any price they please and there is no desire on the part of the association or its executive committee to hamper or interfere in any way with the members' rights in the respects mentioned.

### Relations with Jobbers

One of the most impressive addresses made at the convention was delivered by Mr. W. E. Robertson, of the Rob

ertson-Cataract Company, of Buffalo, N. Y., who defined clearly the respective fields of the jobber, dealer and the contractor, showing that the tendency is toward larger and fewer jobbing houses; more dealers, who will be recruited both from jobbers and contractors, and better and more responsible contractors. The speaker expanded on the excellent results to be obtained by close co-operation between jobbers, dealers and contractors, and by a proper appreciation by each of the definite and respective fields of the others.

At the Friday afternoon session after one of the most spirited contests ever held it was decided to hold the next convention of the association in Detroit, Mich. Minneapolis, Detroit, Richmond, New Orleans, New York and Troy were all placed in nomination, and the merits of each championed by contractors from the respective cities. The fight grew so hot that all proxies were called for, with the result that Detroit won. Owing to the great heat attending the meeting in Chattanooga it was also strongly urged that the association hereafter hold its annual meetings in the spring of the year.

### ELECTION OF OFFICERS

On the recommendation of the nominating committee the following officers were elected: President, Mr. Ernest Freeman, of Chicago; first vice-president, Mr. J. C. Hatzel, of New York; second vice-president, Mr. W. L. Hutchison, of Kansas City; third vice-president, Mr. J. C. Rendler, of Los Angeles; treasurer, Mr. J. R. Galloway, of Washington, and sergeant-at-arms, Mr. J. C. Sterns, of Buffalo. Mr. W. H. Morton was re-elected as secretary of the association with the understanding that the executive committee will fill the position before Sept. 1, when Mr. Morton's resignation becomes effective. The committee has already taken steps to advertise for applicants for the position, the duties of which besides looking after the routine work of the secretary's office include editing the *National Electrical Contractor,* the official monthly organ of the association.

Mr. Ernest Freeman, who has been re-elected president of the National Electrical Contractors' Association, is president of the Freeman-Sweet Company of Chicago. He was born in Chatham, Mass., in 1870, and as a young man went to Chicago and entered the electrical field. His experience has not been limited to contracting work, however, he having been at one time connected with the central stations at Libertyville and Morris, Ill., and with the Consolidated Water & Light Company of Marseilles, Ill., having been president and manager of the latter company. The first two properties are now part of the Public Service Company of Northern Illinois, and the last property is now in the McKinley group. For several terms Mr. Freeman was president of the Chicago Electrical Contractors' Association. Being a man of progressive and broad experience he has contributed liberally toward uplifting the standard of electrical construction work and is recognized as one of the most active and influential members of the national body.

### ENTERTAINMENT FEATURES

In addition to the entertainment provided for the delegates en route to Chattanooga by the electrical contractors at Cincinnati, the local committee at Chattanooga provided abundant recreation during the week. The reception and dance was held in the ball room of Hotel Patten on the evening of July 16, Mr. and Mrs. E. Freeman and Mr. and Mrs. J. Fowler being the committee in charge. Owing to the great heat which prevailed during convention week there was very little dancing, the members and guests being entertained with a negro cake walk.

There being no session allotted for the afternoon of July 17 the entire party was taken in automobiles to Chickamauga Park, passing over the battle fields and returning by way of Missionary Ridge. This trip was considered to be one of the most interesting ever given in connection with the annual gatherings of the organization, and every available sight-seeing automobile in the city was pressed into service. Stops were made at various points in Chickamauga Park and on Missionary Ridge to permit the visitors to obtain closer views of the monuments as well as views of the battle fields from observation towers. In the evening an illustrated lecture on window lighting was given in the hotel ball room by Mr. J. F. H. Aldrich, of the National X-Ray Reflector Company of Chicago. Immediately following the lecture there was a rejuvenation of the Sons of Jove, and ten new members were initiated into the mysteries of the order, Past-Jupiter W. E. Robertson acting as Jupiter.

In the afternoon of July 18 an afternoon tea was given to the ladies and guests of the association in the Hotel Patten by the Chattanooga Electric Club, a local quartet contributing to the entertainment of the guests by some well chosen selections.

The great event of the week was the annual dinner which was given in the main dining room of Hotel Patten on the night of July 18. A book of songs was distributed and all were invited to join in the singing led by Mr. J. R. Strong, of New York. Humor appropriate to the day and occasion, puns on members present and other genial fun made the affair very enjoyable in spite of the heat. After the dinner a vaudeville performance was given by professional actors from a local theater.

On Saturday morning the entire party was taken in automobiles to Signal Mountain, where lunch was served in the grove surrounding the Signal Mountain Inn. The trip was through a very pretty section of the valley in which Chattanooga is located and over a new driveway up the famous Waldron's Ridge. In the afternoon the party left on a special train to visit the lock and dam of the Chattanooga & Tennessee River Power Company, now nearing completion, at Hales Bar, some 33 miles from Chattanooga. The special train returned to the city shortly after 6 o'clock, when the convention disbanded.

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## Society of Heating and Ventilating Engineers

At the semi-annual meeting of the American Society of Heating and Ventilating Engineers, held at Buffalo, N. Y., July 17 to 19, were presented several papers of interest to our readers.

In a paper entitled "Time Analysis in Starting Heating Apparatus" there was given a mathematical discussion by Mr. Ralph C. Taggart, New York, of the methods of computing, with the aid of the calculus, the time interval required to heat radiators, pipes and other equipment.

A paper on "Expense of Operating Heating and Ventilating Plants," by Mr. H. M. Hart, Chicago, contained actual data for school and office buildings. The information obtained for residences and apartment buildings was, however, of such a conflicting character that no extended mention could be made of these classes.

Mr. Frederick Bass, Minneapolis, reported experiments in school-room ventilation with reduced air supply through individual ducts. In these tests made at Minneapolis ozone was introduced in the proportion of one part to 1,000,000 parts of air. It was found possible to "renew" the air in a fully occupied schoolroom for a period of three hours without admitting outside air, all the time keeping the air within sweet and comfortable and the occupants at full normal efficiency. Continuation of these conditions five hours a day for three weeks had no perceptible effect on the children who were under the inspection of expert physiological and psychological observers. "Apparently the ozone was an important factor in keeping the air of the room in a comfortable condition," commented the author, for once during the test the small fan supplying the ozone

[illegible] obtained show conclusively that in rooms and halls only [illegible] proper treatment are as desirable as the introduction of outside air. Persons may occupy such rooms ventilated by renewed air for long periods of time without suffering or exhibiting any effect, either consciously or unconsciously. Air leakage will supply more than enough oxygen.

A paper by Mr. Frank L. Busey, Buffalo, described results obtained from a recent set of experiments made to determine the loss of pressure due to elbows in the transmission of air through pipes or ducts. Heat transmission with pipe coils and cast-iron heaters under fan-blast conditions was the subject of a paper by Mr. L. C. Soule, Chicago.

## Statistics of Electrical Installations in Chicago

By city ordinance all electrical wiring and electrical equipment within the city of Chicago must be inspected and approved by the Bureau of Electrical Inspection of the Department of Electricity. The records of this department give, therefore, an interesting summary of electrical installations in Chicago. Thus, the recently published report of the department for the year 1912 gives the number of electric-lighting installations and lamps in the city under the jurisdiction of the department as expressed in the accompanying table.

TABLE I.—STATISTICS REGARDING ELECTRICAL GENERATING PLANTS

| | | | |
|---|---|---|---|
| [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] |

*Energy furnished by the Sanitary District of Chicago.

TABLE II.—STATISTICS REGARDING THE CONNECTED LOAD OF THE CHICAGO CENTRAL STATIONS

| | Incandescent | Arc | Motor, Horse-power |
|---|---|---|---|
| Gunther Electric Co. | [illegible] | 18 | [illegible] |
| Cosmopolitan Electric Co | [illegible] | 119 | 8,340 |
| Adams Generating Co. | [illegible] | [illegible] | 3 |
| Dearborn Power Co | 2,307 | [illegible] | 393 |
| Monroe Electric Co. | [illegible] | 8 | 10 |
| Zenith Electric Light Co. | 5,280 | [illegible] | 11 |
| Chicago Cold Storage Warehouse Co | 1,800 | [illegible] | [illegible] |
| Fort Dearborn Building | [illegible] | [illegible] | [illegible] |
| Hartford Building | [illegible] | [illegible] | [illegible] |
| Dolton Electric Light Co | [illegible] | [illegible] | [illegible] |
| [illegible] plants) | 4,578,786 | 14,874 | 215,972 |
| Inter Ocean Newspaper Co | 5,000 | 17 | 255 |
| Union Stock Yards & Transit Co | 11,632 | [illegible] | 2,477 |
| First National Bank Building | 5,000 | [illegible] | [illegible] |
| Sanitary District of Chicago | 23,173 | 265 | [illegible] |
| Public Service Company of Northern [illegible] | [illegible] | [illegible] | 3193 |
| North American Building | [illegible] | [illegible] | 293 |
| Total, 20 plants | 4,829,035 | 15,357 | 244,512 |

The number of commercial central-station companies furnishing electrical energy in the city of Chicago is larger than is generally supposed and is shown by the records of the Department of Electricity in Table II.

The total number of electric signs in the city at the close of 1912 was 7241. Of these 6650 projected over sidewalks, 523 were mounted parallel with buildings, and 68 were roof signs. The total number of incandescent lamps used in these signs was 475,839.

## Electric-Rate Discussion in Chicago

The reading of the report of City Electrician Palmer on the rate investigation of the Commonwealth Edison Company was resumed by the committee on gas, oil and electric light of the Chicago City Council on July 16. One point brought out was whether the situation by which the Commonwealth Edison Company sells energy to the street-railway companies results in a double charge for depreciation paid by the people of Chicago. The central-station company, owning and operating the machinery producing the energy, naturally makes a charge for depreciation. Under the 1907 traction-settlement ordinances, as construed by the Board of Supervising Engineers, Chicago Traction, the street-railway companies have also apparently the right to make a charge for depreciation on power plants that might be necessary to produce the energy which they purchase from the Commonwealth Edison Company. Alderman Merriam argued that this double charge was unjust to the people, and Mr. C. B. Willard, the expert accountant from the city comptroller's office, agreed that it might be so. However, Mr. Willard explained that this practice on the part of the street-railway companies allows them to make a better showing in relation to operating expenses, and that the city gets 55 per cent of the "net divisible receipts" thereby increased.

### Valuation of Harrison Street Station

There was some discussion also on the proper valuation of the Harrison Street generating station of the Commonwealth Edison Company. This station was put in service in 1902, and, with its reciprocating engines, is now regarded as of an obsolescent type. It is used to some extent as a substation, although until recently was sometimes pressed into service during the peak load of the winter months. This station is valued at $2,500,000 in the Palmer report, and some of the aldermen appeared to think that this valuation is too high.

### Low Rates in Railway Contracts

At the meeting of the committee on July 17 the reading of the Palmer report was concluded. Mr. A. C. King, assistant city electrician, who collaborated in the preparation of the report, explained, at the request of Alderman Merriam, the long and elaborate contract of 1913 by which the Commonwealth Edison Company agrees to supply electrical energy to the Chicago Railways Company until 1927. Mr. Merriam desired to know the rates provided in these street-railway contracts. Mr. King explained that there was a sliding monthly rate of $1.25 to 83⅓ cents per maximum demand in kilowatts. Similarly the secondary rate for consumption of energy is based on a sliding scale ranging from 0.4 cent to 0.36 cent per kw-hr. In any case a large demand and a large consumption are required, while to earn the minimum rates mentioned in the contract the demand and the consumption must be very large, running up to 100,000 kw in demand and 300,000,000 kw-hr. in consumption.

City Electrician Palmer read a letter which he wrote to Mayor Harrison last January on the subject of this contract and now made public. Before the revised contract was adopted it was necessary to obtain the consent of the city through the Board of Supervising Engineers. Mr. Palmer criticised the contract as on the whole favoring the street-railway company unduly and as being unfavorable to the electric-service company, the city of Chicago and the small consumers. Mr. Palmer figures that th

Commonwealth Edison Company's primary cost per unit of maximum demand in 1911, including depreciation, was about $14. The maximum primary charge under the contract is $1.25 a month, or $15 a year. This, however, decreases with increased demand to $10 a year, and Mr. Palmer thinks that the latter figure is too low, as it is not probable that improvements in the art will justify the decreased rate as the maximum demand increases. Therefore, the rate, in Mr. Palmer's judgment, will place an undue burden on the other customers of the company. At the present time the company receives a return on its investment, including depreciation, under this contract, of about 6⅔ per cent, but the future return may not be so good.

### Emergency Connection for Street Lighting

Another point brought up by Mr. Palmer in the oral discussion was in the nature of a warning against depending exclusively on hydroelectric energy delivered over a 30-mile transmission line for street lighting in Chicago. Not only is the Sanitary District approaching its limit in the matter of furnishing electrical energy for street lighting in Chicago, owing to the government's restriction on the use of water by the Drainage Canal, but the city electrician would like to see a tie line between the Fisk Street station of the Commonwealth Edison Company and the Western Avenue terminal station of the Sanitary District as a precaution for emergency service. The posssible use of garbage incinerating plants operated by the municipality as an auxiliary to the Sanitary District plant in electric street lighting was discussed informally.

### Points Made by Company Representatives

Mr. W. J. Norton, of the Commonwealth Edison Company, made a demonstration for the benefit of the aldermen of the use of the watt-hour meter and Wright demand meter on customers' premises. The instruments were mounted on a board which also supported a bank of lamps, and the measurements of various combinations of carbon and tungsten lamps in relation to energy consumption and maximum demand were explained.

Mr. W. G. Beale, counsel for the Commonwealth Edison Company, added a popular exposition of the maximum-demand principle in rate-making as related to peak load. He used the comparison of two men bargaining with a stable-keeper for the use of a saddle horse an hour a day. One customer, A, desires a horse reserved for him every day between 8 and 9 a. m. Another, B, says that he must have the use of the horse for one hour at any time during the twenty-four hours. The stable-keeper could obviously make a lower rate to A than to B.

In informal discussion Mr. Beale brought up several questions, such as the value of the franchise of the company, rates of depreciation and what effect the existence of the Public Utilities Commission of Illinois after Jan. 1, 1914, will have on the proposed contract ordinance under discussion. The company was given ten days in which to prepare a written answer to the arguments in Mr. Palmer's report.

## Public Service Commission News

### Maryland Commission

A hearing on the application of the Consolidated Gas, Electric Light & Power Company for permission to lease the plant of the Patapsco Electric & Manufacturing Company was given by the Maryland Public Service Commission last Friday and the application granted. The Patapsco Company was formerly owned by Victor G. Bloede, who tried in vain to get a franchise from the City Council to supply electricity in Baltimore.

### Ohio Commission

Authority has been given the Cleveland Electric Illuminating Company of Cleveland to issue $2,000,000 common stock to be sold at par or above, and $1,000,000 in 5 per cent bonds to be sold at not less than 95. The proceeds are to be used to reimburse the company for improvements and betterments already made.

The Sandusky River Power Company of Fremont has received authority to issue $75,000 6 per cent mortgage notes to be used in borrowing money to make repairs on its property and provide against the recurrence of floods in the Sandusky River. The plant was damaged by the great March floods which devastated this state.

### New York Commissions

The Long Island Railroad Company and the New York Consolidated Railroad Company have been ordered by the Public Service Commission for the First District to equip each of their electrically-operated cars with one or more chemical fire extinguishers of such a type that the contents thereof cannot act as an electrical conductor. The cars must be so equipped by Sept. 15, and if any other kinds of fire extinguishers are used, such other extinguishers must be conspicuously labeled that they are not to be used until the circuit has been opened. This action was taken following an investigation into a recent accident upon a trestle at Jamaica where a car of the New York Consolidated Company caught fire and was destroyed. It was found that the car had carried no fire extinguishers whatever.

### California Commission

The Railroad Commission has rendered a decision granting authority to the San Joaquin Light & Power Corporation to issue $1,776,000 of bonds. It was also given authority to pledge these bonds for an issue of two-year 6 per cent collateral trust notes. The proceeds from the sale of the bonds or notes are to be used by the company in completing its power houses, sub-stations and transmission lines in connection with its new hydroelectric work.

The Railroad Commission has rendered a decision denying the application of the San Diego Consolidated Gas & Electric Company to issue 3148 shares of its common capital stock of the par value of $314,800. The corporation applied for authority to issue the stock to pay the discount upon its bonds issued since March, 1909.

### Massachusetts Commission

Hearings were concluded at Northampton, Mass., on July 11 by the Gas and Electric Light Commission, which is investigating the local gas and electric rates upon petition of the city authorities. On the closing day the prices charged for electricity by the Northampton Electric Light Company were considered by the board. For the city Mr. Alton D. Adams, of Worcester, Mass., contended that the existing average price of 3.8 cents per kw-hr. for energy for motor service discourages proper development. Mr. Adams said that the connected motor load is but 700 hp, compared with 1800 hp in Greenfield, which has an average rate of 2.3 cents. The maintenance of a minimum charge of $1 per hp per month in motor installations was also criticised. The speaker advocated fixing a street-lighting price upon a rate of 5 cents per kw-hr., the present return being 7.2 cents. He advocated an average commercial lighting price of 7 cents per kw-hr. in place of 10.44 cents, the existing average. The reductions desired by the city would lower the company's income from $108,584 to $77,123. Mr. Guy M. Cox, of Boston, counsel for the company, argued that the income ought not to be reduced by more than $10,000. He pointed out that the management is about to spend $85,000 in doubling the capacity of the plant, and that expenditures totaling $100,000 are in sight for underground construction. The territory requires an unusual investment in distributing lines. The company felt itself entitled to 6 per cent dividends on an investment of $281,621, or about $17,000, compared with the city's estimate of $12,679 on a capitalization of $117,400. The board took the case under advisement.

# Current News Notes

Parcel Post Rates.—Manufacturers, jobbers and others who make extensive use of the parcel post service, electrical specialties will be interested in the plans for the extension, improvement and reduction in rates announced by Postmaster-General Burleson to become effective Aug. 15. The maximum weight of parcels has been increased from 11 to 20 lb. and a material reduction in the postage rates in the first and second zones will be made. In addition the parcel post map used in computing rates will be abandoned and as a substitute a rate chart will be issued individualized to every post office in the United States. The insurance fee which was originally 10 cents for values up to $25 was reduced to 5 cents on July 1.

* * *

Fight at Providence Settled.—The contention existing between the Rhode Island Transmission Company which is owned by the New England Power Company and the Narragansett Electric Lighting Company of Providence, R. I., has ended by the conclusion of a 30-year contract between the transmission company and the Narragansett Electric Lighting Company. Under the contract the New England Power Company will wholesale hydroelectric energy to the Narragansett company, which will distribute it over the entire district. The New England Power Company will also secure entrance on favorable terms to the great manufacturing section of Rhode Island. It is understood that the agreement was brought about chiefly through the influence of the Public Policy Committee of the National Electric Light Association.

* * *

Philadelphia Board of Lighting Supervisors.—Mayor Blankenburg of Philadelphia, Pa., has appointed a Board of Lighting Supervisors composed of Messrs. C. W. Pike, chief of the Electrical Bureau; Dr. H. Godfrey, chief of the Bureau of Gas, and G. E. Mapes, chief of the Bureau of Lighting. Among the duties of the board will be the consolidation of all charts, maps and other records of gas, gasoline and electric lamps into a correlated group. It will also make a systematic study of the lighting conditions in Philadelphia with a view to co-ordinating properly the use of the three illuminants; to standardize the lighting according to the character and importance of streets and to locate lamps to the best advantage. The division of authority heretofore existing between three bureaus was necessarily lacking in efficiency, and owing to the divided authority there was often an unsatisfactory mingling of the different illuminants on the same streets.

* * *

Railroad Terminal Discussion in Chicago.—The railroad terminals committee of the Chicago City Council, which has in charge the proposed relocation of trunk-line railroad terminals in Chicago, has appointed Mr. John F. Wallace as its engineering adviser. The Union Station Company, with an authorized capital of $50,000,000, has been incorporated to maintain a union station for the Chicago, Burlington & Quincy, the Chicago, Milwaukee & St. Paul and the Pennsylvania lines. It is said that $25,000,000 worth of stock will be held by the Pennsylvania and $12,500,000 by each of the other systems. The directors for the first year are Messrs. John J. Mitchell, the Chicago banker; Joseph Wood and J. J. Turner, vice-presidents of the Pennsylvania; Darius Miller, president of the Burlington, and A. J. Earling, president of the St. Paul road. The Union Station Company wants to build a handsome terminal near the present location of the Canal Street Station, but there is great opposition, particularly on the part of the advocates of the "Chicago plan," as it is declared that the great railroad terminals in Chicago should not be allowed to cluster so near the business center of the city. The incorporation fee paid by the Union Station Company was $50,054.

* * *

College Professors Work in Westinghouse Shops.—To obtain practical knowledge of modern engineering methods of manufacture, twenty-eight college professors are spending their vacations working side by side with the skilled mechanics and engineers of the Westinghouse company's East Pittsburgh shops. Twenty-six colleges and universities are represented, the majority being in the South and Middle West. The average length of time these instructors have been engaged in educational work is 5.25 years, and many of them are the heads of their departments. The objects of the educators are fourfold: To obtain a firsthand knowledge of practical electrical engineering; to secure the opinions of successful engineers and manufacturers on the qualifications of men needed in industrial work, so that they may be properly qualified for success in their chosen branches; to exchange teaching ideas among themselves; and to study Pittsburgh's opportunities. The professors are employed on the shop pay-roll and conform to shop hours and regulations, receiving therefor a compensation of 22 cents per hour, or an average of $55 per month; the regular rate for second-year apprentices. In addition to working all day, meetings and shop inspections are scheduled for four evenings each week and trips are made to some industrial plant every Saturday afternoon.

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## SOCIETY MEETINGS

Summer Meeting of Wisconsin Electrical Contractors.—The Electrical Contractors' Association of Wisconsin will hold a summer meeting on board the steamship *Georgia* on Lake Michigan, Aug. 7 to 12, during a trip from Milwaukee to Sault Ste. Marie, Mich., and return. No papers have been assigned, but there will doubtless be discussions of general interest to members. Mr. Albert Petermann, 626 Lloyd Street, Milwaukee, is the secretary of the association.

* * *

California Electrical Contractors' Convention.—The California State Association of Electrical Contractors will hold its fourth annual convention at Santa Barbara, Cal., Aug. 13 to 16. The first two days are to be devoted to executive sessions, while the 15th will be given over to open meetings. A picnic and field day will close the convention, Aug. 16, the final feature being a Jovian rejuvenation. Mr. J. C. Rendler, Los Angeles, is president and Mr. W. S. Hanbridge, 1408 Merchants' National Bank Building, is secretary-treasurer.

* * *

Annual Meeting of Public Service Association of Virginia.—The annual meeting of the Public Service Association of Virginia, which is composed of a large number of street railway, electric, gas and water companies, was held at the Hotel Chamberlin, Old Point, Va., on July 18. The object of the meeting was to exchange views on matters pertaining to the operation of public utilities and service to the public in general. Among the subjects of general interest discussed were transportation, pay-as-you-enter cars, and problems of electric central stations as well as those confronting gas companies. The following officers were elected: President, Mr. J. W. Hancock, manager of the Roanoke Railway & Electric Company; first vice-president, Mr. J. F. Rison, president of the Danville Traction & Power Company; second vice-president, Mr. B. B. Ferguson, general manager of the Portsmouth Gas Company; third vice-president, Mr. J. N. Shannahan, manager of the Newport News & Old Point Railway & Electric Company, Hampton; secretary-treasurer, Mr. W. J. Kehl, assistant treasurer, Virginia Railway & Power Company, Richmond.

# Central-Station Practice at Waterloo, Iowa

**Steam-plant and substation equipment—Station operating records—Underground three-wire, grounded-neutral, delta-connected secondary distribution system in business district**

The neighboring cities of Waterloo and Cedar Falls, owa, obtain their electrical energy for lighting and indus-rial purposes from the central station of the Citizens' as & Electric Company, whose main generating plant is cated on the east bank of the Cedar River, the stream hich divides Waterloo into two sections. Electricity is pplied to local Waterloo customers directly from the lant and from two substations, one on each side of the ver. Equipment in plant and substations is of the most odern type, while in the business district the former over-ead construction has been replaced with an underground istribution system to which customers' services are being ut over as fast as practicable. This underground system epresents a departure from usual practice in that the light-g and motor loads are supplied from a three-wire, rounded-neutral, delta-connected secondary system, the de-ails of which will e found in the fol-owing columns. During the last ten ears, the maximum onthly output of he Waterloo central tation has increased rom 45,000 kw-hr. to 95,000 kw-hr. An nusually smooth oad curve is main-ained from 7 a. m. ntil 10 p. m., ropping off only at oon and between actory shutdown and he beginning of the vening lighting load. ccompanying curves how the characteris-ic daily load of the tation, the daily out-ut for one month, nd the growth of the lectrical business in Waterloo since 1902. The local load in-ludes a large rating f motors which brings the demand during daylight hours bove even that due to the evening lighting service. Here-ith are given tabulated data on the rating per capita, an-ual load factor and income on investment of this company aken from the report submitted by the committee on entral-station facts and factors at the Iowa Electrical ssociation convention recently held in Waterloo.

As already mentioned, electricity is distributed to Water-oo consumers from the main generating station and from wo substations situated about a mile and a quarter from the ain station. The generating plant and one of the substa-ons is located on the east bank of the Cedar River, while he other substation is on the west side of the river. lthough the plant building is not itself new, the generat-g and switchboard equipment it contains is of the most odern type. The substations have just been completed ring the past year and are duplicates of each other.

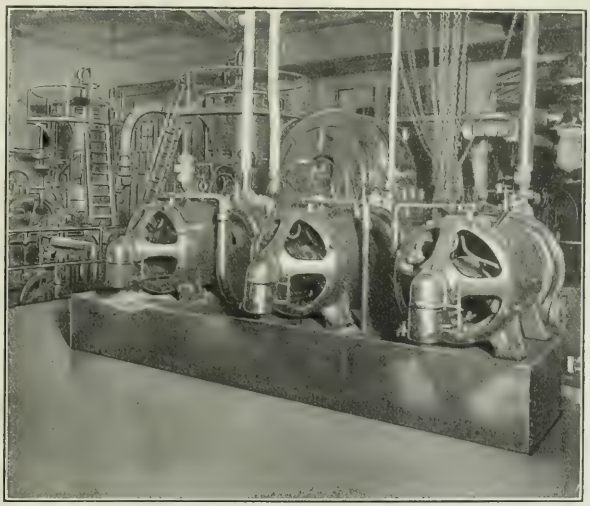


FIG. 1—EXCITERS AND TURBINES AT WATERLOO, IOWA

In the main generating station are six Lyons boilers and two Babcock & Wilcox boilers. The Lyons boilers are of the combination fire-tube and water-tube type, with reversed circulation. Two 400-hp Lyons boilers are equipped with steam-driven Green chain grates, each having 80 sq. ft. of area. The combustion chambers are provided with flat arches located 13 in. above the grate. Iowa coal containing from 20 to 28 per cent ash is burned beneath these boilers. The remaining units which consist of two 400-hp, one 200-hp and one 300-hp Lyons boilers, and two 170-hp Babcock & Wilcox boilers are hand-fired and burn Illinois coal which contains 11 to 13 per cent ash. It is possible to run these boilers at 25 per cent continuous overload and at 50 per cent overload for short periods. The settings for these steam-generating units are of brick, individual mountings being provided. Draft is supplied by a 135-ft. stack.

Each boiler is provided with two safety valves connected on a T, as an additional precaution. The automatic stoker-fired boilers are equipped with Lunkenheimer non-return stop valves, which prevent the whole supply of steam from the main headers blowing back into a boiler in case a tube breaks. To prevent unburned coal being carried under the bridge wall and dumped in the ash pit, those boilers provided with chain grates are equipped with 4-in. high-pressure water backs. The other boilers are fitted with 4-in. low-pressure water backs.

The boilers are carried in separate brick settings and deliver steam to a 10-in. header at the rear of the banks. The main header is supported on brick pedestals 6 ft. above the floor. Beneath the header at each point where a steam pipe from a boiler taps the header is a drip-pocket and a trap. All steam and feed-water pipes are covered to prevent radiation of heat.

Natural draft is maintained under the boilers by a Weber concrete smoke stack which is 90 in. in diameter at the top, and 135 ft. high measured from the grate level. Feed water is heated in both open and closed type heaters, the condensate from which is trapped and returned to the boilers. The inclosed heaters receive exhaust steam from the turbo-exciters and the open type are supplied with the exhaust from the reciprocating auxiliaries. All of the feed water supplied to the boilers is measured by a 4-in. Venturi meter which shows momentary supply, integrates the total, and records these quantities on a chart.

As Iowa and Illinois [illegible] are used in different boilers the fuel supplies are kept separate. An elevated track runs parallel with the boiler settings and the coal cars dump their supply into concrete bunkers, the floors of which are on a level with the firing aisle. From here it is delivered to the respective boilers after being weighed.

The generating [illegible] comprises two two-stage 750-

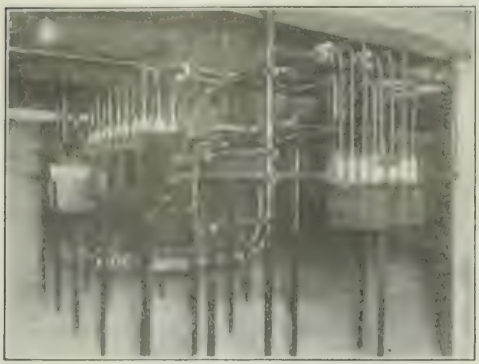


FIG. 2—CABLE AND OIL-SWITCH RACK IN SUBSTATION

kw vertical turbo-units rated at 80 per cent power-factor and one five-stage 1250-kva horizontal turbo-unit. All of the generators are General Electric machines, and furnish three-phase, 60-cycle electricity at 2300 volts when operating at 1800 r.p.m. Exciting energy for the alternators is supplied by three 25-kw General Electric 120-volt generators which operate at 3750 r.p.m. The exciters are connected to a common bus and arranged to equalize the load when one machine is cut in or out of service.

An accompanying illustration presents a view of the generating room showing three turbo-exciters in the foreground and two vertical and one horizontal turbo-alternators in the background.

Wheeler surface condensers are used on all of the generating units except the exciter sets which run non-condensing. Auxiliaries, such as vacuum pumps, are driven in some cases by steam and in other cases by electricity. This mixture of steam and electric drive is employed so that there will be no more exhaust steam that can be utilized in the feed-water heaters.

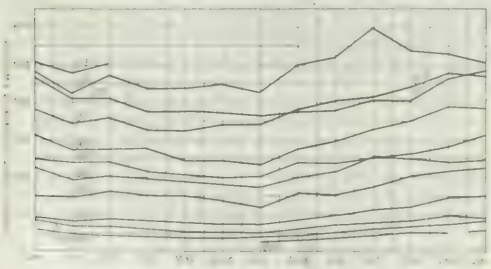


FIG. [illegible] ING OUTPUT OF STATION FROM 1912 TO 1913

Between the turbines and their respective condensers are gate valves which can be opened allowing the machine to exhaust directly into the atmosphere in case the condensers fail to work. This arrangement avoids the heating of the condensers in case the cooling water has to be shut off. The gate valve on the 1250-kva unit is interchangeably operated by motor or by hand. The motor is a 1.5-hp. 115-volt series machine and is geared to the rod operating the gate valve.

On occasions when the power-factor is poor, and all of

STATISTICS CONCERNING CITIZENS' GAS & ELECTRIC COMPANY, WATERLOO, IA.

| | |
|---|---|
| Population served | [illegible] |
| Connected [illegible] per 100 population | [illegible] |
| Installed station in kw at 80% power factor | [illegible] |
| [illegible] | [illegible] |
| Kw per customer | 7.5 |
| Ratio connected load to connected load per cent | 28.4 |
| Average load, in kw | 6[illegible] |
| Ratio average load to station rating in per cent | 30 |
| [illegible] per cent | [illegible] |
| Investment per kw rating | $500 |
| Investment per capita | $29 |
| [illegible] income per kw rating | $[illegible].70 |
| Gross annual income per customer | $[illegible].20 |
| [illegible] income per capita | $[illegible].66 |
| [illegible] income per $100 invested | $[illegible].95 |
| Gross annual income per kw-hr made | $4.00 |
| Ratio operating expense to gross income in per cent, not including overhead charges | 47.8 |
| Net earning per $100 invested | $8.91 |
| Hours in operation per year | 8,760 |

the generators are not running, the output of the station is increased without additional steam consumption by floating one of the generators on the line as a synchronous

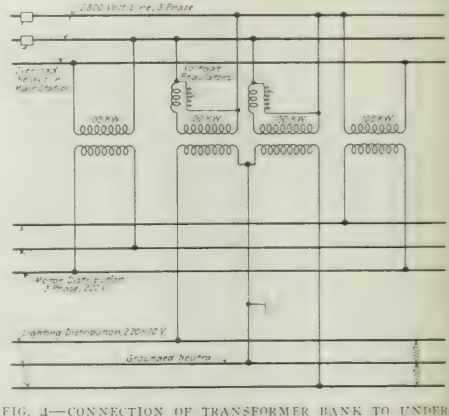



FIG. 4—CONNECTION OF TRANSFORMER BANK TO UNDERGROUND SYSTEM

motor. Steam is bled into the turbine of the machine operating as a motor so that the blades will not become excessively heated.

Air for cooling the horizontal turbine-unit is drawn in from the outside through cloth screens. These are arranged so as to give as large a surface as possible for the inlet of the air, without taking up much room. The cloth is replaced once a month.

### Switchboard in Main Station

The switchboard has been systematically and carefully arranged so that all parts are readily accessible for inspection and repair. The board consists of the customary machine, exciter, meter and distributing panels and in addition an arc-lamp panel for city lighting and four underground distributing panels installed recently. One of our illustrations gives a view of the switchboard, showing the underground distributing panels in the foreground, the oil switches and disconnect switches behind the board or racks, and the voltage regulators on the gallery over the switchboard.

One Tirrill voltage regulator is used to control all o the generators in parallel as it has been found difficult t

maintain uniform voltage on all of the machines with separate regulators. The roll of paper on which the recording wattmeter traces its curve is used for several years in succession for comparative information. As single-phase lighting circuits are employed, each lighting distribution panel is equipped with two oil swtches in order that the energy may be taken from the least loaded phase of the three-phase system. Each motor and lighting panel is equipped with relays which operate voltage regulators on that particular line.

The underground-system distributing panels are similarly equipped with meters, carrying also the oil-switch handles, voltage-regulator relays and overload relays. Each panel is equipped with two overload relays connected so as to protect the generators against grounds of any kind on the lighting and motor systems. An inspection of the wiring diagram shows how the overload protection is maintained at the main station and how the transformers at the substations are connected so as to furnish energy to the motors and lamps. This diagram does not include the voltage regulators which are installed at the main station.

In case the relays fail to control the voltage regulators for the underground 2300-volt distributing system, a lever

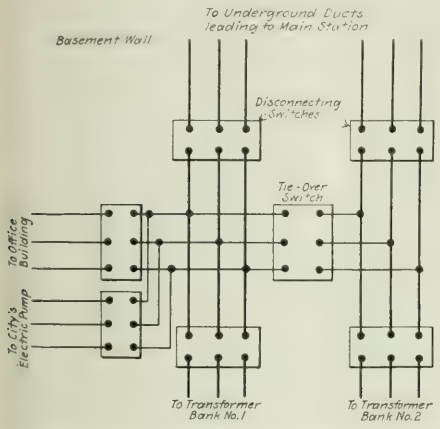



FIG. 5—CONNECTIONS OF UNDERGROUND CABLES TO SUBSTATION OIL SWITCHES

on the face of each panel can be manipulated by hand to operate the voltage regulator motors.

Behind the switchboard, but removed from it sufficiently to permit a person to inspect the back of the board, is a rack made of iron pipes upon which the oil switches are supported. Above each oil switch is a three-blade disconnect switch. The high-tension busbars are supported on insulators on top of the rack. The oil switches are all mechanically connected to the oil-switch handles located on the panels by rods running beneath the floor.

On the gallery above the switchboard are located four Westinghouse inductive-type voltage regulators which compensate for line drop on the underground system. In addition to these there are General Electric potential regulators on each of the five remaining lighting panels. These can be operated by hand if desired by turning a dial on the face of the panel. Any desired voltage can be maintained at the center of distribution by this method without having different voltage buses on which to connect the different feeder circuits.

Three wires from the 2300-volt busbars connect with an aluminum-cell lightning arrester located on this gallery. The usual equipment for charging the aluminum cells, together with the horn-gap arrester, is also located in the gallery. At one end of the gallery over the machine panels are three General Electric generator-field rheostats which are operated by a solenoid and ratchet attachment.

Fuses for the voltage-regulator motors on the underground system are inclosed in a steel cabinet fastened to the brick wall at the rear of the switchboard. All other motors used in or about the station are provided with special cir-

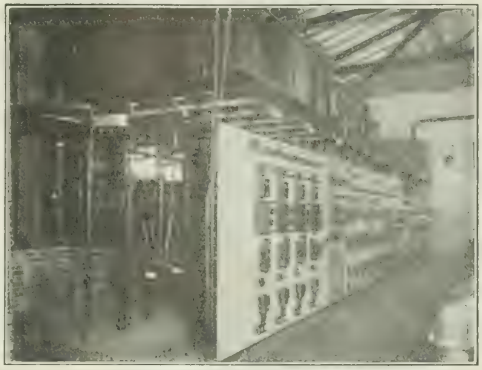


FIG. 6—MAIN SWITCHBOARD

cuits and fuses located in a separate panel box. A special bank of transformers supplies energy to lamps used for the station lighting. A three-blade double-throw switch installed in a special panel box may be used for transferring this lighting circuit onto the exciter busbars in case the 2300-volt system fails.

Since the city of Cedar Falls also receives its supply of electricity from Waterloo, a bank of three 75-kw General Electric transformers is installed in a room opening onto the main floor of the generating room. These transformers step the pressure from 2300 volts up to 10,500 volts. There are no disconnect switches on the Waterloo end of the 10,500-volt line, the oil switches being connected in the 2300-volt leads. The energy supplied to Cedar Falls is recorded on a separate panel from the rest of the energy generated.



FIG. 7—SUBSTATION TRANSFORMER INSTALLATION

A reproduction of the station log chart is shown herewith. It was designed especially for this company and is laid out so that when filed in a loose-leaf binder, comparisons can easily be made with any other date. By referring to this chart, weather conditions, period during which men are on duty, meter readings on electrical and steam appa-

showing the varying total kilowatt reading. On the reverse side of the sheet spaces are divided off in which curves are plotted showing the variation in current readings.

The cables which feed overhead lines in the city of Waterloo are carried up the wall back of the switchboard through conduit and run to the lightning arrester gallery, which is located at one end of the building under a cupola through which the cables are conducted outside. Choke coils and multiple-gap lighting arresters are located in this gallery.

In each substation cables run from the disconnect switches to separate transformer oil switches, which are connected with two banks of delta-connected transformers located on the second floor. The transformer banks can be operated separately or in parallel by closing a tie-over switch. Oil switches are connected in between the 2300-volt cables and two other circuits supplying one of the city's electric pumping stations and a motor-generator set located in an office building. The disconnect switches and the two last-named switches can be operated by hand only in the basement. The remaining switches are connected mechanically to switch handles on first-floor panels.

On the main floor is a six-panel switchboard and a 50-

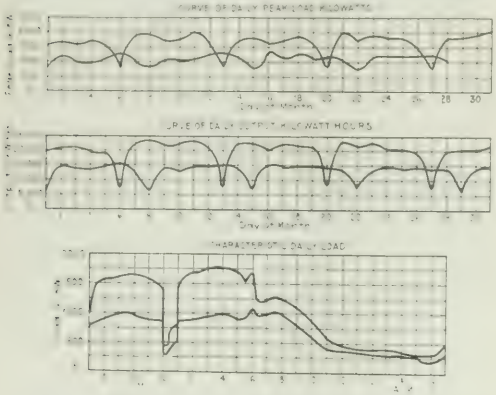


FIG. 8—CHARACTERISTIC LOAD CURVE

amp mercury-arc rectifier which is used in charging the company's automobiles. Two of the panels are equipped with apparatus controlling the 2300-volt circuits entering the station. The low-tension light and motor circuits are controlled on two other panels which are equipped with meters, switches, tie switches, etc.

Cables are brought from the oil switches in the basement through conduit to the second floor. Here they are run horizontally over the transformer banks and are supported on insulators secured to overhead racks. Each transformer bank consists of four 100-kva, oil-cooled General Electric transformers. The primary winding of two of the transformers are connected in parallel across one phase of the 2300-volt circuit and the two remaining transformers are connected in delta with them. The secondaries of the first two transformers mentioned are connected in series so as to give 220 volts across the extreme terminals, and a neutral tap taken out between them for lighting.

The secondary terminals from the transformers are connected to low-tension busbars consisting of 1.25-in. copper tubing which is run down the wall back of the switchboard on the first floor. The copper tubing connects to copper pot-heads sweated on cables which connect with the switchboard busbars.

At present five three-conductor low-tension cables run out of the substation described through the basement wall into a distributing manhole. For lighting service a grounded neutral is used. From the substation under consideration, two grounded neutrals extend in each direction; one has a cross-section of 1,500,000 circ. mil and the other has an area of 500,000 circ. mil. The other substation has two 1,000,000-circ. mill grounded neutrals.

The grounded-neutral three-wire system shown herewith

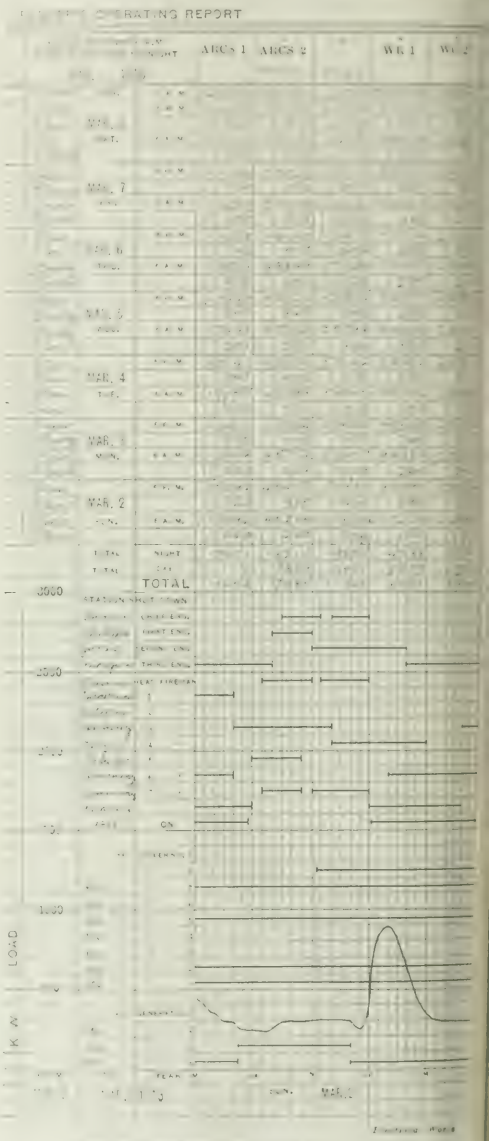



FIG. 9—SECTION OF LOOSE-LEAF RECORD

was designed by Mr. Austin Burt, manager of the Citizen Gas & Electric Company, of Waterloo. Mr. Burt plans to deliver a technical paper on the vector analysis of such a system before the American Institute of Electrical Engineers at some future meeting. The regulators placed as shown in the diagram permit of considerable unbalancing of the system without unsatisfactory voltage conditions.

## Water Sterilization by Ultra-Violet Rays

By Dr. Max von Recklinghausen

In Europe the ultra-violet rays are now being used industrially for the sterilization of water by the system which is based on the experiments made jointly by the writer with Messrs. Henri and Helbronner at the Sorbonne University, Paris, as described in the *Electrical World*, on April 6 and Dec. 30, 1911. It may be well to mention briefly the main principles embodied in these types of apparatus. The first requirement is that water free from suspended matter —that is to say, properly filtered water—be exposed as close as possible to a mercury-vapor quartz-tube lamp which is kept running at a high temperature, thereby producing economically ultra-violet rays in great quantity. To maintain this high temperature the apparatus must be so constructed that the water does not touch the source of light itself. In the first apparatus described the water flowed underneath the lamp, while in the large apparatus it passed successsively under four lamps. This principle is still applied in the industrial water sterilizer shown in Fig. , where the water circulates in an undulating fashion within a cone of light produced by a 110-volt, 3.5-amp quartz-tube lamp. Such apparatus has been in constant use in Europe for several years.

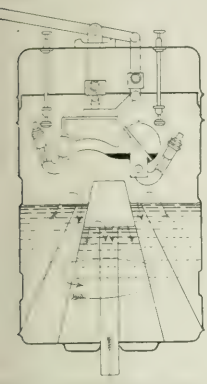


FIG. 1—APPARATUS WITH WATER BENEATH LAMP

This type of apparatus is being utilized by the army for field work. As indicated in Fig. 2, in this case it is placed on an artillery cariage, together with the necessary water pump, filter, gasoline motor-generator set, etc. Such a set makes use of any kind of river or spring water and produces therefrom safe drinking water for the troops in the field, combating thereby an enemy far more dangerous than the opposing army.

Installations of apparatus for large masses of water using a 220-volt, 3.5-amp lamp inclosed in a box fitted with quartz windows have now been in service in several cities in Europe, some even more than two years and a half, and have constantly done their bactericidal work in such a satisfactory manner that the writer was soon led to study the construction of larger units. An important element for such larger units was a more powerful quartz-tube mercury-vapor lamp. In making such a new lamp an effort was made to follow as closely as possible the practice previously established for the illuminating quartz-tube lamps regarding the proper temperature of the electrodes and of the luminous tube and the density of the vapor. It was considered desirable to avoid increasing the diameter of the luminous tube because among other difficulties trouble was foreseen in the regular manufacture of large quartz tubing. It was decided to utilize the same diameter of tubes and practically the same type of electrodes, increasing only the length of the lamp and therewith its operating voltage. The largest type of these new lamps now in service are used on a 500-volt circuit, operating with about 3 amp and 375 volts at the electrodes.

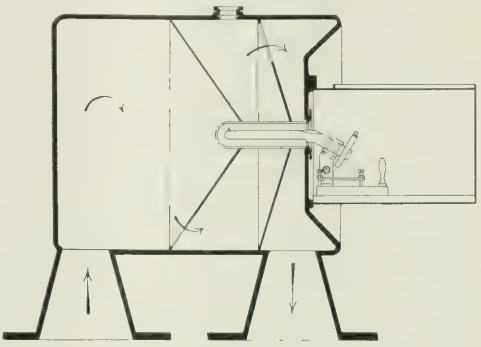


FIG. 3—SMALL UNIT FOR CITY-WATER STERILIZER

The most important change in connection with these new lamps has been in the shape of the luminous tube, which is not straight but U-shaped, the two branches being kept very close together. When viewed from the side in cross-section, as indicated in Fig. 4, such a lamp resembles more or less a pistol, and this name has been adopted for this type of the lamp. The reason for giving to the luminous tube of these "pistol" lamps the shape described above is to be able so to construct the sterilizing apparatus that practically all of the light given out by the tube is utilized. In

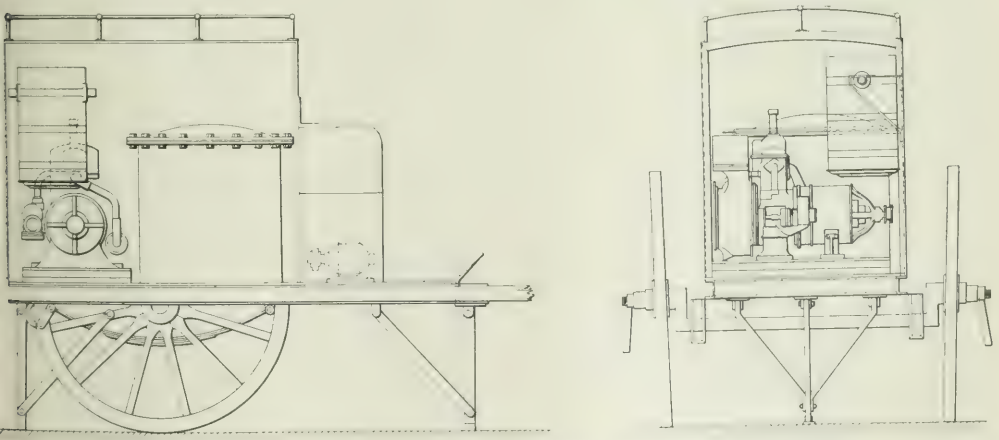


FIG. 2—TYPE OF EQUIPMENT USED IN ARMY AND FIELD SERVICE

the earlier type of apparatus only about 60 per cent of the light entered the water. The peculiar shape of the luminous part of the pistol lamps permits it to be inserted completely in a small cylindrical space, all the bulky parts of the lamp being only on one side and producing practically no shadow.

The lamps are started as heretofore by tilting. However, the lamp is removed from the cylinder and started in a kind



FIGS. 4 AND 5—A CROSS SECTION AND TOP VIEW OF THE U-TUBE LAMP

of a box fitted with a dark glass window which protects the operator. After lighting, the lamp is placed in the protecting cylinder, which itself is a quartz tube about 2 in. in diameter. This quartz tube successfully protects the lamp from contact with the water. The lamp box and the 2-in. quartz tube are fastened to a vertical metal plate, which plate itself forms one of the walls of the sterilizing chamber or is inserted into the wall of the water chamber or canal.

The ultra-violet efficiency of these lamps has been determined very closely by means of sterilizing and chemical tests and also by the effect on photographic paper. All these tests show this lamp to be much superior to the lamps formerly used, the improvement being far more than one would expect from the proportionate increase in the power consumption. For example, the ultra-violet production measured as above is fifty times as great as that of a 110-volt, 3.5-amp lamp, although the ratio of power consumption is only about four to one. This result is probably due to the mutual heating effect of the neighboring branches of

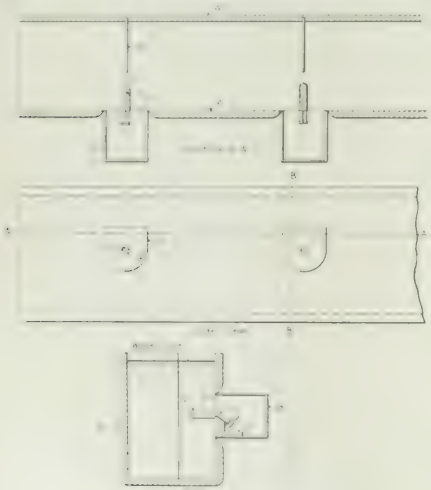


FIG. 6—DETAILS OF CANAL

the U-shaped luminous tube. Such lamps have been in service in a large European water plant for nearly a year and have given excellent satisfaction as to life and efficiency.

For small units for city water sterilizers—that is, from 500 to 2000 tons of water per twenty-four hours—only one or two such 500-volt lamps, constructed according to Fig. 3, are used. For larger water quantity use is made of a multiple unit consisting of a canal (Fig. 6) about 50 in. by 70 in. in cross-section through which the water flows. The canal is made of metal or else of reinforced concrete and coated with tiles inside. Into the walls of this canal are inserted ten or twelve of the above-mentioned 500-volt [illegible] lamp equipments, baffle plates of glass being inserted into the walls of the canal at proper places so as to keep the water continually stirred up while under the influence of the light. An electric water valve held open by the electric current used in all or some of the lamps allows the water to pass through this canal only when the lamps are in service, insuring thereby that no unsterilized water leaves the canal. For several minutes the water in such a canal is under the influence of the ultra-violet rays, although theorectically an exposure of infinitely less duration would be sufficient—such as a fraction of a second within 1 in. of the lamp. However, the writer prefers a longer exposure so as to allow time for turning over and over under the light any microscopic particles passing through the filters, behind which microbes might be hidden.

A canal of this type with twelve lamps has been in continuous operation for eight months in a municipal water plant in Europe. The water, which flows at a rate of from 7500 to 8000 tons per twenty-four hours from a river, is first cleared by a sand filtration plant. As will be seen the whole arrangement is extremely simple, and practice has shown that the apparatus needs scarcely any attendance.

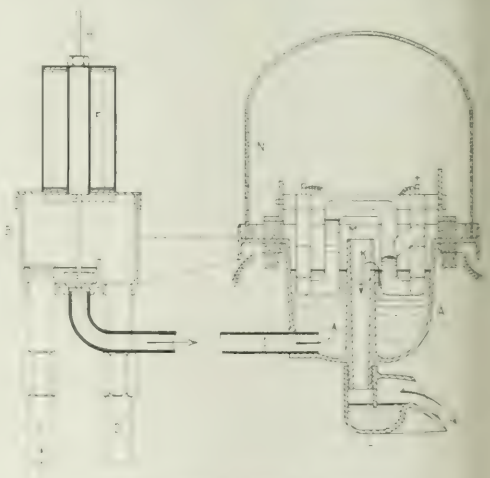


FIG. 7—SMALL DOMESTIC STERILIZER

During most of the time only a part of the lamps are in service, all being used simultaneously only in case the water is extremely dark. For large water plants the best plan is to make use of a number of such canal units.

Regarding smaller apparatus the most recent development is the small domestic sterilizer shown in Fig. 7. To promote simplicity in this type of apparatus it was thought desir-

ble to minimize the complications of the quartz-tube lamp self. The lamp consists of an ordinary U-tube, the necesary cooling of the electrodes being done by inserting the ercury containers partly into the water which is to be erilized, there being, however, no contact of the water ith the luminous tube itself. This procedure eliminates ie necessity of condensing chambers and enlarged elecodes. It is naturally important that the water level in this pparatus should not change during operation. This reult is obtained by means of large overflows indicated on ie design. This apparatus is designed to produce up to gal. of sterile water an hour. The lamp consumes about amp on a 110-volt direct-current system.

In conclusion it may be stated that experience shows that ny water can be sterilized by ultra-violet rays if it is free rom suspended matter. The only difficulties encountered practice have been attributable to such suspended mateals which escaped the rather superficial inspection of the ater. Whenever a careful observation does not disclose ny suspended matter one can be sure that the water is conomically sterilized by ultra-violet rays, the economy epending upon the transparency to ultra-violet rays of the articular kind of water. The transparency can easily be etermined by comparing the actinic effect from a quartz mp on photograph paper through a column of air and the ater being examined.

## Canadian Electrical Association Papers

In the issues of the *Electrical World* for July 5 and July 2 an account of the convention held at Toronto on June 5 to 27 were given. Below are to be found abstracts of apers and discussions relating to graphic meters, integrating attmeters with recording attachments, magnetite arc lightng, flame carbon arc lamps and electric vehicles.

### Magnetite Street Lighting

Mr. L. Burpee, of the Canadian General Electric Comany, in a paper on "Magnetite Street Lighting," traced ie development of the arc-lighting industry from the old irect-current arc lamp to the present luminous arcs. He lso compared the power consumption and life of the arious types of arc lamps, showing that while the 6.6-amp iagnetite lamp has an energy consumption only slightly reater than that of the open-arc lamp, its specific conumption is 0.38 watt per hemispherical candle-power as ompared to 0.59 in the case of the open-arc lamp. Speakng on the subject of ornamental street lighting, the author aid that for some years back the desire, especially in ongested thoroughfares and on residential streets and arkways, for ornamental lighting was first met by tungsten lusters on ornamental standards spaced about 75 ft. apart n both sides of the street, but, owing to the fact that the fficiency of this system was very low and maintenance nd operating charges high, the magnetite lamp has been dopted for ornamental lighting within the last two years, ith excellent results. He rehearsed all the advantages of he ornamental luminous-arc standards for downtown, resiential and parkway lighting, describing the lamps and ectifier outfits for such systems. Lantern slides were also hrown on the screen showing the magnetite arc instalations in New Haven, Utica, Baltimore, Calgary and Edmonton.

### Flame Carbon Arc Lamps

The long-hour series alternating-current flame carbon rc lamp of the Westinghouse Electric & Manufacturing Company was described by Mr. T. J. Pace, of that comany, and its advantages and applications were pointed out. One of the most interesting applications in this particular orm of lamps is to low-frequency circuits of 25 cycles. Since the light of an unimpregnated carbon arc is emitted rom the positive crater, the source shifts continually from upper to lower electrode with each reversal, and as this results in giving alternately a downward and an upward illumination, the light variation at this low frequency is very marked. In the flame or impregnated carbon arc the light is obtained from the arc screen and is therefore independent of the polarity. There is, of course, a slight decrease of light at each reversal of current due to cooling of the arc gases. This, however, is not considered objectionable in industrial plants where the need of the work does not require accuracy of vision. The author predicted that the long-burning flame carbon lamp will be more freely used in the future on low-frequency circuits for street lighting than at present. Stereopticon slides were shown of street lighting in some Pennsylvania towns and also of the illumination of the Baltimore armory during the Democratic convention in that city last year.

The papers on luminous-arc lamps were discussed in common, Messrs. A. L. Mudge, of the Electric Power Company, Ltd., of Toronto; H. W. Hillman, of the General Vehicle Company, Long Island City, N. Y.; Wills Maclachlan, of the Trenton Electric & Water Company, Belleville, and Messrs. Howell and Hastings, of Toronto, participating. Mr. Mudge said that the five-lamp tungsten clusters were not so good as the magnetite arc for the business sections of cities and that in Calgary, where the magnetite lamps are mounted on the trolley posts on both sides of the street about 18 ft. from the ground, good results are obtained. Magnetite arcs are installed on Eighth Avenue, whereas tungsten clusters are to be found on Seventh Avenue in Calgary, so that a comparison of both systems can easily be made. In the residence section of Calgary the magnetites are widely spaced on high standards, but give good results owing to the fact that there are no trees on the streets of Calgary. Mr. Hillman told of the development of the magnetite-arc lamp, work on which was started fourteen years ago. The lamps, however, were not placed on the market until fully developed. Mr. Maclachlan said an excellent impression of the relative merits of the tungsten cluster and the magnetite standard could be had from the square at the junction of Main and Genesee Streets in Buffalo looking toward the Buffalo General Electric Company's new building. On the street the right magnetite arcs are installed, while the street leading off to the left is equipped with tungsten standards. Mr. Howell questioned the advisability of installing magnetite lamps in residential sections where the light would enter the sleeping rooms on the upper floors. It was pointed out also during the discussion, in answer to a question, that rectifiers operating on 25-cycle circuits gave a frequency of 50 on the direct-current side. This is obtained by intermixing the two parts of the secondary coil.

### Graphic Meters

Mr. G. D. Gratton, of the Electric Power Company, Ltd., of Toronto, gave a review of the experience and methods followed by his company with graphic meters. After stating the general principles of the measuring element of graphic meters, the author said that the selection of any particular meter depends on several conditions, such as the nature of the load, the terms of the contract and the accuracy by which the load must be measured. If the charges are based on the indications of the meter, it is important that it should be accurate even if accuracy can only be obtained at great cost, while, on the other hand, if the meter is merely intended to show the nature of the load, a cheaper instrument will suffice. The speed at which the paper should travel is also determined by the character of the load to be measured and the duration of the peak, especially in the case of graphic wattmeters. For instance, on a light load, with a slow rising and falling peak and generally a peak of rather long duration, a paper speed of 1 in. per hour may be used with good results. On the other hand, with a motor load comprising mill machinery, such

as rock crushers, air compressors, pulp grinders, etc., where the load is fluctuating and the peaks are of short duration, if a high speed is used the curve will be extended and the intervals between the peaks plainly distinguished. For a one-minute peak a chart speed of not less than 4 in. an hour should be used, but in general a chart speed of 1.5 in. or 2 in. an hour will suit the majority of cases and will permit a peak of short duration (not less than five minutes) to be scaled with accuracy. Moreover, a meter with a fairly wide chart is better adapted to accurate reading than one using a narrow chart, especially in the case of large wattmeters and ammeters. According to the author, the scale of a graphic meter should be so chosen that with the average working position of the pointer it will be at least half-way across the chart. This tends to accuracy in reading and in the case of an alternating wattmeter will permit it to operate on the load with a lower power-factor without overloading the series windings and still keep the pointer well up on the scale. On the question of repairs and maintenance the author was particular to state that, inasmuch as a large portion of the work is light and delicate, repairs should not be attempted by anyone who has not had previous experience in such work. He also stated that it is very poor policy to buy a graphic meter, which while low in first cost is constantly in need of repairs. The cost of doing various kinds of repairs (labor only) as found by the writer is as follows: Hand-wound clocks, $1.60 to $4, average $2; motor-wound clocks, $0.75 to $3.50, average $2; clock motor, $2; paper mechanism, $2 to $6.50; replacing pivot, $1.80; repairs to pen, $1 to $2, average $1.80; dotting mechanism, $1.50 to $4, average $2; pen-lifting mechanism, $1.50, pen-shaft bearings, $1; cleaning jewels and contact points, $2; repairing resistances, $5; repairing control circuit, $2.

After giving some information on shop testing and testing in service, the author accentuated the following points which should receive consideration when deciding on the purchase of a graphic wattmeter: (1) Size of the contracted load and the possibility of a quick increase; (2) the kind of load, whether steady or intermittent; (3) the power-factor of the load; (4) the length of the contract peak and its relation to the actual peak (this is in order to determine the correct chart speed); (5) the maximum fluctuations of the load or the average fluctuations.

### Integrating Wattmeters with Recording Attachments

Mr. H. S. Baker, of the Ontario Power Company, Niagara Falls, Ont., in a paper described a form of integrating demand meter developed by Messrs. S. Piek and R. C. Downing, of the Niagara, Lockport & Ontario Power Company, which graphically registers integrations of power during intervals of one minute or longer. A Westinghouse watt-hour measuring element is used and the clutch device which operates the recording mechanism is upon a shaft which rotates once for every hundred revolutions of the meter shaft. On the clutch shaft an electrically released clutch is mounted which remains closed for an interval of one minute. A contact operated by clockwork mechanism serves to disengage the clutch so that it can be pulled back to zero position by a spring. The opening of the clutch contact allows the clutch to close and be driven for another minute by the watt-hour element. Upon the driven half of the clutch is an arm which engages a pen mechanism so arranged that the linear deflection of the pen in a direction at right angles to the travel of the paper is proportional to the number of revolutions of the clutch which engages the recording element with the rotating spindle of the watt-hour meter. The deflection of the pen at the expiration of the time element selected for the measurement of the demand measures the kilowatt-hours consumed. Instead of entirely resetting the pen at the expiration of each such period to the zero position, the pen is only partially returned, but is reset to zero or near it every six hours by a separate electromagnet energized through a corresponding six-hour contact on the clock. The chart in these meters is registered on a strip of paper 5½ in. wide and 45 ft. long passing through the meter at the rate of 1 ft. a day. The paper has only one line on it—namely, the zero line—and is pulled through the meter between rubber rolls. The deflections are measured both in calibrating and in billing from the top edge of the zero line to the top edge of the ink line drawn by the pen. The one-minute integrating peak of power is represented by the momentary peak on the chart, which is not affected by paper speed. The clock is wound electrically from the potential circuit feeding the meter or some other potential circuit every 14.4 minutes, but a no-voltage release is provided which connects the clock winder to a set of dry cells whenever the voltage fails owing to customers' switching or otherwise. Another no-voltage release is provided which closes a contact that operates the clutch magnet as soon as voltage is again established, thus avoiding the registering of a fraction of a minute of power before shut-down plus another fraction after starting up, which might amount to nearly two minutes of power. The following advantages are claimed for the meter: (1) Reduced interruptions to meter chart due to clock and pen trouble; (2) increased permanency of calibration; (3) increased accuracy in reading of peaks on account of peaks on chart being definite; (4) reduced maintenance expenses; (5) determination of peaks on kilowatt-hour basis.

### *Discussion*

Both of the foregoing papers were discussed at the same time, Messrs. R. J. Smith, of the Canadian Electric & Water Power Company, Perth; H. S. Baker, of the Ontario Power Company, Niagara Falls; C. G. Keyes, of the Ottawa Electric Company, and A. A. Dion, of the Ottawa Electric Company, participating.

### The Electric Vehicle

In a paper on "The Electric Vehicle," prepared by Mr. Stephen G. Thompson, of the Electric Vehicle Association of America, it was pointed out that, although there is ample field for the use of the electric pleasure machine, the probabilities of its wide general adoption are remote. On the other hand, visible evidence of the possibilities of electric commercial vehicle application is apparent on the slightest investigation. The author pointed out that with those concerns of whose business a considerable part is teaming or delivering electric trucks find special favor. The field of application of the gasoline machine is not generally found within city limits. Stops and starts reduce its average speed to a point below that of the electric vehicle, and the total running time possible in a full day's operation is not sufficient to allow a mileage radius beyond that of the electric. Paradoxical though it may seem, an electric machine of moderate speed capacity will move faster in city streets and where the stops are numerous than will the higher speed gasoline truck. The author proved this point by tests which showed that an electric vehicle possessed a general average speed nearly 10 per cent greater than that of a gasoline machine, notwithstanding the fact that the latter was geared to a speed 50 per cent higher. Data on the operating costs of motor vehicles in several similar lines of business also disclosed the fact that for the electric vehicle the average cost per mile for maintenance increased only 13⅓ per cent for a period of four years, while that of the gasoline machine increased 362.5 per cent in the same time, and further at the end of the four-year period the maintenance cost for the electric vehicle was less than 50 per cent of that of the gasoline. These figures, representing fifty-four gasoline and sixty-nine electric machines, were obtained from the records of the operators themselves and included all items chargeable to the replacement of mechanical apparatus, storage batteries and tires. The reason for

the disparity is found in the simplicity of construction and design of the electric. Moreover, because of the characteristics of the motor, the electric machine is not subjected to the abuses of an unskilled operator, so that the machine is seldom out of service for any extended time. Considering the increased high average speed of operation and the decreased operating cost, the author said it is no wonder that nearly all of the large vehicle installations are of the electric type and that less than ten active electric vehicle manufacturers are marketing over 20 per cent of the total number of commercial motor vehicles employed, in competition with over 300 manufacturers of gasoline trucks.

### Electric Vehicles from the Central-Station Point of View

Mr. C. Rummel, of the British Columbia Electric Railway Company, Vancouver, B. C., in a paper treating the electric vehicle from the central-station point of view, stated that his company found that the practice of selling vehicles through combination agents did not result satisfactorily to its interest in connection with the sale of electric cars of the commercial type. As a result of these conditions, the company this year decided to take an agency, enter the selling field and make a genuine effort to introduce electric commercial cars within its territory. The company purchased three electric trucks last year for its own work, and on the basis of the good showing made by the few trucks in use in Vancouver it felt that vigorous efforts should be made to introduce the electric commercial vehicle, although it then still preferred to leave the matter in the hands of the agents, provided the business was properly pushed and adequate garages were afforded. Upon canvassing the agents the outlook was far from encouraging, so that the company decided to take up the matter itself. At the very outset it engaged an electric-vehicle expert of eleven years' practical experience both in selling and garaging. This man received the advantage of extensive advertising in the daily press, thus thoroughly acquainting merchants with the advantages of electric trucks as well as the entrance of the company into the business. The salesman began his campaign among the wholesale merchants on Feb. 15, and a very effective method followed was to offer the service of one of the company's trucks to reliable merchants for an ordinary day's delivery. Since the campaign began the company has sold a 2-ton truck to a wholesale fruit merchant, a 2-ton truck to a wholesale hardware firm and a 1-ton truck for a hotel bus. During the period the company has also found use for two 2-ton trucks, which have replaced a gasoline truck and a horse-drawn wagon, and a business electric vehicle for the light and power department. In addition to the company's orders there have been sold to Vancouver firms through outside agents a 2-ton truck of the electric type to a milling firm and a 750-lb. delivery rig to a local fish merchant. The company generally orders the chassis only, the bodies and tops being built in the city to suit the purchaser. This plan is necessary owing to the duty on cars imported from the United States. A garage is now being built in the center of the city and a charging outfit, consisting of a motor-generator set rated at 45 kw, is being installed. For caring for electric vehicles of the commercial type the charges range from $45 a month for a 750-lb. truck to $70 for a 5-ton truck. These charges cover the supply of energy, charging of the batteries, storage of the vehicle, daily washing and oiling and the making of minor adjustments. It is not the intention of the company to care for pleasure vehicles in the garage, since this work is receiving the attention of the regular garages, where a monthly charge of $30 is made for general garage services, covering charging of batteries, washing, oiling, etc. Since entering the field the author said he noticed that the vehicle manufacturers look for the assistance and co-operation of the central station and that every central-station manager along the Pacific Coast is fully alive to the possibilities of the electric vehicle as an energy-using device. If the manufacturers will for their part bring the cost of the truck within reach of the average merchant, the co-operation attained will be most effective and complete.

### *Discussion*

The two papers devoted to the electric vehicle were discussed in common, Messrs. W. L. Bird of the Kaministiquia Power Company, Fort William; B. C. McBurney, of the Canadian General Electric Company; W. H. Munro, of the Peterborough Light & Power Company; A. A. Dion, of the Ottawa Electric Company; R. A. Merritt, of the Toronto Electric Light Company, Ltd.; G. W. Magalhaes, of the Toronto Electric Light Company, Ltd.; H. W. Hillman, of the General Vehicle Company; Wills Maclachlan, of the Trenton Electric & Water Company, Belleville; C. G. Keyes, of the Ottawa Electric Company; A. B. Lambe, of the Department of Inland Revenue, Ottawa, and J. D. Lachapelle, of Montreal, joining in the discussion.

Mr. McBurney stated that it was the intention of the Canadian General Electric Company to manufacture and assemble electric trucks at Peterborough. He also suggested that central-station companies act as agents for electric trucks, for by so doing they could standardize the trucks in a city and carry spare parts. Mr. Dion said that if the first cost could be spread over a number of years the price of the vehicle would not be so high. That gasoline cars are so much cheaper he attributed to large output, and he said if by means of co-operation more electric cars could be built the price of these would also be lower. He could not convince himself, however, that a central station should handle cars, since competition would bring best results. Manufacturers of vehicles, he contended, do not push the sale of their vehicles. His company was induced to buy a truck on the plea that the manufacturer could then sell others, but thus far the manufacturer has not made a sale. Mr. Merritt told of the status of the electric vehicle in Toronto, where the company is making no effort to push any particular vehicle. The rates for charging are 5 cents for the first 50 kw-hr., 1 cent for the next 50 kw-hr. and 0.5 cent for all in excess on one month's bill. The average return ranges from $10 to $12 per month per vehicle. There are at present eighteen electric trucks in use in Toronto and about 125 pleasure cars. The Toronto company also does not believe in acting as agent for any particular make of truck, because customers come to the lighting company for advice. By using tact with agents, he said, competition can be relied on to effect sales. The income per kilowatt demand from electric trucks, he claims, is five times what it is from other classes of service such as flatirons, heating devices, etc. The two charging stations in Toronto are equipped with motor-generator sets, payment for which the company accepts in instalments extending over five years. Rectifiers do not give good results in Toronto, owing to the fact that there are intermittent interruptions in the service and the regulation is not good. Mr. Hillman told of the sales made by the central stations in Hartford, Conn., and Baltimore, Md., the former selling 50 trucks and the latter 100. The Hartford company also sold during the month of May eight trucks to six new customers. He enunciated the principle that central stations should guide and lead the merchants in the vehicle business, as they do in the lighting and motor business.

Mr. Maclachlan questioned the feasibility of using electric vehicles in small towns where the roads are very bad and where paved streets do not obtain, and Mr. Lachapelle told of experiences in Montreal on bad streets where the chief item of expense was repairs to jars. Mr. Bird told of the excellent results obtained with electric vehicles in Denver and Kansas City.

# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Illuminated Billboard Advertising

Like electric service companies in a number of other cities, the Commonwealth Edison Company of Chicago does a good deal of illuminated billboard advertising. The accompanying illustration represents one of the many bill-




ILLUMINATED BILLBOARD IN CHICAGO

boards used for this purpose. In this case the announcement relates to the domestic appliances sold in the Electric Shop. The illuminated display is painted in colors and is effective either by day or night. Five tungsten lamps in conical reflectors are used to illuminate the board. Similar signs are in use in various parts of the city to exploit the use of electrical energy and electrical appliances.

## Boston Electrical Development Increasing

The report of the Wire Commissioner of Boston, Mr. James E. Cole, which has been made public for the year ending Feb. 1, 1913, shows a striking increase in electrical development during the period covered. The total generating equipment of the electric plants of the city expressed in engine and turbine rating, is 336,659 hp, compared with 294,128 hp a year ago, and there are now in service 26,129 motors aggregating 453,953 hp, compared with 22,858 motors of 365,217 hp combined rating early in 1912. The average size of motor is now 17.3 hp, or a gain of about 1.3 hp in the year. The largest system supplying motors with energy is that of the Boston Elevated Railway Company, which owned 8317 motors of 362,340 hp total rating at the end of the fiscal year as against 6911 motors of 285,640 hp rating twelve months previously. The Edison Electric Illuminating Company of Boston reported 15,250 motors of 70,541 hp on its system for 1913, a gain of 1709 motors and [illegible] per cent in connected motor load.

At the date of the report there were 363 generating plants in service in Boston, there being no net gains or losses in the number of isolated plants in the city. Within the last five years the rating of the generating stations in Boston has increased by over 100,000 hp, or nearly 50 per cent. The underground electric service now installed comprises 2,123,687 ft. of conduit, 13,293,693 ft. of single duct and 16,959,649 ft. of cable, there being 9405 manholes. In the past year there were installed 180,688 ft. of conduit, 930,341 ft. of duct, 1,631,345 ft. of cable, 730 manholes, 1542 services and 9150 ft. Edison three-wire tube. Of this material the Edison company installed 1,211,134 ft. of underground cable, 369,695 ft. of duct and 98,754 ft. of conduit, exceeding the installation of all other concerns with the exception of the New England Telephone & Telegraph Company, which installed 393,358 ft. of duct. The wire used in Boston cable service varies in size from two-conductor telephone and messenger leads to 2,000,000-circ. mil feeders, the largest telephone cable having 600 pairs. During the year the department removed 191,800 ft. of overhead wire and owners removed 2,104,559 ft.

During the year the Edison company installed an additional 15,000-kw turbine at the South Boston station, with eight 508-hp water-tube boilers equipped with Murphy stokers in compliance with the smoke law. Additions have been made to various substations, and new substations are shortly to be completed for service in West Roxbury and in the rapidly developing Park Square section of Boston. During the year the Boston Elevated Railway Company installed a third 15,000-kw unit at its South Boston station.

Regarding fires, in the report it is pointed out that during the year none was due to wiring or apparatus approved by the department, and those due to electrical causes were with a few exceptions insignificant in character, the total insurance loss as a result of so-called electrical fires being only $13,917 for the entire city.

## The Electric Vehicle in Department-Store Service

Investigation of electric delivery service for department stores frequently confronts central stations advocating motor-vehicle transportation, and data bearing upon this branch of the industry are often helpful in indicating the economy of electrical operation in comparison with horse traction. In the following tables are given the results of a recent study by a central station of the estimated cost of electrifying the service of a New England department store, comparing the expenses on a mileage basis and taking account of both fixed and operating charges:

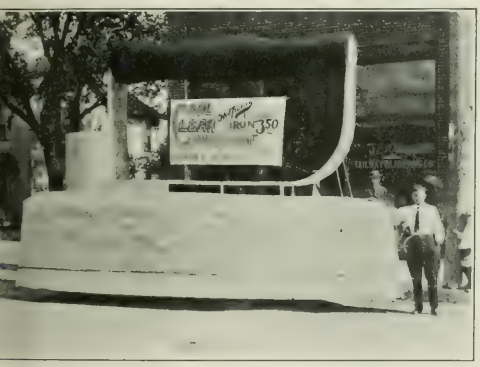
ELECTRIC DELIVERY SERVICE FOR NEW ENGLAND DEPARTMENT STORE

| | | |
|---|---|---|
| [illegible] delivery wagon less horses, tires and [illegible] top and side entrance ... | $300.00 | $1,650.00 |
| Cost complete with body, Edison A-4 battery and tires, or two horses and necessary harness.... | 900.00 | 2,600.00 |
| Depreciation on complete wagon, less tires and batteries or harness and horses..... | 30.00 | 165.00 |
| Interest at 5 per cent on complete investment.. | 37.50 | 98.75 |
| [illegible] costs..... | 67.50 | 253.75 |
| Fixed daily cost..... | 0.23 | 0.85 |
| [illegible] per Mile | | |
| Electricity, at 0.8 cent per kw-hr., off-peak rate.. | ... | 0.45 |

| | | |
|---|---|---|
| orse feed: Oats, $0.60; hay, $26; 15 qt. oats per day, 10 qt. Sunday; 12 lb. hay daily, 8 lb. Sunday; cost per week, two horses, $5.83; cost per mile for 200 miles per week | 0.029 | ... |
| epreciation on batteries, $1,200 for eight years, 15,000 miles per year | .... | 0.01 |
| epreciation on horses, $550 for four years, 10,000 miles per year | 0.014 | ... |
| epreciation on tires, "Firestone," $140 set solid, 10,000 miles | .... | 0.014 |
| epreciation on harness, 14 per cent or $8 per year; shoeing, $1 per week for two horses; wagon repairs, $15 per year; veterinary service for two horses, $10; total cost per year, $85 per mile | 0.07 | ..... |
| echanical upkeep | ... | 0.04 |
| ages for auto delivery service: Driver, $2.50; helper, $1; total, $3.50 for 50-mile day; per mile | ... | 0.07 |
| ages for horse delivery service: Driver, $2.25; helper, $1; total, $3.25 for 33-mile day; per mile | 0.10 | 0.1025 |
| otal operating cost per mile | 0.15 | ..... |
| *perating Cost per Day:* | | |
| perating cost, 33 miles per day | 4.95 | 3.38 |
| aily fixed charges | 0.23 | 0.85 |
| able and garage service, washing, polishing, etc. | 1.00 | 0.50 |
| otal operating cost per day | 6.18 | 4.73 |
| aving per day by electric service, 23 per cent, or | ... | 1.45 |

## A Winning Flat-Iron Float

The winning float exhibited in the industrial parade held t Merrill, Wis., July 4, was the mammoth electric flat iron ntered by the Merrill Railway & Lighting Company, and




FLAT-IRON FLOAT, MERRILL, WIS.

llustrated herewith. This monster iron was constructed of ight wood ribs covered with paper and cloth, the whole orm being built over the body of a Detroit Electric underlung roadster. The "iron" measured 18 ft. long, 10 ft. vide, and 14 ft. high. Advancing down the street with no isible guidance or means of propulsion the display created ively interest among the by-standers. The illustration was urnished by Mr. F. W. King, and shows the unique display standing in front of the Merrill company's office.

## St. Louis Board of Education Purchases Electric Trucks

To replace its horse-drawn vehicles the St. Louis Board of Education has recently purchased four Baker electric trucks which will be used in distributing supplies and in transferring furniture. Permanent garages will eventually be built but at present the warehouses used by the board are being utilized as temporary garages. Electricity for charging the batteries is furnished by the municipal generating station. Three of the trucks have two tons capacity, and the fourth is capable of hauling one ton. Each of the trucks is supplied with Exide Ironclad storage batteries. In choosing this type of vehicle it was found that the mileage required on one charge and the traffic speed desired was within the possibilities of the electric truck. In answer to bids for furnishing drayage facilities, the electric truck was quoted at a lower figure than horse vehicles.

## Electric-Cooking Service in Two Idaho Cities

The valuable results to be accomplished by energetic electric-cooking campaigns have been fully demonstrated during the past few months by the commercial departments of the Great Shoshone & Twin Falls Water Power Company of Twin Falls, Idaho, and the Southern Idaho Water Power Company of Pocatello, Idaho. Early in the summer of 1912 there was begun a campaign of advertising, publicity and education of the public in the use of electricity for cooking purposes. This was not attempted, however, until many tests had been made to determine the most reliable electric-cooking devices available.

Newspaper advertising was followed by a rapid succession of circular letters, tending to interest the public further in the advantages of the electric range over fuel-burning stoves. Public demonstrations of electric cooking were held, and the people turned out by the hundreds. At one exhibition in Twin Falls more than 1000 visited the display rooms in one day, and each was served with a small portion of a daintily prepared, electrically cooked food. The demonstrations were followed up by well-planned solicitations for the sale of electric ranges among consumers.

During the fall of 1912 about sixty complete electric ranges of various sizes were sold. A carload of 125 Simplex ranges was ordered later during the winter, and practically all of this shipment has already been actually sold or spoken for. Five hotels and several restaurants and bakeries have during the past six months discarded all kitchen fuel and are using electricity exclusively for cooking and baking purposes.

The greatest difficulty experienced thus far in the sale of electrical ranges is the fact that the customers have no means for disposing of their fuel ranges. Were the people able to dispose of their fuel ranges at anything like a reasonable price, there would be little difficulty in selling a thousand electric ranges during the current year. The campaign of advertising and publicity has been very fruitful, and the public is not only interested but it is already thoroughly convinced that the electric way is really the best.

The two companies referred to have adopted a rate of 2.5 cents per kw-hr. for energy used for domestic cooking. For commercial cooking the guarantee-rate schedule is as follows:

COMMERCIAL COOKING RATES

| Monthly Guarantee per Kw Connected | Rate per Kw-hr., Cents |
|---|---|
| $1.50 | 2.0 |
| 2.00 | 1.5 |
| 2.50 | 1.4 |
| 3.00 | 1.2 |
| ... | 1.0 |

A marked diversity-factor is to be considered in determining the actual revenue obtained from electric-cooking installations. This is especially true in the case of domestic electric-range equipments. It is reasonable to consider three divisions: one due to the non-coincident use of all the ranges connected, one due to there being separate switches for each heating element, and one due to the three-heat arrangement on each individual element. The maxi-

[illegible] and broiler cannot both be connected at the same time. By this arrangement the maximum demand of the No. 6 range is reduced to [illegible] and that of the No. 7 range to 3510 watts. This has been found to work little or no hardship on the one using the range and is an advantage to the electric-service company. From the company's records of its consumers the average revenue from the domestic cooking ranges installed prior to April 1, 1913, was $3.89 per range.

## Electrical Propaganda on Wheels

Leaving Chicago on Independence Day for Marshall, Mo., the new electrical exhibition car *Electra* of the Middle West Utilities Company began a career that is hoped to have a sensible influence in extending the demand for electricity in smaller cities and towns of the country. Reference was made to this car on page 1154 of the *Electrical World* of May 31 last in the article entitled "Unified Public Utilities in Central Illinois." The car is sent out under the direction of Mr. Mike S. Hart, general manager of the commercial department of the Middle West Utilities Company, and is in immediate charge of Mr. F. H. Soden, an electrical man of wide experience, who travels with the display.

The car, illustrated herewith by exterior and interior views, is 60 ft. long and 10 ft. wide over all. It is a standard-gage double-truck car built by the McGuire-Cummings Manufacturing Company of Chicago, especially for the purpose of giving electrical exhibitions, demonstrations and entertainments in various cities, and is designed to operate over steam and electric railways as a trailer.

It is planned to spend a day or two in each town visited. Several hundred feet of insulated wire is carried by which the car may be connected to a local pole line wherever it is stopped. In the car there is a regular distributing board controlling the various circuits, including the outside signs and the outlets to which apparatus is attached for demonstration. A Thomson watt-hour meter measures the consumption of energy.

Arrived in a town, the car is connected to the local source of electrical energy. After dark a screen which is carried is set up about 100 ft. from the car and by means of an Edison machine, also forming a part of the car's equipment, a moving-picture show is given. This and the previous announcements serve to attract an audience. A phonograph is part of the equipment and this gives selections during the intervals between moving-picture displays. After the show the audience is invited to inspect the exhibition in the car. Mr. Soden travels with the car from point to point and is aided in each town by local salesmen. The car runs on a two-week schedule.



FIG. 1—EXTERIOR OF EXHIBITION CAR

Electric signs form a conspicuous feature of the exterior. The words "Free Electrical Exhibition" are outlined in electric lamps when the car is stationary at night, two signs extending longitudinally on the roof of the car one on each side. When the car is traveling these electric signs are covered by outside painted signs lettered with the words "Do it Electrically." The large electric signs are



FIG. 2—INTERIOR OF EXHIBITION CAR

operated by a flasher installed inside the car. Ten-watt tungsten lamps are used. In addition there are miniature signs displaying the words "Entrance" and "Exit" above the four main doors leading into the car. Folding steps with railings are provided to give access to these doors from the ground. During cold weather the car will be heated by a hot-water system.

The interior of the car contains a large exhibit space surrounded by a substantial railing and with a passageway running alongside. At one end is the office and stateroom, with sleeping accommodations, for Mr. Soden, and at the other end of the car a complete electric water-pumping outfit as a demonstration, and the heating plant. Every inch of space in the car is utilized to some purpose. Printed matter is laid out for distribution on the railing and signs of various kinds are displayed. Three windows are provided on the passageway side of the car.

A great variety of electrical appliances is exhibited, including flatirons, lamps and fixtures, desk lamps, cooking stoves, washing machines, cooking utensils, percolators, toasters, signs, meat choppers, desk fans, luminous heaters, miscellaneous motors, coffee grinders, vacuum cleaners, electric drills, bell transformers, electric incubator, feed grinder, glue pot, sewing-machine drive, horse clippers, soldering irons, dentists' equipment, vulcanizers, pumping machine, electric traveling sets for women, massage apparatus and other electrical necessities and conveniences.

The apparatus exhibited was purchased outright by the Middle West Utilities Company from a number of manufacturers, including the General Electric Company, Westinghouse Electric & Manufacturing Company, Simplex Electric Heating Company, Federal Sign System (Electric), Hotpoint Electric Heating Company, A. J. Deer Company of Hornell, N. Y.; Chicago Pneumatic Tool Company, Electric Manufacturing Company of New Orleans, Reliable Electric Company, Dayton Pump & Manufacturing Company, Chicago Miniature Lamp Company, Pelouze Manufacturing Company, Hylo Lamp Company and Mid-West Sales Company.

In addition to the electric signs the exterior of the car is tastefully lettered with painted signs. One inscription arranged in a circle reads "Safe, Clean, Modern, Economical, Convenient Electricity for the Home, Store, Factory, Farm." A special effort will be made by means of this car to bring about a greater use of electricity.

# Illumination and Wiring

## Electric Wiring and Illumination of the Continental and Commercial Bank Building, Chicago

Modern practice in the electrical equipment of a large banking and office building is well displayed in the construction of the Continental and Commercial National Bank

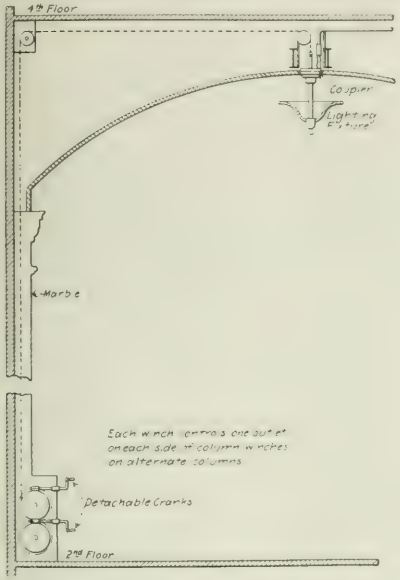



FIG. 1—SCHEME FOR LOWERING LIGHTING FIXTURE

Building in Chicago, now nearing completion. The edifice is one of the largest office buildings in the city, occupying an entire block. It is a twenty-story structure, 260 ft. high, having a frontage of 323 ft. on West Adams and Quincy Streets and 166 ft. on South LaSalle Street and South Fifth Avenue. The framework of the building consists of steel; the exterior walls on the lower floors are built of granite blocks, and the remainder of the exterior is of dull-finished terra cotta, matching the granite.

The greater portion of the first floor will be occupied by the Hibernian Banking Association and the Continental & Commercial Trust & Savings Bank. The second floor, which is really the main floor, will be used by the Continental & Commercial National Bank. Here the entire space, with the exception of the four corners of the building, which are devoted to elevator shafts, is taken up by banking quarters. No pains have been spared by the architects, D. H. Burnham & Company, in making every detail on this floor elaborate. Running the whole length of the central portion of the building is a large semi-cylindrical arch having a radius of 32 ft. with crest about 65 ft. above the level of the banking floor. A portion of this arch is covered with a clear-glass skylight which opens into a court which extends up through the building. It is asserted that this is the largest clear-glass skylight which has ever been installed.

On each side of the main arch are two smaller arches running parallel to it, with crests about 38 ft. above the level of the floor. The drop beams between these arches are supported on tan-colored marble columns arranged in four sets of ten columns each. Two spacious stairways open into the central portion of the banking space opposite the LaSalle Street and Fifth Avenue entrances.

In addition to occupying the second floor the bank will use the third and third mezzanine floors as well as about one-third of the fourth, fifth, sixth and seventh floors. The remaining portion of the upper floors will be leased to tenants, most conspicuous among whom, perhaps, will be the United States Steel Corporation and its subsidiaries, which will take about six floors.

### Electric Crane for Skylight Cleaning

The electrical equipment of this building is no less interesting than the architectural construction. One of the novelties is an electrically operated traveling crane, by means of which the under side of the skylight will be cleaned and washed. This crane consists of a steel arch supported on wheels which run on tracks on each side of the main arch. As the wheels on both tracks are designed to exert a tractive effort, and as only one motor is used to drive them, a series of shafts and bevel gears is used to connect them. The motor which is of 2 hp, is supported on the south leg of the traveling crane, and is operated by a 110-volt storage battery, also supported on the crane. On the top of the crane are steps on which the men who clean the skylight may stand. Tanks containing the water used in cleaning the skylight are also supported on the crane.

To conceal the crane when it is not in use, a receptacle was built in the wall at the west end of the main arch. In this recess is a 110-volt terminal and a battery-charging rheostat. When the crane is run into the recess it is concealed, as one side of the crane is designed to match the rest of the building, and is plastered and decorated to correspond to the opposite end of the main arch. The storage battery was used instead of a third rail so as to avoid any additional conspicuous rails and also to prevent accidents. It is designed to furnish enough energy to operate the crane through eight round trips on one charge.

### Illumination in the Banking Space

Perhaps the most interesting feature of the illumination of the building consits of the lighting in the banking space on the second floor. Supported from the crests of all of the arches in each bay are semi-indirect lighting fixtures, containing eleven 60-watt tungsten lamps, arranged so that they can be lowered for cleaning and relamping. Each of these fixtures is supported by two bronze cables which run



FIG. 2—CONDUIT HUNG FROM CEILING

over pulleys concealed in the ceiling and terminate in a hand-operated winch. When the fixtures are lowered the electrical connection is automatically broken at the ceiling so that the lamp sockets can never be energized when the fixture is being cleaned or relamped.

The disconnect device consists of two plungers which form the terminals of the lamp fixture. When the fixture

is in position [illegible] engages are pressed by helical springs against segments which connect with the terminals of the service lines. An interlocking device is installed which prevents arcing at the disconnecting point by opening a service switch when the fixture is lowered.

It may be interesting to note that these lamps are all fed from the fourth-floor cut-out cabinets, on account of the height of the ceiling, and are controlled by momentary-contact pilot switches which operate remote-control switches located in the cut-out cabinets on the fourth floor. The pilot switches are installed in gangs on columns at four corners of the banking space, so that all of the bank ceiling lamps can be controlled from any one of these positions.

In addition to the arch-ceiling fixtures which can be lowered for cleaning there are, in the banking space, some other illuminating features of interest. At each end of the skylight on a level with the fourth floor and beneath the main vaulted ceiling, are beams having channel sections, the recess in which opens upward. The recess in the beams is utilized as an indirect fixture, and each beam contains about sixty-six National X-Ray cone and scoop reflectors set in two rows and connected by conduit. The scoop reflectors are used on the row nearest the central banking space; cone and scoop reflectors placed alternately are used in the row farther from the banking space. All of the scoops are set so that the center line of the sockets is vertical. From the ends of the beams in toward the centers the angle which the axis of the cone reflectors makes with the vertical is varied so that the light is well distributed over the ceiling. These lamps are also fed from the fourth-floor cabinets and are controlled by pilot switches located at four positions on the second floor.

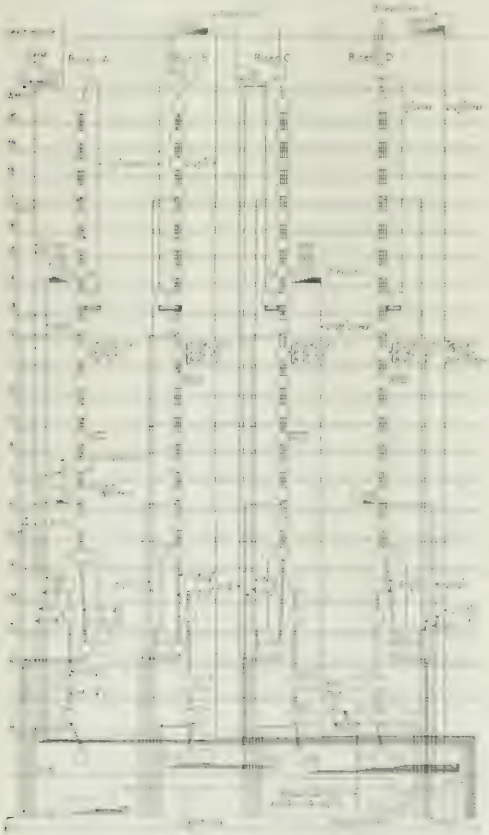



FIG. 3—RISER DIAGRAM

### Indirect Lighting in the Offices

A large number of the office tenants in the building will use indirect-lighting fixtures. After the first feeder system was laid out a general desire for indirect lighting was manifested, and the cross-section of the feeders was increased so that the entire building could be lighted by that method. All of the fixtures were furnished by the Acme Chandelier Company.

### Window-Washing Device

To facilitate washing the large number of windows which light the banking space on the second floor, a unique device is installed on each side of the room. The apparatus, which is about 30 ft. high, looks like the transverse traveling ladders seen in shoe stores and storerooms. It is electrically operated. A 2-hp, 220-volt motor, supplied with energy through a trailing cable plugged into receptacles on alternate columns, operates the ladder in a transverse direction and also operates a small hoist in which the person cleaning the windows sits when he is working.

### Vault Space and Coupon-Booth Lighting

There are three vaults located in the basement of the building. As it was undesirable to pierce the armor-plate walls of these vaults in order to run electrical conduit in for lighting, another scheme was employed. For each vault a 110-volt sub-feeder cable is run from one of the auxiliary risers, located in the basement, to a sheet-steel cabinet located on the same floor, in which a circuit-breaker is installed. From the circuit-breaker service wires are run to a receptacle on the exterior of the vault walls near the vault door. Lamps are installed inside of the vault and are connected by steel conduits to a receptacle on the inner vault wall. When it is desired to have a light in the vault the steel door is opened and a flexible cord is used to connect the receptacles mentioned. The circuit-breaker which is installed in the cut-out cabinet is employed to open the circuit in case the vault door closes and short-circuits the flexible cord connecting the receptacles. As one of the vaults has two doors, one main and one auxiliary door, an alarm system is installed to notify the bank clerk in case he fails to close and lock both doors.

Coupon booths are located on the basement floor for the use of patrons of the vaults. Each booth is about the size of a public telephone booth, and is lighted by two lamps. One lamp is supported on a bracket above the desk provided in the booth; the other lamp is held in a screw-clamp socket beneath the desk to illuminate the space below it and eliminate any shadow which might conceal valuable papers dropped on the floor. The circuit supplying both lamps is closed by a door switch when the occupant closes the door.

### Service Inlet

At the time this was written it was still undecided whether central-station electrical energy would be purchased. In any case, however, a connection will no doubt be made with the outside service mains in Adams Street through the curb wall to a sheet-steel pull box located on the north curb wall of the building. As planned, twelve 1,500,000-circ. mil cables will enter the pull box from the back near the top and make a right-angle bend and emerge from the bottom of the box. The cables will be carried down behind a curtain wall to the basement floor and run through the floor structure, which is of concrete, to outlets located above and back of the switchboard. Because of this construction it will not be necessary to install service switches previous to the cables' entrance above the switchboard. Five of the cables are of positive polarity, five are negative, and two are neutral. Two empty conduits are in place as reserve for future equipment.

### SWITCHBOARD

The switchboard, which is located on a gallery in the sub-basement, consists of polished blue Vermont marble panels and stands 90 in. high. The panels extend down to the floor line and rest on channel irons securely grouted to the floor. Over the top of the board inclosure is a 0.125-in. sheet-steel plate to which the down-coming cables are fastened with locknuts and bushings.

There are three service panels in the center of the switchboard, on which are mounted single-pole service switches, each capable of carrying 1500 amp. On the left of these panels are the energy-distributing panels for the motors installed in the building, and on the opposite end of the switchboard are the lighting-distribution panels. The distribution panels are equipped with feeder switches supplying the circuits.

On the main service panels are the integrating watt-hour meters for recording the amount of energy supplied for public lighting, elevator service and miscellaneous motors. All of the energy supplied to the bank and tenants is measured by meters installed in the cabinets on the floors from which they receive their energy. Separate buses are provided for light and motor loads, and are supported on insulated brackets secured to the angle-iron frame of the switchboard, so that no portion of their weight comes on the switch or fuse studs.

### WIRE SHAFTS AND CUT-OUT CABINETS

From the switchboard to the fourth floor there are no regular wire shafts and the cables are carried through auxiliary shafts which are connected on the various levels by offset conduits. From the fourth floor up there are four wire shafts located on each floor at the corners of the building near the elevator shafts. The feeder cables are brought out above the switchboard and are carried along the ceiling of the sub-basement on horizontal supports hung from the I-beams overhead. The cables are run parallel to the walls of the building to the auxiliary shafts, of which there are four. These shafts connect with the main shafts which were previously mentioned.

In every shaft on each floor are cut-out cabinets containing fused main-line switches, each capable of carrying

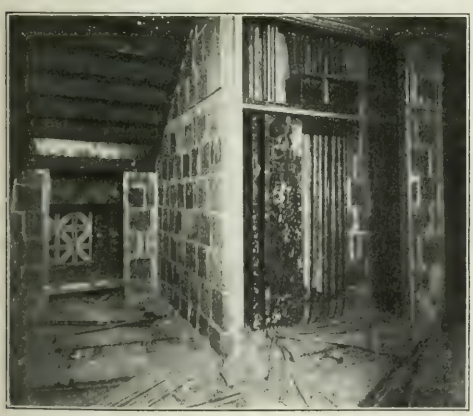


FIG. 4—CONDUIT ENTERING RISER SHAFT

the total amount of energy supplied from its respective cabinet. In addition each cabinet contains a metering panel which measures the amount of energy supplied to the tenants. Plug-type fuses are installed in each office circuit on a standard type fuse-terminal board.

The construction of the cabinets is interesting. Each cabinet is made of No. 10 sheet steel and contains two compartments: one in the rear about 10 in. deep to contain the necessary connections between the cables and the panels, and a somewhat shallower compartment in the front for the fuse, meter and switch panels. A large door opens into the front compartment, and two side doors open into the rear wiring compartment. These are fitted with piston bolts and locks. All of the panels in the building are of the same

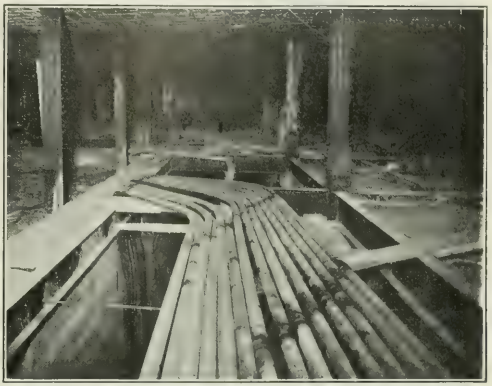


FIG. 5—SERVICE FEEDERS RUNNING TO SWITCHBOARD

type. The feeder cables enter from the bottom and pass through the rear compartment only. The cabinets are placed in the shaft opening so as to be directly over the cables which are to supply them with energy, thus avoiding any bends in conduits through which it would be difficult to thread the feeders. Each branch circuit is numbered and a typewritten directory explaining the circuits is placed under a heavy plate of glass which is inclosed in a frame on the front door of the cabinet. A wall receptacle is secured on the face of each panel in the cabinet to facilitate the inspection of the board. Entrance to the shaft space where the cabinets are located is obtained through wooden doors hinged from either side and parted in the middle. The wiring shaft is lined with fire tile.

All of the cut-out panel boards, with the exception of those used for public lighting, are constructed so that the energy passing through any circuit or combinations of circuits may be measured without rearrangement of external wiring.

Main feeders which supply the cut-out cabinets are securely anchored at their upper terminals, and are supported by cable racks inclosed in sheet-steel pull boxes at intervals of three or four floors. These cable racks are built of heavy strap iron hung from the I-beams at the back of the slot in the floor. At no point do the cables come in contact with metal; each support is made of porcelain. In addition to the supports mentioned the cables are supported at each cabinet by porcelain insulators. The feeders inside the conduit are gripped at intervals by split-knob strain insulators.

### FEEDERS FOR LAMPS AND MOTORS

Intsead of dividing the building into sections by floors and feeding each section from a midpoint, as is usually done to improve regulation, the various sections of tenant lighting are fed from the lowest point of each section, and the cross-section of the feeders is designed so as to keep the voltage drop at a minimum.

Lighting feeders are proportioned so that with all of the lamps in the building burning, there will be only a drop of three volts between the main switchboard bus and each of the cut-out cabinets, measured across the outside legs of the three-wire system. The loss of potential across any one

of the two wires [illegible] from the cabinet to the farthest lamp will not exceed 1.5 volts.

Public or corridor lighting is supplied over a separate set of feeders which are also carried up through the auxiliary and main shafts the same as the tenant lighting feeders. One public lighting feeder capable of feeding all of the public lamps on the second, fourth, and upper floors is carried up each of the main shafts. From this feeder several sub-feeders are run to the distributing centers. Practically all of the public lighting, with the exception of the lighting on the first floor and that in the banking space on the second floor, is controlled from a cut-out cabinet located on the thirteenth floor.

On account of the time required to turn on public lamps from their respective floors, it was decided to control all

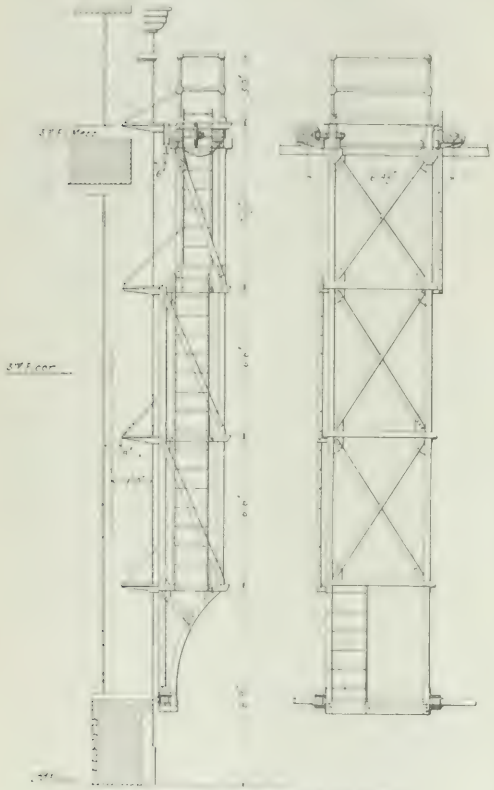


FIG. 7.—WINDOW-WASHING APPARATUS

of the public lamps, with the exceptions mentioned, from the thirteenth floor. This floor was also selected because it is halfway between the upper and lower floors thus controlled.

On each floor there are twelve corridor emergency lamps, one of which is placed at each corner of the building; the remainder are spaced at equal intervals down the corridor. Stairway lamps are also used as emergency lamps. These lamps are fed from the cut-out cabinets which are nearest them on their respective floors, and are controlled from the thirteenth floor. Two switches are installed in each of the cabinets on that floor, one of each set controlling all of the lamps below the thirteenth floor, and the other switch controlling the lamps on the thirteenth floor and above.

Practically all of the motors installed in the building will be operated at 220 volts, and are supplied at the place of installation with individual circuit-breakers and fuse panels enclosed in cabinets similar to the main shaft cut-out cabinets. The distributing cabinets which supply these motors are equipped with sub-feeder switches and fuses except in the case of elevator cabinets, which are equipped with circuit-breakers. Two sets of motor feeders are carried up each shaft and connect with sub-feeders at different points which feed the distributing centers.

In the sub-basement there will be eight motors installed with an aggregate rating of 155 hp; in the sub-basement there will be sixteen motors having a total rating of 233 hp. On the upper floors there will be motor units as follows: Sixth floor, six with total rating of 5 hp; seventh floor two with total rating of 25 hp; fourteenth floor, twelve with total rating of 35 hp; attic, seven units with a total rating of 145 hp; pent house, fourteen units with a total rating of 465 hp.

### Distribution of Circuits for Office Lighting

From the cut-out cabinets on the various floors two-wire 110-volt lighting circuits are carried to the different offices and corridors in conduits, none of which is less than 0.75-in. in diameter. In laying out the circuits 660 watts was the maximum load which was allowed to be supplied by any of the branch circuits.

At each outlet is a pressed-steel outlet box of the knock-out type, which is secured to the conduit feeding it with a lock nut and bushing. The ceiling outlet boxes have an independent support aside from that given by the conduit. This support consists of a pipe nipple fastened to the box with a lock nut and bushing which extends through the floor and terminates in a tee which rests on a cross-bar that transmits the weight to the floor arching.

Where direct lighting has been employed instead of indirect, the fixtures are designed for 40, 60, 100 or 150-watt lamps as desired, supported in sockets adapted to the fixtures and designed by the Benjamin Electric Manufacturing Company of Chicago. White-glass shades are used in most cases.

In the public corridors from the fourth to the twentieth floors, 20-amp flush receptacles are installed every 50 ft. on one side of the hall to supply energy for portable electrical apparatus, such as rotary scrubbing brushes.

### Telephone and Telegraph Connections

Telephone and telegraph connections in a building of the magnitude of this one are of interest. The service mains of the Chicago Telephone Company will enter the building on the west and are run along the ceiling of the basement, exposed, to the telephone service room, which is located in the basement. A sheet-steel thimble is set in the floor of the service room, so that it is flush with the sub-basement ceiling, and the distributing cables are run through this thimble into the sub-basement, where they are carried along the ceiling to the wire shafts. Similar thimbles are installed in each wire shaft on every floor except where there are offsets in the shafts.

At each offset there are three 3-in. conduits and two 2-in. conduits connecting the shafts; two of the 3-in. conduits contain the Chicago Telephone Company's cables; one 3-in. conduit is used by the Chicago Tunnel Company (operating the automatic telephone system), and the 2-in. conduits are used for telegraph and low-tension cables. The telephone service of the Chicago Tunnel Company enters the building through a tunnel connection. The cables run exposed along the sub-basement ceiling to the four wire shafts mentioned previously.

### Exterior Lighting

Exterior lighting will be employed on the parapet and pent-house walls as well as at the La Salle Street main entrance. Along the parapet walls, spaced at intervals of about 17 ft., are ornamental urns supporting frosted glass

globes which contain tungsten lamps. Each of the globes located at the corners of the building contains four 150-watt tungsten lamps, and each of the globes along the side walls contain one 150-watt lamp. On the La Salle Street side of the building along the pent-house walls, are hemispherical "bull's-eye" lenses spaced 6 ft. center to center. Behind these lenses are 250-watt tungsten lamps, the light from which is reflected toward the street by parabolic reflectors. All of these lamps are controlled by remote-control switches which are operated by pilot switches located on the thirteenth floor. Over the piers in the La Salle Street entrance are eight ornamental brackets. All of these fixtures were designed by the Acme Chandelier Company.

### Vacuum Cleaner System

For the purpose of cleaning the corridors, office suites and banking spaces a vacuum-cleaner system will be installed throughout the building. Two electrically driven vacuum-cleaner pumps are located in the sub-basement. Each of the driving motors has a rating of 25 hp and will be connected by a silent chain drive to the vacuum pump. One set is sufficient for ordinary use and the other is held in reserve.

Discharge pipes from the vacuum pumps are run to the

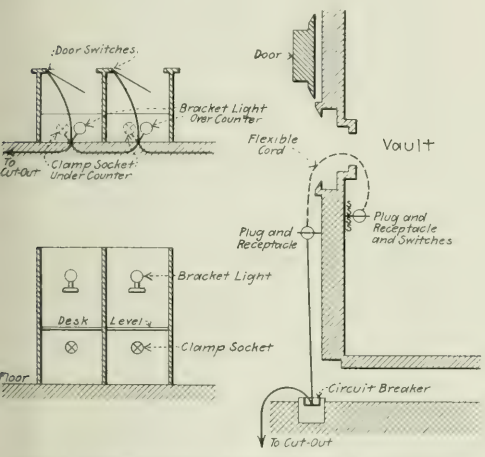



FIG. 7—ILLUMINATION OF COUPON BOOTH AND VAULT

smoke breeching. Suction pipes connect the pumps with a riveted steel tank from which feeder pipes are run to the various distributing centers on the different floors of the building. Each riser is clamped to the beams or walls at every floor. A sufficient number of outlets is provided on every floor so that the entire floor may be cleaned without using more than 100 ft. of hose from each outlet.

### Heating Plant

Four Babcock & Wilcox boilers, each having about 5000 sq. ft. of heating surface, are installed in the sub-basement to generate steam for heating purposes. Coal for firing the boilers may be obtained from two sources—from coal cars brought to the building through the tunnel of the Chicago Tunnel Company, or from wagons on the street above. The tunnel will be utilized for bringing in the coal supply ordinarily used, in which case the cars will be run into the building through the tunnel entrance and will be raised on a tunnel lift to the proper level from which to unload into the main receiving hoppers. When the supply of coal is brought to the building in wagons it is unloaded through manholes in the sidewalk into four coal storage bunkers below.

The handling of the coal after delivery presents some interesting features. Running parallel to the firing aisle is an endless belt conveyor, which takes coal on its upper travel from the main receiving hoppers near the tunnel entrance and conveys it to coal hoppers which feed the stokers, and to the auxiliary receiving bin. Only part of the coal carried on the belt will be delivered to the stoker hoppers on its first trip, as the supply brought in will be generally much in excess of the amount required for normal firing. An auxiliary conveyor running parallel to the first one but along the center line of the coal bunkers, receives coal from the auxiliary receiving hopper on its lower travel, and conveys it to the adjacent coal storage bunkers which communicate with the street manholes.

From the coal storage bunkers to the stoker hoppers the coal brought in through the tunnel and the coal brought by wagons, is conveyed along the same route. The construction of the bunkers is such that the coal is discharged onto the lower travel of the main conveyor and is carried up to the hoppers which feed the stokers.

Ashes may be disposed of by means of the main conveyor. They are raked from the ash pits under the grates onto the lower travel of the main conveyor and are delivered either to ash hoppers located above the main coal receiving hoppers near the tunnel entrance, or to auxiliary ash hoppers located above the main coal receiving hoppers near the tunnel entrance, or to auxiliary ash hoppers near a sidewalk lift. From the main ash hopper the ashes can be delivered by gravity into tunnel cars, and from the auxiliary ash hopper the ashes can be delivered to a telescoping ash elevator arranged to lift the ashes and discharge them into a wagon in the street. By the arrangement mentioned two methods of coal supply and ash disposal are obtained, each entirely independent of the other.

The main conveyor is of the pivoted, overlapping-bucket type and the auxiliary conveyor is of the gravity-discharge type. On vertical runs the conveyors are encased in sheet-steel casings to prevent any person being caught in them, and also to avoid spilling the contents of the conveyors on the floors. Each conveyor is capable of delivering 40 tons of coal an hour at a maximum speed of 40 ft. per minute. Each of the conveyors is operated by a 25-hp motor, and the ash lift is operated by a 5-hp motor. Each motor is furnished with a starting rheostat, speed controller and circuit-breaker.

### Elevators

There will be twenty-four electric passenger elevators in the building, twelve of which are high-rise elevators, the remainder being low-rise elevators which run only to the fourteenth floor. The building has been constructed, however, so that the low-rise shafts may be extended to the top of the building if traffic demands the change. These elevators are manufactured and installed by the Otis Elevator Company. The motors used for operating the elevators are of the one-to-one gearless traction type, each having a rating of 35 hp. Up-and-down signals are used on the elevators, both for informing the elevator operator and the passenger. The energy for operating the signals is supplied by small motor-generator sets located in the pent house and fed from the public lighting feeders.

In addition to the regular elevators mentioned for the use of all occupants there are two private elevators for the use of the bank employees only, which operate between the vaults in the basement and the sixth floor only.

There are three hydraulic sidewalk lifts, for which the water pressure is maintained by electrically driven pumps. One of these lifts has its plunger cylinder interchangeably connected with a high-pressure or a low-pressure pump so that an abnormally heavy load may be lifted when desired.

### Ventilation and Refrigeration

Ventilation is maintained by electrically driven inductive and exhaust fans. The former are located in the sub-basement; there are eight in all having a total rating of 112 hp. Seven exhaust fans having a total rating of 145 hp are

Before the air is admitted to the ventilating shafts it passes through air-washing chambers in which there is a continual shower of water which removes the dust. The water is pumped by three electrically driven air-washing pumps having a total rating of 6 hp. The illumination in these rooms is somewhat different from that ordinarily used in such cases. Instead of placing the lamps on the outside of the room and arranging them so that their light is reflected through a glass inspection door into the air-washing chamber, the lamps are placed inside. They are supported from the ceiling in marine sockets.

Refrigeration for cooling the drinking water in the building is furnished by an absorption system.

The Thompson-Starrett Company is the main contractor for the building construction, L. K. Comstock & Company having the sub-contract for the electrical work.

# Letter to the Editors

## Furthering Electrical Invention

*To the Editors of the Electrical World:*

SIRS:—There is no more important subject before the electrical industry to-day than the solution of its inventive problems. At the present time these problems present themselves in a haphazard manner to a few individuals. These men may not themselves have the inventive faculty, and so years go by before a genuine inventor notices the difficulty and solves it.

But supposing on the other hand that engineers, electricians and others would give publicity through the columns of your paper to the difficulties encountered by them in their practice. Even if only one out of the thousands of your readers should create an improvement over existing methods, progress in the art would be that much furthered. No more important topic for discussion in your columns can be imagined than this, which would aid in an accelerated progress of the electrical industry. Compared with the present practice how much better would it be if the needs and problems now known to a few, could be spread before the hosts of your readers, thus letting all combine in hastening development.

To open the subject, here are a few inventive problems which have come to the writer's attention as apparently still awaiting solution.

1. While inspecting a house with regard to renting it, we found the laundry table on fire, and the maid fled. The incendiary (an electric flat-iron) stood in the midst of the conflagration. A word to the wise is sufficient.

2. Engineers complain of the undue jerking of rotors at starting, especially in hoisting machinery.

3. How much longer must we endure the test clicks heard by the calling subscriber while waiting for the called party?

4. People still steal electrical energy by by-passing the meter.

5. An electric motor starter seems to say, "I am doing the best I can," which isn't very much in the opinion of buyers and users.

6. Electric connectors are coming to be known as devices which will hold wires connected except when they inadvertently pull asunder.

7. I searched the shops for an electric massage vibrator, but refused to buy any as I suspected that the noise they made would be more injurious to my wife's nerves than the good they could ever do to her circulation by massage.

8. When I learned that people often broke their wrists by the kick of the starting crank on automobiles, I lost my desire to buy that kind, as a lost wrist means lost business. An electrical invention might assist in solving this problem.

9. No longer does the motorman on a trolley car have to leave his platform to actuate the track switches, as once thought necessary. But apparently he must still leave his car to telephone at a post, to actuate the block signal switch, to get his lunch pail from a wayside house, and to replace trolley wheels which have left the wire.

10. An automatic oiler suitable for trolley wheels is needed.

11. Some way should be devised of electrically consuming all the zinc in batteries, so that practically no stubs shall remain.

12. An invalid remarked to me that he was obliged to refuse the use of an ozonizer on account of its noise.

13. Can any one explain why the inoperative air-escape valve on steam radiators continues in use? By wrongfully locking in the air, it causes the room to remain cold although there is steam in the pipes. Some electrical engineer may have the needed extra ingenuity for inventing a reliable automatic air-escape valve.

14. Electrically transmitted pictures for illustrating distant news events are now a fact to a limited extent. The fascination of this field lies in an attempt to transmit such visions as readily as the words are carried, even if the apparatus is more intricate.

15. Once the automatic telephone system was declared only theoretically possible; later, the first installation was laughed at; and now it is receiving serious inventive development. Only men who can imagine a hundred things being done simultaneously or in quick succession, should enter this field. It now only needs reduction to simplicity as compared with present apparatus.

16. "Turn-down" electric lamps have not appeared in general use, although many electric-light companies forget, however, that a few million people prefer a small light in their bed-rooms over night.

17. The telephone mouthpiece is certainly more unhygienic than the old public drinking cup, as far as germs, dangerous to the lungs, are concerned. If an acceptable substitute were invented, boards of health would feel called upon to require its use.

18. A watchman's clock is needed that cannot be tampered with by dishonest watchmen.

19. One feature in which the electric vehicle needs to copy the gasoline automobile is in its ability by being able to be charged with electricity as quickly as one can fill a tank with gasoline.

20. There is a market for an invention to render it impossible for the elevator man to start his car until he has closed the door. A proposed device is so complex as to lead to delays.

21. An improved device would be welcome for overcoming the troubles of ice, etc., on trolley wires.

22. An attempt is being made to produce a more practical means of quickly splicing wires.

23. The cord length-adjuster for electric reading lamps in homes and offices, consisting of a ball with holes or slots, is not popular, for a layman dislikes the tedious mechanical operation needed for lengthening or shortening the height of the lamp.

24. Can telephone engineers not invent a more effective way than the "howling" one for calling attention when a telephone has been left off its hook inadvertently. The neglectful individual, it most usually happens, is out of hearing distance.

25. Some simple device that could be operated by any one, as a substitute for hand manipulation in resuscitation cases, would be a valuable adjunct to every central station, for it is next to impossible to remember rules any length of time without the aid of a device for carrying out those rules.

*Washington, D. C.* EDWARD P. THOMPSON.

# Field of the Operating Engineer

**A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers**

## reparing the St. Louis System to Receive Keokuk Waterpower

To parallel a local 60,000-kw steam plant with a hydro-ectric station 150 miles away is no small task in the case f a city the size of St. Louis. On June 28 the Union Elec-ic Light & Power Company, of that city, synchronized or the first time with the Mississippi River Power Com-any's plant at Keokuk, and during an initial period of two inutes received 1800 kw from the water-power develop-ent. Before thus attempting to operate in parallel with eokuk the electrical department of the central-sation com-any had conducted some very thorough tests on the relation f the two systems with a view toward such interconnected peration.

As the system of the Union company was all properly beled and tagged to show phases and corresponding con-uctors, the attention of the electrical department was specially directed to the equipment in the new receiving ubstation (described in these columns May 31, 1913) and o the cables connecting this station with the existing ectric-service system.

First of all a test was run on the conductors and sheaths f the latter cables to ascertain the continuity of the feed-rs, to test for grounds, and also to "phase out." This test as carried out with direct current. The cables were then ubjected to a gradually rising alternating-current poten-al, the maximum value of which was set at the normal orking voltage. By this test it was purposed to bring out ny faults which might exist in the cables due to faulty nsulation or leakages. Finally one end of the cables was onnected to the Keokuk receiving substation and the other nds tested out for the proper phase rotation with the gen-rator busbars of the St. Louis company's system.

Three methods were employed in this test in order that here might be no doubt left as to the proper connections. 'hasing-out transformers, synchroscopes with lamps, and ynchronizing lamps were used. The preliminary tests roved correct and the two systems were successfully aralleled during the short initial period above mentioned -long enough to show that everything was satisfactory.

On June 30 two 12,000-kw 25-cycle turbo-generators at the shley Street station of the Union Electric Light & Power ompany were operated in parallel with Keokuk from 7:25 . m. until 11 p. m. During that time from 8000 kw to 0,000 kw was received from the hydroelectric plant at eokuk. On the following day two turbogenerators were gain operated in parallel with Keokuk from 6:05 a. m. ntil 11 p. m., 15,000 kw being this time received from the ater-power station and 9000 kw generated by the steam-rbine unit at Ashley Street. Since that date the Keokuk ater-power plant and the St. Louis steam-generating sta-ion have been operating in parallel from 6 a. m. until 11 . m. each day.

From 15,000 kw to 18,000 kw is supplied by the Union ompany at the present time to the United Railways Com-any, of St. Louis, during its peak load so that the steam enerating equipment which was formerly used to supply is energy may operate at a better load-factor. During the ailway company's largest peak load, which comes from 7 . m. to 8 a. m., all of the transformers which ordinarily upply the Union company with energy from Keokuk are sed to furnish the railway company with energy. Simi-larly during the evening peak load, the railway company is fed entirely from Keokuk. This arrangement is permissible as the Union Electric Light & Power Company is allowed to use energy from the hydroelectric line at any time it de-sires, as long as the peak load supplied does not exceed 22,000 kw.

Most of the parallel operation up to the present time has been for the purpose of ascertaining what combination of hydroelectric and steam-generated energy will give the most economical operation of the central station in St. Louis. Up to this writing the lighting circuits have been supplied with energy from Keokuk only once since hydro-electric service has been available in St. Louis. Regular service relations with the Mississippi River Power Company will commence Aug. 1.

## Rapid Rehabilitation Work at Shreveport, La.

Supplying the business section of a city of 35,000 popu-lation with electrical energy for all purposes within six or seven hours after its plant had been almost destroyed by

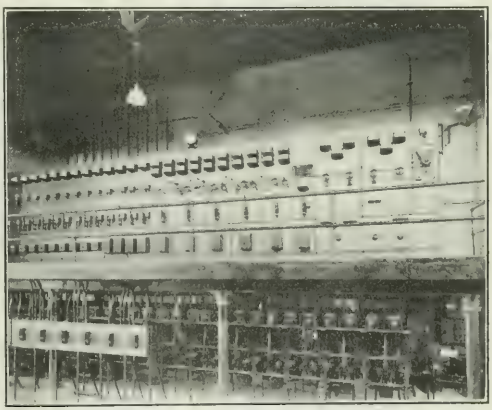


FIG. 1—FRONT VIEW OF MAIN SWITCHBOARD AND 2300-VOLT CONSTRUCTION AT SHREVEPORT, LA.

fire was the recent feat of the electrical department of the Southwestern Gas & Electric Company at Shreveport, La. This disaster occurred after the same plant had been par-tially disabled by another accident a few days before.

During the afternoon of Feb. 26 last the station was dis-abled by the collapse of the structural steel framework of a 60-ft. tile roof covering an extension of the engine room then in course of construction. Fifty-nine men were buried beneath the tons of twisted trusses and crumbled brick and tile of the walls and roof. With the exception of one negro all escaped with only minor injuries. In falling, one of the roof members tore away a portion of the old engine-room wall which had been left standing to shelter the switch-board while the extension was being built. This exposed the board but by next morning a temporary wooden en-

closure had been built around the weather sides, and the plant was placed in operation.

The reconstruction of the extension, designed to house the largest gas-engine set in the Southwest, was at once begun, and was about completed on March 13, when the plant had a second bad-luck visitation, this time by a fire resulting from a short-circuit on the high-tension three-phase motor circuit.

The "short" occurred shortly before seven o'clock in the evening of a wet, dismal day, the flash at the board igniting the temporary wooden shelter, from which the fire quickly spread throughout the engine room, in one corner of which the board was located, putting out of commission all but one of the plant's four generating sets. Three 48-in. belts driving as many generators, two 40-kw exciters and one 400-kw generator were destroyed inside of ten minutes. Altogether the whole fire lasted not more than a quarter of an hour.

The engine room had not cleared of smoke before the local staff "got busy." Hunting up all the scrap belting they could find they managed to splice one of the three belts, which, fortunately, was only half burned; and by three o'clock of the morning of March 14, seven hours after the fire two three-phase motor circuits were working, while by ten o'clock in the forenoon all lighting circuits were in service the demand being met by the one belt-driven generator and a 750-kw direct-connected generator. The latter was the only piece of machinery not affected by the accident.

The only instrument left in the plant was a 300-amp oil switch, and through this and a set of buses installed on two poles set up in the alley adjoining the station the entire city was served. In the meantime a contract had been placed in Dallas for a new switchboard, and new belts were ordered from Chicago. On an emergency order these belts were shipped, received and fitted and the three generators put in service on March 19.

The specifications and drawings of the new board included five 1000-kw generator panels, four three-phase circuit panels, nine single-phase circuit panels, and four exciter panels. The board, illustrated herewith, is of the remote-control hand-operated type and contains modern

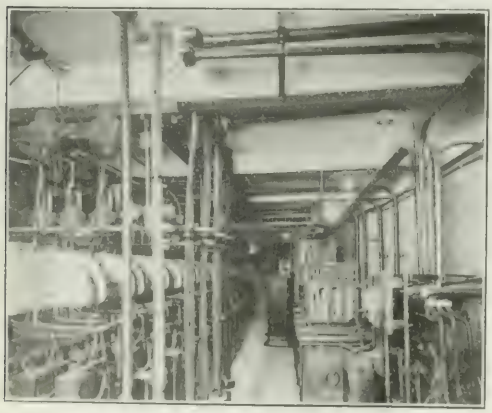


FIG. 2—REMOTE CONTROL EQUIPMENT ON THE 2300-VOLT CIRCUITS AT SHREVEPORT, LA.

instruments and protective devices, each panel being equipped with indicating and recording wattmeters, alternating-current voltmeter and ammeter and time-relay non-automatic oil switches.

The manufacturer guaranteed to ship the board within two weeks of receipt of complete specifications and drawings, and completed the feat of delivering it f.o.b. Schenectady, April 12, twenty-one days from the date of the order. It was received in Shreveport eight days later, April 19, only thirty-three days after the order had been placed.

No time was lost in setting up the board at the plant and within three months from the date its plant was almost completely wrecked the Southwestern Gas & Electric Company was giving Shreveport patrons regular and satisfactory service. Mr. J. E. Cowles is superintendent of the electrical department of the company and directed both the emergency relief measures and the rehabilitation work described.

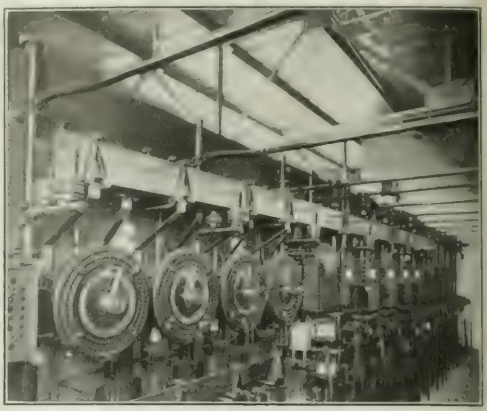


FIG. 3—REAR OF MAIN SWITCHBOARD, SHOWING RHEOSTATS AND REMOTE-CONTROL APPARATUS

## Reliability of Very Large Boilers

In the case of very large boilers such as the 2365-hp units employed by the Detroit Edison Company, are the advantages of higher efficiency and increased simplicity sufficient to offset the proportionately greater chances for stoppage due to failure of some minor part withdrawing the entire boiler from service. O. H. W.

With the big boilers at Detroit test efficiencies of 81 to 85 per cent have been obtained on bituminous fuel, which is probably the most efficient operation ever achieved under practical plant conditions. These 2365-hp Stirling boilers have been drawn upon for outputs equivalent to 10,000 kw and 11,000 kw of turbine load. Ordinarily they are run at from 7000 kw to 8000 kw, being operated in pairs to supply steam to a fully loaded 14,000-kw turbine. After eighteen months' experience at Detroit, the verdict there is that these large boilers are more reliable than the turbines with the latter's numerous auxiliaries, for a small accident to any one of the latter will put the prime mover out of commission. The large double-fired boilers can be operated with the stoker on only the one side, at a decrease of only 40 per cent in output. Boilers, it is added, are not "lost" as quickly as prime-mover apparatus, for possible causes of failure around a boiler can be reduced to a minimum by frequent and painstaking inspection. Of course the tubes nearest the fire are most likely to fail, but an occasional bagged tube can be discovered in the first row by rubbing with the hands at the time of inspection. These have not, however, necessitated shutting down the boilers on emergency calls. Several other companies have used large boilers with success although the fact that there are, on the other hand, a number of comparatively large stations recently completed or now under construction in which the usual battery of small steaming units has been provided, is evidence that the case of the big boiler is not even yet altogether proved in the minds of all engineers.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*High-Speed Direct-Current Generators.*—MAURICE LEBLANC.—The author emphasizes the great progress made in recent years in the manufacture of special steels like nickel steels and nickel-chromium steels which when used in the construction of rotating machinery make possible higher speeds and smaller dimensions. The author first discusses the actual limits of the tangential speeds of rotors and commutators. For the rotor he limits the maximum tangential speed to 120 meters per second, for the commutator to 60 meters per second. He then takes up the construction of machinery of high angular and tangential speed and emphasizes that in order to build a commutator machine with higher angular speed a method of cooling the commutator segments and brushes must be devised which is far more effective than ventilation. The article is to be continued. *La Lumière Elec.*, July 5, 1913.

*Power-Factor of Three-Phase Motors.*—P. SAUVAGE.—An article illustrated by diagrams on the difficulty of determining the power-factor of a three-phase motor, the different phases of which are unequally loaded in spite of equality of the voltages. In this case the motor has really three power-factors. It is shown that in this case the usual method of calculation yields very inaccurate results. An exact method of determining the three power-factors is given. A suggestion is made that the definition of the power-factor should be revised in the standardization rules of the German Association of Electrical Engineers.—*Elek. Zeit.*, June 19, 1913.

*Combination of a Commutator Motor with an Induction Motor.*—P. EHRMANN.—The conclusion of his mathematical article illustrated by diagrams on the "operation and the applications of the Leblanc exciter." The author gives the vector diagram of the operation of an induction motor excited by a three-phase commutator motor connected in cascade. Two principal methods of operation are discussed. The author's method permits an easy determination of the slip and the power-factor of the induction motor for any load of the induction motor and for any displacement of the brushes of the exciter. A diagram is given which shows how the use of such a commutator-motor exciter raises the curve which represents the power-factor as a function of the load for various speeds of the exciter.—*La Lumière Elec.*, June 21, 1913.

*Undulating Currents.*—L. BARBILLION.—The author first gives the general formulas for undulating currents (obtained by the superposition of alternating current over direct current) and then discusses in detail the operation of a direct-current motor by undulating currents. The separately excited motor is first discussed and the series motor is next taken up.—*La Lumière Elec.*, June 28, 1913.

### Lamps and Lighting

*Flicker Photometer.*—H. C. STEVENS.—Lord Rayleigh has suggested the possibility that the "physiological process" which affords the common basis by which colored and uncolored lights are measured by means of the flicker phenomenon, is the iris, or the contraction of the iris when exposed to bright light. From this viewpoint the flicker adjustment would be complete when the iris has no tendency to alter under the alternating illumination. This hypothesis is susceptible of an experimental test. By the simple expedient of paralyzing with atropin, an iris is secured which is entirely immobile in the presence of lights of different intensities. If the flicker phenomenon persists in an eye with a paralyzed iris, obviously some other physiological process must be sought as the cause of the phenomenon. An experiment was made in which the irises of both eyes of the author and those of C. D. Livingstone were paralyzed with a solution of homatropine sulphate. When the pupil ceased to change in size with changing intensities of light, the flickering fields was observed through the tube of their apparatus with each eye separately, the rate of the motor which caused the flicker to disappear was determined. Under these conditions the appearance of the flicker was not changed in any observable particular from the appearance of the flicker to the normal eyes. All degrees of flicker remained as before the atropine was placed in the eyes, and it is to be noted also that the disagreeable quality of the coarse flicker persisted undiminished. Moreover the numerical results obtained for each eye and for each observer agree very well among themselves.—*Philos. Mag.*, July, 1913.

*Storage Battery Lighting of Railway Trains.*—WILCKE.—The pure storage battery system of lighting railway cars is now finding continually increasing favor with the Prussian railways. Each car is equipped independently with a storage battery, which is recharged at charging stations provided at intervals. The equipment of each car, the arrangement of the charging system, and the equipment of the charging stations are discussed. It is emphasized that with this system the light is uniform without any fluctuations. The manufacture of metallic-filament lamps has made so much progress that the constant vibration of the car affects neither the uniformity of the light nor the life of the lamps. With the careful equipment chosen there is no danger of short circuits. The careful treatment which the storage batteries need is assured since on each charging station the batteries are handled by expert attendants, their behavior is observed during charging, and the condition of the acid is tested.—*Elek. Kraftbet. u Bahnen*, June 24, 1913.

### Generation, Transmission and Distribution

*Large High-Tension Networks.*—AUGUST PETRI.—In three-phase stations a power-factor of 0.8 is usually assumed and when the power plant of Belgard was erected, which supplies energy over a very large agricultural district, it was assumed that a power-factor of 0.7 would be normal. The length of the lines first erected was 1000 km (600 miles). When the transmission line was extended the situation changed completely so that as a result of the capacity of the 15,000-volt line of 1830 km (1100 miles) and of the 43,000-volt line of 120 km (72 miles) the load factor is now not less than 0.8 during the day. Usually it is about 0.9 and increases to unity for a certain load, decreasing again when the load increases further. Control measurements showed that this result is due to the capacity of the long transmission line and not to any errors of measurements. In the same plant the earth current in the case in which one phase is earthed was measured. The measurements were made for different lengths of the line and with the increasing voltages. The results are given in Fig. 1. For the whole network of 15,000 volts with a

length of line (1080 miles) the earthing current was .38 amp. It is of importance to decide the question whether the automatic circuit breakers will immediately operate when a line should break and fall on the earthed protective ring. The circuit breakers in the plant in question operate at 36 amp, so that according to the diagram the circuit breakers will operate with certainty if 800 km (480

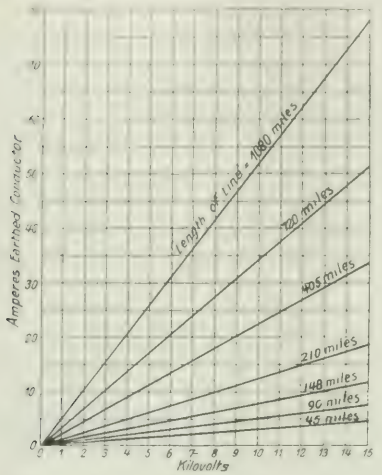



FIG. 1—EARTH CURRENT WITH ONE PHASE GROUNDED

miles) are connected. Further experiments showed that whether the earth resistance is greater or smaller, is of little importance for the earthing current.—*Elek. Zeit.*, June 19, 1913.

*Sectionalizing Devices for Central Stations.*—F. HERPENSTALL.—The author thinks that to take care of the two opposing problems of reliability of supply and low cost of operation in central stations some system of sectionalizing should be applied, and describes various systems for this purpose.—London *Electrician*, June 20 and 27, 1913.

*Exhaust Steam.*—F. L. RICHTER.—An illustrated article on the utilization of exhaust steam in turbines.—*Elek. Zeit.*, June 19, 1913.

## Traction

*Direct-current Shunt Motors for Mountain Railways.*—REUTENER.—In order to recuperate energy in running down grades, the Prussian State Railways made experiments some years ago with motor cars operated with a direct-current shunt motor, but the results were not satisfactory largely on account of difficulties of speed regulation, etc. The Siemens-Schuckert Co. has worked out a new system with a compound motor on a motor car which permits satisfactory recuperation of energy down grades. The feature is the use of a single compound motor in connection with storage battery, the two halves of which are operated in series of parallel. Eight of the fourteen controller positions are for parallel operations and six for series operation. The four-pole compound motor has four commutation poles, the windings of which are supplied with the armature current. The shunt winding is divided into two parts and each half is connected to one-half of the battery. The motor has a rating of 230 hp and is air-cooled. Not only recuperation of energy is possible but there are other advantages on mountain roads. For every position of the controller the speed is practically independent of grades or curves. This permits a very exact formulation of the schedule and of exact rules as to the controller positions to be used on the different portions of the road in order to maintain the schedule and obtain economy of operation. Details are given of operation on a line near Limburg. The conclusion is that on mountain roads the system is superior to the standard direct-current series-parallel system.—*Elek. Kraftbet. u. Bahnen*, May 14, 1913.

*Storage Battery and Gasoline-Electric Motor Cars.*—WEYAND.—A long review of the trials which have been carried out with motor cars of three different types on the Prussian-Hessian railways. The first type was for operation with steam, the second for operation with storage batteries, and the third for operation with gasoline engines and electric transmission. The steam cars have not proven satisfactory. The storage battery cars have proven very successful and reliable though they have some disadvantages. Data are given on the maintenance of the batteries and the expense of the storage battery operation during a whole year. The system may be further developed by extending the limit of the operation of the cars with one charge by building larger and also lighter batteries. The erection of charging stations at the correct place is very important as is also their proper equipment for easy charging. The gasoline-electric motor cars have freedom from smoke in common with the storage-battery cars and are greatly superior to the latter in their almost limitless range of operation, since they are practically independent of charging stations. Nevertheless they are not yet as satisfactory as they could be. The reliability which has been the most remarkable feature of the success of the storage battery cars is not yet as great for the gasoline-electric cars which require far more intelligent maintenance and attendance than the exceedingly simple storage battery cars. In commercial respects the gasoline-electric car seems to be superior to the storage battery car, although this is not yet certain in view of the rising price of gasoline. All the doubtful technical points have to be decided by experience with some new gasoline-electric cars to be placed in operation in the near future.—*Elek. Kraftbet. u. Bahnen*, May 4 and 14, 1913.

*Electrification of Main Railways.*—W. REICHEL.—A review of progress of electrification during the last year. The author concludes that the direct-current system will be reserved for railroads of short length and dense traffic. This system does not seem to be advisable for heavy trains because the current-collecting device can handle hardly more than 300 kw continuously or 500 kw for short periods, while heavy-traction systems require from 3000 to 5000 kva. The three-phase traction system has not been introduced to any great extent outside of Italy. Diagrams are given showing very rapid extensions of the single-phase traction system and its suitability for heavy traction in general. Above a certain limit of weight of train and a certain limit of capacity of a single-phase traction system locomotives are superior in operation to motor-cars because the electric equipment of the motor-cars becomes too complicated and heavy. The article contains concise reviews of recent installations in different countries.—*Elek. Kraftbet. u Bahnen*, Feb. 24, April 14 and June 14, 1913.

*Single-Phase Traction in Spain.*—WAGENKNECHT.—An illustrated description of the interurban railway from Pamplona to Sanguesa, which is the first single-phase railway of Spain. The energy is supplied from a water-power station containing two 500-hp turbines, the single-phase current being generated at 6600 volts and 25 cycles. The voltage on the trolley wire is 6000, but through the City of Pamplona it is only 600 volts. Only motor cars are used which have been built partly by a Spanish and partly by a German company. In the former Latour single-phase motors are used, while in the latter use is made of single-phase motors of the Winter-Eichberg type.—*Elek. Kraftbetrieb u. Bahnen*, June 14, 1913.

*Electric Traction in Saxony.*—A report of the memorial of a government department of Saxony on the possibilities of introducing electric traction on the state railways of Saxony. From a comparative discussion of electric trac

tion with other traction systems it is concluded that wherever cheap coal or water-powers are available and were traffic is heavy electric traction can compete successfully with steam traction. This is especially true for city and suburban lines if the traffic has developed to a certain extent. In Saxony this is especially true for Dresden and Leipzig. The whole third chapter of the memorial is devoted to a discussion of electric traction in the city and suburbs of Dresden. *Elek. Kraftbet. u. Bahnen*, June 24, 1913.

### Installations, Systems and Appliances

*British Municipal Electrical Association.*—The annual report of the council of the Incorporated Municipal Electrical Association of Great Britain. The membership is now 386. Parts of the report deal with the rating of metallic-filament lamps, a proposed electric lighting bill for England, the standardization of the conditions of contract, and a proposed change in the constitution of the council.—London *Electrician*, June 27, 1913.

*Testing of an Oil Switch.*—M. VOGELSANG.—An illustrated English translation in abstract of his German paper noticed sometime ago in the *Digest* on a test at a Norwegian power station of a three-pole, 20,000-volt, 200-amp oil switch.—London *Electrician*, June 27, 1913.

### Electrophysics and Magnetism

*Resonators for Short Electric Waves.*—W. S. NELMS AND W. L. SEVERINGHAUS.—An account of a systematic study of linear and non-linear resonators for short electric waves. The object was to determine the relation of the dimensions and distribution of the resonators to the resulting wave-length. The "multiple reflection method" (see *Digest* last week) was employed. A summary of this investigation follows: A change in the distance between the resonators measured along the direction of the electric oscillation has very little effect on the period of oscillation of the resonator. This applies to both linear and non-linear resonators. For a screen of resonators the ratio of the wave-length of the energy radiated to the length of the resonators depends very largely upon the separation of the resonators measured perpendicularly to the electric oscillation. The value of this ratio is given in curves which may be used to determine the proper distribution of resonators to give any desired wave-length. The effect on the wave-length of the distance between the resonators measured perpendicular to the electric oscillation is more simply expressed in terms of the center-to-center distance between the resonators than in terms of the side-to-side distance. An increase in the width of the resonators of a given length has a very small effect on the wave-length re-radiated. An increase in the width of the resonators increases the damping of the oscillation. As a result the interference curves are irregular and the oscillation shows a more marked tendency than in the case of the linear resonators to correspond to that of the first overtone. For widths greater than one-fourth of the length of the resonator, the energy decreases with an increase in the width. If the width of the resonators be greater than 1.5 times the length, there is very little effect of resonance. The wave-length of the energy from the screen is determined almost entirely by the wave-length of the incident energy. The ratio of the wave-length to the resonator length for a resonator not under the influence of other resonators has been shown to be greater than 2. The value estimated from this investigation is about 2.4. It appears from the results of this investigation that any resonator having a width less than one-fourth of its length may be taken as a "linear resonator." If the ratio be greater than this there is only a small change in the wave-length but a marked change in the character of the re-radiated energy.—*Phys. Review*, June, 1913.

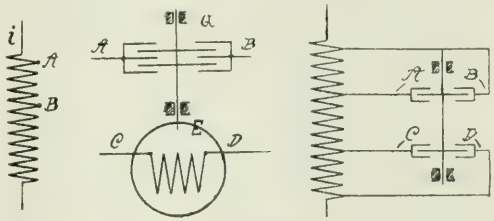
*Resistance of Graphite.*—D. E. ROBERTS.—An account of an experimental investigation of the effect of temperature and magnetization on the resistance of graphite. The author gives theoretical considerations which lead one to suspect a very large effect of this kind. The results of his experiments confirm this view. For instance, in experiments at ordinary temperature with different specimens of Ceylon graphite. The increase in a transverse field of 20 kilogausses varied between 300 and 500 per cent of the resistance in zero field.—*Philos. Mag.*, July, 1913.

*Energy Required to Ionize an Atom.*—R. T. BEATTY.—The energy required to ionize an atom, that is, to detach an electron from an atom, is a quantity of importance in checking theories of atomic constitution. This calculation can be made if the number of electrons in the outer ring and the atomic radius are known. This is the case for the gases of the helium group, and the author shows that for the gases helium, neon and argon, the ionizing potentials calculated from his theory agree closely with the values observed.—*Philos. Mag.*, July, 1913.

### Units, Measurements and Instruments

*British Physical Laboratory.*—An account of the opening of the new buildings of the (British) National Physical Laboratory. The laboratory was opened in 1901, and the new buildings just opened comprise a building for metallurgy, laboratories for optics, and a central block for administrative purposes, with the section where the receipt and discharge of instruments for tests will be dealt with.—London *Electrician*, June 27, 1913.

*Measuring Frequency.*—MANDELSTAM AND PAPALEXI.—An illustrated description of an instrument for measuring




FIGS. 2 AND 3—CONNECTION DIAGRAMS

the frequency of a wireless telegraph current, the measurement being independent of the damping and the amplitude of the current. The current $i$ to be measured passes through the conductor A B in Fig. 2. If the effective voltage between A and B and effective current are measured the ratio of effective voltage to effective current depends on the frequency, the ohmic resistance, and the self-induction of the conductor A B. If the instrument is connected to the same points A and B, the self-induction and the ohmic resistance remain constant and the reading depends only on frequency. An instrument of this kind may consist of a quadrant electrometer Q coupled with an electrodynamometer E so that they have the same axle of rotation. The electrical connections are so made that the two instruments tend to revolve in opposite directions. The deflection depends on the ratio of effective voltage to effective current. The quadrants of Q are connected to points A and B while the current A B passes through the movable coil C D. Of course, C D may be connected to a shunt. Another method of determining the frequency is shown in Fig. 3, in which the instrument is a combination of two electrometers A B and C D, having the same axle of rotation. The two pairs of quadrants are connected to four different points of the coil through which the current under test passes and the electrical connections are so made that one electrometer tends to rotate in a direction opposite to that of the other. The resulting deflection will depend on the ratio of the voltages impressed on A B and C D. The resulting deflection of the needle depends only on the frequency. The same instrument may, of course,

[illegible] since if the frequency kept constant [illegible] April 26, 1913.

*Electric Measurements.*—[illegible] The method of R. Goldschmidt for measuring wind velocities depends on the comparison of the temperatures of two identical wires A and B. In Fig. 4 the wire A is suspended from a mast M and is subject to the wind the velocity of which

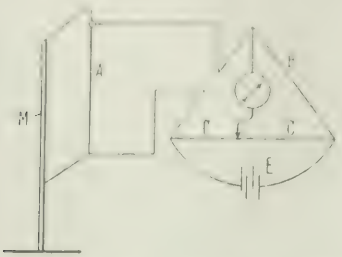



FIG. 4—INSTRUMENT FOR MEASURING GAS VELOCITIES

is to be measured. The wind has a cooling effect on this wire. The wire B is protected from the wind. The temperature difference of the two wires is a measure of the wind velocity. To measure the temperature, a resistance measurement is used with the two wires A and B being connected as two arms in a Wheatstone bridge which also contains the slide wire C C and the bridge containing the galvanometer. The cooling effect of the wind disturbs the equilibrium of the bridge and the wind velocity may be found either from the deflection of the galvanometer or from the displacement of the contact of the slide wire required to bring the reading of the galvanometer back to zero. O. Bordoni has recently investigated this method and applied it also to the measurement of low gas velocities. In his experiments the contact of the slide wire was adjusted to bring the galvanometer needle to zero position. If L is the position of the sliding contact with zero current in the galvanometer and both wires A and B cool, then if the wire A is heated, the position of the sliding contact must be changed to L′ to reduce the galvanometer again to zero. If now the temperature of A is again changed due to the cooling effect of the wind or of a current of gas the sliding contact requires another adjustment, say, to L″. The difference in the positions of the sliding contacts is found to be proportional to the temperature difference. The difference L L′ relates to the condition of air or gas at rest. The difference L L″ relates to wind or the passage of a gas current. The slide wire may be calibrated directly in air or gas velocity. For slow velocities of gas currents it is best to use a thick, bright, loose wire, 0.1 to 0.2 mm thickness. For higher wind velocities a tightly stretched thicker wire blackened on the surface is preferable.—*Zeit. f. Feinmechanik,* May 20, 1913.

*Air-Gaps in Moving Coil Instruments.*—C. G. GARRARD.—The author first gives a formula for the torque experienced by a wire carrying a current in the field of a permanent magnet. He then discusses the method of magnetizing permanent magnets and the maximum value of magnetization which can be obtained. He emphasizes that the maximum number of magnetic lines which can be got through the magnetic circuit depends almost wholly upon the character of the steel and the cross-section of the magnet, and not upon the shape or size of the narrow air-gap of the instrument. He discusses the parallel arrangement of air-gaps and shows that, with equal magnets, the density in the air-gap of the parallel arrangement is half that in the series arrangement (assuming the air-gaps equal in area). Therefore the effect of exterior fields is double in the parallel-gap instrument and the working field is one-half. He finally discusses the method of aging permanent magnets by demagnetization with an alternating current and additional mechanical vibration treatment.—London *Electrician,* June 27, 1913.

### Telegraphy, Telephony and Signals

*Electrothermal Detectors.*—W. H. ECCLES.—An abstract of a (British) Physical Society paper on electrothermal phenomena at the contact of two conductors. The paper which is purely theoretical deduces mathematically the laws connecting the current and the applied emf in a circuit containing a light contact of two conductors. When an electric current passes across a light contact of two different substances, heat is liberated or absorbed in accordance with the law of Peltier and is generated in accordance with the law of Joule; in the regions of the conductors where there is a temperature gradient, heat is liberated or absorbed in accordance with the "Thomson effect." These thermal actions are very noticeable in contacts made of badly conducting natural oxides or sulphides on account of the high resistivity and the large thermo-electric effects in these substances. The low thermal conductivities of these substances exalt the electrical consequences by conserving the heat. It is shown that, in general, when a contact is used as a radio-telegraph detector, there may be some coherer action mixed up with the thermo-electric "rectifying" action; and that whether there is or there is not any coherer action, the principal features of the characteristic curve connecting current and emf are determined by the Thomson rather than by the Peltier effect. Thus if two contacts could be made having all their electrical and thermal properties of equal measure excepting the Thomson property of which the measures were of opposite signs, the curve connecting current and emf for one contact would rise more rapidly on, say the side of positive emf than on the side of negative emf while the reverse would be true for the other contact; a direct experiment of applying heat to the contacts in turn and observing the consequent thermo-electric forces, showed these to have the same direction in both.—London *Electrician,* June 27, 1913.

*Wireless Detector.*—R. MORETTI.—A description of a new detector for electric oscillations based on the same principle as the electrodynamometer of Arno, namely, the change of hysteresis, due to electric waves, in an iron or steel piece in a variable magnetic field.—*Elettriciste,* Feb. 15, 1913; abstracted in *Zeit. f. Feinmechanik,* May 20, 1913.

*Wireless Time Signals.*—E. DE LONGUEVAL.—A detailed article on the transmission of time signals from the wireless station of the Eiffel tower in Paris.—*La Lumière Elec.,* June 28 and July 5, 1913.

## Book Review

RESUSCITATION. By Charles A. Lauffer, M.D. New York John Wiley & Sons. 47 pages, illus. Price, 40 cents

This book includes a reprint of a paper on resuscitation read before the Philadelphia Section of the National Electric Light Association by the author, who is medical director of the Westinghouse Electric & Manufacturing Company. After explaining a number of successful results which have been obtained from employing resuscitation methods on men who were supposedly dead, the author gives a clear description of the mechanism of respiration, a number of views of the various parts of the anatomy being used for illustrative purposes. The prone-pressure, or Schafer, method of resuscitation, which has been adopted by the National Electric Light Association and a number of other engineering societies, is described in detail. The author brings out in a clear, concise manner the necessity of people in general being versed in the principles of resuscitation.

# New Apparatus and Appliances

**An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers**

## Self-Tightening Cable Clamp

The accompanying illustration shows a new self-tightening cable clamp for dead-ending and supporting power cables. By the ingenious lever construction of this clamp the cable is gripped with a force proportional to the tension applied. Being boltless, it can be attached in a minute, holds the tighter the greater the strain imposed, and can be

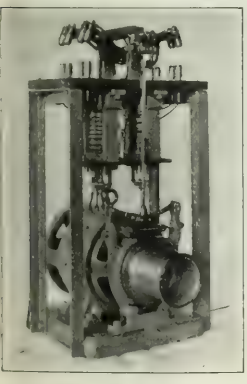


BOLTLESS CABLE CLAMP

removed quickly as soon as tension is released. When dead-ending power cables with these clamps, the insulation is first removed from the cable for a distance of 5 in., after which the clamp can be attached in one-fifth the time of the old methods, and without soldering. Sharp turns and difficult adjustments are rendered easy with this cable clamp. The clamp is built to withstand strains of 10,000 lb. and for cables of 250,000 to 1,000,000 circ. mil in cross-section, the manufacturer being the Automatic Cable Clamp Company, Donora, Pa.

## Direct Drive of Dumb Waiter Elevator Mechanism

Friction in the worm-gear drive of elevator mechanisms constitutes a considerable portion of the total power loss incident to the electric-motor drive of this class of machinery. The illustration herewith shows the installation of a 0.5-hp, 500-volt, 160-r.p.m. steel-frame motor driving the mechanism of a small dumb-waiter. In this case the drum carrying the cable is mounted directly upon an extension of the armature shaft. The drum is about 4 in. in diameter. The entire installation occupies a small space as the switches and starting resistors are mounted on a frame which is made part of the motor base by angle-iron framework bolted to the bedplate. The brake is applied directly to the drum.



MOTOR AND CONTACTORS

The motor illustrated was made by the Diehl Manufacturing Company, Elizabeth, N. J.

## Improved Plug Attachment

A plug attachment which is particularly well suited for use with electrical household devices has recently been brought out by the Tregoning Electric Manufacturing Company, 418 West Prospect Street, Cleveland, Ohio. This attachment is so designed that in case undue strain is brought to bear on the cord connection between the outlet and the device the plug attachment will be released from the outlet, thus lessening the danger that the break will occur in some other place or that the portable device will be injured by an accidental fall. The plug attachment is also fitted with a so-called "anti-knot feature" so that the conductor cord may be turned or screwed into the composition cap and need not be knotted on the inside as is the usual practice. It is stated that this method of fastening the cord saves an inch of cord on each connection and prevents frayed edges and wear to a great extent.



PLUG ATTACHMENT

## Pulley with Protection from Rain and Sleet

The long enclosing case of the pulley illustrated herewith forms a covering to keep the rain and sleet out of the interior of the device. The guide ridges are cast as an integral part of this casing. The rounded edges of the rope clamp keep the rope from being damaged by the sides of the pulley. When the pulley and hanger are in the position shown all of the strain is relieved from the rope and the weight is taken by the safety knob, which is supported by the enclosing case.



PROTECTED PULLEY

These pulleys are made with five standard types of top

clamps for suspension from mast arm, outrigger, ceiling or span wire by the Line Material Company of South Milwaukee, Wis.

## Improvements in Induction-Motor Design

The use of pressed steel in motor construction represents an advance in motor design. As this material imparts mechanical strength and is uniform in structure, a motor of a given weight can be made with more active material than motors in cast-iron frames.

In all sizes the rotor bars are insulated with cement

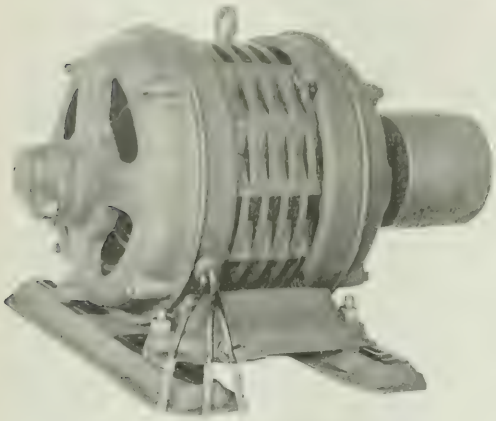


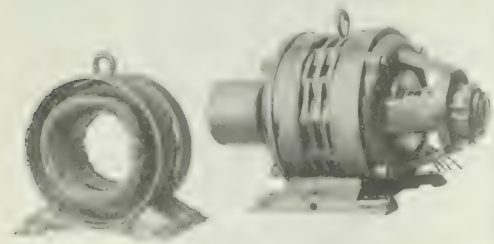
FIG. 1—MOTOR WITH CAST-STEEL FRAME

which is moisture resisting and will withstand a high degree of heat and mechanical stress.

The bearings, being the only wearing parts, are protected from dust by a cap on the front end and by felt washers between metal rings on the pulley end. It is said that the efficiency and power-factor are high, not only at full load but at fractional loads also.

The motor shown in Figs. 2 and 3 is of the repulsion-starting type and when up to speed, runs as an induction motor. For most applications, it can be connected directly to the line, but where very low starting current is desired a starting rheostat can be used.

The bearings and frame are of the type described above. The rotor coils are form-wound and arranged to permit



FIGS. 2 AND 3—SMALL REPULSION-STARTING TYPE MOTOR

good ventilation. The commutator is of the radial type with undercut mica segments. The shaft can be pressed out of the rotor without disturbing the windings or the commutator.

These motors are being made in sizes ranging from 2 hp to 10 hp and can be arranged for operation on either 110-volt or 220-volt circuits. Both of these lines of motors are products of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

## Batteries for Starting, Lighting and Ignition

Two types of storage batteries in which the active material in the positive plates is said to be very hard, dense and closely bound are now being put on the market for use with gasoline automobiles by the Gould Storage Battery Company of 18 East Forty-second Street, New York City. The advantages claimed for the hard paste composition used in these batteries are resistance to wear, retention of full rating and elimination of damage due to jarring and vibration. It has been the aim to proportion the material in the




STORAGE BATTERY FOR AUTOMOBILES

negative plates so that any tendency toward shrinkage will be automatically offset during the life of the plate. The group of cells in hard-rubber jars is inclosed in a hardwood box and the terminals are designed so that leakage of the acid and consequently corrosion of the terminals will be avoided.

## Electric Trucks in Freight Pier Service

On the marginal street along the west side of Manhattan Island much annoyance and expense to merchants are caused by delays to teams and trucks carrying merchandise to the waterfront for shipment on outgoing vessels. At Piers 14 and 15, North River, used by the Fall River and

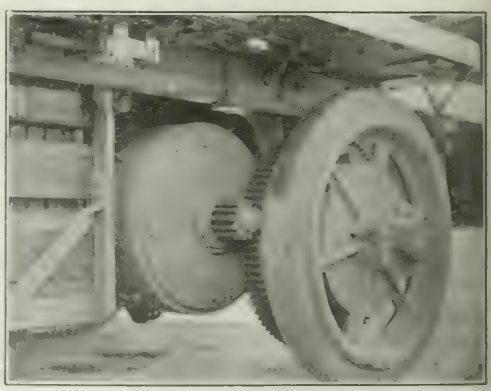


FIG. 1—MOTOR PINION AND GEAR

Providence Steamship Companies' lines a very successful attempt to relieve this congestion is being made. The method adopted consists of using a receiving platform across which the incoming freight is unloaded from the wagons and quickly loaded upon electric trucks, which are run directly to the vessel receiving the freight.

One of the distinctive features of the trucks is the single

reduction gear shown in Fig. 1. The pinion on the end of the armature shaft meshes with a gear bolted to the wheel and both the pinion and the gear are enclosed in gear cases which are partially filled with lubricant so that the gears constantly operate in oil. There is no differential, no countershaft and no chain. The trucks now being used at the pier of the Fall River Line are equipped with two

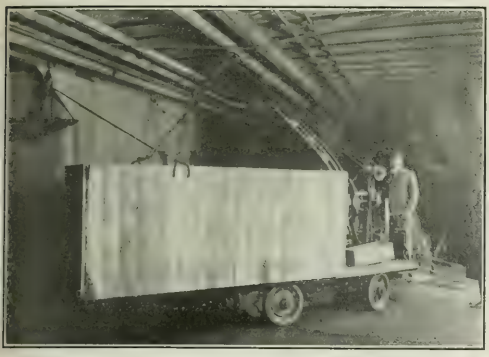


FIG. 2—AN UNWIELDY BOX HANDLED BY CRANE TRUCK

motors and will successfully climb a 28 per cent grade when fully loaded. Grades approximating the above figure are met with in pier service at high and low tides, otherwise a single motor truck could successfully perform the work. It is said that single motor trucks will climb a 20 per cent grade.

Electrical energy for operating the trucks is furnished by a 44-cell lead storage battery suitable for charging directly from 115-volt direct current circuits. Each cell has a 48-amp-hour rating and the battery will deliver 85 volts on discharge. The motor is of the series type and is wound to take 10 amps at 85 volts. The maximum speed of the truck fully loaded is 7 miles per hour.

A so-called electric loader intended to lift and carry on its own platform merchandise weighing a ton or less, to load other trucks of either the hand or the electric type with heavy freight, to load and unload delivery wagons and



FIG. 3—SELF-LOADING TRUCK UNLOADING BALE OF ROPE

to pile and tier freight, is also being used on these piers. The platform of this crane truck is low so that it can be run under the body and axle of the ordinary delivery wagon, and the height of the boom in the lowest position permits the machine to be run through doors in the ordinary freight house or through the side ports of covered barges or steamboats. The boom does not swing, but the truck can be turned in a radius of 13 ft. giving the same effect as though the boom was swung by a motor. The quadrant can be raised or lowered by an electric motor, the time required for the complete movement being about 11 seconds.

In its highest position the hoist line is directly over the middle of the platform. When carrying a full load of 1



FIG. 4—CRANE TRUCK WITH PLATFORM UNDER WAGON AXLE

ton the maximum speed of this vehicle is 7 miles an hour. The crane hoist will lift a weight of 1 ton at the rate of 40 ft. per minute. The truck is 10 ft. in length, 4 ft. wide and the platform stands 21.5 in. above the floor. The quadrant has a range of 7 ft. being at a height of 15 ft. from the floor in its highest position and 8 ft. from the floor when at its lowest extreme of travel. The storage battery consists of 44 lead cells of 70-amp-hours rating each and the energy from this battery drives two series motors rated at 10 amps, 85 volts. The motors on this electric loader are geared directly to the driving wheel as are those in the smaller trucks. The weight of the empty vehicle is 4500 lb. and the truck is said to be able to climb a 20 per cent grade either when empty or loaded.

The operation of the electric trucks at the Fall River Line and Providence Line piers have been highly satisfactory to the patrons of the line and to the management.



FIG. 5—BATTERY TRUCK ON PIER 14

Freight is now received at the platforms extending along the entire street front of piers 14 and 15. This method of handling freight has reduced to a minimum the time required to discharge teams, resulting in economies not only to the steamship company but also to the shippers. As yet no authentic operating cost data have been prepared, but the management of the steamship company is satisfied from

the preliminary investigations that the balance will be in favor of the electrical equipment.

Both the trucks and the electric loader are the products of the Sprague Electric Works of the General Electric Company, New York City.

## Telephone Equipment for Mine Rescue Work

There are a number of special points to be taken care of in the design of telephone equipment for mine rescue work which do not arise in any other service for which similar apparatus is used. In the first place, the members of the rescue party invariably have to wear oxygen helmets, because of the presence of poisonous gas in the mine, and this prevents the use of the ordinary type of transmitter. Moreover, the rescue party is apt to be encumbered with tools and stretchers and any additional equipment carried must be made absolutely as light and compact as possible. Finally, the wires which connect the rescue party with those at the mouth of the mine or other vantage point must be light and durable and absolutely waterproof in order to stand the rough handling and moisture encountered in this service.

Working in conjunction with the federal bureau of mines and from a broad experience gained through supplying numerous regular mine telephone installations during the past few years, the Western Electric Company has finally developed a light, simple and serviceable equipment for use in mine rescue work. The details concerning this apparatus are noteworthy. In place of the ordinary type of mouthpiece a "throat" transmitter has been produced, which, it is claimed, works practically as well as the standard mouthpiece instrument. A single-piece receiver is used and the combination instrument when strapped onto the operator's head takes up hardly any room. The connecting cable consists of two copper wires insulated with black enamel and two layers of silk, the whole being wound with stout linen braid and impregnated with a moisture-resisting compound. A 500-ft. coil of this wire is carried in a case strapped to the back of the operator's belt and arranged to pay out automatically as the rescue party advances. The total weight of the apparatus carried by the operator is slightly over 5 lb.



[illegible] EQUIPMENT

At the other end of the line are the battery box and auxiliary supply of cable, together with a standard switchboard operator's set, consisting of a chest-type transmitter and head-band receiver. The entire outfit has been designed and built with the single object of providing a practical and durable equipment for this special work.

## Lighting Equipment for the City of Niagara Falls

The city of Niagara Falls will be one of the first in the United States to adopt the double-bracket combination lamp and trolley pole. In the near future Falls Street between Riverway and Fourth Street and North Main Street between Michigan Avenue and North Avenue will be illuminated with units such as the one shown in the accompanying illustration. The poles will be spaced 70 ft. apart with two lamps on each pole, one extending over the roadway and one over the sidewalk. The sixty poles which will be erected on Falls Street and the fifty-four poles which will be installed on Main Street will take the place of the present iron trolley poles and will become the property of the city.




COMBINATION LIGHTING AND TROLLEY POLE

In order to avoid slotting the poles at the ground line, thus weakening them at the point of greatest strain, the cut-outs have been placed as shown in the body of the ornamental fixture. The small ring suspended by a short chain is the only outward evidence of the cut-out. By using a small hooked rod the operator can light or extinguish the lamp from the sidewalk by pulling the chains. The chains are insulated from the current-carrying parts to obviate danger of leakage at this point.

The poles and the ornamental fixtures will be furnished by the Electric Railway Equipment Company, of Cincinnati, Ohio, and the inverted magnetite arc lamps will be supplied by the General Electric Company, of Schenectady, N. Y. Energy for the operation of the lamps will be furnished free by the Hydraulic Power Company and the Niagara Power Company, and will be distributed without charge by the Niagara Falls Electric Light & Power Company.

## Noiseless Gasoline-Electric Vehicles

The problem of transmission of torque from the gasoline engine shaft to the driving wheels of a vehicle has been perplexing automobile engineers since the first motor vehicle was designed. Even to-day as the heavy 5-ton and 7-ton truck rushes over the highway, its clutch and transmission buzzing in a manner which makes the noise of a honking horn weak in comparison, it is apparent that there is still much left to be desired in the way of noiseless drive.

In a paper presented by Mr. T. B. Browne, president of the British Institution of Automobile Engineers, before the Society of Automobile Engineers in New York, a description of the London omnibuses was given. Mr. Browne said in substance that the two main factors which have principally conduced to the present efficiency of the gasoline

omnibuses now running on the London streets, are the insistence of the police authorities that the vehicles comply with a high standard of noiselessness and reliability and the determination of the constructors to produce vehicles capable of passing these tests. As an example of the difficulty of passing the police inspection of these vehicles it may be mentioned that cases have been known where vehicles have failed to obtain a license to run solely on account of the hissing noise caused by the passage of the air through the carbureter inlet.

There are about 120 gasoline-electric motor omnibuses running in London in which the transmission from the engine to the worm-driven live axle is accomplished by means of an electrical set, consisting of a compound-wound generator directly coupled to the engine and a series-wound motor coupled through a cardan shaft to the worm. The generator is connected to the engine by means of a flat leaf spring coupling, no friction clutch being used. No electric circuits are made or broken when driving, as the generator is designed so that the field coils are unexcited when the engine speed falls below 300 r.p.m. Thus by nearly closing the throttle the torque of the motor is reduced to zero.

The generator is capable of a maximum output of 20 kw at a speed of 1400 r.p.m. with a maximum emf of 300 volts. The control is effected entirely by the gas throttle pedal, except when ascending very steep hills, in which case a shunt resistor contained in the controller box is employed to allow of increased engine speed.

The generator and motor are of the semi-enclosed type and are ventilated by a disk fan carried on the rear end of the generator shaft. The efficiency of the generator is stated by the makers to be 90 per cent, and that of the motor 88 per cent, the resultant efficiency of the electrical set being 79.2 per cent.

The average running costs of these vehicles is said to be just over 14 cents per mile. This figure includes all cost of running, maintenance, tires, drivers, gasoline, lubricating oil, grease, paraffin, lighting, depreciation, rent, rates and taxes, conductors, body upkeep and traffic expenses.

All of the gasoline motor omnibuses now running in London are either owned or controlled by the London General Omnibus Company and most of them were manufactured by de Dions, Straker Squires, Leylands and Daimler Motor companies.

## Apparatus for Electric-Arc Welding

Theoretically any source of direct current is suitable for electric welding, but when it is considered that a potential of only from 10 volts to 60 volts is necessary at the arc it is evident that if this voltage is secured by introducing resistance in series with existing shop circuits the method will be wasteful and only a small fraction of the energy drawn from the line will actually be used in maintaining the arc. Furthermore, unless means are provided for maintaining the proper potential and for protecting the line against short circuits which necessarily occur, it would be impracticable to do electric welding from the regular shop circuits.

In order to surmount these difficulties, the C. & C. Electric & Manufacturing Company, of Garwood, N. J., has developed a special motor-generator set, together with automatic controlling apparatus, providing a ready means of efficiently transforming the energy from the shop circuit, whether alternating or direct current, to the voltage required for welding and at the same time providing against short-circuiting the machine.

The generator is of the variable-voltage type, having liberal commutator surface, and in the larger sizes is duplex wound. By employing open-type armatures large ventilating surfaces are provided and low heating limits are obtained.

The switchboard consists of a marbleized slate panel having angle iron frames on which are mounted a fused main line switch placed between the motor and the supply circuit, a no-voltage release starting rheostat for motor, and an automatic series relay in each welding circuit which operates a magnetic switch. An automatic overload relay in the motor circuit operates only on extremely heavy loads as the relays in the individual circuits take care of all ordinary rushes of current. In addition to the foregoing there are provided on the switchboard a voltmeter, an ammeter, a voltage-controlling rheostat in the generator field circuit, a set of current-regulating contacts and a small bank of resistors in the rear of the panel secured to the angle-iron frame.

When it is desired to use both the metallic electrode and the graphite electrode from the same set, a single-pole, double-throw switch is added, which permits of using either the metallic or graphite electrode alone or both at the same time. When two or more arcs are required for independent

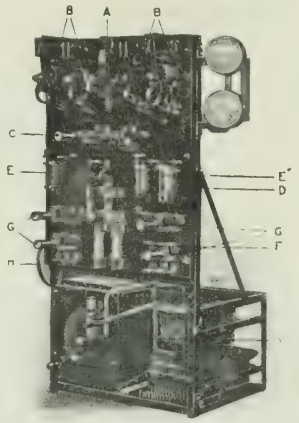



FIG. 1—QUADRUPLE CIRCUIT SWITCHBOARD

operators from the same set, the current-regulating contacts, the magnetic switch and the automatic series relay are duplicated, as shown in Fig. 1. This permits of adjusting each welding circuit independently of the other, so that the voltage and amperage can be regulated to meet exactly the requirements of the work being done by each operator.

It is evident that, unless some protective device is provided, the moment contact is made between the electrode and the work a short circuit will occur and the generator will be burned out or the motor circuit-breaker thrown, making it impossible to get the arc started. This contingency is provided against by means of an automatic

DATA ON ELECTRIC-WELDING REPAIRS IN RAILWAY SHOPS

| | Time in Minutes | Kw | Average Costs |
|---|---|---|---|
| Gear-case lugs | 10 | 6 | $0.07 |
| Armature shaft (broken), 2-in. | 60 | 20–30 | 0.80 |
| Dowel-pin holes | 5–12 | 4–8 | 0.07 |
| Broken motor cases | 150–200 | 75–90 | 4.95 |
| Broken lugs on a compressor cover, doors and grease cup hinges | 2–5 | 1–3 | 0.03 |
| Broken truck frames | 30–60 | 20–35 | 0.63 |
| Worn bolt holes in motors and trucks | 5–10 | 3–5 | 0.05 |
| Enlarged and elongated holes in brake levers | 2–4 | 1½–3 | 0.03 |
| Armature shafts, 2-in., worn in journals | 120–180 | 60–90 | 3.75 |
| Armature shafts, worn in keyways | 10–15 | 7–12 | 0.10 |
| Armature shaft, worn thread | 20–30 | 10–15 | 0.24 |
| Air brake armature shafts (broken) | 20–30 | 10–20 | 0.27 |
| Leaking axle boxes | 5–15 | 3–7 | 0.08 |

It is evident that, unless some protective device is provided, the moment contact is made between the electrode and the work a short circuit will occur and the generator will be burned out or the motor circuit-breaker thrown, making it impossible to get the arc started. This contingency is provided against by means of an automatic

series relay which, when the electric welding circuit is broken, inserts resistance in series with the electrode. When it is brought into contact with the work only enough current is allowed to pass to form the arc, and when the arc is drawn this resistance is automatically cut out of the circuit and practically the full potential of the welding circuit is applied at the arc. This arrangement makes unnecessary the method that is often resorted to, namely, that of using a machine of much larger rating than is necessary to take care of the momentary overload imposed at the time of making the contact. As the machine is fully protected and operates automatically, the operator can make and break his arc as often as desired without paying any attention to the generating outfit.

To give an idea of the cost of making ordinary repairs the accompanying data, which have been compiled from the records of an electric railway repair shop, are given. A charge of 2 cents per kw-hr. is assumed for the electrical energy consumed and the labor cost is figured at 30 cents an hour. By using the figures given in the first and second

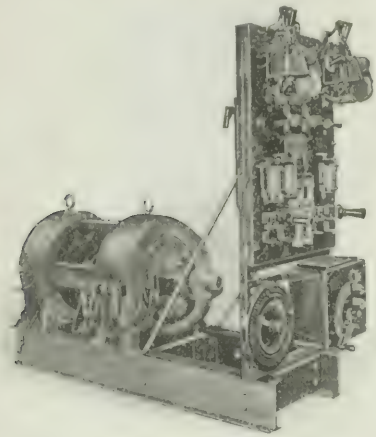


FIG. 2—MOTOR-GENERATOR AND SWITCHBOARD

columns the cost of each operation can be calculated for other shops under various conditions.

Standard equipments are built in sizes of from 150 amp to 200 amp. The average weld on heavy sections using the graphite electrode will be found to require approximately 400 amp. This includes broken truck frames and motor cases, and in general steel sections having an area of 4 in. by 5 in. Locomotive frames or pieces of similar dimensions require from 500 amp to 600 amp, while sections 6 in. in diameter and upward are best welded with from 700 amp to 800 amp at about 70 volts. In steel foundries, from 700 amp to 800 amp at from 60 volts to 75 volts will be found to be sufficient, but where there is much cutting to be done, such as removing heavy risers, etc., from 800 amp to 1000 amp at from 60 volts to 75 volts will be found to be more effective.

## Moving Pictures as Targets for Marksmen

At Coney Island, the home of innovation, the latest adjunct to the shooting galleries is the addition of moving pictures as targets. A device invented by Mr. Eliot Keen has been installed to register the hits and misses of the shooters. This apparatus consists of a steel screen behind which a number of steel balls are hung by small pieces of chain at intervals of about 3 in. A bullet striking the screen imparts an impulse to the suspended balls causing them to swing outward from the screen. As the balls move away from the screen, the chains short-circuit a pair of conducting rods which are placed behind them and in this manner complete an electrical circuit and light a lamp in front of the marksman. Contactors and relays actuated by perforations in the film are arranged so that only the portion of the screen carrying the moving figure in the picture is sensitive to the bullets of the shooters. Thus if the marksman misses the moving picture no lamp is lighted, the absence of the flash signifying that the bullet has gone astray.

## Turbo Air Pump

The entire absence of the external ejector nozzle marks the design of the turbo air pump shown herewith as being

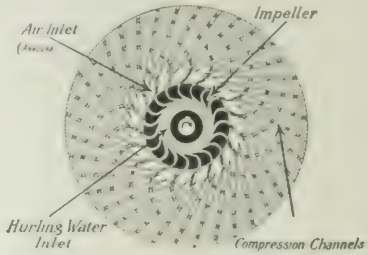



FIG. 1—SECTIONAL VIEW SHOWING PRINCIPLE OF AIR REMOVAL

distinctive from other centrifugal pumps. The pump consists of a small high-speed impeller with a large number of ports or nozzles on its periphery, a ring of tapered compression channels and a discharge casing or volute. Water enters the eye of the impeller as in an ordinary side-suction centrifugal pump and is impelled at high velocity through the ports in the impeller, which rotates in the opposite direction to the impeller of a centrifugal pump. Air is admitted around the entire periphery of the impeller and is drawn into the entrance of the tapered compressor channels by the aspirating effect of the rapidly discharged water. As the slugs of water move outward they become elongated owing to the tapering of the channels, the space between slugs decreases and the air entrapped is compressed. The mixture of air and water is delivered from the tapered channels into a volute casing, somewhat similar to that of

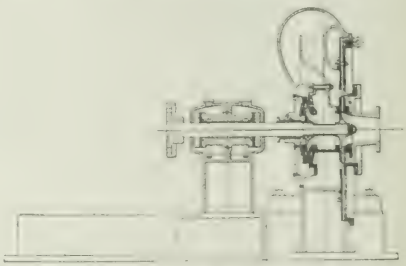


FIG. 2—CROSS SECTION OF TURBO AIR PUMP

a centrifugal pump, and is finally passed out through a suitable outlet nozzle.

These pumps are used for both jet and surface condensers. For the latter service the turbo air pump is frequently combined in a common casing with the condensate pump, thus securing many obvious advantages. The photograph, Fig. 2, and the drawing, Fig. 3, illustrate a combined pump of this type. A distinct saving results from the fact that the amount of piping between condenser and pump is reduced and simplified, the space ordinarily required by the

two pumps for air and condensate is less, and both pumps are driven on a single shaft.

It is stated that pumps of this type will maintain a vacuum within 98 per cent to 99 per cent of the theoretical value; that is, within a very small fraction of an inch of mercury column of the vacuum corresponding to the temperature of the hurling water. This is not only true for low temperatures of water from 32 deg. Fahr. to 60 deg. Fahr. but also for hurling water at temperatures of 70 deg., 80 deg., 90 deg. Fahr. and higher, such as are encountered during the summer months and in cooling-tower work.

This pump is based on the designs of the German pump built by the Allgemeine Elektricitäts Gesellschaft and is manufactured by the Wheeler Condenser & Engineering Company of Carteret, N. J.

## Electric Apparatus Uninjured by Submersion During Flood

Recent flood conditions have brought to light some interesting information regarding the dependability of electrical apparatus despite immersion. The Gray Coal Company, Danville, Ill., has two 35-hp and two 25-hp motors, one of which was completely submerged in March, 1912, owing to an ice jam which backed up the river water. The motor remained immersed ninety-two days, after which it was protected from the weather and left on the bank of the river till the early fall, when, a motor being needed, this one was tested out to determine its condition. The test showed it to be all right, much to the surprise and gratification of its owners, and so it was immediately put into service again, operating until March 24, 1913, when it was again submerged during the recent flood and remained under water until April 7, again being tested out "O.K." The other 35-hp motor was submerged last January and remained under water for ten days. It was then dried out and connected up and found to be in perfect condition. One of the 25-hp motors was also submerged but when the waters had receded it, too, was all right.

Some time ago a standard motor performed remarkable service when submerged. A 20-hp, three-phase, 220-volt induction motor geared to a mine pump at the bottom of a shaft in the mines of the Richmond Iron Works, Richmond Furnace, Mass., was submerged by surface water that flooded the shaft during a thaw. Although 2 ft. below the surface of the water, the motor continued to operate perfectly and at the end of two hours had pumped itself clear of water. It was then shut down just long enough to clean the dirt and chips from the rotor and to put oil in the bearings, after which it was restored to regular service again, pumping twenty hours a day. Its performance since shows that it was uninjured by its remarkable experience.

Motors in the Comstock mines were recently submerged with water having a temperature of 165 deg. Fahr. for twenty-four hours. After operating for a few hours with the impressed voltage reduced to dry them out, the normal load was thrown on. The motors were not damaged, although a telephone receiver was melted out of shape.

In the works of the Sweet & Doyle Foundry & Machine Company and the Twinvolute Pump & Manufacturing Company, of Green Island, N. Y., three motors and a switchboard were completely submerged during the flood the latter part of March. When the waters had subsided the dirt was washed off and the motor bearings cleaned and oiled. After an hour's run without load to dry them out, the motors were put into service and apparently had suffered no injury.

The apparatus which passed unscathed through the unusually severe tests mentioned above was manufactured by the General Electric Company, Schenectady, N. Y.

The remarkable performance of two Crocker-Wheeler motors was recently brought to light by a representative of that company while on a business trip through California.

A ranchman, Mr. W. E. Green, of Tulare, Cal., has an induction motor which drives a pump for irrigation purposes. One night the service failed and the no-voltage release disconnected the motor, thereby stopping the action of the pump. During the night the water backed up from the irrigation ditch into the pit and submerged the set under 4 ft. of water.

In the morning the ranchman, who had not noticed that the motor was flooded, started the set which ran from 10 to 15 minutes under water. When he discovered to his surprise that the motor was submerged the machine was taken out, dried in an oven and immediately put into service again. It has been continuously running without repair or extra attention ever since.

A somewhat similar occurrence was reported by Messrs. Sturgeon & Saults. In this case the water backed up from the ditch into the pit while the set was running and submerged both the pump and the motor. The set, however, continued to run until the pump became so clogged with dirt that the fuses blew out. The farmer having cleaned the pump and pit started the set again without further precautions and this set also has been running satisfactorily ever since.

While the Crocker-Wheeler Company has made in certain instances specially insulated waterproof apparatus, the two motors mentioned above were standard stock machines for which no claim was made that they would operate under water.

## Floating Transformer Station and Pumping Outfit

In order to irrigate its rice fields along the Sacramento River, the Moulton Irrigated Land Company, Butte County, Cal., has adopted the somewhat unique plan of installing a motor-driven pump on a barge, which is towed from point



FLOATING PUMPING OUTFIT ON SACRAMENTO RIVER

to point by a gasoline launch and is thus able to accomplish what would otherwise require four stationary plants.

The barge contains a 20-in. Dow centrifugal pump belted to a 100-hp Westinghouse induction motor. Electrical energy is obtained at the four pumping points from the 11,000-volt lines of the Pacific Gas & Electric Company. A bank of transformers on the barge transform the energy to 440 volts for use by the motor.

The pump is capable of delivering about 16,000 gal. of water per minute. The head varies from 12 ft. to 23 ft. as the river rises and falls, and the motor is overloaded about 30 per cent when the river is at its lowest point, but it has carried this overload for considerable periods of time without distress.

The pump is operated almost continuously from April to August, being shut down only when the barge is being towed from one point to the next.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Copper-Covered Wire.**—The increasing demand for copper-covered wire is strikingly shown by an order recently received by the Standard Underground Cable Company for ten carloads of "Colonial copper-clad" wire from a customer who has been using this kind of wire for years.

**Finds a Demand for Metallic Brushes.**—The Nungesser Carbon & Battery Company, of Cleveland, Ohio, which makes a specialty of furnishing metal brushes for automobile electric starters, reports that it is enjoying an excellent business among the manufacturers of that class of apparatus.

**May Sales Record-Breaking.**—Gross sales for the month of May, 1913, by the Western Electric Company reached a total of $7,800,000, which is $800,000 greater than the total for the best previous month's sales in the company's experience, namely October, 1912. Although the latter year was the most active in the history of the company, the sales this year have been showing steady gains over those for corresponding periods in 1912.

**Ohio Manufacturer Busy.**—Recent sales made by the Foos Gas Engine Company of Springfield, Ohio, include oil and producer gas engines for use in waterworks and refrigerating plants and for driving generators. Among the purchasers are the city of Saline, Mich., United States Government, Fredericksen Ice Company of Chicago, Ill., William Gordon, Atlantic City, N. J., and the Deposit Milling Company of Deposit, N. Y. The combined horsepower represented in these sales is 550.

**New Welding Machine to Be Marketed.**—The Lincoln Electric Company, of Cleveland, Ohio, has completed the development of a machine which will take alternating current and deliver direct current with a drooping characteristic, adaptable to welding work without the necessity for using resistance in series with the arc. It is expected that this machine will have even a larger field than the welder, operating on direct current, which this company has sold for several years.

**Terry Turbines and Pumps Sold.**—A good sized order was recently placed with the Terry Steam Turbine Company, of Hartford, Conn., by the Milwaukee Electric Railway & Light Company, of Milwaukee, Wis., including two 60-hp turbines for driving circulating pumps, and two boiler feed pumps, rated at 20 gols. per minuts. There was also purchased in the same order, three stoker blower sets for the Racine plant of the latter company, and two sets of pumps for their generating station at Kenosha.

**Taylor Stoker Sales.**—Sixteen large companies have recently placed orders with the American Engineering Company, of Philadelphia, Pa., for its Taylor stokers. The Rochester Railway & Light Company, of Rochester, N. Y.; Lake Shore & Michigan Southern Railway Company, Air Line Junction, Ohio; Fitchburg (Mass.) Gas & Electric Company and the Narragansett Electric Light Company, Providence, R. I., were among the larger utilities buying this apparatus.

**The Moloney Electric Company** of St. Louis has established offices at Toronto, Ont., Winnipeg, Manitoba and at Vancouver, B. C. Its office at Toronto is located in the Canadian Pacific Railroad Building and is under the supervision of Mr. George C. Leacock, who was formerly with the Packard Electric Company. Mr. Leacock is district business manager of the entire part of Ontario. The district office which was opened at Winnepeg is located in the Electric Railway Chambers Building and is in charge of Mr. C. H. Abbott, who was also formerly with the Packard Company. Mr. Abbott will have charge of all business in Manitoba, Saskatchewan, Eastern British Columbia and Alberta. Mr. Seth B. Smith, formerly business manager of the Westinghouse office at Vancouver, is now district manager of the Moloney Electric Company's office in that city. This office is located in the Vancouver Block. Mr. Smith has been with the latter company several months.

In addition to the factory which the Moloney Electric Company has in St. Louis, it also operates a factory at Windsor, Ont., employing about 45 men. Mr. W. R. Ker is in charge of the offices at that place.

**Forthcoming Convention of Federal Sign System (Electric).**—The annual convention of branch-office managers and department heads of the Federal Sign System (Electric) will be held in the Moraine Hotel, Highland Park, Ill., on July 30 and 31 and Aug. 1. It is expected that between seventy-five and eighty men will be in attendance. One day will be devoted to an exposition of the products of the Sangamo Electric Company, Pittsburgh Transformer Company and other manufacturers for which the Federal Sign System acts as distributor.

**Alberger Sales Steady.**—The Alberger Pump & Condenser Company, of 90 West Street, New York, is doing a good business in spite of the dull season. Among the recent shipments of special note have been to the Monarch Cotton Mills, at Union, S. C., Boston & Maine Railroad, Pennsylvania Coal Company, for its Underwood Colliery, at Dunmore, Pa., and to the San Joachim Light & Power Company, Bakersfield, Cal. The first two concerns each bought a 32-in. "Spiroflo" condenser with centrifugal removal and vacuum pumps, while the latter company obtained a 15,000 sq. ft. surface condenser.

**Western Hydroelectric Apathy.**—A prominent New York man, who is in close touch with hydroelectric development work throughout the country, has recently returned from a trip to the Pacific Coast, and in an interview with a representative of the *Electrical World*, he stated that, due to the difficulty of financing at this time, there are practically no new hydroelectric plants now projected in the West. Work is progressing on installations now partially completed, but nothing new is planned. He stated further, that the same condition in general exists in the South, to the best of his knowledge, and that he did not expect any real activity in this line until after the first of the year.

**Electrically Operated Grain Elevator at Kansas City, Kan.**—The new electrically operated 1,000,000-bushel concrete grain elevator which was built for the Chicago, Rock Island & Pacific Railway Company at Kansas City, Kan., by the Macdonald Engineering Company of Chicago was completed and received its first supply of grain by means of its new electrical equipment on July 1. The erection and electrical wiring of this elevator, as well as the conversion of the old 1,000,000-bushel steel elevator, which adjoins it, from a rope-transmission to an electrically operated elevator, was commenced on Jan. 15, 1913, so that the time of erection is considered somewhat of a record. The electrical wiring was done by the Freeman-Sweet Company, Chicago, and the placing of conduits, which had to be laid in the forms before the concrete was poured, was in charge of Mr. J. C. McGivney, superintendent on the job. Motors ranging in size from 5 hp to 75 hp were installed in the two elevators with an aggregate rating of 1040 hp. Although energy for the operation of the motors will under ordinary conditions be supplied by a 450-kva, three-phase, 480-volt, 60-cycle General Electric generator on the grounds, auxiliary service for use in case of emergency will be available from the municipal electric plant of Kansas City, Kan.

**Crocker-Wheeler Apparatus Used.**—Under the heading "Electrical Energy for Large Chicago Tannery" mention was made in the July 19 issue of the *Electrical World* of the power equipment for the Griess-Pfleger Tanning Company. Word comes from the Crocker-Wheeler Company, of Ampere, N. J., correcting the statement of the make of electrical apparatus installed. According to these advices the equipment consisted of two 715-kva, 440-volt, three-phase, 60-cycle engine type Crocker-Wheeler generators, running at 120 r.p.m. and directly connected to Corliss engines of Nordberg Manufacturing Company's make, and one 214-kva alternator of the same type, running at 150 r.p.m. and directly connected to one of the Bail Engine Company's four-valve engines. All three units have belt-driven exciters.

**Boston & Maine Power Plant Equipment.**—An extension installation of electrical and power apparatus is being made by the Boston & Maine Railroad at its Billerica shop power house. Five 500-hp Babcock & Wilcox boilers with Murphy Iron Works stokers are being put in, together with a considerable amount of auxiliary pump condenser and air compressor equipment. The electrical machinery to be installed consists of two Rice & Sargent engines, each connected directly to a 350-kw, 600-volt, 25-cycle, 3-phase generator; one 750-kw generator of the same type driven by a mixed pressure turbine, and one 50-kw generator, also of the same type, coupled to a marine type engine; two 50-kw, 125-volt exciter sets, connected to marine type engines, and one motor-generator set, comprising a 200-kva, 25-cycle motor, directly connected to a 125-kw, 250-volt, direct-current generator. All of the electrical apparatus is of General Electric make. On the section between Hinsdale, N. H., and Brattleboro, Vt., just recently put in operation by the Boston & Maine twenty-five automatic and five semi-automatic electric block signals are in use, supplied by the Union Switch & Signal Company, of Swissvale, Pa. Okonite wire used for the underground circuits on this signal system was supplied by the Pettingell-Andrews Company, of Boston, Mass.

**Additional Electrical Equipment for the Western Electric Company.**—Three five-story structures have been added to the existing factory of the Western Electric Company at Hawthorne, Ill., the motor and electric light wiring for which is being done by the Freeman-Sweet Company of Chicago. About 2600 incandescent lamps will be installed, which will be of 25-watt, 50-watt and 100-watt tungsten types. Service wires will also be run for supplying motors with energy, but no definite number of units has been decided upon at the present writing. Outlets have been provided from which wires can be run to the motors as they are installed. Six feeders will be run from the isolated generating station which this company operates, through a tunnel in lead-sheathed cables, to the buildings in which the service is required. Each of the feeder cables contains three conductors having 250,000 circ. mils cross-section. Service for both the lamps and motors will be supplied at 440 volts, 60 cycles, three-phase, through exposed conduits. The lighting panel boards are peculiar in construction as the lamps will be fed from the 440-volt feeders and from a grounded neutral. Each lamp outlet is supplied with a phase wire and a grounded neutral.

**Electrical Equipment of a Modern Loft Building.**—By courtesy of C. A. Williams, of the Van Wagoner-Linn Construction Company, contracting electrical engineers, of 1133 Broadway, New York, details on the electrical equipment of the new Mercantile Building, 424-438 West Thirty-third Street, New York, have been received. The building is twelve stories high and is equipped with two high-speed Otis passenger elevators and three three-ton freight elevators. The main switchboard of marbleized slate was supplied by the Metropolitan Electric & Manufacturing Company, of Long Island City, N. Y., and contains separate feeder switches for each riser, also a breakdown panel providing for the future installation of an isolated generating plant if desired. At present Edison current is used. There are fifty six-light outlets on each floor for illumination. Provision has been made for supplying 100 hp for drive purposes on each floor and the installation of empty conduits will take care of future needs in this line. There are two marbleized slate panel boards measuring 6 x 4 ft. on each floor, divided into two sections, one for the lighting and the other for the power circuits. The lighting section of each board has fourteen circuits of 25 amp capacity each, and the power section has sixteen circuits of 50 amp each. These boards were also supplied by the Metropolitan Company. The conduits used were made by the Central Tube Company, of Pittsburgh, Pa., and there are installed on the power circuits now in use twelve 50-amp solenoid switches, furnished by the Hart Manufacturing Company, of Hartford, Conn. There were also installed a number of Cutler-Hammer starters of the latest type, operated by remote contact switches. The entire equipment was put in by the Van Wagoner-Linn Construction Company, of New York.

**Electric Trucks Popular.**—Among recent sales of the General Vehicle Company's electric trucks the following are of special note: American Express Company, twenty-five two-ton cars; New York Railways Company, twenty-nine; New York Edison Company, five five-ton trucks; Lord & Taylor, six 1000-lb. wagons; General Baking Company, four 1000-lb. cars; American Agricultural Chemical Company; three 2000-lb. trucks; and Franklin Simon & Company, three 1000-lb. cars. The great bulk of trucking and delivery work lies in the field of short haul service and for such work the electric truck and delivery wagon are preeminently fitted. But there is occasionally a demand for a truck for long haul service and in the process of this company's growth it has been found that calls for cars to handle such service are sufficiently frequent to make it advisable to develop a car especially for that service. About a year ago a thorough study of this question led to the determination that a gasoline car would be best fitted to meet this special demand and, after considerable investigation into the merits of various makes, the American rights of the German Mercedes car were secured and plans laid for the manufacture of these cars in this country. At the present time there is building at the Long Island City plant of the company a one-story brick factory, measuring 50x240 ft., which will be devoted to the manufacture of the above type of gasoline trucks, ranging in capacity from four to ten tons. A reflection of the growth of the company's business in the electric truck line can be seen in the fact that there is also under construction, at the same location, a six-story factory, measuring 75 x 500 ft., the lower five stories of which will be equipped for the manufacture of electric commercial cars, the top floor being intended for the company's main offices. Two passenger and two freight elevators will be installed in this building, which is of fireproof, structural steel and reinforced concrete design, and the cost of the building alone without manufacturing equipment is estimated at close to $500,000. An isolated generating plant installation will supply light and power for the entire group of buildings when completed. It is expected that the construction work will be finished and cars turned out from both of these factories about Jan. 15, 1914.

## NEW YORK METAL MARKET PRICES

| | July 15 | | July 22 | |
|---|---|---|---|---|
| Copper: | Bid. | Asked. | Bid. | Asked. |
| Standard, spot* | 13.25 | ..... | 14.00 | ..... |
| | Selling Prices | | Selling Prices | |
| | £ s d | | £ s d | |
| London, standard, spot* | 62 8 9 | | 64 8 9 | |
| Prime Lake | 14.50 | ..... | 14.50 | to 14.60 |
| Electrolytic | 14.15 | to 14.25 | ..... | 14.50 |
| Casting | 14.05 | to 14.15 | 14.25 | to 14.35 |
| Copper wire base | 15.50 | ..... | ..... | 15.50 |
| Lead | | 4.35 | | 4.35 |
| Nickel | 40.00 | to 45.00 | 40.00 | to 45.00 |
| Sheet zinc, f. o. b. smelter | | 7.00 | | 7.00 |
| Spelter, spot | 5.30 | to 5.35 | ..... | 5.40 |
| Tin, spot* | 39.70 | to 40.00 | 41.00 | to 41.50 |
| Aluminum: | | | | |
| Prompt delivery | 23.00 | to 23.50 | 23.00 | to 23.50 |
| Future | 21.00 | to 22.00 | 21.00 | to 22.00 |

### *OLD METALS

| | | |
|---|---|---|
| Heavy copper and wire | 13.25 | 13.25 |
| Brass, heavy | 8.12½ | 8.25 |
| Brass, light | 7.25 | 7.25 |
| Lead, heavy | 4.25 | 4.25 |
| Zinc, scrap | 4.37½ | 4.25 |

### *COPPER EXPORTS

Total tons to July 22 ..... 18,033

*From daily transactions on the New York Metal Exchange.

### Industrial Securities

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
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| | | | | | | | |
| | | | | | | | |
| | | 101,363,600 | | | | | |
| | | 41,380,400 | | | | | |
| | | 50,000,000 | | | | | |
| | | | | | | | |
| | | 34,496,400 | | | 59 | | |
| | & M., pf. | 3,998,700 | | | 109 | | |

## Business Notes

**The Blake Signal & Manufacturing Company** has moved its Boston office from 246 Summer Street, to 251 Causeway Street.

**General Electric Company.**—Mr. S. H. Boyer, formerly assistant district manager in the Chicago office of the General Electric Company, has been made district manager for the company at St. Louis, Mo.

**R. H. Henderson,** for a number of years works manager of the Westinghouse Lamp Company, has resigned and will be succeeded by H. S. Black, formerly manager of the St. Louis Magda Lamp Works of the General Electric Company.

**The Electric Construction Company** has been organized at Gadsden, Ala., and has opened a store at 111 North Fourth Street. A line of electrical supplies will be carried and general electrical work engaged in. Mr. B. W. Erwin and Mr. Holly Midgeley are the organizers of the new company.

**Mr. C. M. Welch,** formerly manager of the transformer department of the Duncan Electric Manufacturing Company, Lafayette, Ind., has been recently chosen for a position in the main office of Moloney Electric Company, St. Louis, Mo. His brother, Mr. Jas. E. Welch, who was associated with him, is superintendent of the St. Louis factory.

**C. V. Kerr,** formerly chief engineer for McEwen Brothers, Wellsville, N. Y., has severed his connection with that company after three and a half years' work in developing a helical pump and a propeller blower and is now engaged in the private development of a group of turbine-driven power-plant auxiliaries. His business address is Wellsville, N. Y.

**Gagen & Butler, Inc.,** have opened offices as electrical engineers and contractors at 1402 Broadway, New York. James M. Gagen is president and Edwin C. Butler secretary and treasurer of the firm, which will continue the business carried on by Mr. Gagen for the past two years. Mr. Butler was associated for several years with Harry Alexander and other electrical concerns.

**National Carbon Company's Jovian Ritual Team.**—The rejuvenation of the Jovian Order held at Cedar Point, Ohio, July 18, during the nineteenth annual convention of the Ohio Electric Light Association, was in charge of an organized ritual team composed of representatives of the National Carbon Company of Cleveland. The team, which consists of seventeen members, possesses a complete outfit of costumes and paraphernalia, and is in a position on twenty hours' notice to conduct a ritual anywhere within a night's ride of Cleveland without expense to the local chapter. The National Carbon Company has organized its own Jovian chapter with a membership of seventy, the first in the order to be formed entirely within a commercial organization. The newly elected officers of this chapter are: President, Mr. N. C. Cotabish; vice-president, Mr. M. W. Allen; secretary, Mr. E. M. Spellman; treasurer, Mr. T. J. Wearty; sergeant-at-arms, Mr. A. T. Baldwin; press agent, Mr. E. H. Martindale. Nine candidates were initiated at Cedar Point, the rejuvenation being in charge of Statesman M. H. Moffet of Cleveland.

## New Industrial Companies

**The Graves Engineering Company,** of New York, N. Y., has been incorporated by C. A. Graves, of Brooklyn; C. N. Jones and F. B. Erwin, of New York. The company is capitalized at $100,000 and proposes to do a mechanical and civil engineering and contracting business.

**The Right-Light Company,** of Marion, W. Va., has been incorporated with a capital stock of $10,000 by A. F. Millan, T. V. Morgan, E. D. Conway, H. R. Williams, W. C. Byrd and G. B. McNeely, all of Mannington, W. Va. The company proposes to manufacture light and heat appliances.

**The Mutual Railways Utilities Corporations,** of New York, N. Y., has been incorporated by William Chapman, 20 Benet Street, Arlington, N. J.; Walter Neville, 31 Nassau Street, and C. William Stengel, 146 Liberty Street, both of New York. The company is capitalized at $1,000,000 and proposes to do a manufacturing and construction business.

## Trade Publications

**Pumps.**—In Bulletin No. 115 double-acting plunger pumps of the horizontal type, made by the Goulds Manufacturing Co., Seneca Falls, N. Y., are illustrated, and complete specifications are given.

**Watt-Meter Boxes.**—The Appleton Electric Company, Chicago, Ill., has issued a complete booklet listing and describing its complete line of watt-meter boxes which have been approved by the National Board of Fire Underwriters and are used by the city of Chicago in all apartment, store and office buildings. The boxes are made in three sizes, 1-30 amp, 31-60 amp and 61-100 amp.

**Measuring Instruments.**—The American Every Ready Company, 304 Hudson Street, New York, has assembled within a recently published 32-page catalog information concerning "Eveready" direct-current measuring instruments. Various types of switchboard instruments, automobile types, portable types, portable shunts and switchboard and semi-portable external shunts are illustrated, and a page is devoted to a diagram of connections.

**Reflectors.**—A number of pleasing designs of Brascolite Luminous Units are shown in a recent publication of the Luminous Unit Company, Jefferson and Washington Avenues, St. Louis, Mo. These units are self-contained, and do not depend upon the ceiling in any way for reflection of light. Some efficiency test data are given. The catalog shows a wide range of designs. It is printed on paper free from glare and has an effective cover.

**Paint.**—Rice's "Mill White," a special paint made for the interior of industrial plants, is the subject of some recent advertising literature issued by the United States Gutta Percha Paint Co., Providence, R. I. The advantages of this paint are convincingly set forth in a pamphlet entitled "More Light" and in another entitled "Make the Most of Daylight in Your Plant." Both of these contain illustrations of industrial plants in which this paint was used.

**Storage Batteries.**—The Edison Storage Battery Company, 1022 Lakeside Avenue, Orange, N. J., has issued an illustrated booklet with the front-cover title of "N. E. L. A. Chicago Convention, June 2-6, 1913. In Memoriam," which contains, as stated on the first page, "convention conversations that did not get into the 'Proceedings,' and some of the features of the convention and stories that were told but not recorded referring particularly to the Edison storage battery." Some interesting pictures and catchy paragraphs make a readable booklet.

**Electrical Trucks.**—"G. V. Electrics for Grocers" is the title of a booklet issued by the General Vehicle Company, Long Island City, N. Y. It tells the story of the successful use of its electric trucks by wholesale and retail grocers, pictures and data adding interest and usefulness to the little publication. The actual experiences of grocers in the use of trucks are set forth, and a table showing approximate cost of operation is included. The subject of trucks in department stores is similarly treated in a separate pamphlet.

# Personal Mention

**Mr. S. T. Stewart,** manager of the Muskegon office of the Grand Rapids-Muskegon Power Company, has resigned.

**Mr. T. N. Young** has succeeded Mr. L. B. Carl as superintendent of the municipal water, electric lighting and power plant of Marshfield, Wis.

**Mr. Samuel T. Beatty**, formerly at Hackettstown, N. J., is now associated, as superintendent, with the Danville (N. Y.) Gas & Electric Company.

**Mr. Kempster B. Miller,** consulting engineer, has returned to his home in Chicago after a short vacation sojourn in Great Britain and on the Continent.

**Mr. M. L. Sperry,** manager of the Savannah (Ga.) Electric Company, has been transferred to the New London (Conn.) Gas & Electric Company, controlled by the same interests.

**Mr. H. L. Williams,** who has been associated with the Rawlins (Wyo.) Electric Light & Fuel Company, has become manager of the Evanston (Wyo.) Electric Light Company.

**Mr. F. A. Sherwood,** formerly of the Richfield (Utah) Electric Light & Power Company, has been appointed local manager of the Caldwell (Idaho) plant of the Beaver River Power Company.

**Mr. John O'Connell,** manager of the South Deerfield office of the Greenfield (Mass.) Electric Light & Power Company, has resigned. His successor is Mr. R. Leavitt of Shelburne Falls.

**Mr. Louis Streng,** formerly chief engineer of the Kentucky Electric Company, Louisville, has been retained as consulting engineer by the Louisville Gas & Electric Company, its successor.

**Mr. G. O. Miller**, who has been local manager of the Muncie Electric Light Company at Eaton, Ind., has been transferred to Hartford City, Ind. His successor at Eaton is Mr. Wilber Lyons.

**Mr. F. Rainbow,** formerly with the Neligh Mills lighting plant, at Neligh, Neb., has assumed the management of the Pierce (Neb.) Milling Company, which operates an electric light plant in connection with its mill.

**Mr. H. E. Smoot,** formerly general manager of the Idaho-Utah Electric Company, has become associated with the Richfield (Utah) Electric Light & Power Company as manager, succeeding Mr. F. A. Sherwood.

**Mr. Theodore T. Haldeman,** for the last 18 months superintendent of the Washington Electric Company of Washington, N. J., has been appointed superintendent of the municipal electric-light plant at Dover, Del.

**Mr. Joseph A. Brennan,** formerly with the electrical construction department for the new Subway, New York City, has been appointed to a position with the electrical staff in charge of the Panama Canal work on the Isthmus.

**Mr. C. W. Kellogg, Jr.,** has been appointed manager of the Beaumont (Tex.) Electric Light & Power Company. Mr. Kellogg was formerly local manager for the Stone & Webster Company in charge of the El Paso Gas & Electric Company.

**Mr. Charles W. Wilcox,** for the last three years manager of the Shelburne Falls (Mass.) office of the Greenfield Light & Power Company, has resigned his position. Mr. Wilcox has been connected with the electric-lighting industry for 18 years.

**Mr. H. E. Brandli** has been made manager of the properties of the Citizens' Gas, Electric & Heating Company at Mt. Vernon, Ill., succeeding Mr. C. B. Severson, transferred to New York, as purchasing agent for the Doherty Operating Company.

**Mr. Jefferson Alexander,** superintendent of the Houghton (Mich.) County Electric Light Company, has been appointed general superintendent of the Savannah (Ga.) Electric Company as successor to Mr. H. C. Foss, who has been made acting general manager.

**Mr. W. T. Maddox,** assistant general manager of the Utah Light & Railway Company, Salt Lake City, Utah, has resigned from the company and has retired from active work. Mr. Maddox left for Southern California, where he will live on his ranch near Gardena.

**Mr. Thomas W. Haldeman**, who has been general manager of the Point Pleasant (N. J.) Electric Light & Power Company, has returned to Washington, N. J., to resume charge of the Washington Electric Company, a position which he relinquished in February, 1912.

**Mr. T. W. Norcross,** formerly district engineer at Denver, Col., for the United States Forest Service and engaged in power and irrigation work in eight of the western states, has been promoted to the position of assistant chief engineer, with headquarters at Washington, D. C.

**Mr. J. Hoadley Cochran,** who has for several years been in charge of the plant of the George Fetter Company of Louisville, recently acquired by the Louisville Gas & Electric Company, continues the management of that plant, which manufactures considerable quantities of ice.

**Mr. W. E. Shaw** has been appointed local manager of the York Light & Heat Company, Biddeford, Me., as successor to Mr. J. G. Shaw, former vice-president and manager, who resigned when the company was taken over by the Cumberland County Power & Light Company, Portland, Me.

**Mr. L. A. Bailey,** at present electrical inspector of the Oklahoma Fire Inspection Bureau, will leave Aug. 7 to become engineer for the Rock Mountain Fire Underwriters Association, Denver, Col., succeeding Mr. W. J. Canada, who has resigned to take up special investigation work for the Bureau of Standards.

# Obituary

**Anthony Nicholas Brady,** the well-known public utility magnate of New York and Albany, died in London, England, on July 22, from angina pectoris. At the time of his death Mr. Brady was close on to seventy years of age, having been born on Aug. 22, 1843, at Lille, France, of Irish parents. He came to the United States with his parents and settled in Albany, N. Y., where young Brady attended school until he was thirteen years old. He then went to work and for a time was employed at the Delevan House, an Albany hotel, where he remained until he became of age. His subsequent career is merely indicative of the fact that the country possesses untold wealth for those who care to wrestle with it. His financial career was at its zenith when the end came. His personal influence, however, went beyond the sixty large corporations in which he was a director and his interests included those of transportation, electricity, gas, rubber, oil, paving materials and tobacco. He was a power in the American Tobacco Company and also made much money in the oil industry. Mr. Brady was best known, however, as a promoter of public service corporations. He first purchased the gas plants at Albany and Troy, N. Y., and in Chicago, and then began to buy up trolley lines, first in Albany and then in other cities, and also electric light plants. A list of the purely electric public utility companies in which he was interested follows: Astoria Light, Heat & Power Company, Long Island City, N. Y.; Consolidated Gas Company of New Jersey, Long Branch, N. J.; Consolidated Light & Power Company, Whitehall, N. Y.; Edison Electric Illuminating Company of Brooklyn, Kings County Electric & Power Company of Brooklyn, New York Edison Company, United Electric Light & Power Company, New York; Consolidated Gas, Electric Light & Power Company, Baltimore; Glens Falls Gas & Electric Company, Louisville Lighting Company, Memphis Consolidated Gas & Electric Company, Northern Westchester Lighting Company, Peekskill Lighting & Railroad Company, Utica Gas & Electric Company, Westchester Lighting Company, Yonkers Electric Light & Power Company, Municipal Gas Company of Albany, United Gas, Electric Light & Fuel Company, Fort Edward, N. Y.; Troy Gas Company, Dayton Light, Heat & Power Company and the Chattanooga & Tennessee River Power Company. He was also a member of the board of directors of the Westinghouse Electric & Manufacturing Company. He is survived by his widow, his son, Nicholas F., who succeeded him recently as president of the New York Edison Company, another son, J. C. Brady, and three married daughters.

# Construction

## New England

[illegible] of public instruction, State House, Concord, N. H., for the erection [illegible] plumbing, heating, electric wiring, chimney and boilers. Plans and specifications may be obtained upon application to Brainered & Leeds, architects, 89 Franklin Street, Boston, Mass. A deposit of $10 will be required for each set of plans, to be refunded upon return of same.

NEW BOSTON, N. H.—The Manchester Trac., Lt. & Pwr. Co. has petitioned the Public Service Commission for permission to purchase the electric-light plant in New Boston, owned by Allen P. Wilson.

SUNAPEE, N. H.—The Public Service Commission has granted the Sunapee El. Lt. & Pwr. Co. permission to issue $10,000 in capital stock.

CHESTER, VT.—The Chester Wtr. & Lt. Co. expects to purchase within the next six months 60-cp incandescent tungsten street lamps, [illegible] prices on street lamp posts.

MONTPELIER, VT.—The Consolidated Ltg. Co., of Montpelier, is erecting 22 miles of 33,000-volt, three-phase transmission line on wish[illegible] to have an ultimate capacity of 2700 kw. H. D. Larrabee is manager.

PROCTOR, VT.—The Vermont Marble Co., of Proctor, expect to have erected within the next six months a hydroelectric plant at Beldens, Vt., consisting of two 1200-hp units to furnish power for its 45,000-volt system. The company is also extending its distributing circuits to outlying quarries and plants, and installing about 300 hp in motors this summer. C. T. Maynard is electrical engineer.

BOSTON, MASS.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Aug. 30 for installing an underground electric transmission line from the navy yard, Boston, to the naval hospital at Chelsea, a distance of about 1 mile. Plans and specifications may be obtained on application to the bureau. William M. Smith is acting chief of bureau.

BOSTON, MASS.—Bids will be received at the office of the fire commissioner, Bristol Street, Boston, Mass., until Aug. 7, for work in connection with the underground construction of the fire alarm branch of the Fire Department of the city of Boston, comprising the laying of about 5000 ft. of single-duct, 200 ft. of two-duct, 100 ft. of four-duct, the setting of 46 lamp posts and four test posts, according to plans and specifications, which may be obtained at the office of the superintendent of fire alarms, Bristol Street, Boston. Charles H. Cole is fire commissioner.

FALL RIVER, MASS.—Many improvements and extensions are being made to the plant of the Fall River El. Lt. Co. An addition will be made to the boiler house and equipment installed which will double its capacity. A 4000-kw Curtis General Electric turbine and a complete coal-handling equipment and Taylor stokers are to be installed. At the Hartwell Street substation a 16-panel switchboard with concrete-cell construction is now being added. The ornamental lighting system, the contract for which was recently signed by the Mayor (see issue of June 14) will require 96 6.6-amp magnetite inverted arc lamps and two 75-lamp 6.6-amp General Electric mercury-arc rectifiers, and will soon be in operation. Albert F. Dow, president.

FITCHBURG, MASS.—The Board of Aldermen and Council have authorized the installation of 37 twin-cluster lamps on Water Street.

LUDLOW, MASS.—Work has begun on the steam-power plant of the Ludlow Manufacturing Associates. This extension is to supply energy for the new mill which is now under construction. A General Electric 2500-kw turbine, together with boilers, stokers and other equipment, has been ordered. Sidney Stevens is agent.

SOUTHBRIDGE, MASS.—Arrangements are being made, it is reported, by the Central Mills Co. to operate its mills by electricity. Two new motors and a 200-kw generator are to be installed. Calvin D. Page is president.

SPRINGFIELD, MASS.—A permit has been granted to the Hendee Mfg. Co. for the erection of a power house, 163 ft. by 43 ft., to be located on Page Boulevard.

SPRINGFIELD, MASS.—The United El. Lt. Co., of Springfield, is now installing one 4500-kw Parsons steam turbine and four 400-hp Porcupine boilers, four Murphy furnaces, several sections of 5500 volt switching apparatus and erection of substation for 500-kw, 66,000-volt transmission system. W. L. Mulligan is manager.

STERLING, MASS.—Extensions have been made to the distributing system of the municipal electric-light plant to the farming district this year at a cost of $10,000. Further extensions may be made in the fall or next spring as the town may vote. Energy for operating the municipal plant is purchased from the Connecticut River Transmission Co., of [illegible]

STOCKBRIDGE, MASS.—The Stockbridge Ltg. Co. expects to erect within the next three months 2 miles of No. 2, four-wire two-phase, and approximately 3 miles of No. 6, single-phase, 2300-volt tranmsission lines. Joseph Franz is engineer.

TAUNTON, MASS.—The finance committee of the City Council has voted in favor of appropriating $50,000 for the purchase of a new turbo-generator for the municipal electric-light plant.

WARE, MASS.—The Central Mass. Elec. Co. has extended its lines through the woods to the shores of Forest Lake, a summer colony. Energy will be furnished for lighting and also for domestic purposes. At the water's edge a sign will be built giving the name of Kamp Wumfort Canoe Club, which will provide ample illumination at that point.

WRENTHAM, MASS.—Bids will be received by the trustees of the Wrentham State School, at the office of Kendall, Taylor & Co., architects, 93 Federal Street, Boston, Mass., for construction of brick custodial building, two brick dormitories, three wooden employes' buildings and administration building, additions to the service building and [illegible] tion to power house; separate contracts will be made for erecti[illegible] ing, plumbing and electric work. Plans and specifications may be seen at the office of the architects, and plans will be loaned if desired at the cost of printing same. Albert L. Harwood is chairman, trustees.

PROVIDENCE, R. I.—The Rhode Island Transmission Co., which is owned by the New England Pwr. Co., is reported to have closed a contract with the Narragansett El. Lt. Co. and the city of Providence, whereby it will secure entrance on favorable terms to the manufacturing section of Rhode Island. Under the contract the New England Pwr. Co. will sell hydroelectric power to the Narragansett company, which will distribute it over the entire district.

WOONSOCKET, R. I.—The new five-year contract recently granted the Blackstone Valley Gas & El. Co. for lighting the streets becomes effective July 1 and provides for arc lamps at the rate of $85 [illegible] year, instead of $120 as in the past five years. The incandescent [illegible] will be 60 cp instead of 40 cp as in the past, and will cost $27 [illegible] each instead of $30 for the 40 cp. When the number of incandescents reaches 185 the price will be reduced automatically to $25 each. The present number is 114. A. T. Townsend, manager.

ANSONIA, CONN.—The Ansonia Brass & Copper Co. is reported to be making arrangements to operate all its local plants by electricity, to be supplied from the plant of its subsidiary, the A. B. & C. Co. Permission has been granted the Ansonia Brass & Copper Co. to lay conduits between the plants.

## Middle Atlantic

BUFFALO, N. Y.—The Buffalo Package Co., 478 Babcock Street, Buffalo, will erect a power house at its plant at Babcock Street and Erie Railroad.

CHATHAM, N. Y.—The Village Trustees are considering the question of establishing a municipal electric-light plant.

CLAYVILLE, N. Y.—Arrangements are now being made by the Board of Village Trustees with the Utica Gas & El. Co., of Utica, for lighting the streets of Clayville with electricity.

CORNING, N. Y.—The Corning Gas & El. Co. is reported to have abandoned its plan to erect an electric plant in Corning and will contract with the Elmira Lt., Wtr. & Ry. Co. for the energy to operate its system. Energy will be delivered to the city line at 22,000 volts.

JAMESTOWN, N. Y.—The Board of Electric Lighting Commissioners expects to purchase within the next few months one 1000-kw 60-cycle, 2300-volt turbo-generator, three stokers and switchboard panel for above generator; also two 75-lamp rectifier sets, and 150 series arc lamps. It is also proposed to repair the testing shops and store house. All improvements are subject to outcome of election on a proposition to issue $40,000 in bonds. C. O. Johnston is superintendent.

KINGSTON, N. Y.—The Kingston Gas & El. Co. has, since January, erected 77,600 ft. in extensions to its transmission line, providing for the installation of 450 hp in motors besides building 41,978 ft. of distribution line to Lake Katrine. Two 200-kva transformers, five 13,200-volt, three-pole Burke high-voltage air-break switches, five 13,200-volt three-phase combined horn-type lightning arresters, three steel substation towers, one 500-kva transformer, 330 direct-current [illegible] inclosed arc lamps, nine 50-lamp combined rectifier sets, 7 lightning arresters, 28 static protectors and 200 ornamental street-lighting [illegible] are among the items of equipment purchased during that period. Waldron, Jr., is assistant manager.

NEWFANE, N. Y.—The Newfane El. Co. and the Newfane Basket Co. have entered into an agreement whereby the latter will erect a power house on the site of its factory, recently burned, and the former will furnish machinery for it, lease the power house and water rights and furnish to the basket factory about one-fourth of the 300 hp to be developed.

NEW YORK, N. Y.—The Interborough Rapid Transit Co., of New York, N. Y., is asking for bids for three 30,000-kw turbo-generators for Seventy-fourth Street power house.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, until July 28 for additions and repairs to electric equipment at Public School 2, 116 Henry Street, and Public School 184, No. 31 West One Hundred and Sixteenth Street, borough of Manhattan; also for installing electric equipment in the Public School 102, on East One Hundred and Thirteenth Street, near Second Avenue, borough of Manhattan. Blank forms, plans and spe

ns may be obtained at the office of the superintendent, Park Avenue Fifty-ninth Street.

IAGARA FALLS, N. Y.—The lighting committee of the Business 's Association has engaged H. B. Sweet, of Utica, N. Y., consulting neer, to prepare plans for an electric-light and power plant to be built he association.

SWEGO, N. Y.—The People's Gas & El. Co., of Oswego, is reported nave closed a deal whereby it will secure electrical energy gen- ed at the plant of the Salmon River Pwr. Co., now in course onstruction at Stillwell in the town of Orwell. The contract calls 2000 hp. The People's company has purchased a private right-of-way the city limits to the plant, and will erect new transmission lines install new machinery in the plant. The company will expend be- en $100,000 and $200,000 in this city and vicinity.

OME, N. Y.—The Board of Public Works has awarded the contract the ornamental street-lighting system to the Rome Gas, El. Lt. & . Co. The contract calls for 76 four-lamp clusters (100-watt tungs- lamps) at $56 each per year, and four five-lamp clusters (150-watt s), at $78.41 each per year. Albert B. Morton is local superin- ent.

YRACUSE, N. Y.—The contract for the permanent illumination of State Fair grounds and buildings has been awarded to the Conduit Co., of Syracuse, at $17,089. The contract provides for the installa- of 85 ornamental lamp standards along the principal thoroughfares.

REELAND, PA.—The Lehigh Coal & Navigation Co.'s plant at Hauto be connected with a transmission line to the Harwood El. Co.'s plant reeland. The completion of this work will insure Freeland against eakdown if the Harwood plant should meet with an accident to its hinery.

ARWOOD, PA.—The Harwood El. Co., of Hazleton, has practically pleted extension to its turbine room and the installation of a new 0-kva General Electric turbine, Westinghouse Le Blanc condensers, ension to switchboard, etc. Contract has been awarded and work ted on extension to boiler room. Order has been placed for five hp Babcock & Wilcox boilers, equipped with improved Coxe auto- ic stokers. The Scofield Engineering Co., of Philadelphia, has rge of the engineering work. John S. Wise, Jr., is manager.

IAZLETON, PA.—The Harwood El. Co. is constructing an addition substation supplying Hazleton and vicinity with electricity, increasing output from 2000 to 5000 kw, alternating-current; also installing two -kw Westinghouse motor-generator sets; General Electric switch- rd, lightning arresters, etc. The Scofield Engineering Co., of Phila- hia, is engineer. John S. Wise, Jr., is manager.

ORTVUE, PA.—Application has been made to the Borough Council J. P. Wood (a southern promoter) for a franchise to establish an tric-light plant in Portvue. Mr. Wood has also applied for an tric-light franchise in Glassport.

INGTOWN, PA.—The stream which furnishes water power to rate the plant of the Ringtown El. Lt., Ht. & Pwr. Co. will be con- ted into a reservoir to furnish water for domestic purposes, which make it necessary for the company to install a steam or gas power it within the next year. J. A. Yost is secretary.

FREEHOLD, N. J.—The Town Commissioners have awarded the nmouth Lt. Co., of Freehold, a contract for street-lighting for the ning year. The contract provides for eight decorative arches to be cted over Main Street, each containing 15 25-watt tungsten lamps, at 0 each per year, 12 four-lamp clusters, at $75 each per year; in the lying districts 26 single 60-watt lamps, at $24 each per year, will be d.

ERSEY CITY, N. J.—Bids will be received at the office of the ervising architect, Treasury Department, Washington, D. C., until g. 11 for pneumatic tube system in the United States post office in sey City, in accordance with specifications and drawings, copies of ich may be obtained at the above office or of the custodian of post ce in Jersey City, N. J. O. Wenderoth is supervising architect.

BALTIMORE, MD.—The Consol. Gas, El. Lt. & Pwr. Co., of Balti- re, it is reported, will extend its 11,000-volt transmission line to the lages of Granite and Woodstock. A number of quarries in that vicin- will be equipped for electrical operation.

HUNTINGTON, W. VA.—Application has been made to the Public rvice Commission by the Tri-State Pwr. & Milling Co. for a permit condemn land and build a dam on New River below Anderson Falls, Summers County. The plans provide for the construction of a dam ft. high, 98 ft. wide, with a wall 900 ft. long at crest to develop put 65,000 hp. O. L. Stearns, of Salem, Va., is president.

CHARLOTTESVILLE, VA.—The Charlottesville & Albermarle Ry. ., of Charlottesville, expects to erect within the next two months a w power plant and has purchased the following equipment for same: o 400-hp Babcock & Wilcox boilers, one 500-kw and one 1000-kw neral Electric steam turbine, two Wheeler condensers, switching ipment for same, one General Electric rectifier and material for dis- ution system. John L. Livers is manager.

RICHMOND, VA.—Contracts, it is reported, will soon be awarded the trustees of Richmond College for the erection of the power se, which will contain the central heating and electric plant of the w Richmond College at Westhampton.

WASHINGTON, D. C.—An American consular officer in the far east has been advised that a mining concern will shortly require a 2000 to 2500-kw electric power plant. For further information address No. 11,307, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C.

## North Central

ALBION, MICH.—The Commonwealth Pwr. Co. has erected a temporary plant to take care of 2500 kw of load which was put into operation four days after the fire started. O. H Stecker is local manager.

DETROIT, MICH.—Bids will be received at the office of the Secretary of the Board of Education, 5 Broadway, Detroit, Mich., until Aug 12, for the erection, including general masonry work, general carpentry work, heating, plumbing and electric wiring, for a 16-room school building on Trombley and St. Aubin Avenues. Plans and specifications may be seen at the office of the supervisor of school buildings, Room 1, 5 Broadway. Charles A. Gadd is secretary.

EDMORE, MICH.—J. H. Gibbs & Son, proprietors of the local electric-light plant, expect to purchase a 45-hp steam engine directly connected to a three-wire direct-current generator to take the place of storage battery.

GRAND RAPIDS, MICH.—The Grand Rapids-Muskegon Pwr. Co. has leased the electric power system of the Muskegon Traction & Lt. Co. and will occupy the entire lighting and power field in Muskegon. The Muskegon company will continue to operate the gas and street-railway properties.

MACKINAC ISLAND, MICH.—The Municipal Wtr., Lt. & Pwr. Co., of Mackinac Island, expects to purchase within the next six months a 250-kw direct connected generating unit for lighting load. A. J. Doherty, Jr., is secretary and treasurer.

STANDISH, MICH.—The Michigan Cooperage Co., of Standish, has sold its electric plant to C. F. Hall, of Standish.

THREE RIVERS, MICH.—At an election held recently the proposition to issue $20,000 in bonds to establish a municipal lighting system and $30,000 in bonds to develop the city water power and to rebuild the pumping station was carried.

CLEVELAND, OHIO.—Bids will be received at the office of the secretary to the director of public service, No. 204 City Hall, Cleveland, until Aug. 5 for furnishing three-conductor paper-insulated cable for the municipal electric-light plant. Proposals must be made out on blanks furnished by the engineer of construction. W. J. Springborn is director of public service and W. H. Kirby secretary.

COLUMBUS, OHIO.—Bids will be received by the director of public service, City Hall, Columbus, until Aug. 5 for the erection of cluster lamps on the following streets: Fourth Street, from Mount to Livingston Street; High Street, from Warren Street to Fifth Avenue; State Street, from Fourth Street to Grant Avenue. Plans and specifications are on file in the office of the director of public service; proposal blanks may be obtained from the chief engineer. Samuel A. Kinnear is director of public service.

GREENWICH, OHIO.—Recent purchases of the municipal electric lighting plant include one 100-kva, 1100-volt, 60-cycle, three-phase Westinghouse generator; one panel for a commercial circuit and one for street lighting; 50 cedar poles, 20 lightning arresters, one 12-kw and one 5-kw transformer. Later it is expected to purchase a few smaller transformers. Wire and supplies will also be bought. F. H. Daniels is clerk.

LOWELLVILLE, OHIO.—Bids will be received by C. W. Baker, village clerk, until Aug. 1 for the purchase of $6,000 in bonds. The proceeds will be used for reconstructing electric-light lines, etc.

LOUISVILLE, KY.—Bids will be received at the office of the business director of the Board of Education, Administration Building, corner of Eighth and Chestnut Streets, Louisville, until Aug. 1, for electric wiring in George W. Morris and Eight-ward schools. Plans and specifications may be obtained on application to the above office. Samuel D. Jones is business director and J. Earl Henry is architect and engineer.

PADUCAH, KY.—The municipal electric-lighting plant expects to purchase within the next six months two 75-hp alternating-current motors directly connected to pumps for its sewage system. L. A. Washington, city engineer, has this matter in charge. J. O. Keebler is superintendent of the city lighting plant.

FORT WAYNE, IND.—The Fort Wayne & Northern Trac. Co. is planning to build a new power house and has already placed orders for two 6250-kva General Electric Curtis turbines complete with Worthington condensers and all switchboard apparatus. The company is changing its present 2200-volt, two-phase, four-wire system over to 4000 volts, three-phase, four-wire, and proposes to change all its motors from two-phase to three-phase and is making arrangements to install two-to-three-phase transformers in order to change the entire system over; the boilers are also being equipped with the new type of Roney stokers. The company has just connected up with the S. F. Bowser Oil Tank Co. and the Perrine-Armstrong Co. sawmills, furnishing the former with 375 hp and the latter with 265 hp. E. S. Myers is electrical engineer.

KOKOMO, IND.—The Indiana Rys. & Lt. Co., of Kokomo, has erected transmission lines to the towns of West Middleton, Russiaville, New London, Forest and Michigantown, for the purpose of furnishing

[illegible] be installed this summer. Thomas C. McReynolds is secretary and treasurer.

PIERCETON, IND.—The Pierceton El. Lt. & Wtr. Co. expects to purchase within the next 20 days a new switchboard and circuit breaker. C. F. Shorb is superintendent.

[illegible] the Centralia Gas & El. Co. to its electric and gas plants, costing about $100,000. New equipment, including a 625-kva turbine generator, marble switchboard and two new boilers, has been installed. A new sub- [illegible] H. C. Higgins is [illegible]

MONMOUTH, ILL.—It is reported that Monmouth Commercial Club has secured funds to install an ornamental lighting system.

[illegible] pleted the erection of a new cement engine room. A new generator and oil engine were installed last month. H. C. Stair, secretary.

[illegible] plant expect to purchase and erect within the next 90 days a new generating unit, consisting of a 500-hp cross-compound condensing engine directly connected to a 375-kva, 60-cycle, 220-volt generator, with switchboard panel for same. T. N. Young is superintendent.

MENOMONIE, WIS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 19 for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches, of the United States post office at Menomonie. Drawings and specifications may be obtained from the custodian ot site at Menomonie or at the above office. O. Wenderoth is supervising architect.

MONROE, WIS.—The Monroe El. Co. expects to erect 1 1-3 miles of transmission line within the next 30 days. H. A. Smith is secretary.

PRAIRIE DU SAC, WIS.—William Albers, owner of the local electric-light plant, expects to rebuild about ¼ mile of the transmission line and will purchase about 30 meters and one test meter within the next 30 days.

DULUTH, MINN.—The Great Northern Pwr. Co., of Duluth, operating a hydroelectric plant at Thompson, which furnishes energy in the cities of Duluth and Superior, Wis., is reported to have authorized an increase in its capital stock from $2,500,000 to $11,000,000. The proceeds will be used to extend its transmission lines to a number of communities in northern Wisconsin and Minnesota.

ELLSWORTH, MINN.—Bids will be received by F. W. Stanton, village recorder, until July 31, for construction of an electric-lighting system for the village of Ellsworth according to plans and specifications which are on file in the office of the village recorder and also in the office of Earle D. Jackson, consulting engineer, Capital Bank Building, St. Paul, Minn. The work is divided into two parts as follows: (1) Consisting of cement block building; (2) furnishing and erecting oil engines, generators, storage battery, switchboard, pole line, etc. Separate bids will be received on parts 1 and 2. The sum of $2 (to cover cost of printing) must accompany application for copies of plans and specifications.

WADENA, MINN.—The Village Council has voted to purchase a new engine and generator to replace the two machines now in use. The new unit will have a rating of 200 hp and be directly connected. George S. Hughes is superintendent.

WORTHINGTON, MINN.—The city of Worthington is installing about 40 ornamental lamp standards and making short extensions to the municipal electric light and water systems. W. H. Buchanan, superintendent, has charge of the work.

BAYARD, IA.—At an election held July 8 the proposition to issue $6,000 in bonds for the construction of a municipal electric-light plant was carried. The Alamo Engine & Supply Co., of Omaha, Neb., has charge of the engineering work.

FOREST CITY, IA.—The Forest City El. Lt. & Pwr. Co. expects to erect within the next two months a new power house and to purchase one boiler, one 14-in. by 36-in. Corliss engine, one 100-kva revolving field generator, one two-panel switchboard with necessary instruments for alternating-current, pole insulators, transformers, lightning arresters, wire, etc.; also electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, wiring supplies, etc. Frank Kellogg is president.

GRUNDY CENTER, IA.—The Grundy Center El. Co. expects to purchase within the next six months one three-phase switchboard-type watthour meter with current transformer (150 kw) and about 20 steel poles from 30 ft. to 35 ft. long for the Main Street circuit, which is being rebuilt.

LAWLER, IA.—At an election held recently the proposition to issue $6,000 in bonds for the installation of an electric-light plant was carried.

OSKALOOSA, IA.—The Oskaloosa Lt. & Tract. Co., which was recently purchased by W. B. McKinley, is planning to erect within a few months a 60-ft. by 120-ft. carhouse, and to purchase the equipment for a 12-mile transmission line and one 350-hp boiler. H. W. Garner,

STORY CITY, IA.—Within the next two months a new power house [illegible] erected for the municipal electric-light plant and a new boiler, [illegible] generator will be installed, contracts for which have been

HAMILTON, MO.—The local electric-light plant, owned by the late Frank Clark, has been purchased by David Miller and H. L. Gilbert. The new owners, it is understood, will make extensive improvements to the property during the summer months.

JEFFERSON CITY, MO.—Bids will be received at the office of the State Capitol Commission Board, Jefferson City, until Aug. 14, for construction of power house and tunnel of the Missouri State Capitol, in accordance with drawings and specifications, copies of which may be obtained at the office of the commission or at the office of Tracy & Swartwout, architects, 244 Fifth Avenue, New York, N. Y. A deposit of $25 will be required for plans, which will be refunded upon return of same. J. Kelly Pool is secretary of board.

NECK, MO.—At a special election held recently the proposition to grant an electric-light franchise to a foreign company was carried. The company, it is said, will install a plant at a cost of about $25,000. A. M. Baird, of Cartersville, is attorney.

ELK POINT, S. D.—A. Smythe, city auditor, writes that the city is contemplating the installation of an electric-light plant, but as yet nothing definite has been done.

GRESHAM, NEB.—The proprietor of the local electric-light plant expects to install one Muncie 30-hp engine within the next two months.

CHANUTE, KAN.—The Commercial Club, it is reported, will consider the proposition of Carl Reynolds and associates who propose to construct a modern hydroelectric power plant and auxiliary steam plant near Austin, at the site of the old mill and dam. If the contract is secured it is proposed to organize a company and build a $100,000 plant. The plans provide for a 500-kw hydro-electric power plant and a steam generating plant of the same capacity. E. M. Stevens, of the E. M. Stevens & Co., of Kansas City, Mo., consulting engineers, has been engaged to prepare plans for proposed plant.

HUTCHINSON, KAN.—The city commission has adopted an ordinance authorizing the mayor and clerk to enter into a contract with the United Wtr., Gas & El. Co. for street-lighting for a period of ten years. The contract provides for the installation of an ornamental lighting system in the business district and for 40 additional arc lamps in the residence [illegible]

TOPEKA, KAN.—The contract for extensions to the ornamental street-lighting system on several streets has been awarded to the Tucker Electrical Co., of Topeka, for $15,679. The contract provides for use of poles made by the Topeka Fdy. Co.

## Southern States

TRYON, N. C.—The Tryon El. Lt. Co., it is said, will extend its transmission line to Landru, a distance of 3 miles.

CEDARTOWN, GA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 19 for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches, of the United States post office building at Cedartown, Ga. Drawings and specifications may be obtained from the custodian of site at Cedartown, or from the above office. O. Wenderoth is supervising architect.

REYNOLDS, GA.—The City Council is contemplating the construction of a muncipal electric-light plant and would like to communicate with contractors and manufacturers of machinery for electrical plants. As yet nothing definite has been done or engineer engaged. G. L. Cooper is clerk and treasurer of the council.

ROME, GA.—The City Council has voted to enter into a contract with the Georgia Ry. & Lt. Co., of Atlanta, to furnish electricity for the new pumping station, the equipment to be installed within 90 days.

ROME, GA.—It is reported that arrangements are being made to transmit energy to Rome from the Tallulah Falls plant of the Georgia Ry. & Pwr. Co. Heretofore Rome has been furnished with energy from the plant of the Tennessee Pwr. Co., near Cleveland. The Georgia Ry. & Pwr. Co. has already erected a substation at Lindale, 5 miles from Rome, at a cost of $65,000, and arrangements are being made to complete the plant, which will cost about $200,000

JACKSONVILLE, FLA.—Posts have been ordered from the Union Foundry Co., Anniston, to be used in illuminating the business section, the energy for which will be supplied by the city lighting plant.

WINTER PARK, FLA.—The Council, it is stated, is contemplating issuing $10,000 in bonds for the installation of a municipal electric-light plant.

CENTERVILLE, TENN.—The Buckeye Spoke Co., Bon Aqua, Tenn., will petition the Mayor and Board of Aldermen for a franchise for an electric-lighting plant.

DICKSON, TENN.—Changes are being made in the engine of the municipal lighting plant which will effect a saving of 20 per cent. E. L. Payne, chairman.

ETOWAH, TENN.—The Etowah Wtr. & Lt. Co. is considering the question of establishing an ice factory next year. W. H. Price is manager.

EMPHIS, TENN.—Bids will be received by the Mississippi River nission, First and Second Districts, at the United States Engineer , Memphis, Tenn., until Aug. 21, for furnishing turbines, pump ced water heater and electric-light plant for hydraulic grader No. Further information may be secured on application to Major . Markham.

ELBYVILLE, TENN.—Bids will be received at the office of the vising architect, Treasury Department, Washington, D. C., until 28, for construction, including mechanical equipment, interior ng fixtures and approaches of United States post office building elbyville. Drawings and specifications may be obtained from the lian at Shelbyville, or at the above office. O. Wenderoth is super- architect.

AYTON, ALA.—The power plant of the municipal electric-light n was completely destroyed by fire recently.

LFPORT, MISS.—The Yaryan Naval Stores Co., of Gulfport, it ported, will make improvements to its plant, including replacing engines with steam turbines and directly connected generators, etc.

NA, ARK.—W. B. Crossland, manager of the Newport El. Lt. & Co., of Newport, is reported to have closed a deal with the Council and has purchased the franchise for the electric-lighting here under the name of the De Soto Co-operative El. Lt. & Pwr. Work, it is stated, will begin at once on construction of a new in Mena.

LVILLE, LA.—The installation of a municipal electric-light plant ported to be under consideration.

ARKSVILLE, TEX.—Bids will be received at the office of the vising architect, Treasury Department, Washington, D. C., until 19, for construction complete (including plumbing, gas piping, g apparatus, electric conduits and wiring, interior lighting fixtures pproaches) of the United States post office at Clarksville, Tex. ings and specifications may be obtained from the custodian of site arksville or from the above office. O. Wenderoth is supervising ect.

EEPORT, TEX.—The Gulf, Freeport & Northern Ry. Co. has been ized, with principal office at Freeport, for the purpose of construct- nd operating an interurban electric railway between Freeport and , about 100 miles. The proposed road will run through a number wns, the more important ones being Brazoria and West Columbia. company will construct a central power station at Freeport. The y for the proposed road will soon be started.

ANDVIEW, TEX.—The Texas Lt. & Pwr. Co., of Dallas has pur- d the property of the Grandview Mill Lt. & Ice Co. and will take the plant Nov. 1.

EENVILLE, TEX.—The managers of the municipal electric-light expect to purchase a switchboard panel for the municipal electric- plant to handle energy for Peniel, a nearby town, with integrating and circuit-breaker; also within the next month to purchase a nt-current arc regulator (50 lamps) in addition to one already led which will split the arc circuit and call for 7000 ft. of No. 6 and within the next two months to purchase five 5-kva trans- rs, one car of 30-ft. poles, 500 lb. of No. 8 wire and 48 5-amp M. M. Arnold is alderman.

OUSTON, TEX.—The city of Houston is reported to be contemplat- he installation of a municipal electric-light plant. At first the plant urnish electricity for municipal purposes only.

NGVIEW, TEX.—The Longview Ice & Lt. Co. expects to erect n the next two months an annex to its engine room and has con- d for one 200-kva Fort Wayne generator and exciter, together with 225-hp Diesel oil engine and auxiliaries. F. A. Matthes is manager.

ARBLE FALLS, TEX.—The city of Marble Falls is contemplating nstallation of an electric-light plant and water works system.

ARSHALL, TEX.—Bids will be received at the office of the super g architect, Treasury Department, Washington, D. C., until Aug. or construction complete, including mechanical equipment, mail lift, or lighting fixtures and approaches of the United States post office Marshall. Drawings and specifications may be obtained from the dian of site at Marshall, or at the above office. O. Wenderoth is rvising architect.

## Pacific States

ERDEEN, WASH.—The fire and light committee of the City ncil has recommended the construction of a municipal electric-light at the falls of the Wishkah River. For further information ad- the city clerk.

OTIN, WASH.—A telephone line from this city to Rogersburg, a nce of 24 miles, will probably be built before fall by A. H. Graves, r of the local telephone system. Earls Ferry, Idaho, will be passed oute.

POKANE, WASH.—It is reported that an electric-light plant will nstalled in the new building being erected by Patrick Welch at the r of Main Avenue and Howard street for use of the Culbertson- e-Rankin Co. The plant will be located in the sub-basement where rs for heating and power purposes and other machinery will be d. The building will be equipped with five passenger elevators, two large freight elevators and two electric dumb waiters, a vacuum cleaning plant, air compressor, ventilating machinery, several pumps, etc. The Hurley, Mason Co., of Spokane, has the contract for construction of the building. Monroe K. Miller has supervision of the building for Mr. Welch.

SULTAN, WASH.—The Sultan El. Co. expects to purchase wire and all necessary material for a 4-mile 6600-volt transmission line. F. I. Anderson is secretary and treasurer.

VANCOUVER, WASH.—The Northwestern El. Co., it is reported, is contemplating the construction of a new substation at the corner of Albina and Railroad Street in Lower Albina.

BURNS, ORE.—The El. Lt. & Pwr. Co., of Burns, expect to install within the next two months one oil engine, generator and auxiliaries (about 75 kw) and to purchase within the next three months several distributing transformers and series tungsten lamps and within the next few months will purchase household labor-saving devices, including vacuum cleaners, washing machines, etc. The company will establish a day service (one day a week). Roy C. Dwyer is manager.

KLAMATH FALLS, ORE.—The sawmill and light plant at the Klamath Indian agency was destroyed by fire recently.

NEWBERG, ORE.—The Yamhill El. Co. expects to erect within the next two months a transmission line and distributing system at St. Paul, Ore., and to purchase within the next 30 days transformers, wire and material for same. C. J. Edwards is president and manager.

PORTLAND, ORE.—The contract for wiring the Northwestern Bank Building (15 stories high) has been awarded to the Pacific Fire Extinguisher Co., Railway Exchange Building, Portland, at $14,000. The Pacific Company, it is understood, will ask for bids for material in the near future.

BAKERSFIELD, CAL.—The San Joaquin Lt. & Pwr. Co. has been granted a permit to build an addition to its steam plant on the outskirts of Bakersfield, which will cost with additional machinery, $40,000. Improvements at the Kern River canyon plant, it is reported, call for the installation of a 5000-hp turbine engine.

LOS ANGELES, CAL.—The State Railroad Commission has granted the Southern California Edison Co., of Los Angeles, authority to issue $3,000,000 in capital stock, the proceeds to be used to pay existing indebtedness and for plant extensions.

LOS ANGELES, CAL.—The Department of Agriculture has issued a water power permit granting the Pacific Lt. & Pwr. Co., of Los Angeles, authority to operate power plants in the Sierra National Forest. The company will transmit energy 240 miles to Los Angeles at 150,000 volts. The permit allows 12 years for construction. Four power houses, two reservoirs and 25 miles of cement-lined tunnels will be built. Electricity will be transmitted over a double steel tower line of aluminum cables.

OAKLAND, CAL.—Plans are being prepared by George Babcock, city electrician, for the gradual installation of a municipal system of street lighting, by which the city shall own poles, lines and other equipment, and purchase energy from private corporations. The plan provides for installing the street-lighting system district by district, gradually spreading the municipal lines throughout the city.

SANTA BARBARA, CAL.—The Santa Barbara Gas & El. Co. has applied to the State Railroad Commission for authority to issue $100,000 in bonds for the purpose of extending and improving its system.

BUTTE, MONT.—Plans are being prepared by Paul Gow, city engineer, for the installation of 320 luminous arc-lamps in Butte. The cost of the work is estimated at about $32,525.

LOVELOCK, NEV.—Steven R. Young, of this city, is reported to have acquired the Lovelock Lt. & Pwr. Co. It is understood that the Southern Pacific Co. is arranging to purchase energy.

## Canada

EDMONTON, ALTA.—The installation of a cluster-lamp lighting system on the principal streets of Edmonton at a cost of about $250,000 is contemplated. A. W. Ormsby is superintendent.

VICTORIA, B. C.—The Campbell River Pwr. Co., of Victoria, is reported to be preparing plans for the construction of a large hydro-electric power plant on Campbell River, in the northeastern portion of Vancouver Island. It is understood that it is proposed to develop 300,000 hp from the waters of the three falls of the river at a cost of about $12,000,000. George C. Hinton, of the Hinton Electrical Co., of Vancouver and Victoria, is one of the promoters of the project.

HALIFAX, N. S.—The Halifax Pwr. Co., it is reported, contemplates developing two sites on the Indian River, 18 miles west of Halifax. The upper station will be equipped with two units of 1200 kva each, one operating under a head of 90 ft. from the Indian River water shed and the other under a 160-ft. head from the North East water shed. About 5600 hp will be developed which will be transmitted to Halifax at 33,000 volts. C. H. & P. H. Mitchell, consulting engineers, of Toronto, have charge of the work.

PETERBOROUGH, ONT.—The Hydro-Electric Power Commission has been asked to set a price on the distribution system of the Peterborough Lt. & Pwr. Co. so that the local power committee may be in a position to know what price to offer for the equipment.

ST. THOMAS, ONT.—[illegible] Heat & Power Department of [illegible] of St. Thomas expects to erect within the next two months one auxiliary substation with an output of 450 kva for supplying energy to the St. Thomas Packing Co. and the Pere Marquette Ry. Co.; also to install within the next two months switchboard and equipment for new substation for which contract has been awarded to the Canadian General El. Co., and three 150-kva transformers, contract awarded to the Packard El. Co. The Michigan Central Ry. Co. is installing electrical equipment in its yards and shops at St. Thomas, and expects to use about 1000 hp, which will be furnished by the Light, Heat and Power Department of St. Thomas. E. H. Caughell is manager.

BATTLEFORD, SASK.—The managers of the municipal electric-light plant expect to purchase within the next three months two 250-hp engines with Westinghouse generators and switchboard, two 250-hp [illegible] the output of the present plant; also to purchase within the next three months material for 6 miles of transmission line. F. K. Marlin is manager.

## New Incorporations

REEDSBURG, WIS.—The Reedsburg El. Co. has been incorporated with a capital stock of $10,000 by James R. Semple, James A. Stone and Anna L. Semple.

TORONTO, ONT., CAN.—The General Pwr. Corpn. has been incorporated with a capital stock of $5,000. The incorporators are: R. W. Hart, G. M. Miller and P. Stokes.

TORONTO, ONT., CAN.—The Kipawa Pwr. Co. has been incorporated with a capital stock of $100,000,000 by W. A. J. Case, J. B. Taylor and D. D. Fisher.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JULY 15, 1913.

[Prepared by Robert Starr Allyn, 15 Exchange Place, New York.]

1,067,246. WIRE-CLAMP FOR INSULATORS; J. H. Hubbard, Iron River, Mich. App. filed Dec. 6, 1911. Yieldable cam lever operates to clamp the wire to the insulator.

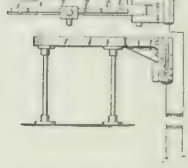
1,067,264. HOLDER FOR GLOWERS; R. Neckerman and O. Foell, Pittsburgh, Pa. App. filed Sept. 3, 1910. Pivoted supporting members are weighted so as to hold the glowers under proper tension and prevent them from sagging.

1,067,270. INDUCTION MOTOR; K. A. Pauly, Schenectady, N. Y. App. filed Mar. 31, 1911. Without changing connections, the rotor circuits are in inductive relation to the stator winding for both sets of poles.

1,067,274. TELEPHONE REGISTER AND LOCK OUT DEVICE; C. V. Richey, Washington, D. C. App. filed Nov. 6, 1912. Combined mechanical and electrical switching device adapted to bring about the transition from a lockout to a register system.

1,067,287. MAGNETIC SEPARATOR; G. Ullrich, Magdeburg, Germany. App. filed Jan. 12, 1912. Non-magnetizable rotatable carrying member shields the poles of the magnets.

1,067,311. WATTMETER; F. Conrad, Swissdale, Pa. App. filed June 21, 1912. Two potential coils mounted for movement about an axis located between them and two load coils adjacent opposite sides of the potential coils, each load coil opposite both potential coils.



1,067,478—Welding Machine.

1,067,325. ELECTRIC LOCOMOTIVE; G. M. Eaton, Wilkinsburg, Pa. App. filed Nov. 8, 1909. Yielding connection between the two articulated trucks.

1,067,331. FLUSH SWITCH MOUNTING; M. Guett, Hartford, Conn. App. filed Apr. 26, 1911. Switch receptacles removably secured transversely on a pair of longitudinally extending U-shaped supporting straps.

1,067,354. TRAIN TELEPHONE-CONNECTION POLE; W. Leach, Moose Jaw, Saskatchewan, Canada. App. filed Mar. 18, 1913. Pole carries a pair of sockets into which the two wire connecting members fit, controlling cords extending from the connecting members through the sockets and down along the pole.

1,067,407. SIGNALING DEVICE FOR LOCOMOTIVES; C. H. Cobb, Ga. Falls, Montana. Apl. 28, 1911. Dec. 28, 1912. For signaling between the locomotive and the cars of the train.

1,067,437. NEGATIVE POLE PLATE FOR STORAGE BATTERIES; W. Morrison, Des Moines, Iowa. App. filed Sept. 7, 1912. Bond of active material electrochemically formed "in situ" from the grid interpenetrating and uniting the pasted active material and the grid.

1,067,452. ELECTRIC SWITCH OPERATING MECHANISM; O. N. Wiswell, Snoqualmie, Wash. App. filed July 12, 1911. Switch for three-wire line.

[illegible] MACHINE; J. H. Gravell, Philadelphia, Pa. App. filed Oct. 31, 1912. Movable tool-carrying arm on one terminal and work-supporting member on other terminal extending beneath the [illegible]

1,067,481. SMELTING FURNACE; C. A. Kuenzel, Buena Vista, Colo. App. filed Aug. 17, 1912. Gas-fired furnace for smelting metallic ores.

[illegible] filed Feb. 3, 1909. Pull socket construction with one-piece porcelain [illegible]

1,067,498. FUSE HOLDER; H. W. Young, Chicago, Ill. App. filed Jan. 10, 1913. Fuse casing has longitudinal [illegible] with a slidable cover plate to close same.

1,067,510. Trolley; J. Eberwein, North Tonawanda, N. Y. App. filed Dec. 28, 1912. Provides the trolley pole with auxiliary yieldable trolley wheels.

1,067,527. SIGNALING SYSTEM; C. A. Larson, Highland Park, Ill. App. filed Sept. 30, 1911. Selective signaling system for telephone exchanges.

1,067,561. TELEPHONE RECEIVER CASING; L. Swanson, New York, N. Y. App. filed May 25, 1910. Perforated metal strengthening body is embedded in the receiver casing.

1,067,562. ELECTRIC PUMP-GOVERNOR; W. V. Turner, Edgewood, Pa. App. filed May 28, 1907. Movement of the actuating piston to either the cut-in or cut-out position is rapid so as to gain a quick snap-like movement of the controlling device.

1,067,568. ELECTRICAL FUSE; H. W. Young, Chicago, N. Y. App. filed Dec. 14, 1912. Fuse member is shaped to pass through a zig-zag slot in the casing whereby the substitution of a fuse of different capacity is prevented.

1,067,573. END-CELL SWITCH; J. W. Achard, Philadelphia, Pa. App. filed Dec. 23, 1911. Movable brushes contact with contact rails and engage with different contact points when shifted.

1,067,580. ELECTRIC CONTROLLER; A. E. Berdon, La Fayette, Ind. App. filed Dec. 18, 1912. Combination of permanent magnet and pressure coil which is subjected to the pressure of the controlled circuit.

1,067,606. TELEPHONE SYSTEM; M. E. Grönvigh, Bergen, Norway. App. filed Apr. 15, 1913. Underground system of distribution for telephone cables.

1,067,620. COMMUTATOR BRUSH FOR ELECTRIC GENERATORS AND MOTORS; P. P. Nungesser, Cleveland, Ohio. App. filed May 19, 1911. A cap clamps a flattened plate enclosing the spread wires of the conductor to the carbon brush.

1,067,627. AUTOMATIC TEMPERATURE REGULATOR; B. F. Teal, Deceased, Glenside, Pa. App. filed July 22, 1910. Interdependent thermal controllers in the room and at the heater respectively.

1,067,629. TELEGRAPH DISPLAY SIGNAL; F. W. Wood, Newport News, Va. App. filed Feb. 11, 1909. Ship's telegraph system in which the signal received is repeated back to the sending station.

1,067,630. CAR-AXLE LIGHTING SYSTEM; J. L. Woodbridge, Philadelphia, Pa. App. filed Jan. 10, 1908. Maintains constant potential at the generator terminals through widely varying speed charges.

1,067,631. SYSTEM OF ELECTRICAL DISTRIBUTION; J. L. Woodbridge, Philadelphia, Pa. App. filed June 22, 1912. In which storage battery is employed to carry the load of an electric circuit when normal source of supply is interrupted.

1,067,647. ELECTRIC FLUID HEATER; W. H. Fox, Minneapolis, Minn. App. filed Aug. 8, 1912. Particularly for attachment to a radiator.

1,067,648. ELECTRIC CARTRIDGE FUSE; G. W. Frazier, Portland, Ore. App. filed Dec. 23, 1912. Fuse held at its ends by sectional tapered plugs fitting in correspondingly tapered sleeves.

1,067,685. METHOD OF MAKING BALL BEARINGS; J. Schmid, Roost, Oerlikon, Switzerland. App. filed Nov. 21, 1912. The two cage rings of the ball bearing are connected together by melting the projecting part of the thin connecting member which extends through the rings.

1,067,698. METHOD OF ELECTROLYTICALLY RECOVERING NICKEL; H. L. Wells, New Haven, Conn., and T. C. King, East Orange, N. J. App. filed June 22, 1907. Treats finely divided matte with hydrochloric acid, subjects solution to electric current, whereby nickel is plated out and chlorine gas evolved, and finally treats said gas with sulfureted hydrogen and absorbs produced acid gas in water.

1,067,702. TERMINAL LUG; H. J. Wiegand, Milwaukee, Wis. App. filed June 22, 1910. Sheet metal lug with body portion of double thickness, each layer having a lug clamping the conductor.

1,067,711. MULTIPLE SIGNAL TRANSMITTER; C. E. Beach, Binghamton, N. Y. App. filed June 3, 1911. Selective signal mechanism for fire alarm and district telegraph signaling.

1,067,715. TELEPHONY; S. G. Brown, London, England. App. filed Feb. 18, 1913. Telephone relay system for obtaining balance of electrical conditions in the two parts of the system on opposite sides of the relay.

1,067,718. TELEPHONE TRANSMITTER; J. Collins, Quaker City, Ohio. App. filed Oct. 21, 1912. Electrodes and resistance varying medium all carried by the diaphragm.

1,067,734. CROSSING SIGNAL; W. A. Hesse, Alameda, Cal. App. filed Nov. 1, 1912. Oscillating signal arm operated upon approach of train.

1,067,735. ELECTRIC SWITCH; E. M. Hewlett, Schenectady, N. Y. App. filed July 15, 1910. Oil-switch with arc-extinguishing device.

1,067,782. DYNAMO-ELECTRIC MACHINE; A. B. Field, Norwood, Ohio. App. filed Oct. 5, 1907. Rotor construction for alternators.

# Electrical World

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**Edison Free-Renewal Policies**

As an index of the policies of some of the large Edison lighting companies in granting reductions in the price of tungsten lamps to customers, the short news item published elsewhere in this issue offers food for thought. Hartford, ever progressive, has placed all tungsten lamps of 60 watts rating and over on a free-renewal basis, while New York, Chicago and Brooklyn have placed the lower limit at 100 watts. Beyond that, however, there is a wide divergence in practice, and the keenness with which the company appreciates what is meant by public policy is reflected in the policy adopted. Without betraying a desire to have customers use lamps of large rating, the Brooklyn and Detroit companies offer all at the same price, knowing full well that human nature is frail enough to choose the largest if it costs no more than the smallest. The New York companies seek the same end but by different means, and it remains to be seen whether diplomacy will score over expediency. Some of the Edison companies have contented themselves with reducing the price of tungsten lamps following the cut made by the manufacturers without adopting any free-renewal policy whatever.

**The Business Outlook**

There are now up for consideration by Congress two momentous measures, neither of which, however, will materially affect the market for electrical goods directly. Changes in the tariff and the banking system of the nation necessarily cause stagnation in some branches of trade and stringency in the money market, because the manufacturer prefers to have on hand as little raw material as possible until he knows at what price he will have to market his product, and the jobber does not load up his shelves so long as there is any possibility of a new tariff depreciating the selling price of his goods by changing the cost of production. Fortunately these conditions have had little effect in the electrical industry, although apprehension has been expressed in some quarters and a degree of prudence has been exercised. True, owing to the high price of money, some of the large syndicates here and there are husbanding their resources and temporarily refraining from pushing into new fields; but the industry as a whole is advancing steadily without the slightest indication of retrenchment. The lighting companies are adding to their load curves and the manufacturers have never been more prosperous. Yet, in spite of this unique position which the electrical industry enjoys in the manufacturing and industrial world, with record-breaking sales and no signs of let-up, some of the seeds of pessimism which have produced tares in other fields have blown over into the electrical field and have taken root, but happily in rocky soil. The ghost of the tariff and the uncertainties of the banking system have caused needless fear. Years hence when the electrical industry shall have reached the saturation point these conditions may affect it; but at present, with the country only partially developed and untold millions still to learn of the advantages of electricity, the outlook is so glorious and the opportunities are so great that the wonder is that anyone seeking after facts should fail to perceive them. The electrical industry is immensely prosperous and is growing more and more so.

**Substitute for Platinum**

Among the problems encountered by the makers of large-size incandescent lamps or rectifying apparatus not the least important is that of obtaining an air-tight joint between the leading-in wires and the lamp or rectifier bulb. With small units satisfactory results are secured by the use of platinum of which the coefficient of thermal expansion is the same as that of the glass bulb. In addition to the high cost of the platinum, there are several reasons why this method is not equally satisfactory when applied to large units. In the *Digest* in this issue a brief description is given of a recent development in accordance with which tubular leading-in conductors of platinum, copper or other high-conductivity metal are employed instead of solid wires of platinum. The secret of the process lies in avoiding any appreciable local differences of temperature while making the seal. If the method proves as satisfactory in practice as one would be led to believe from the description, it will find wide application in the production of large lamps and rectifiers, with some possibility of causing the substitution of copper for platinum in small incandescent lamps.

**Specifications for Street Lighting**

The general discussion of the suggestions for specifications recently promulgated in England furnishes striking evidence of the great uncertainty of all problems relating to out-of-doors illumination. The various participants in the discussion seem to find very little common ground upon which to stand, each adhering to his own opinion until the end, thus leaving the subject in a less satisfactory state than appeared at the start. A fundamental difficulty with all attempts prroperly to define street illumination seems to be the great doubt as to what is really wanted, about which there is remarkable diversity of judgment. The British specification was based fundamentally upon horizontal illumination taken at 1 m above the ground. Now, this represents a condition which is undoubtedly simple to determine, but the measurement of horizontal illumination has little real meaning. It seems likely that for most practical purposes the vertical component of the illumina-

tion is more important than the horizontal in determining the visibility of things which one wishes to see. When the vertical component is taken its usefulness is limited to that portion of the light which proceeds in general from one direction. One does not see the face of a person by the light falling upon the back of his head. On the other hand, in the case of very dim lighting, in which silhouetting is a matter of some consequence, it is the diffused light from the ground level behind the object seen that is most important. One has, therefore, sorrowfully to admit that the solution of the street-lighting problem is indeterminate as regards the desired end. Before proceeding further in an effort to get out of the tangle it would seem advisable to secure first some general concurrence of opinion as to the end sought in furnishing light on the streets. Once this matter is settled, the data thus obtained will very much simplify the consideration of proper means for doing the lighting and suitable specifications to guide the contractor. The British controversy is both interesting and valuable and will tend to clear the way for more practical results in the future.

## Will the Telephone Suit Be the Last?

The government has filed its petition in the long-expected anti-trust suit against the American Telephone & Telegraph Company. The suit is brought in the federal court for the Oregon district. The allegations on which it is based pertain to the acquisition by the Bell interests of certain independent telephone companies in the Pacific Northwest. The charges set forth are of that purport and tenor with which the public has become very familiar through wide discussion aroused by the long series of anti-trust cases considered by the courts in recent years.

The prayer of the petition in the present case asks among other things that the Bell companies be required "to dispose of the stocks, bonds and physical property thus illegally acquired to persons not connected with the Bell companies as stockholders or otherwise, and that so far as practicable competitive conditions be established as they were prior to such acquisitions."

The citizen who has had experience with "competitive conditions" in telephone service will think it ridiculous to talk about restoring them with all their confusion, waste and extravagance. Telephone service is essentially monopolistic in character, and when it is other than monopolistic in administration and control it is inefficient and costly. Of course the mere existence of monopoly will not insure efficient service and reasonable tolls; strict governmental regulation is essential. Monopolies are peculiarly sensitive to the kind of management they receive, whether good or bad. Yet governmentally enforced competition in the telephone service would be governmentally enforced extravagance.

In its prayer in this telephone suit the government asks the court to do what we believe would be a foolish thing. If sanctioned by a favorable decree from the bench, that thing would be intrinsically no less foolish. Yet we do not join with those who cry out at the department of justice for instituting these prosecutions and who are disposed to criticise the tendencies of recent anti-trust decisions of the Supreme Court. The statutes are such that neither the executive nor the judicial branch has any other course open to it. Nothing is to be gained by denouncing the courts for their interpretation of the law or the officers of the government for enforcing it. The trouble arises from the fact that, having adopted the policy of commission regulation of public utilities and natural monopolies, we still adhere to the theory of enforced competition prescribed in the Sherman anti-trust act.

In the end these cases themselves in the aggregate may become the evidence on which the court of public opinion will order a modification of our anti-trust laws. It is unthinkable that the American people—above all others a business nation—will much longer tolerate a condition of conflicting statutes under which business men are damned if they do, and ruined if they do not, conform to the workings of those natural laws which control commercial forces. It may not be unreasonable to hope that the telephone suit will prove to be the last bit of evidence called for by the court of public opinion in this great cause.

When the average man is told that our laws will be satisfied only with that sort of competition which calls upon him to have two telephones in his house when one should suffice, he may wake up. Once he is really awake to the situation the telephone user, the average citizen, will put an end to the nerve-racking ferment and hysteria caused by the spirit of the Sherman act and the spirit of the act to regulate commerce screaming at each other.

## Self-Synchronizing Machines

It is well known that the ordinary synchronous alternating-current motor or converter requires some care and skill to bring it into synchronism, and that in this particular it is not so convenient to operate as is an induction motor. On the other hand, once the synchronous motor has been electrically locked to its circuit, it has distinct advantages over an induction motor, especially as regards its power-factor. In the last issue of the *Journal* of the (British) Institution of Electrical Engineers Dr. E. Rosenberg describes two interesting forms of synchronous machines that are self-synchronizing. One form is more particularly applicable to motors and the other to converters. In the self-synchronizing three-phase motor the field-magnet rotor is provided with a three-phase distributed winding in such a manner that if supplied with direct current from a separate exciter the regular field-magnet polarity is produced, but if short-circuited externally through a three-phase rheostat the rotor winding virtually becomes the secondary of an induction motor.

In order to start the motor, the three-phase stator winding is subjected to reduced line voltages by the use of a star-delta switch acting as a starting auto-transformer. The rotor windings are short-circuited through a three-phase rheostat. The machine then starts and accelerates as an ordinary three-phase induction motor with wound secondary. Meanwhile, the exciter is being accelerated likewise and is creating its own direct-current voltage. The exciter is now gradually inserted into the rotor circuit,

nder cover of a reducing rheostat, thereby superposing creasing direct current and direct-current polarity on e three-phase induced currents and alternating-current olarity. Finally, when the machine has nearly reached nchronous speed, the direct-current polarity becomes pre-ominant and the rotor jumps into synchronism.

The modifications required in the machine structure to ake it self-synchronizing are a distributed rotor winding, n extra slip-ring, a three-phase rotor-starting rheostat, nd also an exciter-introducing rheostat. With these modi-cations the starting process is rendered very simple, and e distributed rotor winding subsequently plays a useful rt and acts as a damper, or synchronism preserver, in se of any accidental disturbance of frequency on the stem.

In the single-phase self-synchronizing converter a small otor, which may be a single-phase commutating or series achine, is inserted between the step-down transformer condary winding and the converter armature. This small otor, being on the converter shaft, supplies the initial celerating torque. At the same time, the initial alter-ating current passing into the converter armature is re-ricted by the impedance of the single-phase starting otor. Consequently, the field-magnet windings perma-ently connected to the commutator of the converter are revented from being excited powerfully enough to destroy eir residual magnetism in the field-poles. As the ma-ine comes up to speed the residual magnetism asserts its lective power, and the armature finally locks electrically the alternating-current supply system without any un-ne sparking at the commutator brushes and without any ar of having the direct-current polarity reversed. The nall starting motor is then cut out. In this case the odification consists of the small starting motor on the nverter shaft, but some such accelerator is needed in the se of a single-phase converter, unless the starting can effected from the direct-current side.

## Graphical Statics Applied to Transmission-Line Calculations

The value of graphics in aiding the mind to grasp and eal with the problems of statics is so great and so well stablished as to have become axiomatic among engineers. Ir. Alfred Still has rendered all transmission-line engi-eers a service by indicating, in his article in this issue, the ery simple and interesting geometrical relations which nter into the statics of every flexibly suspended conductor cted upon by gravitation alone, whether the form of the urve is a simple catenary, an elastic catenary or a parabola, nd whether it be free or ice-coated. These geometrical elations are so simple and convincing that it becomes diffi-ult to forget them once they have been apprehended.

From the use of the graphics outlined in Mr. Still's rticle follows the curious result that in almost any practical roblem to which the method may be applied graphics will ot be used and an arithmetical method will be substituted. he graphical relations will be present in the mind, how-rer, and from the mental drafting-board the problem will be projected in arithmetical form. In other words, the salient principles of the statics of a transmission-line span are engraved on the mind in geometrical forms which are usually very compact and permanent, so that they are readily recalled when needed, whereas if the relations are apprehended in the first instance in non-geometrical terms, they are apt to be forgotten after a lapse of time.

## The Disadvantage of Placing Single-Phase Mains in Iron Tubes

It is well known that when a long, straight insulated wire is placed at the axis of an iron tube and a continuous current is sent steadily along the wire the tube is subjected to a magnetic stress, or gradient of magnetic potential, and magnetic flux is set up therein, in loops or circles coaxial with the wire, through the substance of the iron walls. Theoretically in this simple case the presence of the iron tube does not modify the intensity of the magnetic field set up either inside or outside the tube. In other words, the tube merely intensifies the cylindrical magnetic flux within its own walls, without affecting the remainder of the cylindrical flux distribution.

If, however, we send an alternating current through the single wire at the axis of the tube, the magnetic field in the tube alternates and sets up eddy currents in the iron, to say nothing of hysteresis effects. These eddy currents react on the central wire. The result is sixfold. First, there is an increase in the active, or inphase, drop in potential along the wire. Second, there is an increase in the reactive, or quadrature, component of drop in potential along the wire. Third, there is a resultant increase in total drop of potential. Fourth, there is an increase in the active power lost in the wire, which is heated thereby. Fifth, there is a loss of active power in the iron tube, which is heated thereby, this rise in temperature of the pipe tending to enhance the rise in temperature of the inclosed wire. Sixth, the alternating magnetic field external to the tube is distinctly affected and ordinarily diminished. Any single-phase single current inside an iron conduit, pipe or tube brings about, therefore, some additional heating, drop of potential and waste of energy.

If, however, both the going and returning insulated conductors of a single-phase system, or the three insulated conductors of a three-phase system, are inclosed in one and the same iron tube, the resultant magnetic field in the iron tube wall is comparatively feeble; so that the extra heating and losses are ordinarily insignificant. Some experimental results completely confirming the well-known doctrine above outlined were recently published by Dr. L. Bloch in the *Elektrotechnische Zeitschrift,* which article is now translated and abstracted in the London *Electrician* as alluded to in this week's *Digest.* The article shows that the drop of potential in single alternating-current wires in an iron tube may be more than ten times as great as for the same wires carrying direct current, while the rise of temperature may be increased several-fold. On the other hand, brass-coated paper tubes had but slight extra alternating-current losses in them.

# The News of the Week

**Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.**

## Pennsylvania Utility Bill Signed

Governor Tener of Pennsylvania affixed his signature to the public utilities bill on July 26, and the names of the seven commissioners who will administer the law will be announced shortly. The law, which was outlined in these columns in the issue of July 19, becomes operative on Jan. 1, 1914, but the commission has authority to organize and select its employees on or before Oct. 1, 1913. The State Railroad Commission having been legislated out of office on July 1, it is expected that the new commission will organize promptly and take up pending cases transferred to it by the Railroad Commission.

## Demonstration of Panama Lock Control Board

On Monday of this week the General Electric Company demonstrated for the benefit of editors of the technical press and officials the control board for operating the Gatun locks of the Panama Canal. For this purpose the board was partly set up in the switchboard shop of the Schenectady works and one section was wired. The board shows graphically the operation of the various valves, fender chains and guard and main gates, together with the rise and fall of the water levels. To guard against any false move so far as the sequence of operations is concerned, the entire system of control is interlocked. Small synchronous motors operating in synchronism with the 50-hp motors at the gates are employed to duplicate the action at distant points on the benchboard, which is a miniature of the lock itself. The board is now being dismantled for shipment. The boards for the Miraflores and Pedro Miguel locks will follow in a month or two.

## Edison Companies Reduce Price of Tungsten Lamps

On Aug. 1 a great many of the licensee Edison companies placed in effect new tungsten-lamp prices for customers entitled to free renewals of carbon-filament lamps. Strange to say, there is no unanimity in the price schedules, although some of the companies operating in large cities, such as the New York Edison Company, the Commonwealth Edison Company of Chicago, the Edison Electric Illuminating Company of Brooklyn and others, have placed all tungsten lamps of 100-watt rating and larger on a free renewal basis. The Brooklyn Edison company is among the most progressive in its attitude on the lamp question, selling 10, 15, 25, 40 and 60-watt lamps, whether plain or frosted, at a uniform price of 20 cents. The Detroit Edison company has pursued a similar policy and has made arrangements with one of the local firms handling tungsten lamps to renew all tungsten lamps for its customers at a uniform rate of 30 cents regardless of size. The New York Edison Company and the United Electric Light & Power Company have adopted a graded scale of prices which is peculiar in that the smaller the lamp the higher the price. The schedules for both companies are as follows: 10-watt lamp, 28 cents; 15-watt lamp, 25 cents; 25-watt lamp, 18 cents; 40-watt lamp, 16 cents; 60-watt lamp, 14 cents. For frosted lamps an extra charge of 2 cents above the foregoing prices is made. The Buffalo General Electric Company sells clear-bulb tungsten lamps rated at 25 watts to 40 watts for 30 cents and other sizes as follows: 60-watt, 35 cents; 100-watt, 65 cents; 150-watt, 95 cents, and 250, 400 and 500-watt lamps at $1.60, $2.90 and $3.20 respectively. Reductions have also been placed in effect in Philadelphia, St. Louis, Boston, Minneapolis and Cincinnati. The Hartford Electric Light Company some time ago placed tungsten lamps of 60-watt rating and over on a free renewal basis.

## Overhead-Line Dispute at Glenwood Springs

Aug. 14 has been set by the District Court for hearing the suit of the Glenwood Light & Water Company against the Mutual Light, Power & Utility Company, both of Glenwood Springs, Col. It is contended that the erection by the latter company of its distribution lines on the same side of alleys occupied by the former company has resulted in such close proximity of primary and secondary lines that the life of linemen is endangered. The Glenwood Light & Water Company as prior occupant seeks to compel the Mutual company to remove its poles and lines to the opposite side of the alleys. The Rocky Mountain Fire Underwriters have also called attention to the life and fire hazards existing because of the present spacing of wires.

## Change in Control of Springfield and Worcester Railways

By purchasing the controlling interest in the common stock of the electric railways in Springfield, Worcester and environs owned by the New England Investment & Security Company, Messrs. Sanderson & Porter, of New York City, will add these properties to the rest of their utilities. The New England Investment & Security Company was organized in 1906 to acquire the electric railways in Massachusetts controlled at that time by the New York, New Haven & Hartford Railroad Company, and the latter company guaranteed interest on the bonds and dividends on the preferred stock. The Springfield system comprises 166 miles of track, and the Worcester system 266 miles.

## A Year's Record of Electrical Fires in Chicago

During the year 1912, according to the records of the Department of Electricity of Chicago, there were seventy-one fires due to electrical causes, with a total loss of $29,152.50, or an average of about $410 for each fire. It is instructive to note the causes of these fires as tabulated Eleven were due to low-tension wires short-circuited; six to burnouts of motor armatures; six to flatirons left in circuit; five to short-circuits in lamp cords; four to short circuits on conduit; three to ignition of films on motion picture machines, and three to inflammable material about incandescent lamps. The remaining electric fires were due to a wide variety of causes. Only one fire caused a serious loss, and in this case the fire was thought to have been caused by a short-circuit in the lamp cord attached to a portable lamp. The branch circuit was over-fused. In this case the loss was estimated at $20,000. The loss from the other seventy fires averaged a trifle over $130.

## overnment Suit Against the A. T. & T. Company

On July 24 suit was filed in the District Court of the Jnited States for the district of Oregon by the United tates District Attorney, in behalf of the federal govern- ent, against the American Telephone & Telegraph Com- any. The bill of complaint names in addition to the merican company six of its subsidiary companies operat- g on the Pacific Coast, eleven independent telephone com- anies operating in the same territory and twenty-five in- ividual defendants, including the president of the Ameri- an company and its seven vice-presidents. The bill in eneral charges the defendants with restraining trade and ommerce in the transmission of telephonic messages and ith monopolizing such commerce in violation of the act f July 2, 1890.

Prior to 1905, the bill of complaint sets forth, the Bell ompanies owned and operated substantially all means of lephonic communication between the States of Oregon, Vashington, Montana and Idaho. It is charged that the rvice given by the Bell companies at that time was ineffi- ent and unsatisfactory, and that in consequence indepen- ent companies were formed to give local and long-distance rvice in competition with the Bell companies. These in- ependent lines were gradually formed into interstate sys- ms, of which there were finally three, the Northwestern ong Distance Telephone Company, the Interstate Consoli- ated Telephone & Telegraph Company, and the Indepen- ent Long Distance Telephone Company.

The bill states further that the construction of the inde- endent lines in many respects is superior to that of their ompetitors and declares that their service was more effi- ent. They also used automatic telephones, affording crecy in communication, which the government states was popular feature and in demand by the public. Automatic rvice, however, was not given by the Bell companies.

Among the alleged unlawful acts with which the defen- nts are charged are the following: The Bell companies reducing rates below a paying basis at some points, by ving free service at others, and by threatening to do these ings at still other places, forced certain of the indepen- nt companies to violate their contracts for connections th the Northwestern Long Distance Company and to ve their business exclusively to the Bell companies. It charged that in some places where connections were vered in this manner the public authorities required em to be restored, but after such restoration all interstate essages were sent by the Bell companies over their own es unless the senders specifically requested otherwise. certain instances, so the government charges, represen- tives of the Bell companies frequently stated to patrons the Northwestern company that the latter did not serve rtain points with which they desired to communicate, hen in fact it did. The Bell companies are also charged ith urging the independent company of Seattle and other dependent companies to violate their contracts for inter- ange of business with the Northwestern company, and in me instances with agreeing to pay counsel fees and other penses incurred by them in litigation resulting from ch breach of contract.

Among the independent companies which it is charged the ell system acquired unlawfully are the following: The In- pendent Telephone Company of Seattle, the Home Tele- one Company of Puget Sound, controlling interest in the orthwestern Long Distance Telephone Company, con- olling interest in the Interstate Consolidated Telephone ompany, and the Independent Long Distance Telephone ompany of Idaho.

It is also charged that the treasurer of the Northwestern mpany entered into an agreement with the Bell com- nies to deliver to them at least two-thirds of the stock d all of the bonds and the physical property of his com- ny. To this end, it is declared, he failed to pay interest e on the bonds, although sufficient funds were available, and foreclosure proceedings were then brought against the Northwestern company, which are now pending. The government charges that unless these proceedings are restrained the property of the Northwestern company may be sold thereunder and thereby interfere with the effectiveness of any court judgment in the present case.

The bill prays that the court adjudge the defendants guilty of conspiracy to restrain and monopolize interstate trade and commerce in violation of the anti-trust law; that the purchase of the securities and property of the several independent companies named be decreed unlawful and in violation of the anti-trust act; that the Bell companies be required, subject to the approval of the court, to dispose of securities and property so acquired to persons not connected with the Bell companies as stockholders or otherwise; that competitive conditions as they formerly existed be re-established as far as practicable, and, if necessary to the public interest, that a receiver be appointed to take possession of such securities and physical property.

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## W. E. Robertson on the Cost of Membership in the Society for Electrical Development

The cost of participation on the part of jobbers and contractors in the work of the Society for Electrical Development has been fixed at one-twentieth of 1 per cent on the gross sales. To some 0.05 per cent on sales seems to be a substantial tax on the cost of doing business, and many hesitate to commit themselves to a contribution of this amount.

A correct analysis of the purpose of the contribution will take it out of the "cost-of-doing-business" column and place it properly where it belongs, that is, in the "creating-a-larger-market" column. Few, if any, contractors or jobbers have such a column in their ledgers, but it is high time such a column were provided, as it is of great importance to all to provide an increased market in which each may participate.

An appropriation of from 1-300 to 1-400 of 1 per cent of the expense account of jobbers and contractors is equivalent to one-twentieth of 1 per cent on the sales. Viewed from this standpoint the cost of co-operation in creating an increased market is infinitesimal.

The average cost of doing business over a period of years on the part of both contractors and jobbers is from 15 to 20 per cent of the sales, and heretofore this entire amount has been spent in securing business on a competitive basis, and nothing has been spent in increasing the total demand.

It has never been possible in the history of civilization to secure co-operative effort on the part of an entire industry, the reason being the very old one that human nature is so distrustful of the future as to make it exceedingly difficult to get men as a class to part with a present tangible dollar for the purpose of securing, and in fact positively insuring, many future dollars.

The impossibility heretofore of overcoming this stupidity on the part of men should not prove detrimental, as an increasing confidence in one's fellow-men, added to an ever increasing intelligence, has prepared our industry to do what has never before been done. By its repeated accomplishment of the so-called scientifically impossible, the electrical industry, more than any other, has stirred the imagination of those connected with it, and one has but to mention the incandescent lamp, the telephone, the X-ray and the wireless telegraph to establish the truth of this statement.

Since our industry as a whole owes its existence to the demonstration that what was formerly impossible is now possible, it is logical to believe that the imagination of the jobbers and contractors has been sufficiently aroused, and their faith in the integrity of the administrative details of the society has become sufficiently strong, to warrant the

belief that from 1-300 to 1-400 of the cost of doing business will be set aside for the purpose of increasing the sum of the opportunity to do business, leaving the other 299-300 or 399-400 of the cost to be used in its present and former channels.

Does not the history of the industry and the smallness of the stake to participate warrant the risk? I am of the belief that the subscriptions will be forthcoming when the logic of participation and the infinitesimal cost thereof are thoroughly understood.

## Engines at Panama Pacific Exposition

A conspicuous feature of the display in the department of machinery exhibits at the Panama-Pacific International Exposition, to be held in San Francisco in 1915, will be the presentation of the methods of power development which have been evolved in recent years. The exposition is to be a contemporaneous one and not of a historical character, and the evolution of the steam engine, which was the work of the last century, will have only a very small part to play. The exhibits will include a number of oil engines, operating upon California crude oils, which form such a large part of the resources of the State. The development of this type of motor has been somewhat checked in the past year by increasing prices of fuel oil, and this result is inevitable as increased use is made of it.

In the original conception of the Diesel engine it was anticipated that pulverized coal could be used as the fuel in the cylinder of the engine in the same manner as the liquid fuel is now used. It was found, however, that the residual ash from the solid fuel made this impossible. There is being tried out in England to-day an engine of 100 hp in which powdered coal fed by worm screw through tubular openings in the cylinder head is heated by the exhaust gases and the air supply for the engine drawn through the coal in such a way as to form producer gas, which is utilized in the engine in the same manner as it would be in the ordinary gas engines. The range of fuel with which such an engine can be operated is much wider than that of the Diesel type, and it is expected that among the exhibits at the exposition it may have its place and will represent the latest development in prime movers.

## Exhibit of German Safety Appliances

The great movement for safety which has been occupying so prominent a place in European industrial and commercial life for many years is now making itself manifest in "safety first" campaigns in the larger industrial enterprises throughout America. Upon the solicitation of the American Museum of Safety, New York City, the Allgemeine Elektricitäts Gesellschaft has shipped to this country a most complete array of protective devices, insulated linemen's tools, sanitary equipment and instructive models, such as are used in protecting and educating the German industrial worker. This exhibit of safety appliances will be shown at the International Exposition of Safety and Sanitation to be held at the Grand Central Palace in New York City, Dec. 11 to Dec. 20, 1913, with the hope of bringing the American manufacturer face to face with his duty in protecting his workmen.

Much attention has been given to displaying devices for protecting the electrical workman. On one board have been grouped such tools as pliers, bolt cutters, S-wrenches and socket wrenches, the handles of which are insulated with hard rubber or with vulcanized rubber as the case may demand. Another panel carries an assortment of sockets, push-buttons, switches and cut-outs, the safety features of which lie in the fact that each piece of apparatus is colored to indicate the rating of the device so that the workman will soon come to associate danger with certain colors and will instinctively avoid them in his work. A third panel similar to the foregoing carries out this same idea in a display of porcelain insulators. An entire switchboard fully equipped, a set of choke coils and electrolytic lightning arresters with all of the modern protective devices were included in the shipment and will be used to give the exhibit a touch of station realism. Rubber gloves with long gauntlets and insulated wooden tongs for handling live high-potential leads are provided as adjuncts to the insulated linemen's tools.

Looking toward the solution of a distinctly German problem, the Allgemeine Elektricitäts Gesellschaft has evolved an original scheme for diminishing the extensive use of alcoholic beverages among its workmen in order to reduce the number of accidents. Four times each day drinks are sold in bottles by the company to the workmen. Beer and milk may be had at a price of 2.5 cents a bottle, while soda, seltzer and soft drinks are sold for 1.25 cents a bottle. This scheme is reported to have decreased the beer drinking in the works by 33 per cent since it was inaugurated less than one year ago. A system of charts and price lists illustrating this system are included in the exhibit.

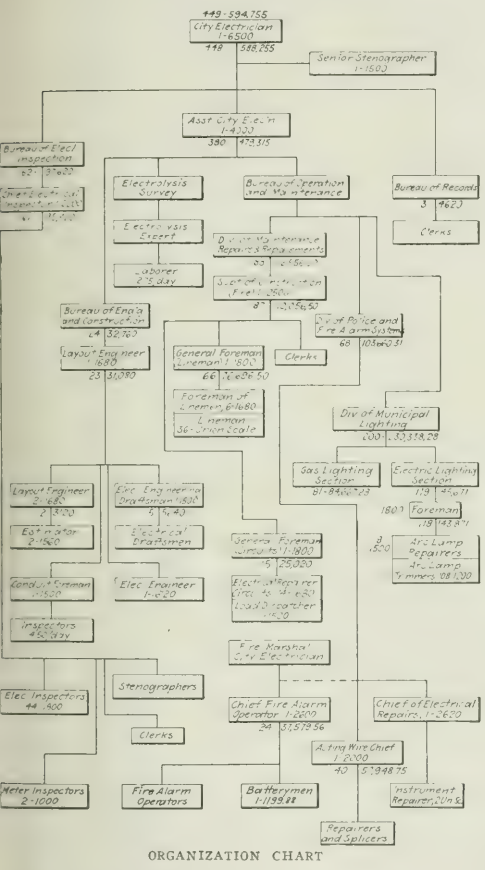
In view of the fact that more than 40,000 workmen are killed and 2,000,000 injured in industrial accidents in the United States every year, it would seem that any attention American manufacturers may give to the German methods of safeguarding human life and any effort they may make to reproduce these methods or better ones in our factories would be well worth while.

## Reorganization of the Department of Electricity, Chicago

Organized in 1898, the Department of Electricity of the city of Chicago was for several years an operating and maintenance department having supervision principally of the municipal street lighting, electrical inspection and the bureau of fire-alarm telegraph and police telephones. Within the last two years, however, the scope of the department has broadened, and it is now doing engineering, construction and rate-research work. Mr. Ray Palmer, the city electrician, wrote to the Civil Service Commission of the city of Chicago on Aug. 30, 1912, asking that a thorough investigation be made, with a view toward a reorganization of the department as a more efficient and economical working force. He asked that an assistant city electrician be appointed so that the city electrician could be relieved of much of the detail work, enabling him to give his time to the general building up of the department and to the study of the city's future electrical problems. The investigation of the organization of the Department of Electricity, made public on July 7, was carried on by Mr. J. L. Jacobs, efficiency engineer of the Civil Service Commission, and a number of changes have been made, the organization now being as indicated in the accompanying chart.

The work of the Department of Electricity divides itself into four natural bureaus—the bureau of electrical inspection, the bureau of engineering and construction, the bureau of operation and maintenance, and the bureau of records. In addition there is the separate electrolysis survey. The appropriation for the electrolysis expert is made under the bureau of engineering of the Department of Public Works, but the work is performed under the supervision of the city electrician. Entries on the chart are based on the appropriation ordinance for the year 1913. The number of positions and the total salary appropriated are indicated by the figures given. The salary of the city electrician is $6,500 a year and that of the assistant city electrician $4,000. Mr. A. C. King is the present assistant city electrician.

Under the bureau of operation and maintenance are included three distinct divisions—those of "maintenance, repairs and replacements," "municipal telephone and telegraph systems" and "municipal lighting." The office of inspector of gas and gas meters will probably be abolished and the office of superintendent of gas and electric lighting will be created at a salary not exceeding $3,000. In the division of fire-alarm, police and other municipal telephone and telegraph systems it is recommended that the number of fire-alarm operators be reduced to seven and that the new position of wire chief be created. The larger part of the work of the division of maintenance, repairs and replacements will be repairing, with some new work in connection




ORGANIZATION CHART

with street-lighting extensions and the new construction and maintenance of fire-alarm and police telephone systems. It is recommended that the bureau of interior wiring be abolished.

The bureau of engineering and construction, with an electrical engineer in charge, is to have charge of the estimating, inspection and laying out of routes of new circuits for street lighting and also the construction work. The head of this bureau will necessarily work in conjunction with the superintendent of construction of the division of maintenance.

The bureau of electrical inspection, in charge of the chief electrical inspector, issues permits to do electrical wiring and certificates of inspection, and makes inspection of wiring and equipment. It maintains a testing laboratory. It is also proposed to create a meter-testing division. The Civil Service Commission recommends that the office of assistant chief electrical inspector be created.

The bureau of records, in charge of the head clerk, takes care of the general clerical work of the department.

## Additions to Dam Structure at Fremont, Ohio

An addition is being made to the dam structure of the Sandusky River Power Company at Fremont, Ohio. This hydroelectric development has been under the supervision of the W. H. Schott Company, Chicago. The dam, seawall and generating station were completed at the time the floods occurred in the Central States in April, with the exception of the installation of the machinery. The river, which was higher during the floods than at any other time of which there is record, overflowed the seawall, carrying away the earth embankment back of it and widening the river channel at this point considerably. Although the dam structure was not injured, it became imperative to extend the dam so as to span the new channel. This addition necessitated extending the dam 160 ft., making a total length of 450 ft. The flood-gate section was increased 200 per cent and the spillway section was increased 50 per cent. When the entire plant is completed it will have a rating of 6000 hp with a head of 40 ft. The dam with its extensions will be capable of taking care of a maximum flow of 45,000 cu. ft. per second. Electricity will be generated at 18,000 volts, three-phase, 25 cycles. It is hoped that the station will be furnishing energy early in this month.

## Option of A. T. & T. Company on Chicago Automatic Telephone Service

At a meeting of the committee on gas, oil and electric light of the City Council of Chicago on July 24 the fact was brought out that a tentative agreement has been reached by which the American Telephone & Telegraph Company agrees to purchase the telephone property of the Chicago Tunnel Company under certain conditions for $6,300,000. The Chicago Tunnel Company is the successor of the Illinois Telephone & Telegraph Company and operates an automatic telephone service in the central portion of Chicago, serving between 20,000 and 30,000 subscribers. The tunnels of the Chicago Tunnel Company under the central portion of the city are utilized for the telephone cables. The Chicago Tunnel Company is not making money and is anxious to sell to the A. T. & T. Company, which controls the Chicago Telephone Company. Mr. C. W. Hotchkiss, president of the Chicago Tunnel Company, in a letter to the committee says that the receivers of the Illinois Telephone & Telegraph Company and the reorganized company, now known as the Chicago Tunnel Company, have expended $5,441,000 on the present automatic telephone-exchange system in Chicago. In addition, the valuation of the old plant was $2,000,000, so that the total present valuation is $7,441,000. This does not include interest on investment nor a loss to Mr. Joseph Harris, of the Automatic Electric Company, the contractor in rehabilitating the plant of the Chicago Tunnel Company, of $400,000. Negotiations for the sale of the automatic telephone system of the Chicago Tunnel Company were begun more than six months ago, and on July 8 an agreement tantamount to an option to buy on the part of the American Telephone & Telegraph Company was reached, the price fixed being $6,300,000. Mr. Schuyler and Mr. David W. Fairleigh, of Louisville, counsel for Mr. Harris, addressed the committee. The latter said that it would probably require an additional investment of from $15,000,000 to $20,000,000 to make a comprehensive automatic telephone system for Chicago. He added that the American Telephone & Telegraph Company owns a number of automatic telephone plants outside of Chicago

and that if it purchases the automatic exchanges in Chicago it may use some of the apparatus elsewhere.

The aldermen were very much interested in knowing what portion of the telephone property of the Chicago Tunnel Company would be added to the equipment of the Chicago Telephone Company and capitalized for rate-making purposes. The lawyers for the Chicago Tunnel Company were not prepared to answer this question. There was considerable discussion, and City Electrician Palmer was called in to advise the committee. The committee finally adopted a motion requesting the Chicago Tunnel Company to furnish an inventory and appraisal of its telephone property. The city electrician was instructed to go over the inventory and appraisal and report to the committee as to what portion of the property he considered useful to the Chicago Telephone Company.

## Proposed Absorption of Competing Telephone Service in Chicago

Mr. D. J. Schuyler, Jr., a lawyer, appeared before the committee on gas, oil and electric light of the Chicago City Council on July 14 and said that tentative negotiations were under way for the sale of the telephone plant of the Chicago Tunnel Company to the Chicago Telephone Company. Mr. Schuyler appeared on behalf of the Tunnel company. The ordinance under which the telephone business of the Tunnel company is operated was adopted originally in 1899 and prohibits the sale of the business to a competing company without the consent of the City Council. Mr. Schuyler said that the negotiations had proceeded to a point where the Chicago Tunnel Company had agreed to sell and the Chicago Telephone Company to buy the telephone property of the former, provided a price could be agreed upon and provided the consent of the city could be obtained. He said the basis of sale, if made, would be the appraised value of the property, and that the Tunnel company did not wish to go to the expense of making an appraisal unless assured that the city was willing that the transfer should be made.

The freight-transportation business of the Chicago Tunnel Company is not involved in the proposed deal. The Tunnel company operates an automatic telephone exchange, competing with the Chicago Telephone Company and serving the central portion of the city. It has about 30,000 subscribers and the Chicago Telephone Company has about 329,000 subscribers. The price for unlimited service by the automatic company is $85 a year, and by the Chicago Telephone Company $125 a year. Mr. Schuyler said that the Chicago Telephone Company is controlled by the Chicago Utilities Company, which has issued bonds having a par value of $5,000,000 or $6,000,000.

Mr. L. G. Richardson, counsel for the Chicago Telephone Company, said that under no circumstances did his company wish to buy the telephone rights of the Chicago Tunnel Company; it might buy the property used in the telephone work. Mr. Richardson said he presumed a considerable saving could be made by using the tunnels for the wires and cables of the Chicago Telephone Company.

In answer to a question Mr. Schuyler said that the Chicago Tunnel Company's connections with outside independent telephone toll-line companies were not very extensive. Alderman Martin J. Healy raised the point that the proposed absorption of the competing company by the Chicago Telephone Company would be a blow to the independent telephone interests throughout the country. Other aldermen thought the existence of two telephone systems in one city a nuisance. Alderman James B. Bowler contended that the city should be prepared to wipe out competition if it insisted on regulation. On his motion consideration of the matter was deferred, with the idea that the Tunnel company might come before the committee later with a fixed valuation.

## Public Service Commission News

### Vermont Commission

Governor Fletcher has removed Chairman Charles D. Watson and asked for the resignation of Mr. W. R. Warner, of the Public Service Commission, in pursuance of a campaign for lower telephone rates. The third member of the board, Mr. G. H. Babbitt, recently resigned. Present difficulties began two months ago when the Governor called upon the commission to investigate complaints regarding the service and rates of the New England Telephone & Telegraph Company and allied organizations. The commission has not yet reported upon the matter, and a short time ago the Governor appointed Messrs. H. F. Graham and J. H. Cook a special commission to investigate the telephone situation throughout the State. Following the removal of Chairman Watson, the Governor named Mr. Robert C. Bacon, of Brattleboro, as chairman of a new board.

### Massachusetts Commission

Mayor John F. Fitzgerald of Boston, Mass., has filed a petition with the Gas and Electric Light Commission contending that the prices charged by the Edison Electric Illuminating Company of Boston should be reduced and asking for a public hearing upon the issue. The petition states that the company has a surplus of $616,212 in the present year after paying dividends of 12 per cent and contends that the charges should be reduced to the lowest possible figure consistent with a reasonable dividend to the stockholders.

Consumers of service furnished by the Newburyport Gas & Electric Light Company have petitioned for a reduction in the price of gas and electricity. A petition has also been presented to the board from various consumers of electric service in the city of Taunton requesting the commission to determine the maximum price at which electricity shall be furnished by the municipal lighting plant. It is contended that by the scheme of management now in vogue the private consumers of electricity in the city bear the major part of the maintenance cost of the plant, divided between municipal and commercial service, and that the price of electricity is greatly in excess of its fair market value and not only constitutes an excessive burden to present users but also is a deterrent against the use of electricity by others. An associated petition sets forth that a material reduction is about to be made in the price of electricity for motor service and asks the board to determine whether the proposed reduction in rates for motor service is for the best interests of taxpayers and citizens at large.

### Wisconsin Commission

The Wisconsin Railroad Commission has dismissed the application of the Fort Atkinson Water & Light Commission for authority to increase its rates for electric service outside the corporate limits of the city of Fort Atkinson. The chief reason advanced by the city for such an increase was that the consumers involved are not city taxpayers and consequently should pay more for receiving the conveniences of electric service from the municipal plant. The commission pointed out that, in order to promote the welfare of its residents, a municipality may own and operate a utility, and may grant to the consumers thereof certain advantages to which they would not ordinarily be entitled if served by a privately owned utility. That is, if a city and its taxpayers have relinquished the profits which would ordinarily be earned if the service had been rendered by a private utility, it would appear just and reasonable to extend the benefits only to the consumers situated within the city and not to those consumers who take no share in the risk and whose property does not stand security for the payment of bonds or of delinquent debts. On investigation, however, it was found that the present revenues from commercial lighting are considerably in excess of the cost of

roducing the service with interest at 4 per cent and taxes t 1.5 per cent. The revenue from consumers outside the ty was also greater than the total cost of furnishing such ervice even with interest at 7.5 per cent and depreciation, ixes and interest allowed upon a separate appraisal of the roperty used in supplying service outside the city. Inasuch as the revenues from the out-of-town consumers ould be sufficient to pay for the costs of service were the lant privately owned, the commission held that no reason xisted for increasing them. Attention was called to the act that the present schedule for commercial lighting is equitable as between individual consumers inasmuch as it kes into account only the quantity of energy consumed by ach. Although no request was made for a reduction in ates, the commission recommended schedules for city and on-resident consumers which will effect a reduction in ates for the former. The schedule prescribed for resident onsumers is as follows: Primary rate, 10 cents net per w-hr. for the first thirty hours' use per month of the active onnected load; secondary rate, 6.5 cents net for the next xty hours' use of the active connected load; excess rate, 5 cents net. The corresponding rates for the out-of-town onsumers are to be 12 cents, 8 cents and 5.5 cents respecvely. The division of consumers into classes according o the percentage of their active connected loads is the same s has been noted in previous decisions of the commission. he recommended rates for energy for motor service for onsumers within the city are as follows: A fixed charge f 50 cents net per month per active hp connected, plus a eter charge of 3.5 cents net per kw-hr. The correspondg charges for non-resident consumers would be 60 cents nd 4 cents. The active connected load is to consist of 90 er cent of the first 10 hp nominal rating of the total conected load; 75 per cent of the next 20 hp, 60 per cent of ie next 30 hp, and 50 per cent of all over 60 hp. In ldition to the above schedules, the commission recomended a lower rate for street lighting. The city was rdered to purchase all meters now owned by consumers r to pay such consumers a reasonable rental for meters vned by them. In lieu of meter rentals hitherto charged ere is to be substituted a minimum charge of 60 cents er meter for resident consumers and 75 cents per meter or non-resident consumers. It is stipulated in the decision at if the municipality decides to put any of the schedules ecommended into effect, all must be put into effect.

The Wisconsin Commission has handed down its decision n the matter of the complaint by citizens of Lake Geneva leging that the rates charged by the Equitable Electric ight Company are excessive. The investigation showed at the company supplies a comparatively large number f consumers who maintain summer homes in the vicinity f Lake Geneva and demand a higher class of service an is usually rendered by the small utility. On account f the relatively high cost of service occasioned by this emand, the commission departed somewhat from its usual ractice and differentiated in its prescribed schedule of ates between resident and non-resident consumers. No hange, therefore, was made in the present rate of 15 cents er kw-hr. in so far as it applies to the out-of-town conmer, but a slight reduction will be effected by the folwing schedule which was prescribed for residents of ake Geneva: Primary rate, 14 cents net per kw-hr. for ie first 30 hours' use per month of the active connected ad; secondary rate, 12 cents net per kw-hr. for the next o hours' use; excess rate, 8 cents net. In Class A, consting of residences, the active load is to be taken as 60 er cent of the first 500 watts and 33⅓ per cent of the xcess; in Class B, consisting of banks, offices, stores, hops, depots, etc., 70 per cent of the first 2.5 kw and 55 er cent of the excess is to be the active load; in Class C, onsisting of public buildings, schools, churches, hotels, lubs, etc., 55 per cent of the connected load is to be active. he minimum bill is to range from a charge of 60 cents for a connected load of 1 kw or less to a charge of $2.25 for a connected load of over 5 kw. The company's schedule for motor service, ranging from 7.5 cents to 4 cents per kw-hr., was ordered abandoned and the following schedule substituted: A service charge of 75 cents per active hp per month; an energy charge of 5 cents net per kw-hr. for the first 50 hours' use per month of the active hp and an excess rate of 3 cents net. The percentage active is to be determined as follows: 90 per cent of the first 10 hp; 75 per cent of the next 20 hp; 60 per cent of the next 30 hp; 50 per cent of all over 60 hp. The above schedule will effect an increase in the revenue from motor service. The commission pointed out that one reason for the high operating costs in the present case was to be found in the inefficient plant equipment, and methods were suggested for improvement.

# Current News Notes

Fire Losses in Philadelphia.—Mr. J. S. Mallory, of the Philadelphia Fire Prevention Commission, in speaking of the methods adopted in the Philadelphia fire prevention crusade said faulty electric wiring and conduits and loose and lax methods for caring for the transmission of electricity contributed largely to the excessive fire losses of that city. The annual fire loss in Philadelphia exceeds $3,000,000.

* * *

Dry Season in California and Nevada.—That the water supply of Lake Tahoe will be insufficient for power purposes this year is the statement made by the engineers of the Truckee River General Electric Company, Reno, Nev., after making examinations, surveys and collecting data and statistics on the present supply of water in the lake. Plans are being laid to meet the emergency, but it is conceded that the outlook is very gloomy.

* * *

Examination for Radio Sub-Inspector.—The United States Civil Service Commission will hold an open competitive examination on Aug. 20, 1913, for radio sub-inspector. The eligible candidate appointed to this position will receive $6 a day in the New York Navy Yard, and the assistant radio sub-inspector will receive $4 a day. For theoretical and practical questions in the construction, use and adjustment of radio apparatus and auxiliaries sixty credits will be allowed, and forty for technical training and experience.

* * *

Efficiency in Technical and Trade Journalism.—A feature of the annual convention of the Federation of Trade Press Associations in the United States at the Hotel Astor, New York, Sept. 18, 19 and 20, will be fifty ten-minute addresses making up symposiums on vital questions affecting all those who have dealings with the business press of America. At an inspirational mass meeting addresses will be made by representative business and professional men on subjects of live interest to manufacturers and publishers.

* * *

Examination for Radio Electrician.—An open competitive examination for radio electrician will be held Aug. 20 by the United States Civil Service Commission. From the register of eligible candidates certification will be made to fill a vacancy at $4.48 a day in the New York Navy Yard. The examination will consist of practical questions upon the construction, use and adjustment of radio apparatus and auxiliaries, and fifty credits will be allowed for experience in the line of the required duties. Form 1312, to be had from the United States Civil Service Commission, Washington, D. C., will give further particulars.

Old-Time Telegraphers to Meet.—A reunion of the Old-Time Telegraphers' and Historical Association will be held at Detroit from Aug. 26 to Aug. 28. Mr. F. J. Scherrer, 30 Church Street, New York, is secretary and treasurer of the association.

* * *

Machinery Building at San Francisco to Be Finished Soon.—In the course of an after-luncheon address before the City Club of Chicago on July 28 Dr. Frederick Vining Fisher, lecturer for the Panama-Pacific Exposition of 1915, said that Machinery Hall at the exposition would be finished in October of this year. Only machinery in operation will be shown. In all departments no award will be given to an exhibit over ten years old; the aim is to make the exposition very modern.

* * *

Electric Locomotive Head-Lamps in Illinois.—At the recent session of the General Assembly of Illinois a bill was passed providing for more powerful head-lamps on railroad locomotives. The law seems to be construed as a demand for the use of electric head-lamps. The State Board of Railroad and Warehouse Commissioners has decided, however, that the railroads shall be given a reasonable time to comply with the new law and that no prosecutions shall be begun until further orders from the board.

* * *

Electrically Heated Schoolhouse.—Rupert, Idaho, is the principal town on the North Side Minidoka irrigation project of the United States government. Two years ago a school building was erected at a cost of $16,000. Six months after completion this building was outgrown, and a contract has been let recently for a new schoolhouse to cost $46,000. Electricity is furnished at very low rates by the Government Reclamation Service, and the whole building will be heated as well as lighted by electricity. Fresh air will be blown over electric-heating units, and thus the heating and ventilating will be combined. In addition to the heating equipment, the school will have a household economics room equipped with a large electric range and twelve individual electric stoves. There will also be a large water heater for supplying hot water for all purposes in the building, including the baths for the gymnasium.

* * *

Minnesota Critics of Governor Dunne.—According to the Chicago newspapers a number of citizens of St. Paul and Minneapolis have united in a letter to Governor Dunne of Illinois criticising him severely for signing the public-utilities bill. These gentlemen, if correctly quoted, regard the creation of the State Public Utilities Commission of Illinois as a "flagrant violation of the principle of home rule in government," and as a movement "notoriously in the interest of the exploiting public-service companies of Illinois." The statement continues: "In signing this bill you have not only betrayed your own people of Chicago, but by your example you have given substantial aid and encouragement to the public-service-company philistines in Minnesota now working through the state machine and plutocratic newspapers to put over similar legislation in this State." The letter is said to be signed by Messrs. S. A. Stockwell, Albert W. Rankin, Stiles P. Jones and a number of other citizens.

* * *

The Deadly Curve-Drawing Meter.—Not long ago a Pennsylvania central-station company received a report of poor service from a local bookstore and dispatched one of its inspectors with a recording voltmeter to make a test of the pressure regulation on the premises. The inspector reached the store in the middle of a busy afternoon when the place was full of customers, and, not wishing to interfere with the merchant's business, connected up the meter in a small closet at the rear of the shop, afterward leaving without explaining to anyone what he had done. Next morning when everything was comparatively quiet the loud ticking of the clock in the closet aroused first the curiosity and then the terror of the clerks. After a hasty investigation they telephoned the police to send someone to take charge of the "infernal machine" they supposed they had discovered. A convenient bathtub was being filled with water to douse the electric bomb when the company's inspector happened in, just in time to prevent the unwonted bath which his pet recording voltmeter was about to receive.

* * *

## SOCIETY MEETINGS

Electrical Workers' Convention at Boston.—The International Brotherhood of Electrical Workers will hold its biennial convention at Boston, Mass., during the week of Sept. 15. Mr. J. W. O'Donnell, 987 Washington Street, Boston, Mass., is secretary of the organization.

* * *

Convention of the New England Section, N. E. L. A.—The fifth annal convention of the New England Section of the National Electric Light Association will be held at the Hotel Vermont in Burlington, Vt., Sept. 17, 18 and 19. Papers on electrical subjects of national interest are being prepared by authorities in New England and an entertainment committee is arranging to make the three days' stay one of special enjoyment.

* * *

Galveston Jovians.—At the meeting of the Jovian Lunch Club of Galveston on July 21 there were a number of out-of-town visitors, including Messrs. Arthur Binz, Edward Hale, Lee Johnson, F. B. Hathaway, B. S. Craig, William Archibald and Ray Schneider, all of Houston. Mr. K. E. Mason, secretary of the Brush Electric Company of Galveston, demonstrated the use of the pulmotor, using Mr. Hale as a subject. The next meeting will be held on Aug. 21.

* * *

Maine Electric Association Annual Meeting.—The following officers were elected at the annual meeting of the Maine Electrical Association held in Portland, Me., last week: President, Mr. John H. Maxwell, of Livermore Falls; first vice-president, Mr. Fred O. Eaton, of Rumford Falls; second vice-president, Mr. Charles E. Smith, of Newport; secretary-treasurer, Mr. W. S. Wyman, of Augusta. Executive committee, the above with Messrs. Harry B. Ivers, of Portland; Edward R. Graham, of Bangor, and Thomas W. Hawkes, of Rockland. In addition to the business meeting, sails were enjoyed around Portland harbor and an old-fashioned clambake was held at Long Island.

* * *

Missouri Association to Hold Convention on Boat Next Year.—At a recent meeting of the executive committee of the Missouri Electric, Gas, Street Railway and Waterworks Association it was decided to hold the 1914 convention on board a Mississippi River steamboat when en route from St. Louis to Keokuk and return. The convention will take place in May. In addition to arranging for the next convention, the committee proposed plans for increasing the membership of the association. Those in attendance at the meeting were President J. E. Harsh, of Sedalia; Messrs. F. E. Murray, of Louisiana; J. R. Woodfill, Jr., of Aurora; Hugo Wurdack, of St. Louis; H. Spoehrer, of St. Louis, and S. W. Henderson, of Excelsior Springs, of the executive committee, and E. S. Seeley, chairman of the membership committee, and F. D. Beardslee, of St. Louis, secretary-treasurer.

# Tacoma's Nisqually River Development

**Hydraulic features of a 19,000-kw municipal plant utilizing a 500-ft. fall in the glacier-fed Nisqually River. By R. H. Richards**

TACOMA, Wash., has recently placed in operation its own hydroelectric generating station, utilizing a fall of 500 ft. in the Nisqually River at a point 36 miles from the city limits. For some years Tacoma has had municipal electric lighting, but prior to the inauguration of the present station the city purchased its energy from the Seattle-Tacoma Power Company. It was at the local election of 1910 that the citizens of Tacoma voted to build their own public generating plant, and the plans for the Nisqually development were drawn up at that time. Although during the construction of the plant there were three changes in political administration and three different sets of engineers were in charge of operations, the original specifications were carried out to the end.

The new Nisqually station is located at Lagrande, Wash., about 36 miles south of Tacoma, on the Nisqually River. The latter has its source in the Nisqually Glacier on Mt. Rainier, and, since the stream is of this glacial origin, special care had to be taken to remove the sand and silt from the water by an arrangement of settling channels.

The first construction work on the plant was started in 1910 at the headworks about 2 miles above Lagrande. The river takes a precipitous course between this point and the power-house site, undergoing a fall of 500 ft. in the interval.

### The Headworks Dam

The headworks dam is a solid concrete structure 225 ft. long, set at right angles to the river and resting on bedrock 20 ft. below the riverbed. It is 40 ft. wide at the base and 5 ft. wide at the top, and stands 35 ft. high. At the north side are two wing-walls keyed into solid rock, and at the south side are the two gatehouses, one leading into the settling channel, the other to a wasteway. These gate houses are of brick construction, each containing two electrically operated 5-ft. by 7-ft. gates.

The settling channel, designed to remove glacial débris, is 1300 ft. long. It is built of solid concrete, the walls on the river side being 6 ft. at the base and 1 ft. at the top. The channel is 25 ft. wide and 14 ft. deep. On the side opposite the river the wall is built against solid rock and is accordingly a mere lining a foot in thickness, top and bottom. The concrete in the floor of the channel is 6 in. thick.

About 25 ft. from the end of the settling channel is located the mouth of the 2-mile tunnel leading to Lagrande. This tunnel entrance is elevated 6 ft. above the base of the settling channel. The end of the settling channel is also closed by a gate house similar to the one at its entrance.

### Two-Mile Rock Tunnel

The tunnel is bored through solid rock, and is 10,069 ft. long, 9 ft. wide, and 8.5 ft. high. The roof has been left just as it was after blasting, but the sides are walled with concrete which varies from 8 in. to 24 in. in thickness. The floor is concave in section, with a 6-in. invert at the center. The tunnel follows a tangent with a 2 per cent grade throughout its full length.

Emerging from the tunnel the water is carried across the river in a 10-ft. steel pipe, supported on a steel bridge shown in one of the illustrations. This section of pipe line is 540 ft. long and contains three expansion joints, one at each end of the bridge and one in the center. The river at this point flows 432 ft. below the pipe bridge. Reaching the

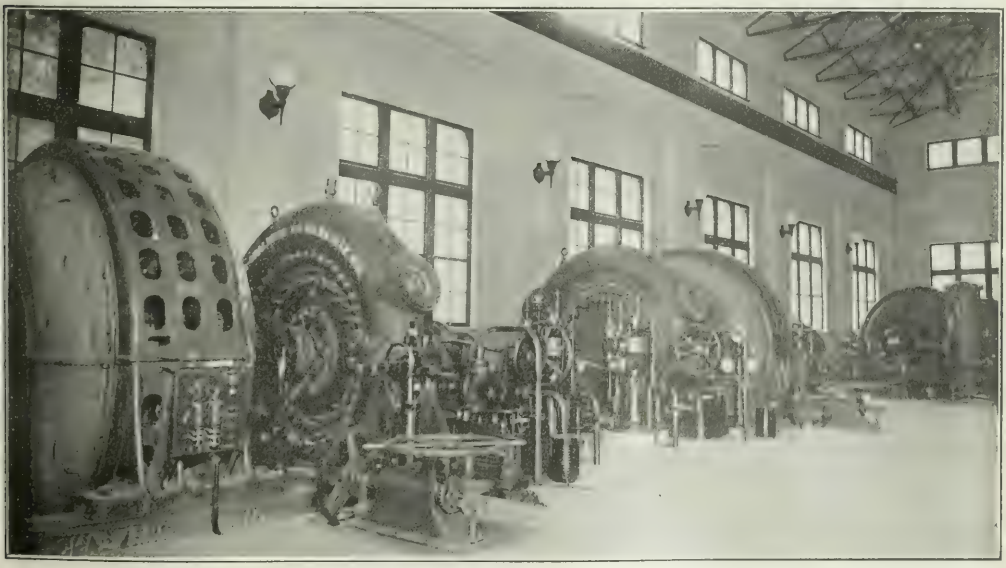


FIG. 1—INTERIOR OF NISQUALLY STATION, SHOWING WATER TURBINES AND ALTERNATORS

further bank, the water again enters a short tunnel for a distance of 1200 ft., and emerges at the by-path channel of the reservoir.

### The Reservoir

The reservoir of the Nisqually development is of solid concrete construction and has a storage capacity of 3,200,000 gal. Its massive walls have expansion joints at intervals



FIG. 2—HEADWORKS DAM, SHOWING GATE HOUSES AND ENTRANCE TO TUNNEL

of 30 ft., and the floor is laid in 19-ft. square slabs, 16 in. thick. The 1-in. openings between each slab were filled with oakum and hot pitch, and 6-in. drain tiles have been laid under each joint.

There are three gate houses located around the reservoir. The one at the end of the reservoir channel contains four gates, each 5 ft. by 7 ft. in opening. Two of these gates lead to the spillway and two lead through a tunnel under the reservoir to the main gate house, where the pressure pipes extend over the hill to the power house. Thus it is possible to divert the incoming water directly to the turbines without having it enter the reservoir at all.



FIG. 3—STEEL BRIDGE CARRYING PIPE LINE ACROSS CANYON OF NISQUALLY RIVER

The reservoir channel is divided from the reservoir proper by a 10-ft. weir wall. The gate house at the south end of the reservoir contains the "washout" gates for the reservoir. These two gates measure 5 ft. by 7 ft. and are electrically operated in the same manner as the ones at the headworks.

The four main penstocks are each 72 in. in diameter at the gate house, reducing to 54 in. at the turbine. They vary from 0.26 in. in thickness at the top to 0.75 in. in the lower sections. The exciter pipe is 24 in. in diameter throughout its entire length and has walls 0.625 in. thick.

The pressure pipes are set on a 62 per cent grade, the power house being situated 410 ft. below the reservoir. At 80-ft. intervals the pipes are supported on concrete anchors which extend 2 ft. over the top of the pipes. In addition, however, the first anchors above the power house extend 12 ft. over the pipes, forming a retaining wall to prevent slides of rock from striking the power house. All anchors are set into the native rock and are also keyed into the rock cuts on each side. After the pipes had been tested the pipe ditches were backfilled with earth to the level of the tops of the tubes, the earth being tamped well into place.

At the power house the 24-in. exciter pipe branches into two 16-in. pipes, which are also connected to the main penstocks by 16-in. pipe. The main gate house is fitted with a 24-in. by-path pipe for filling the pressure pipes

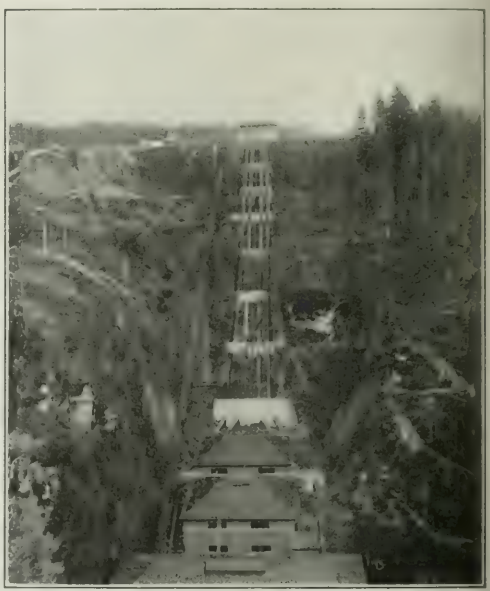


FIG. 4—PENSTOCKS, SHOWING MAIN GATE HOUSE, PRESSURE PIPES AND INCLINE FOR BRINGING IN MACHINERY

Near the entrance to the turbines each of the main pressure pipes is fitted with a 54-in. butterfly valve operable electrically from the switchboard.

### Generating Equipment

The main generating equipment consists of four 4750-kva, 6600-volt, 60-cycle, three-phase units running at 450 r.p.m. Each generator is direct-connected to a turbine rated at 8000 hp. Both turbines and generators were furnished by the Allis-Chalmers Company, as was also the exciter equipment. The latter consists of two Doble waterwheels, each direct-connected to a 300-kw, 125-volt direct-current generator operating at 400 r.p.m.

Both the turbines and the water-wheels are controlled by Allis-Chalmers oil-pressure governors. The turbines are also fitted with 24-in. Allis-Chalmers relief valves. The draft tubes of the main units are built of steel, while those of the exciters are of concrete. The generator room of the power house is provided with a 35-ton crane. During construction of the plant, all the machinery had to be lowered

down an inclined track set at 68 per cent grade. The heaviest parts handled were the revolving fields, each of which weighed 37 tons.

The switchboard and switching equipment were furnished by the Westinghouse Electric & Manufacturing Company. The switchboard is of blue Vermont marble and all switches are of the remote-control type. The structure



FIG. 5—RESERVOIR OF NISQUALLY POWER PLANT

for the 6600-volt bus is built of pressed-brick. Both the 6600-volt bus and the 60,000-volt bus are sectionalized at the center by tie-switches. A Tirrill regulator is connected to each side of the 6600-volt bus, but all generator field rheostats are of the hand-operated type.

The transformers are located in a separate room at an elevation 35 ft. above the generator floor. These units are of the water-cooled, oil-insulated type and were furnished by the General Electric Company. The installation comprises twelve single-phase units, each stepping from 6600 volts to 60,000 volts, with delta-connected windings on both the high-tension and the low-tension side.

The transformers are equipped with a duplicate water system and the oil piping is so arranged that any transformer can be drained to a large storage tank. There are also separate pipes provided for filling each transformer. The transformer room is served by means of a 15-ton electric crane.

Two high-tension circuits extend from the power house to the substations and the bus system is so laid out that each pair of generators can be run as a single unit feeding to one line. One exciter is capable of exciting all four generators. The switchboard indicating instruments are of the round-dial type.

Exciter and field switches are solenoid-operated, and are fitted with carbon breaks. Both the 6600-volt cables and the exciter cables in the station are lead-covered and are carried in fiber conduit. All lighting circuits are run in steel conduits, the same construction also applying to all instrument and control wires. The power-house building is lighted by flaming-arc lamps and tungsten clusters.



FIG. 7—HIGH-TENSION ROOM; 60,000-VOLT OIL SWITCHES

### TRANSMISSION LINE

The transmission line is 28.2 miles long and is operated at 60,000 volts. It is carried on 45-ft. cedar poles, placed forty to the mile. Transpositions are inserted at intervals of one-third of a mile.

The line conductor used is 250,000 circ. mil in cross-section. The telephone wire is of No. 10 iron and is carried on wood brackets. The two transmission lines run on separate poles for one-half the distance, the two circuits being mounted on a single pole for the remainder of the length of the line.

The substation contains transformer and switching equipment generally similar in all respects to that already described for the power house.

The total cost of Tacoma's Nisqually development was $2,125,000.

Mr. Frank C. Kelsey prepared the plans for the Nisqually plant, and during its construction the author acted as electrical engineer, being employed by the city of Tacoma.

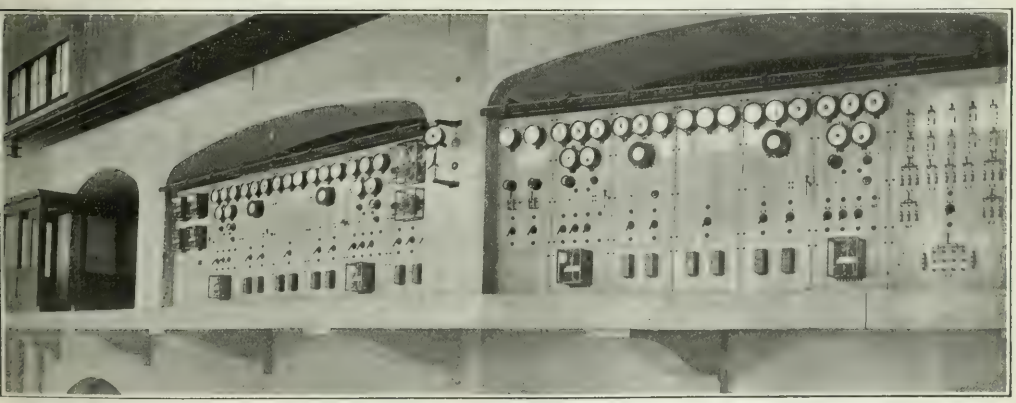


FIG. 6—SWITCHBOARD BALCONY IN GENERATING ROOM

## Graphical Statics Applied to Transmission-Line Calculations

By Allen Sill

It is usual to assume that the form taken by wires stretched between two points and subject to the influence of gravity is either a parabola or a catenary. For nearly all practical purposes either assumption leads to sufficiently accurate results. The first is based on the supposition that

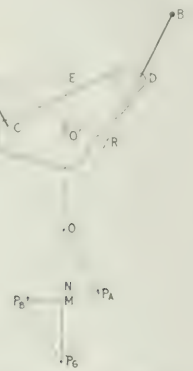



FIG. 1—FORCE DIAGRAM—SUSPENDED MASS

the total weight of the wire is distributed uniformly over the horizontal distance between the two supports, which would give the shape of curve followed by the cables of a suspension bridge. The catenary is the curve of a perfectly flexible homogeneous material of uniform cross-section hanging between two suspension points under the influence of its own weight only.

The use of formulas based on either of these curves is liable to obscure the real nature of the problems to be solved and lead to somewhat hazy notions regarding the component forces and their resultants. It is not suggested that a departure from the usual methods of calculation is necessary or desirable, and what follows is written more for the purpose of obtaining a clear conception of the forces in the wires and at the points of support than to develop new formulas or put forward anything essentially original on the subject.

Many students and practical engineers appear to have trouble in understanding the distribution of forces in overhead lines carried up a steep grade. An unsigned article appeared in the London *Electrical Review* of Aug. 18, 1911, in which an attempt was made to show that, if the supports are of the so-called flexible type, or if the suspension type of insulator is used, there is a transference of the weight of the wires from the poles at the bottom of an incline to the poles on the higher ground. In other words, the supports on the hillside at the lower levels are said to take less than their proper share of the weight of the conductors. The faulty reasoning in the article referred to is due to the assumption that the tension in the wire at the point of support is the same on the up-hill side as on the down-hill side of the pole. This is incorrect, and the conclusions arrived at are therefore valueless. It is because trouble has been experienced on lines carried up steep inclines that theories of this kind are advanced, and the idea that the poles on a steep grade carry increased loads as they occupy positions higher up the hillside appears to be shared by many. As a matter of fact, the troubles referred to have been caused by want of care in erecting the line or want of knowledge on the part of the designer, with the result that the maximum tensions in the conductors have been greater than where the line runs over level country. In the present article particular attention has been given to the calculation of stresses in lines carried up steep grades.

Although at the outset no reference is made to the shape of the curve taken up by the wires, it may be well to conclude these preliminary remarks by pointing out that the one disputable assumption made, namely, that the weight is uniformly distributed over the straight distance between points of support, is virtually equivalent to assuming the parabolic form. It follows that the formulas derived should be equivalent to those commonly used for the solution of sag-span problems.

### General Problem

Consider a mass of any irregular shape, the weight of which may be represented by the vertical vector $OP_g$ passing through its center of gravity $O'$ as shown in Fig. 1. This mass is suspended by two perfectly flexible ties from the fixed points $A$ and $B$. Except for the special case of parallel forces, the resultant $P_g$ and the components $P_a$ and $P_b$, acting in the direction of the suspension cords $AC$ and $BD$ will pass through the common point $O$. The system of forces is in equilibrium and the conditions to be fulfilled are therefore, first, that the vectorial sum of all external forces and reactions shall be zero and, second, that the sum of all moments taken about any point shall be zero.

The following is an explanation of the manner in which a force diagram similar to Fig. 1 may be constructed.

*Known Data*:

(1) The position of suspension points $A$ and $B$.

(2) The magnitude and position, relatively to points $A$ and $B$, of the force of gravity (that is, the length of the vector $OP_g$ and the distance $AE$ of this vector from the point $A$).

(3) The magnitude, but not the direction, of the force $P_b$ acting through the suspension point $B$.

*Required*:

(1) The direction of the force $P_b$.

(2) The magnitude and direction of the force $P_a$.

(3) The horizontal and vertical components of the stresses at the points of support.

Taking moments about the point $A$ gives the equation

$$P_b \times AR = P_g \times AE$$

thus

$$AR = AE \times \frac{P_g}{P_b}$$

From the point $A$ as a center, use this radius to draw an arc of circle the tangent to which, passing through the point $B$, will locate the point $O$. Draw $OP_g$ to the proper scale to represent the force of gravity and complete the parallelogram of forces. The vertical component of the reaction at point $A$ is $NO$, and at the point $B$ it is $MO$. The horizontal reactions at the points of support are $P_aN$ and $P_bM$ respectively. These are obviously equal, but opposite in direction, in every conceivable case of a body in

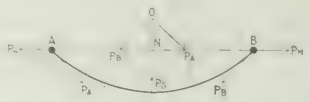



FIG. 2—FORCE DIAGRAM—HORIZONTAL SPAN

equilibrium subject only to the force of gravity acting, as it always does, vertically downward.

### Stretched Wire—Supports on Same Level

In Fig. 2 a wire weighing $W$ lb. per foot is stretched between the supports $A$ and $B$ lying in the same horizontal plane. The maximum tension in the wire is $P_b$ lb. This is the tension at the points of support, and, owing to the symmetry of the figure, it is the same in amount at $A$ as

*B*. The assumption is now made that the total weight f wire is equal to the weight per foot multiplied by the raight-line distance between the points *A* and *B*. Thus

$$P_g = W \times l$$

here *l* is the distance in feet between *A* and *B*. This ssumption is allowable on all except spans of extraordinary ngth, because the actual length of the wire differs only by very small amount from the shortest distance between e points of suspension.

Draw the vector $OP_g$ to represent the total downward rce *Wl*. It will lie on a vertical line midway between and *B*. Let it be bisected by any horizontal line such as *B*. From *O* lay off $OP_b$ at such an angle that the head of the vector lies on the horizontal line bisecting $OP_g$. omplete the parallelogram of forces. Then *ON* repre- nts the vertical component at each point of support, and $P_b$ or $NP_a$ is the horizontal force $P_h$ acting at each sup- rt; it is also the total tension in the wire at the center lowest point of the span.

### Calculation of Sag

Referring to Fig. 3, which shows a span of length *l*, it required to calculate the sag *s* at the center. Consider e moments about the point *A* due to the half span *AD*. hese must balance, and the equation is

$$s \times P_h = \frac{l}{4} \times \frac{Wl}{2}$$

$$S = \frac{Wl^2}{8P_b}, \qquad (1)$$

hich is the well-known formula for sag calculations when e parabolic assumption is made.

### Supports at Different Elevations

In Fig. 4 the difference in elevation between supports is feet. The span measured horizontally is *l* feet, and the gle $\alpha$ which the straight line AB makes with the hori- ntal is

$$\tan^{-1}\left(\frac{h}{l}\right).$$

The actual length of the direct line between points of pport is $l' = \frac{l}{\cos \alpha}$. The weight of wire per foot is *W* lb., d it is assumed that the total weight is $Wl'$ lb. This force ts through the point *C* midway between *A* and *B*. The her known quantity is the magnitude (but not the direc- n) of the maximum tension in the wire; this is the force acting through the highest point of support (*B*).

Draw the vertical line $OP_g$ to represent the total force of ravity ($Wl'$). Through its center *C* draw the line *AB* r a line parallel to *AB*) making an angle $\alpha$ with the rizontal. Then from *O* as a center describe an arc of dius $OP_b$ equal to the known force $P_b$. Its intersection ith *AC* locates the head of the vector $OP_b$. Complete the rallelogram of forces, and drop the perpendiculars $P_aM$ nd $P_bN$ on to the vertical $OP_g$. These last are a measure

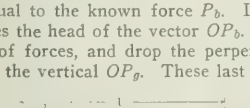



FIG. 3—DIAGRAM FOR SAG CALCULATION

f the (equal) horizontal components of the reactions at the vo points of support and also of the total tension in the ire at the lowest point *D*. The length *MO* is the vertical mponent of the reaction at the lower support *A*, while *O* is the vertical reaction at *B*. Their sum is, of course, ual to $OP_g$. The angle $\beta$ which the vector $P_b$ makes with e horizontal is the slope of the wire where it leaves the oint *B*.

The construction as above described satisfies the fundamental conditions of equilibrium, namely, that all vertical forces shall balance, that all horizontal forces shall balance, and that the sum of all moments taken about any point shall be equal to zero.

In practice it is not convenient to solve such problems by actual measurement of quantities plotted to scale on drawing paper, because the horizontal components of the forces

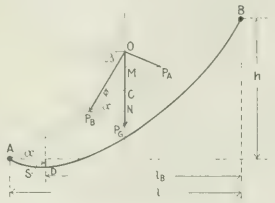



FIG. 4—FORCE DIAGRAM WITH SUPPORTS AT DIFFERENT ELEVATIONS

are usually very much greater than the vertical components. A trigonometrical solution is therefore desirable.

In Fig. 4 the known quantities are the two sides $OP_b$ and *OC* of the triangle $OCP_b$, of which the angle $OCP_b$ is also known, being equal to $\alpha + 90$ deg.

The angle $OP_bC$ or $\varphi$ may be calculated from the relation

$$\sin \varphi = \frac{OC}{P_b} \sin (90 + \alpha)$$

$$= \frac{Wl'}{2P_b} \cos \alpha \qquad = \frac{Wl}{2P_b}$$

and the angle $\beta$ which the wire at the upper support makes with the horizontal is, therefore,

$$\beta = \alpha + \sin^{-1}\left(\frac{Wl}{2P_b}\right) \qquad (2)$$

With the aid of trigonometrical tables or a slide rule the values of sin $\beta$ and cos $\beta$ can be obtained and the other components of the force diagram readily calculated. Thus, the horizontal component at either point of support, which is also the total tension in the wire at the point (if any) where the slope is zero, is

$$P_h = P_b \cos \beta \qquad (3)$$

The vertical component of the reaction at the highest point *B*, where this reaction is greatest, is

$$P_{bv} = NO = P_b \sin \beta \qquad (4)$$

The weight supported by the lower pole is

$$P_{av} = MO = Wl' - P_{bv} \qquad (5)$$

This may, obviously, be a negative quantity; that is, the wire may exert an upward pull on the lower support. In that case the sag *s* below the point *A* will be zero, and this would correspond to the usual condition on a steep incline or on a moderate incline if the spans are short.

### Position of Lowest Point of Span—Supports at Different Elevations

The position of the lowest point *D* in the span will be determined by the vertical weights carried by each of the two supports. Thus, referring to Fig. 4, the vertical component of the forces acting at *B* is simply the weight of that portion of the wire comprised between the support *B* and the point *D* where the tension in the wire has no vertical component. Thus the horizontal distance of the point *D* from *B* (in feet) is

$$l_b = l \times \frac{ON}{OP_g}$$

$$= \frac{lP_{bv}}{Wl'} \qquad = \frac{P_{bv} \cos \alpha}{W} \qquad (6)$$

This may give a distance for $l_b$ which is greater than *l*. In that case the support *A* would be the lowest point in the span. It may be observed that if the formula (4) gives a value for $P_{bv}$ greater than the total weight of the span

($WV$) it is unnecessary to proceed with the location of the point $D$, since the resultant force at $A$ must be in an upward direction.

### Calculation of Sag with Supports on an Incline

The formula (1) as calculated for spans with supports on the same level may be used for spans on an incline provided the distance $l_b$ of Fig. 4 is considered as half of a level span of which the sag is $(h+s)$. Thus,

$$(s+h) \quad \frac{W}{\cos\alpha} \times \frac{4 P_b}{8 P_h} = \frac{W P_b}{2 P_h \cos\alpha} \qquad (7)$$

On a steep incline, where $A$ is the lowest point of the span, it is more useful to know the maximum deflection of the wire from the straight line $AB$ as observed by sighting between the points $A$ and $B$. This maximum deflection will be at the center of the span, the assumption in regard to load distribution being as previously made. A study of the force diagram in Fig. 4 will make it clear that, just as $OP_b$ is the slope of the tangent to the wire at the point $B$, and $P_bN$ is the slope of the tangent to the wire at the lowest point $D$, so $P_bC$ is the slope of the tangent to the curve at the middle of the span. This is therefore the point of maximum deflection from the straight line $AB$.

Consider now Fig. 5. The maximum deflection of the line on the slope is $s'$, and, by taking the sum of all the

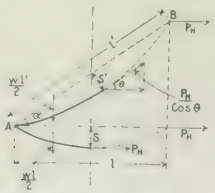



FIG. 5—DIAGRAM FOR SAG CALCULATIONS WITH SUPPORTS AT DIFFERENT LEVELS

moments about $A$ and putting this sum equal to zero, the value of this deflection is found to be

$$S' = \left(\frac{W}{2} \times \frac{l}{4}\right) \times \frac{\cos\alpha}{P_h} = \frac{W l^2}{8 P_h} \qquad (8)$$

which indicates that the maximum deflection from the straight line of a conductor strung between supports on a slope, as measured at the center of the span, is exactly the same as the maximum sag, $s$, of the same conductor strung between points on the same level, provided the span measured horizontally and the horizontal component ($P_h$) of the tension are the same in both cases.

### Example Illustrating Use of Formulas

Consider a span of 485 ft. measured horizontally, with a difference of level of 40 ft. between points of support. The wire is of No. 2-0 B. & S. gage aluminum, weighing 647 lb. per mile. The problem is to calculate the sag and vertical and horizontal components of the forces when the maximum tension in the wire is 185 lb.

The known quantities are:

$$l = 485;\ h = 40;\ W = 0.1226;\ P_b = 185$$

The unknown quantities are calculated as follows:

$$\tan\alpha = \frac{40}{485} = 0.0825$$

$$\alpha = 4 \text{ deg. } 43 \text{ min.}$$

$$\cos\alpha = 0.9966$$

$$\sin\varphi = \frac{485 \times 0.1226}{2 \times 185} = 0.161$$

$$\varphi = 9 \text{ deg. } 15 \text{ min.}$$

By formula (2) $\beta = \alpha + \varphi = 13$ deg. 58 min.

$$\cos\beta = 0.971$$

$$\sin\beta = 0.2413$$

By formula (3) $P_h = 185 \times 0.971 = 180$ lb.

By formula (4) $P_{bv} = 185 \times 0.2413 = 44.6$ lb.

By formula (6) $l_b = \dfrac{44.6 \times 0.9966}{0.1226} = 364$ ft.

By formula (7) $(s+h) = \dfrac{0.1226 \times (364)^2}{2 \times 180 \times 0.9966} = 45.2$ ft.

Thus the sag below the bottom support will be 5.2 ft. when the maximum tension is 185 lb.

### Overhead Lines on Steep Grade

Except for the fact that the pole foundations must be wisely chosen and special attention paid to the setting of the poles, there are no engineering difficulties in the way of running an overhead line up a steep incline. It may be well to reduce the length of span measured horizontally so that this is equal to about $l' \cos\alpha$, where $l'$ is the distance between supports on level ground and $\alpha$ is the angle which the average slope of the line makes with the horizontal. This will insure that the vertical load to be supported by the insulators does not exceed the vertical load on the level runs, but no difficulty need be experienced in providing that each pole shall take its proper share of the weight of the wire (with or without ice loading).

The stringing of the wires may be done with the aid of a dynamometer, or the sag, as calculated by formula (8), can be measured by sighting from pole to pole. If the poles or suspension insulators of a line carried on an incline are deflected from the vertical owing to the unbalancing of horizontal forces at the time when the wires are strung, the effect must be attributed to incompetence on the part of the engineer in charge of construction and not to any unexplained flaw in the known laws of equilibrium. If the conductor is tied to the insulator at the proper point, the horizontal components of the forces at this point will balance.

## Concluding Sessions of Ohio Convention

An account of the first two sessions of the Ohio Electric Light Association convention, held at Cedar Point, Ohio, July 15 to 18, appeared in these columns on July 19. The session of Thursday morning, July 17, was opened with the discussion of the paper on "Means of Developing and Diversifying the Present Load," by Mr. H. E. Armstrong, East Liverpool, Ohio.

### Developing and Diversifying Present Load

In his paper Mr. Armstrong described results obtained during two years' commercial work at Steubenville, Ohio, during which time the motor load has increased from 40 hp to 1500 hp, despite the isolated-plant competition afforded by natural gas at 15 to 25 cents per 1000 cu. ft. Many power users were, however, greatly surprised when their attention was called to the many miscellaneous items such as labor, repairs, auxiliaries, supplies, etc., for which they were paying in addition to their fuel costs. Flat-rate controllers were also employed with success to get residence business. In the July 19 issue there was given an enumeration of the results obtained at Steubenville, showing the increase in connected load from 684.5 kw in 1911 to 2775 kw in 1913 as the result of the commercial campaign. The central station, declared the author, should do all in its power to teach its customers that it is not a soulless corporation but a friend willing at all times to meet them more than half way in all disputes. It should also impress on their minds that the proper place to make a kick—when they have one—is at the company's office and not to their next-door neighbors.

*Discussion*

In opening the discussion Mr. D. L. Gaskill, Greenville, emphasized sign lighting as a means of diversifying the load. Following this suggestion Mr. E. A. Elliott, Mt. Vernon, read a short paper on the possibilities of electric signs as revenue producers. Not only do electric signs increase the income, but they sometimes induce promoters of industrial enterprises to locate in the cities and towns thus lighted, as the signs show the progressive attitude of the locality. Mr. Elliott particularly urged the installation of electric signs near railway stations, where they can advertise points of particular interest in the town. Mr. T. F. Kelley, Dayton, said that where central stations can obtain the co-operation of electric sign companies a successful campaign can generally be realized. Mr. W. C. Anderson, Canton, foresaw great possibilities in the electric soldering iron if the price can be reduced. Mr. J. C. Martin, the president of the association, closed the discussion by saying that a diversified output can be obtained by meeting the demands of the public for electrically operated apparatus.

Business matters left over from the preceding day were next taken up. Mr. Martin appointed the members of the committee on new business, which will conduct a sort of clearing house for new ideas on how to get business. The amendment to the constitution, allowing electrical engineers and instructors in electrical science to become engineering members of the association, was also adopted.

Resolutions recommending the publication of a monthly bulletin and the assessment of active member companies' dues were approved. A committee of five was also appointed to investigate the subject of changing associate members' dues.

### The Human Equation

Mr. S. G. McMeen, president of the Columbus Railway & Light Company, delivered an interesting address on "The Human Equation." He spoke of the relative abilities of the technically trained man and the practical man to adapt themselves to circumstances which require prompt action. Mr. McMeen also spoke of the general opinion which newspapers have created in the public mind concerning public-utility corporations, and said that he believed the average corporation tries to do right to a greater extent than does the average public. If the human equation was understood more fully, he believed it would bring the public and the corporations into better accord.

As a consolation to those believing that legislation would soon be so exacting as to overwhelm the most conscientiously conducted corporations, Mr. McMeen said that belief on the part of the corporations' representatives in the purposes which they foster, coupled with enthusiasm, cannot help but bring satisfactory results. He urged his audience not to object to regulation by commissions, as it will eventually prove satisfactory when those bodies have obtained sufficient experience. Commissions have to deal with two parties—the public and the corporation—and to have equitable conditions both must be consulted. City council regulation is inefficient in that the average councilman is not well enough informed on engineering details to know what is satisfactory to the public which he represents, and his tenure of office is not sufficient for him to become acquainted with such facts.

In closing Mr. McMeen said that although large organizations apply scientific management to their business, the individuals connected therewith seldom apply it to their own minds.

### Report of Meter Committee

The meter committee, composed of Messrs. A. H. Bryant, chairman, Cleveland; C. B. Stelle, Springfield; John Himes, Dayton, and F. C. Jeannot, Marysville, in submitting its report called attention to the success of its metermen's conference during the past year. Three districts were arranged, and division meetings were attended by as many as twenty metermen from nearby member and non-member companies. The result aimed at has been the furtherance of mutual acquaintanceships, stimulation of wider interest and the fostering of a co-operative spirit among the metermen of the State. The committee has also received a number of answers to its letters soliciting suggestions concerning ways in which the committee may increase its own usefulness. Printed with the report were short papers by Mr. F. C. Jeannot, Marysville, on "The Importance of Maintaining Meters Within Commercial Accuracy," and Mr. C. B. Stelle, Springfield, on "Methods of Meter Testing," both of which were presented at the metermen's conferences earlier in the year.

*Discussion*

To bring out a systematic discussion of the committee's report President Martin called on Messrs. W. Parsons, of Springfield; W. S. Culver, of Cincinnati, and John Himes, of Dayton, to read written discussions.

Mr. Parsons presented some interesting figures showing the cost of periodic meter tests in Springfield, and also gave results showing the accuracy of the meters tested. From these figures the increase in revenue due to the correction of slow meters was computed. The confidence of public-utility commissions and the increased satisfaction on the part of the public due to periodic tests were emphasized.

Mr. Culver's paper dealt with the selection, maintenance and operation of different meters. He brought out the severe conditions under which electric meters have to operate, in comparison with water, gas and steam meters, and discussed the relative accuracy of the different types.

Mr. Himes read an interesting paper on the "Reclamation of Flood-Damaged Meters in Dayton," where about 75 per cent of the meters installed had to be rehabilitated. A description of this work was given in the *Electrical World*, June 14, 1913.

Mr. J. T. Kermode, Cleveland, urged periodic testing of meters and the co-operation of the smaller Ohio central stations with the committee. As evidence of the need of small companies for the committee's advice, he told of direct-current meters being used on an alternating-current system in one small Ohio town.

Mr. Gaskill closed the discussion by commending the committee for bringing the subject to the central stations in person through its meetings in the State, and suggested that a standing committee on illumination be appointed.

### Committee on Electrical Transmission

The report of the committee on electrical transmission, of which Mr. M. H. Wagner served as chairman, was confined to a discussion of lightning-arrester problems and overhead-crossing construction. Following an elementary explanation of lightning phenomena, the report passed to a description of forms of arresters, including the multi-gap, open-air horn-gap, electrolytic and compression types. Particular stress was laid upon proper grounding, by pipes being driven into salted earth where necessary. Among new forms of overhead high-tension crossings in use in Ohio, the Dayton company employs an additional loop at each span insulator, carried on an upper insulator which is brought into play to support the crossing span only if the other insulators break. In another form 5-ft. jumpers are soldered to the span wire, while threaded through the loops thus formed is passed a second wire of equal cross-section with the main cable. The report closes with extracts from the Ohio state laws on right-of-way matters, making it clear that electric-lighting companies have eminent domain to secure rights-of-way for their lines, both inside and outside of municipalities, although in the former case the consent of the municipality must first be secured. It has also been repeatedly held by the courts that the erecting of a

for the highway, and the right of the abutting property owner for compensation and damages for such additional use has been always upheld. In proceedings to appropriate a right-of-way, the question is one to be determined by the jury as to the amount to which the property owner is entitled for the additional use.

*Discussion*

Following Mr. Wagner's abstract of the report, Messrs. D. L. Gaskill, Greenville; W. Parsons, Springfield; W. S. Culver, Cincinnati; J. C. Martin, Wilmington, and Prof. F. C. Caldwell, Columbus, took part in the discussion. Mr. Gaskill said that in Ohio there is a fundamental law granting all electric-service companies the right to construct lines on county and state roads as long as they do not interfere with existing lines. A prosecuting attorney in Montgomery County has told Mr. Gaskill that while it would be better for electric-service companies to get permission for erection of lines along highways from the commissioner having the highway under supervision, such procedure is not necessary.

Mr. Parsons spoke in favor of compression-type lightning arresters, saying that these devices are used to protect each transformer installation in Springfield.

Mr. Culver said that it is practically impossible to protect lines against direct lightning strokes, but added that a ground wire grounded at each post is effective in avoiding bad results from such strokes. He brought out the practicability of different types of lightning arresters by quoting the number of strokes which an artificial line equipped with various arresters withstood before serious results occurred.

Professor Caldwell suggested that it would be desirable to send out inquiries to the member companies in the State, requesting information on their experience with lightning. Professor Caldwell also spoke briefly of a case in which line surges noticed in Columbus had been attributed to switching. Subsequent experiments with an oscillograph showed this hypothesis untrue. He advised investigating such cases.

In closing he told of a method of securing a good ground connection in earth which does not receive much moisture. Mr. Wagner said that it has been found that rust accumulating on a ground-plate does not reduce the effectiveness of such a ground, because a rush of current has reached its destination when it arrives at the ground-plate and will be discharged under any condition.

Standing committees on illumination and electric haulage were appointed, and Mr. Gaskill advised that the insurance committee investigate the subject of inter-insurance and report to members through the monthly bulletin.

FRANCHISES

The address on "Franchises" delivered by Mr. James V. Oxtoby, counsel for the Edison Illuminating Company of Detroit, Mich., was deemed of such value by the members that a motion was made and passed to have the entire address published in the *Bulletin*.

Mr. Oxtoby discussed term franchises as to their effect on rates and depreciation charges and on property rights at the expiration of the franchise. In addition he brought out the possibility of rates fixed by franchise being subject to regulation by state commissions. It was the original idea to have franchises expire at a definite time in order that rates and extensions might be adjusted, but with the present regulation Mr. Oxtoby said that placing the property of a company in jeopardy at the expiration of a franchise is wrong. Public-utility corporations are generally at a disadvantage at the expiration of a franchise in not being on an equal footing with the public.

To meet the situation at the expiration of such a term franchise he cited the method used by the Cataract Power & Conduit Company, of Buffalo, as the best solution at present. If a term franchise is held, depreciation and expiration, and charges should be included for removing service from the streets at that time. Wherever the maximum term of franchises is stipulated in a state constitution Mr. Oxtoby expressed belief that this is a step backward in civilization. If the public realized that term franchises mean higher rates the subject would not be urged.

Cleveland's charter would be ideal, said Mr. Oxtoby, if provision was made for termination of franchises on valuation. If there was a general law for framing franchises and permitting municipalities to fill out merely the details, conditions would be more satisfactory. Indeterminate permits are the best provisions up to the present time.

Cases were cited in which states had repealed franchises and regulated rates granted by local bodies. The possibility of such procedure in Ohio was shown by reading a clause from the state constitution. In closing Mr. Oxtoby said that a franchise merely safeguards an investment and gives no added value to the property.

ILLUMINATION AS A COMMERCIAL PRODUCT

Passing from a brief sketch of the history and physics of light, Mr. A. M. Seeger, Toledo Railways & Light Company, divided commercial illumination into the three classes of domestic, business and public lighting. The first-mentioned for convenience may be considered under the headings of general and specific illumination, although in neither class is the problem so much one of engineering as of artistic application. A number of modern, highly efficient systems of public lighting are now available for street lighting, while each class of business presents its own illumination problems. The central station can sell only energy—it cannot sell illumination any more than the merchant can sell satisfaction—so that at best a choice must be made of the best illuminant available at the price the customer wishes to pay, and under such conditions the work of the illuminating company will be most successful.

On account of the prolonged session Mr. Seeger's paper was not discussed.

Throughout the convention the sessions were held during only half the day, the remainder being devoted to entertainments of various sorts for all present. About 625, including members and guests, were registered at the convention, and 412 attended the banquet given at the Breakers Hotel. The latter was followed by vaudeville skits carried out by members of the association. A Jovian rejuvenation was held during the convention, the degree team being in charge of Statesman M. H. Moffett, Cleveland.

## 150,000-Volt Air-Break Switches for Southern Sierras Transmission System

Of special interest among recent hydroelectric developments is that of the Southern Sierras Power Company in California, whose transmission lines will be operated at 150,000 volts. This will be not only the highest voltage in commercial use, but the line itself is the longest direct transmission line in the world, having a length of 238 miles. The line will transmit energy from Bishop, Cal., to San Bernardino, Cal.

The power is generated by several hydroelectric plants in Nevada and California. The transmission line consists of a double circuit of steel-core aluminum cable. Apparatus for the control of the transmission system is of a radical type, including two 150,000-volt circuit-breakers at each end of the line. This apparatus was furnished by the Bowie Switch Company, San Francisco, Cal.

At the upper end of the line the circuit-breakers are pneumatically operated for synchronizing on the high tension side. Each pneumatic operating mechanism consists of two cylinders, the piston rods of which are provided on their outer ends with clevises. A slotted cross-bar con-

connects it in turn to a movable guided bar. This bar carries a rack which meshes with a pinion mounted on the operating shaft.

As the distance from the switchboard to the circuit-breaker is small, direct air control is provided for the breaker. This control mechanism is mounted directly on the switchboard, and consists of a special valve provided



FIG. 1—150,000-VOLT AIR-BREAK SWITCHES AT SAN BERNARDINO SUBSTATION

with two-point position for closure, the opening being accomplished in a single stroke. For closure the operating handle is first thrown to the center position, where it stops automatically. This operates one of the pneumatic cylinders and throws the circuit-breaker to mid position. There are three signal lamps on the switchboard, for the closed, open, and mid positions, respectively. When the mechanism is moved to mid position the corresponding lamp is lighted. The operator may then close the breaker at the proper moment. To accomplish the final stroke of closure, the button in the operating handle is first depressed, and the action of closure is instantaneous.

For opening the breaker only a single motion of the handle is required. The small inertia of the moving parts of these breakers results in practical absence of mechanical jar on operation, and the synchronizing of the line on the

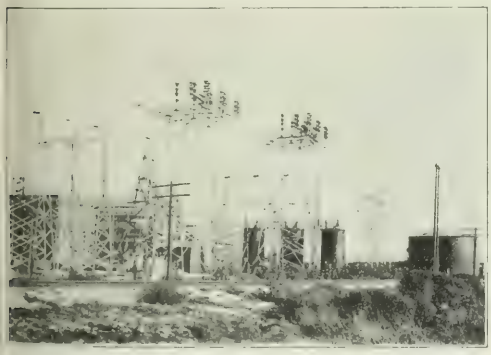


FIG. 2—12,000-KVA OUTDOOR SUBSTATION, SHOWING SWITCHES AND TRANSFORMERS

high-tension side cuts out a large number of complications.

At the San Bernardino end of the line there are two motor-operated type L circuit-breakers, the mechanism for which is mounted on a concrete pier at the base of the tower supporting the breaker. Through worm gearing the motor actuates a vertical shaft, on the lower end of which

main shaft. This gear is in turn held in mesh by a jaw clutch which operates on a sliding feather, its position being governed by the operating handle. When this handle hangs vertically downward the jaw clutch is in mesh, thus connecting the electric operating mechanism. With the handle raised to a horizontal position the motor is cut out, allowing instantaneous operation by hand. This is a valuable feature since the handle is always attached and is available for instantaneous operation by hand if desired.

The mechanism includes an electrically operated clutch for the motor, which is controlled by a coil in series with the armature. When the circuit is broken by the limit switches the armature is immediately disengaged, thus preventing the momentum of the motor from causing overtravel of the mechanism. In the control box are located the signal-lamp switches and the limit switches, the latter being governed by a cam mounted on the main shaft. The motor is protected by a sheet-metal cover which keeps off moisture and dirt, and the control box is provided with a removable cover which slides on a lip allowing ready removal and avoiding the use of gaskets.

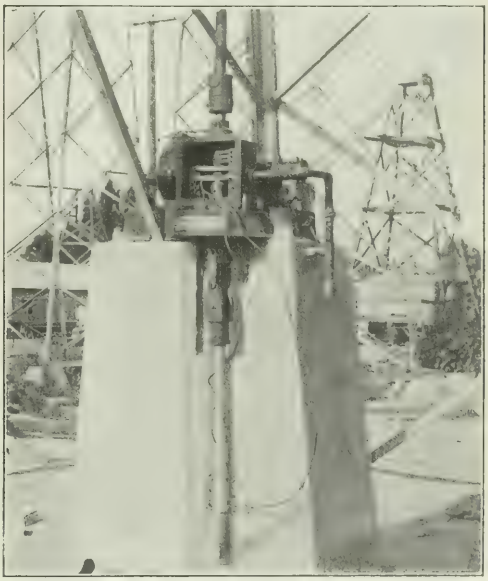


FIG. 3—MOTOR-OPERATING MECHANISM FOR AIR SWITCH

The construction of these circuit-breakers is of interest not only for their electrical design but for the substantial mechanical construction employed as well. They are of the double-break type, each pole comprising two pairs of horns in series. The contacts for the circuit-breaker are mounted adjacent to the horn bases, each pair of horns being bridged respectively by the switch blades. These blades are pivoted at the hinge end and operate in a vertical plane. The contact at the outer end of the blade is made with a clip, and on the extreme outer end of the blade there is a follower contact which is the last to break connection with a corresponding flexible follower on the clip cap, thus protecting the main contacts from burning. The hinge contact is taken through a flexible pigtail connection. As the blade is rotated in a vertical plane, it starts the arc upwards in a direction in which it must travel. After the blade end has passed the horns, the arc is in turn transferred to them and rises and blows itself out promptly. The horns are constructed of galvanized steel which exerts a

caused by the heat of the ascending gases. As the arc lengthens it introduces a high resistance into the circuit, thus cutting down the current value before the final break. This is of importance in the practical operation of the breakers since the current at the instant of the final break is greatly reduced owing to the high resistance of the arc and hence does not set up pressure oscillations.



FIG. 4—150,000-VOLT AIR-BREAK SWITCH, BLADES OPEN

Each pole of the breaker is actuated by a single operating insulator which moves both blades of the pole simultaneously. This insulator rotates around a vertical axis and carries at its top a cap provided with two pins for attachment of the links connecting the blades. At the top the operating insulator is carried by a bronze pivot supported in turn by a bearing mounted on a trussed-steel framework which connects the two hinge caps. This results in an exceedingly strong structure in which all operating strains are practically self-contained. The linkage arrangement is

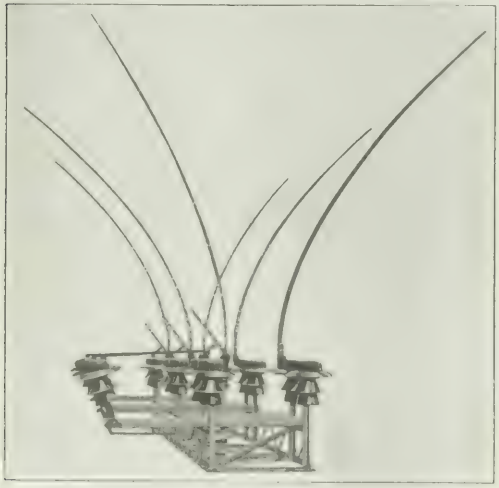


FIG. 5—60,000-VOLT, 600-AMP SWITCH FOR DISTRIBUTION LINES

such that when the blades are closed the pins in the operating insulator are substantially in line with the axis of the insulator and the switch-blade pivot, thus resulting in powerful toggle action at the starting of the blade from the clips when the maximum power is required. This cuts down torsional strain on the operating insulators and also reduces the power required to operate the breaker.

The hinge caps and clip caps are all supported by double insulators thus insuring a very rigid structure. The operating insulators work in babbitted bearings and the weight of each is carried by a bronze ball-bearing lubricated by a compression grease cup, thus insuring against deterioration and rendering the operation of the breaker exceptionally easy. The three operating insulators are connected to move simultaneously by a tie-rod and cranks. The center insulator pin has two cranks, the second being connected to the main operating shaft. The latter is vertical and carries at its upper end a crank which turns through 180 deg. for each stroke of the breaker, thus providing a toggle action at the start and end of each stroke.

All bearings of the breaker are made with fitted bronze pins and all links are adjustable, thus affording a good working fit, insuring against deterioration and allowing ready adjustment in assembly. The operating insulators have the distinction of being the largest rigid insulators ever constructed. They consist of three three-part porcelain insulators joined by semi-steel connecting pins of great strength and rigidity.

The breakers at the San Bernardino substation are now of the single-break type, but will later be changed to double-break when the pressure is raised from 87,000 volts delta to 150,000 volts Y. The breakers at the upper end of the line are, however, now provided with the double



FIG. 6—150,000-VOLT SWITCH, BLADES CLOSED

break. At several intermediate points on the line Bowie circuit-breakers are also provided for sectionalizing or for crossover purposes. The installation at San Bernardino is of interest as it represents one of the largest outdoor substations ever constructed, having a rating of 12,000 kva.

A number of 44,000-volt Bowie circuit-breakers are used on the distribution system. Some of these breakers have already interrupted over twice their rated kilovolt-ampere capacity, showing the conservative rating of the apparatus used in these installations.

## Illumination of a Polo Field

A field at Long Branch, N. J., to be used for playing automobile polo after dark, is now being equipped with electric lighting which will provide an illumination of 1 ft.-candle on the horizontal plane. The field measures 150 by 350 ft. and will be lighted by forty-eight 400-watt tungsten lamps with Holophane-D'Olier reflectors, the units being arranged in twelve rows of four each. Four lamps are suspended from each span wire carried by 35-ft. poles, thus bringing the lighting units at a height of 25 ft. above the ground. Service for the polo-field lighting will be furnished by the Consolidated Gas Company of Long Branch, of which Mr. E. R. Cutchean is general manager.

# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Electrical Conveniences and the Servant Problem

In the vexatious endeavor to secure household servants in American cities the advantages of electrical conveniences in the home may serve as a lure. The Commonwealth Edison Company of Chicago in its advertising takes advantage of this fact. One of its recent display advertisements reproduced a "help wanted" advertisement from a German newspaper in which the householder, desiring a girl-of-all-work for his family of seven, called attention to the value of his electric washing and vacuum-cleaning machines for making the household work "light and pleasant." In its own advertisement the central-station company confirmed the arguments of the householder, making a plea that doubtless has considerable weight with housewives who are "up against" the servant problem.

## Paducah (Ky.) Business Men Maintain Ornamental Lighting System

The ornamental street-lighting system at Paducah, Ky., which has been under construction for some weeks, is now in operation and the citizens appear well pleased with it. The section covered extends from First to Eleventh Street on Broadway, the city's principal business thoroughfare. More than 1000 incandescent lamps have been used, making the street "as bright as day." Strings of 25-watt tungsten lamps are festooned between posts, instead of the use of globes on ornamental iron standards, the expense of which was deemed objectionable. Paducah's "great white way," as the citizens proudly call it, is to be maintained by ninety-seven local business men who have interested themselves and will assume all expenses of operation.

## Wiring Dwellings on a Rental Basis

To extend its service into rented dwellings the Union Light & Power Company, of Franklin, Mass., has had considerable success with a plan of installing and renting wiring installations to customers. If the landlord or tenant will sign a lease, the company offers to have installed electric wiring and fixtures to the amount of say $35, collecting from the lessee 21 cents monthly for the use of the installation. In case only $25 outlay is required for the wiring equipment, the rent charged is but 15 cents per month. Mr. W. K. Bradbury, contract agent for the company, reports that this plan has been the means of adding numerous tenants to the Union company's lines.

The rental charge of 15 cents or 21 cents per month is based on a return of 7 per cent on the company's investment of $25 or $35 respectively in the wiring job. Obviously the company's funds would be doing well wherever they can earn 7 per cent, so it was felt that if money were invested in wiring installations it would not only return good interest but also make possible new customers to use the company's service. At the local rate for energy, 15 cents per kw-hr., the average customer's business amounts to $16 to $18 per year so that the mere interest received is only one of the desirable returns enjoyed by the company. In addition this liberal policy also creates a good feeling in the community, which has not been slow to appreciate the easy means thus put at the disposal of householders to enjoy the benefits of electricity.

Of course, it is preferable that the landlord sign the lease for the wiring in order that the 7 per cent return may be assured to be continuous, but if the landlord will not sign, the company willingly accepts the present tenant's signature. When this tenant vacates the premises his own obligation ceases, but on the arrival of a new tenant the latter's business is solicited, and if he accepts service he is required to sign a new lease, unless the company has been able to induce the landlord to accept the lease himself or to buy the installation outright at its original cost less 10 per cent for cash. The proposition in itself is purely and simply one of rental, and the amounts paid in do not accumulate to pay off the original investment.

Another proposition intended to secure desirable residence customers has been the plan of allowing citizens in good standing credit to the extent of $50 for having their houses wired, provided this amount is returned to the company in twelve monthly instalments without interest.

## A Central-Station Real-Estate Inquiry Office

Several months ago the Baltimore Gas & Electric Company announced that its electric office would answer real-estate inquiries and refer applicants to vacant property lying ready for occupancy and equipped with electric light and gas. As this service has become more generally known the volume of work handled by the counter-salesman who has the real-estate department in charge has been increasing rapidly, despite the close of the usual renting season.

During a recent summer month thirty-eight inquiries were received, the highest number on any day having been five. To these five persons the office referred 102 pieces of property. During the entire month 740 pieces of real estate were referred to applicants. In all, since the bureau has been in operation, 176 inquiriers have been informed of 2770 instances where desirable property was lying vacant, and at the end of this same period the company had listed 1286 properties for which tenants or purchasers were desired.

## Illuminated Bulletins in Kansas City, Mo.

The Kansas City (Mo.) Electric Light Company is original in its method of securing additional sign-lighting load. Scattered about the city were about 300 old billboards averaging about 30 ft. in length. By an agreement on the part of the electric company to advertise on the boards and show the advantages of electrically illuminated bulletins to prospective advertisers, the Thomas Cusack Company was induced to remodel the boards and install electric lamps for illumination. The Cusack company, appreciating the possibility of securing additional advertising facilities, made the boards attractive by painting them white with the advertising in black. Sixty-watt lamps were placed about 25 ft. apart so as to illuminate the bulletin. In the contract the electric-service company agrees to vacate the board as soon as any advertiser desires space. Black and white has proved very satisfactory on account of its legibility. This method of advertising electric-sign service has increased the central-station company's load about 216 kw.

## Analysis of Kilowatt-Hour Costs of Combination System

The accompanying [illegible] on the generating system and energy costs of the Pacific Gas & Electric Company, San Francisco, Cal., were brought out during a recent rate investigation by the San Francisco Board of Supervisors' committee on lighting and rates.

[illegible] PACIFIC GAS & ELECTRIC COMPANY

| | | Per kw-hr. |
|---|---|---|
| [illegible] | $48,815.87 | $0.0006449 |
| [illegible] | 560,170.98 | .0073554 |
| [illegible] | 110,241.48 | .0015278 |
| [illegible] | 62,018.16 | .0008594 |
| [illegible] | 13,114.67 | .0006058 |
| [illegible] | 2,480.75 | .0000344 |
| [illegible] | 91,811.10 | .0013153 |
| | $889,956.71 | $0.012 [illegible] |
| [illegible] | | |
| [illegible] | $125,296.29 | $0.0018411 |
| [illegible] | 186,669.26 | .0027,876 |
| [illegible] | 94,503.94 | .0006,846 |
| Office | 106,976.93 | .0015977 |
| New business | 67,706.94 | .0010112 |
| Sundry expenses | 31,867.07 | .0004759 |
| Uncollectible accounts | 17,601.07 | .0002631 |
| | $568,669.50 | $0.0084932 |
| Interest | | |
| Joint capital, $3,539,903.91 at 7 per cent. | $247,793.27 | $0.0034389 |
| S. F. capital $6,872,[illegible] at 7 per cent | 479,771.08 | .0071,653 |
| | | $0.0105992 |
| Depreciation, 25-year annuity, at 7 per cent: | | |
| Joint capital, $2,523,459.52 | $39,897.16 | $0.0005959 |
| S. F. capital, $4,868,808.43 | 76,978.80 | .0011496 |
| | | $0.0017455 |

SUMMARY OF COST OF ELECTRICITY

| | |
|---|---|
| Maintenance of capital | $0.0024763 |
| Generation | .0073554 |
| Distribution | .0066518 |
| Overhead expense | .0043426 |
| Interest | .0105992 |
| Depreciation | .0017455 |
| Total | $0.0331708 |
| Deduct revenue from minimum charge, $11,972.63 | .0001788 |
| Net cost per kw-hr | $0.0329920 |

AVERAGE RECEIPTS UNDER VARIOUS SCHEDULES

| Schedule | No. of Meters | Per Cent | Kw-hr. | Per Cent | Amount | Average Price |
|---|---|---|---|---|---|---|
| "1912" | [illegible] | [illegible] | 1,079,661 | 16.9 | $76,066.59 | $0.070454 |
| "E" | 280 | 0.6 | 282,114 | 4.8 | 9,911.95 | .03513 |
| "F" | 14 | 0.0 | 1,178 | 1 | 248.30 | .0554 |
| "L" | 2,849 | [illegible] | 189,265 | 2.9 | 10,748.46 | .05679 |
| "A" | 509 | 1 | 105,466 | 1.7 | 5,254.65 | .04982 |
| "P" | [illegible] | 0.0 | 1,090 | 1 | 60.00 | .05504 |
| Metered: | | | | | | |
| Flat rates | 1,425 | [illegible] | 4,128,469 | 64.6 | 122,261.96 | .019614 |
| Area: | | | | | | |
| Flat rates | [illegible] | | 583,010 | 9.2 | 21,510.05 | .03689 |
| Locked meters | [illegible] | 2.9 | [illegible] | | [illegible] | |
| | 48,704 | 100.0 | 16,373,553 | 100.0 | $246,061.96 | $0.038606 |

| Rate per kw-hr. Cents | No. Meters | Percentage | Kw-hr. | Amount |
|---|---|---|---|---|
| 08 | [illegible] | 74.00 | 523,103 | $44,253.45 |
| 07 | [illegible] | 13.80 | 176,810 | 12,399.76 |
| 06½ | [illegible] | [illegible] | [illegible] | 24.30 |
| 06 | 2,681 | 7.15 | 132,592 | 8,380.52 |
| 05½ | [illegible] | [illegible] | 285 | 15.40 |
| 05¼ | [illegible] | [illegible] | 2,741 | 162.40 |
| 05 | [illegible] | 3.25 | 104,053 | 5,254.51 |
| 04½ | 4 | [illegible] | 3,702 | 166.60 |
| 04¼ | [illegible] | [illegible] | 1,488 | 63.25 |
| 04 | [illegible] | [illegible] | 134,528 | 5,346.40 |
| | 36,728 | [illegible] | 1,079,661 | [illegible] |

The steam plants of the Pacific Gas & Electric Company produce about 78,000,000 kw-hr., in addition to which 10,000,000 kw-hr. is received from the hydroelectric station of [illegible] Of the [illegible],000 kw-hr. thus available at the switchboard it is estimated that 31 per cent, or 30,000,000 kw-hr., is lost in distribution, in addition to 150,000 kw-hr. consumed by the company itself, leaving 66,957,215 kw-hr. as the basis for figuring cost of distribution. To nearby hydroelectric lines the company sells, however, about 5,200,000 kw-hr., making a total generation of 72,160,908 kw-hr. (to be exact), which is taken as the basis for calculating unit generating cost.

The tables herewith present details of the cost apportionment under the various headings, and also show the division of income under the several schedules of customers' charges in use.

## One Operator's Rise to Independence

Three years ago the company operating a gas-engine-driven lighting plant in an Indiana town of 700 failed, and the plant was put up at receiver's sale. A bookkeeper earning a fair salary with a nearby traction company recognized in the unsuccessful lighting situation an opportunity to make some money if properly managed. Borrowing the amount, he bought in the equipment for $3,000 and started its operation. In the next two years he added $5,000 to his original investment, devoting this outlay to various plant improvements.

About a year ago the local strawboard works offered to sell him energy at 3 cents per kw-hr. with a reduced rate of 2.5 cents for all used above 10,000 kw-hr. per month. Accordingly the former gasoline plant was abandoned, the electrical equipment being moved to the company's factory. The strawboard company also installed second-hand duplicate equipment, running one generator off its line shaft while the other was connected to a small high-speed engine. The strawboard mill runs night and day so that service is available at all hours, but in order to save loss on his lines, the distributer furnishes day current for electric irons only on Tuesdays and Thursdays, except in cases of storms and dark days.

A five-year contract covers the present sales arrangement, at the end of which time the former bookkeeper-manager has an option for extending the service five years more. The mill furnishes all repairs to its generating equipment, but the operator donates his services in case of breakdown. This arrangement of purchased energy is found much superior to the former plan of separate generation, since energy is now never shut off except in the case of broken or fallen wires. The manager is also saved the worry and annoyance of operating a plant with a gas engine which, as he expresses it, "would rather rest than run."

The local central-station service now returns a gross income of about $5,000 a year from a town which the last census credited with 863 population. The street-lighting contract alone brings in $2,050 per year, part of the installation being arc lamps and the rest 100-watt tungsten units. The citizens of the town pride themselves on having one of the best-lighted communities in the State.

As already noted, some $8,000 has been invested in the local lighting service by the present owner, and now after three years' operation he is altogether out of debt. The plant is paying him 10 per cent interest on $20,000, besides a fair salary. As only about one-third of his time is, however, given to the electric-lighting service, he now plans to take on some occupation or business in addition to the cares of management.

Such an electric-lighting plant in a town even as small as this can be made to pay, declares this former bookkeeper in looking back over things accomplished since he resigned his job, but he insists that the business must be owned by one person and this individual be ready to devote to it some hard work, "with hands as well as with brains."

## Alternating-Current Drive of a Newspaper Plant

By A. B. Spaulding

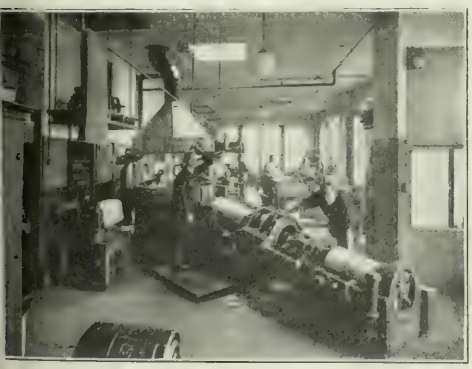
In the past considerable business has been lost to central ations supplying only alternating-current service owing the fact that until about a year ago it was necessary at direct current be employed for the operation of news-



FIG. 1—LINOTYPE ROOM, INDIVIDUAL MOTOR DRIVE

aper presses on account of the fine control required. The sult could, of course, be accomplished by the introduc- on of a motor-generator set, but such equipment would use complications and operate at low efficiency a great art of the time.

One of the first applications of alternating-current press ive was made about a year ago at the new plant of the *ersey Journal*, Jersey City, N. J. The building is new d modern in every respect. In the linotype and stereo- pe rooms individual motors are applied to all machines. Of particular interest is the press room, in which are stalled two sextuple Hoe presses, each with a capacity 48,000 twelve-page or 36,000 sixteen-page papers per our. These presses are each operated by two motors, one



ig. 2—STEREOTYPING DEPARTMENT, JERSEY JOURNAL PLANT

p unit for starting and one 50-hp motor for running. ese motors are standard General Electric 220-volt, 60- le, two-phase machines with wound rotors, and for con- nience are installed in pits beneath the floor. Liability shut-down through motor trouble is eliminated by a ounter-shaft, which by a few minutes' work allows either s of motors to operate either press.

Paper is brought to the presses by monorail cranes of the Sprague type, of which there are two, one for each press. As the rails extend over the presses, the cranes were used for the first assembly of the machines and are now available for the removal of heavy plate parts when changes or repairs are necessary.

The Cutler-Hammer Kohler control panel for the presses



FIG. 3—PERFECTING PRESS DRIVEN BY ELECTRIC MOTOR

is installed on a solid cement shelf in one corner of the press room, and while easily accessible does not take up floor space.

Direct current for the operation of the control panels is furnished by a small motor-generator set, shown to the left in the photograph, and the control is quite as fine and reliable as with direct-current motors.

Two-phase, sixty-cycle, 220-volt alternating-current service is furnished by the Public Service Electric Company, primary energy at 2300 volts being brought into a transformer vault in the basement, where it is stepped down to the local pressure. The primary wires are brought from an overhead distributing system through lead cables, which are installed in duplicate, as are also the transformers,

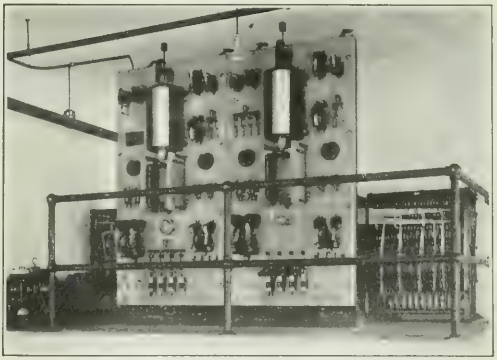


FIG. 4—AUTOMATIC CONTROL FOR PRESS MOTORS

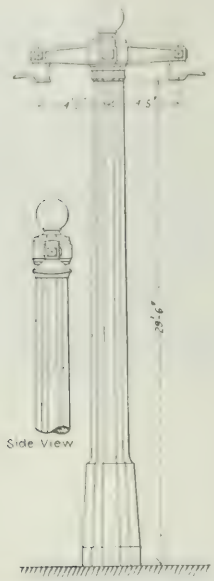
thus relieving the customer of the worry about breakdown from these sources.

This *Jersey Journal* installation has been in operation for about one year and has given no trouble in any way. The owners are enthusiastic over the equipment and declare they would never return to the operation of a private plant with its added expense and annoyance.

# Illumination and Wiring

## Concrete Brackets for Panama Lock Lighting

The accompanying sketch shows the revised design for the concrete lamp brackets to be used in illuminating the canal locks at Panama. Mr. M. J. Schiavoni, assistant




CONCRETE LIGHTING BRACKET

architect of the Canal Commission, prepared the approved design.

The entire bracket, reflectors and ball finial will be of reinforced concrete cast in iron forms manufactured at Gorgona shops, from drawings furnished by the Lighthouse Subdivision. The latter will also fabricate the concrete brackets, 511 in number, consisting of 302 single-arm and 307 double-arm brackets. Each concrete double-arm bracket, with reflectors, will weigh approximately 1610 lb. The solid-ball finial, weighing 730 lb., will be employed to counterbalance the weight of the single-arm brackets on the middle locks. The standards measure 29 ft. 6 in. to the cap supporting the cross-arms. The horizontal distance between lamps is 8 ft. 10 in.

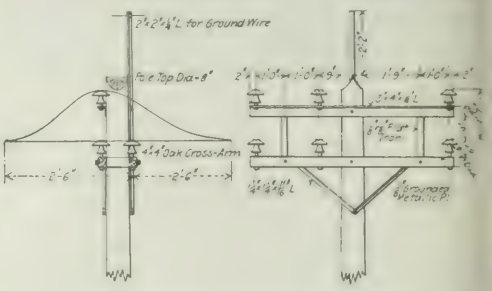
## High-Tension Crossing Construction with Protective Loop

In the accompanying sketch is shown the 6600-volt overhead crossing construction adopted by the Dayton Power & Light Company, of Dayton, Ohio. This design adheres generally to standard specifications but has the added safeguard of an extra loop passing over a pin-type insulator on the upper cross-arm. As initially constructed this loop is free of all other tension than that imposed by its own weight, but if an insulator of the crossing span breaks the upper insulator at once comes into play to support the line both mechanically and electrically. This eliminates possibility of the power line falling and endangering lives.

For railroad crossings this extra-loop construction is employed on the poles at each end of the 90-ft. crossing span. A minimum height of 30 ft. is imposed from track rails to the lowest wire. The adjacent 135-ft. spans are also double-guyed with 5/16-in. stranded-steel cable, each pole top being tied to the adjoining pole butt. For a single-circuit, three-phase line, as shown, all conductors are mounted in the same horizontal plane on four-pin arms. The lower arm is of 4-in. by 4-in. oak, capped with a ⅛-in. metallic ground plate, while the upper arm, on which the emergency loop insulators are mounted, is of 3-in. by 4-in. by 0.25-in. angle section. Anchoring the upper arm rigidly to the lower is a pair of vertical, flat 1.125-in. by 0.25-in. braces, which also serve as ground connections.

Another form of crossing construction reported from Ohio by the electrical transmission committee of the Ohio Electric Light Association involves a reversed catenary arrangement. The regular catenary construction—that is, a suspension cable with loops down to support the feed wire—was considered objectionable, because some difference of potential through leaks might set up rapid depreciation.

The plan adopted was the extension of the main feeder straight through over the crossings the same as in the other part of the line (except for the addition of the double arming on either side of the crossing) and on this main feeder over the space to be protected loops were connected perma-




HIGH-TENSION CROSSING CONSTRUCTION

nently to the main line every 5 ft. The loop wire was of the same size copper as the feeder. The loops were allowed to extend down about 4 in. below the feeder, then through these loops another copper wire of the same size and capacity as the feeder was run. This wire was allowed to hang free in the loops, and extended to and beyond the insulator supporting the feeder on either side of the space to be protected, where the free wire is connected to the feeder with a good soldered joint. Should the feeder break from any cause the free wire will then support the feeder and prevent it from coming down or doing any damage to the crossing, while at the same time continuity of service will be unimpaired.

## Rectifier-Tube Operating Records at Detroit

High average and individual life records in the operation of rectifier tubes have been attained by the public lighting plant at Detroit, Mich., where advantage is taken of the low-temperature cooling water flowing through the Detroit River from Lake Huron. One 4-amp seventy-five-lamp tube has, for example, been in continuous service 11,629 hours. Another tube, started Aug. 15, 1910, ran until May 6, when it was removed after 10,562 hours' use.

For the ninety-seven tubes now in use a total of 324,41[illegible] tube-hours has been recorded, an average of 3344 hours per tube. Forty-five tubes now resting showed an average life of 2692 hours, while 101 which have been discarded ran 2696 hours each. These 243 tubes have altogether, therefore, run 712,831 hours, or an average of 2933 hours per tube.

A mean operating temperature of 80 deg. Fahr. is main

tained at the tubes, the cooling water taken from the Detroit River in front of the station ranging from 33 deg. in winter to 70 deg. in summer. Nearly 3400 General Electric 4-amp magnetite lamps are now in service for lighting Detroit's streets.

## Side-Bracket 44,000-Volt Transmission-Line Construction at Panama

The permanent 44,000-volt transmission line across the Isthmus of Panama is now under construction. This line, as already mentioned in our columns, will transmit hydro-electric energy from the water-power plant at the Gatun spillway to load centers at Miraflores, Balboa and Cristobal, supplying power to operate the locks and lock lighting, bascule bridges, wireless-telegraph stations, etc. At Miraflores the present steam-turbine plant will be tied into the system as a relay station to insure continuity of service.

The unusual bracket form of construction for supporting these 44,000-volt conductors on suspension insulators is shown in the accompanying sketch. The track-span bridge supports one of the duplicate three-phase lines on each side of the railroad tracks. The conductors are No. 00 and are 5 ft. apart and 5 ft. from the frame. The insulators are of vitreous porcelain, in three units. The insulator fittings are made entirely of monel metal to resist climatic corrosion. A ground wire for protection against lightning is carried at the top of each side frame. The ground wire is 5/16-in. copper-clad solid wire. The copper sheath, of nearly one-half the area of the wire, surrounds an amalgamated, carefully selected steel core.

The bridges are spaced on 300-ft. centers, a total of 917 being required to cross the Isthmus. The span between side frames is 36 ft. The track-span bridge, in addition to supporting the duplicate transmission lines, admits of the suspension of a catenary trolley construction, should it prove desirable in the future to electrify the Panama railroad. It also has several advantages for transmission purposes. By paralleling the Panama railroad, material can be brought to within a few feet of the point of actual erection. The side-bracket suspension of the conductors separates the duplicate lines so that a burn-out in one will in no manner affect the other. The conductors are outside the track and will be comparatively free from deterioration caused by smoke from the locomotives. The structure itself is fundamentally strong and is capable of easily resisting all strains introduced by breaks in the wires.

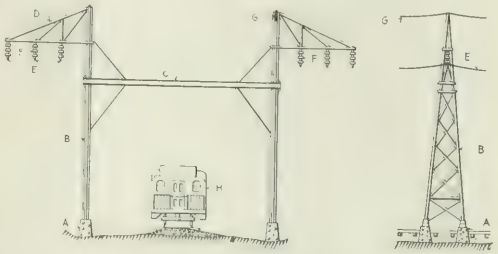
The No. 00 copper conductors are seven-stranded pure copper cables, totaling 1,500,000 ft. in length. The individual strands are manufactured without either a soldered or a welded joint. Splices in the cable will be made with soft-copper sleeves. The conductors are suspended at the insulators from monel-metal fittings bushed with copper sleeves. Thus, in the entire line there will be no point where the copper strands are in contact with a second metal.

At each bridge, the ground wire will be clamped to the tower, and a positive T-connection through a copper wire will be made to ground plates buried in the earth. These ground plates are being manufactured from old scrap copper and cable which have accumulated at the Empire storehouse. By frequently earthing these ground wires, it is expected that line trouble and substation burn-outs caused by lightning will be reduced to a minimum. About 500,000 ft. of copper-clad wire is required for the two ground conductors.

The insulators which will support the conductors are of two types, suspension and strain, each assembled of three porcelain disks, 10 in. in diameter, joined by monel-metal fittings. This metal is used on account of its unusual strength and its ability to resist corrosion. Galvanized fittings, customarily used in the United States and abroad, are practically worthless in the Isthmian humidity. The strain insulator is to be used on sharp curves and for anchoring at intervals. The suspension insulators will be used on tangents and light curves. In all, 4000 suspension insulators and 2500 strain insulators have been ordered for the entire line.

In the design of the bridge the steel is so distributed as most efficiently to resist the maximum stresses incurred. The side frames are A-frames, to resist uprooting of the bridge in case all wires are down in one span. The crosspiece is made of two channels, which are cross-braced to carry the longitudinal pull of the catenary construction which may be attached if the railroad is later electrified. The side brackets for supporting the conductors are three-legged, being designed to resist both gravitational and torsional forces. Brackets and crosspiece are braced to the side frames so that the entire bridge acts as a unit to resist side pull on sharp curves.

Considerable study has been given to the concrete foundations for the track-span bridges. There will be two pedestals under the two legs of each side frame, the pedestals resting upon a spread slab reinforced by scrap-steel rails. Each leg will be fixed to the pedestal by a pair of 15-in. anchor bolts, clamped at the lower end to the steel rails in




SIDE-BRACKET CONSTRUCTION

the spread slab. To anchor the pedestal foundation holes will be drilled and sprung at the bottom with light charges of dynamite. These holes will then be filled with concrete, reinforced with long bars, to which the pedestals will be fixed, making a construction of great strength against both horizontal and vertical forces.

## Recent Telephone Patents

Under some circumstances, especially where the message rate system of charging is in vogue, it is desirable to lock a telephone instrument against use. A lock for this purpose is the subject of a patent granted to Mr. A. Fornander, of New York City. The lock is for desk-stand sets. The lock proper is mounted upon a sheet-metal clamp which is in two parts hinged together to clamp the upright of the desk stand. The arm supporting the lock extends from one of the half cylinders, terminating in a hook which engages the eye of the switch lever to retain it in the depressed position. An arm extending from the edge of the second half cylinder is bent to form a box which will register with and completely cover the lock, the strike for the lock being inclosed within this box. When the clamp is placed in position and the box forced home over the lock, the latch engages and holds the clamp in position. The hook switch lever is accordingly held in the depressed position.

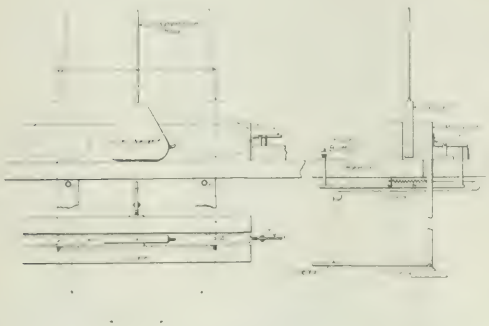
Mr. J. McCausland, of Providence, R. I., is the inventor of a sanitary mouthpiece. This is a removable arrangement of paper or other destructible material which is designed to rest in a clamp secured to the transmitter. Each user can destroy his own mouthpiece and the next user inserts a new one in the clamp.

# Field of the Operating Engineer

**A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers**

## A Milli-Hour Stop-Pendulum

A useful decimal method of testing watt-hour meters which avoids the usual calculations is that due to Mr. O. A. Knopp, of the Pacific Gas & Electric Company, San Francisco, Cal. By this method the time of the meter to complete one, two or three revolutions is taken with an applied load in watts equaling 100, 200 or 300 times the disk



SKETCHES SHOWING ESSENTIALS OF A MILLI-HOUR STOP-PENDULUM

constant. This time interval for a correct meter is supposed to be 0.01 hour. Heretofore these disk time measurements have been made with a special stop-watch whose large hand makes one revolution in 0.01 hour. The dial itself is in turn divided into tenths and hundredths. For laboratory and standardization work, however, this stop-watch was found to introduce slight inaccuracies on starting, so Mr. Knopp recently developed his milli-hour stop-pendulum having a period of 0.001 hour and eliminating starting errors.

In this device the flat triangular bob, weighing 8 lb. or 9 lb., hangs on a 0.125-in. steel rod about 10 ft. long with double-diamond jewel suspension. The bob of the pendulum thus formed swings between two parallel oak jaws, one stationary and the other movable. By means of a foot-lever the jaws can be opened, allowing the bob to swing freely, but a light pressure on the push-button releases the movable jaw, causing it to be closed with force against the bob by two strong springs, and thus clamping the pendulum instantaneously in its momentary position. A scale the length of the pendulum's path is divided into five equal time intervals, each representing 0.01 milli-hour or 0.00001 hour.

When testing the meter, the time of measurement taken is 0.01 hour; hence the pendulum should complete just ten double swings or cycles, returning to the end of its path at the same instant that the meter has made the allotted number of revolutions. If the weight stops at one of the one-fifth interval divisions ahead of the end position, the correction factor would be 0.99. If it stops one-fifth behind, the correction factor is 1.01.

A simple graphical method suffices for the harmonic division of the scale. It is only necessary to erect a semi-circle on the path-length as shown, and to divide this circumference into the desired spaces, projecting the divisions onto the straight path. The pendulum should have a theoretical length of 323 cm, or 10.6 ft., measured to the center of gravity of the bob. The invention described is protected by United States patent issued to Mr. Knopp and assigned to the Pacific Gas & Electric Company.

## Improving a High-Speed Engine

By W. H. Wakeman

The valve gear on a high-speed directly connected engine, which runs at 274 r.p.m., being noisy on account of lost motion internally, repairs were made at the first opportunity. The piston valve of the engine, which admits steam to the cylinder by the middle and exhausts it past each end, is illustrated in Fig. 1. A hole cored through the center of this valve was left as it came from the foundry. Two nuts were locked on the threaded valve stem, as shown at the right hand; the stem was then inserted in the valve, and two more were locked at the other end. No device was provided for holding these nuts in place.

It was a difficult matter so to adjust the nuts that they would not bind on the valve (as the stem must be free to move enough to compensate for error in alignment) and still prevent lost motion endwise. A special wrench, necessary for this job owing to the shape of the valve, was not supplied by the builders.

To overcome these objections the two outer nuts were removed, and the stem drawn out of the valve. One of the inner nuts was securely pinned to the stem as shown at 2; it will never be necessary to turn this nut, as the length of the stem can be adjusted by the threads shown at the right-hand end. This stem, which is 1⅛ in. in diameter, was inserted in the valve, and the exact length marked on it at 3. It was again withdrawn, put in a lathe and the end turned down to ¾ in., leaving a square shoulder at 3. A thread was cut to fit nuts of standard size, and a hole was bored for the cotter pin shown.

The stem was inserted in the valve again, a washer ⅛ in. thick was put against the shoulder, 3, the two nuts were arranged as shown, and a cotter pin was employed to prevent them from coming off in case they should become loosened. The stem can now be moved sidewise but there is no lost motion endwise and the operation is entirely satisfactory. Later, when the parts in contact become worn enough to require adjustment, the stem will be put in a lathe and a light cut made on the shoulder, 3, thus taking

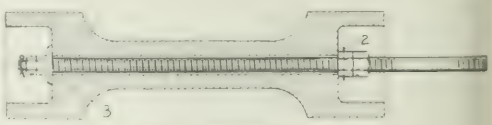



FIG. 1—REPAIRS TO VALVE

out the lost motion; this change will not be required for a long time as the parts wear slowly.

In order to be able to view the piston valve in motion and set it while the flywheel was turned by hand, the steam chest cover was removed. Fig. 2 shows three openings provided solely for observation purpose, steam not being allowed to pass through them under normal conditions

he admission valve is visible through 2 and the exhaust rough 3 and 4. When the steam-chest cover was first acked holes were cut in the packing corresponding to the penings shown, although no holes were necessary. This rrangement left a comparatively narrow strip of packing etween the wide and narrow openings, and a piece of this rip was missing as shown at 5, and there was a free

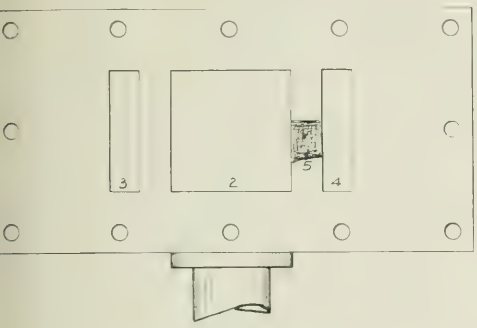



FIG. 2—DEFECTIVE PACKING

assage for steam to blow from the live-steam opening, 2, irectly into the exhaust opening, 4, and thence into the exaust pipe.

After carefully removing all of the old packing, use was nade of a piece large enough to cover the entire surface. The only holes cut in it were round ones for the studs. After covering the outer surface with graphite it was put n place and the cast-iron cover was replaced.

This engine is fitted with a cast-iron baffle plate as illustrated in Fig. 3. It is located between the piston-rod stuffing box and the cross-head to prevent water that comes ut around the rod when the packing is getting old from nixing with oil on the upper and lower guides. The shallow stuffing box illustrated at 2 allowed a small quantity f water to pass. On the inward stroke the packing in the tuffing box wiped water off from the rod, and allowed it to rickle down the face of the baffle plate and mingle with oil

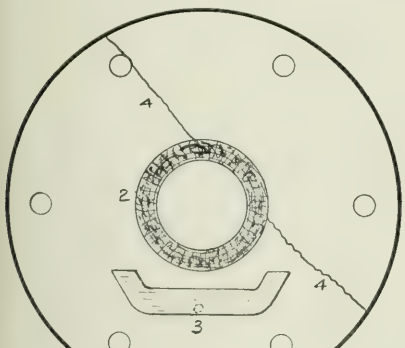



FIG. 3—REPAIRS TO BAFFLE PLATE

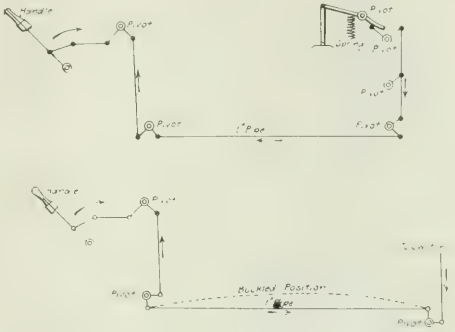
n a small reservoir below the lower guide. In order to vercome the above-mentioned objection a copper trough vas soldered to the plate as shown at 3. A hole was drilled hrough the plate, and a brass tube was inserted on the opposite side to deliver the water where it will do no harm.

After the six cap screws which hold this baffle plate in lace were removed, leaving the plate loose on the piston rod, the flywheel was turned on another account. Just before the inside center was passed, the cross-head caught and broke the baffle plate as indicated by the line 4, 4. The piston rod was unscrewed from the cross-head, the plate was removed and a ring of wrought iron was put on it while hot. As the ring cooled, the broken parts were drawn together perfectly, the plate being thereby made nearly as good as when new at very small expense.

## Switch Pull-Rods in Tension, Not Compression

The oil switches in a certain substation had given trouble ever since the time of their erection. They were operated by long rod-and-lever connections as shown in the accompanying sketch, and the switches controlled a 25,000-volt three-phase line. The difficulty seemed to be that the operators continually broke down the castings of the mechanism, effecting automatic release from the handle. Complaint was made, too, that the switches were hard to open and close.

After investigation it was found that the levers and pull-




FIGS. 1 AND 2—CORRECT AND INCORRECT ARRANGEMENT OF SWITCH PULL-RODS

rods had been wrongly connected, the arrangement being such as shown in Fig. 2, which placed the long 1-in. pipe in compression when the switches were being closed. This caused that part to sag, jamming and blocking the mechanism. The rods were then overhauled and converted to the arrangement shown in Fig. 1, a spring being added, thus putting the parts in tension during operation. Since this change was made the switches have worked easily and without further trouble.

## Meters on Open-Delta-Connected Circuits

Will you kindly state what method can be used for metering the energy consumed by a single-phase motor operating upon one phase of a three-phase system, and what is the usual method of measuring energy supplied from the secondaries of two open-delta-connected transformers?

M. B. H.

The load taken by a single-phase motor can be registered on a single-phase meter without any regard whatever to the number of phases of the supply system. The energy delivered from the secondaries of two open-delta-connected transformers in a three-phase system can be properly recorded on two meters having their series coils connected in two of the wires and each voltage coil connected between the corresponding lead and the third lead of the system. This is the usual method of measuring energy in a three-phase system by means of two meters. This arrangement of meters measures the energy correctly under every conceivable condition of balance or unbalance, high or low power-factor, lagging or leading current.

# Letter to the Editors

## Copper-Clad Steel Suit

*To the Editors of the Electrical World:*

Sir:—In the issue of the *Electrical World* of July 12, 1913, on page 68, is an article entitled "Decree in Copper-Clad Steel Infringement Case," which contains some serious misstatements of fact. The statement is made in the first paragraph of the article referred to that "the chief contention in the infrigement case arose over the question whether the product sold by the Standard company was one in which the copper covering was actually welded to the steel core or base, for if such a weld existed, it was argued that the Colonial copper-clad product clearly infringed the Monnot patent, No. 893,932, granted July 21, 1908, for improvements in copper-clad iron and steel and owned by complainants." Other statements in the article are to the effect that because of testimony showing the Standard company's product to lack a welding of the components the bill was dismissed.

The natural inference from this statement is that the Standard company's product, by reason of some lack or failure, is inferior to the Duplex company's product. Now, instead of such a state of affairs existing, the proofs in the case show that the Standard company's product is actually superior to the Duplex company's product, and especially in respect to the intimacy of the union of components. This being so, it must be plain that such statements as are contained in the article referred to are not only misleading, but are such as to work injury to the Standard company.

The facts being as stated, two questions remained which were important in the case; one was whether the Standard company infringed the Monnot patent, and the other was whether the Monnot patent was a valid patent. The Standard company is manufacturing under Griffith patent No. 580,344, granted in 1897, eleven years before the Monnot patent in suit was granted, and the mere statement of this fact will afford some indication of the weakness of the claim that the defendant manufacturing under the Griffith patent was infringing the Monnot patent, Griffith's junior by eleven years.

The question of weld entered into the controversy, but the question was not whether the Standard company's product revealed a weld, but whether it revealed a weld *within the meaning of the Monnot patent in suit.*

The manufacturing operation upon which the Monnot patent is predicated is an operation which involves a bringing together of molten copper and solid steel and a consequent intermingling or alloying of copper and steel at the surface of contact. The Standard company's operation involves the bringing together of solid bodies of copper and steel, the surfaces having been properly cleaned and prepared, and then the uniting of them by heating and pressure, but at no time in the Standard company's operation is either component melted. The result of the Monnot operation is in the Monnot patent *called* a weld, but manifestly it is not a weld, it is an alloy union. The union which the Standard company produces by heating and pressure is, on the other hand, a true weld. The question of infringement turned on whether the Standard company's union was a weld *within the meaning of the Monnot patent*, and upon that question there could be no uncertainty.

It is said in the article complained of that it was the *defendant's* expert who testified that the Colonial company's operations could not produce a true weld. This is not the case; the defendant's expert testified that in following the Colonial's operations a union was produced which was a weld, but was not the sort of a union which in the Monnot patent is called a weld.

It was the *complainant's* expert (and not the defendant's, as the article says) who testified that the Colonial company's operation could not produce a weld, and when that testimony was given the witness was giving the word "weld" the meaning with which it is used in the Monnot patent in suit.

Thus it will be seen that the essential question in the case was not whether or not a weld existed, but whether or not the defendant was producing what the patent in suit described, and this was proved not to be the case.

As was said above, another serious question in the case was whether the Monnot patent was a valid patent; and manifestly when the complainant came into court with a motion to dismiss the bill, it was ready to forego any chance of success and to pay the costs of both parties to the suit rather than to run the risk of a decision which should declare its patent to be invalid.

So far as the legal matters are concerned, the conclusion of this case is a victory for the defendant, and so far as practical matters are concerned, the testimony in the case is that as between the products of the two companies, the union of the components is in the Standard company's product more secure than in the Duplex company's product.

P. H. W. Smith,
*Vice-president Standard Underground Cable Company.*
*Pittsburgh, Pa.*

[The printed records in the case are very voluminous, there being 412 pages for the complainant and 1452 pages for the defendant. The article referred to was merely an outline of the prominent features of the official record, being confined largely to the decree of the court and the affidavit of the treasurer of the complainant company in accordance with which the decree was rendered. In view of the additional facts now brought forward it seems well to restate the decree of the court, as follows:

"Complainant having admitted that defendant's product referred to in the proofs herein does not infringe the Monnot patent in suit, No. 893,932, it is ordered, adjudged and decreed that the bill of complaint herein, in so far as it is based on alleged infringement of said patent, be, and the same hereby is, dismissed on the ground that defendant has not infringed said patent, and so dismissed with costs to be taxed."

Patent No. 580,344, issued to Mr. William Griffith on April 6, 1897, contained one claim, as follows:

"The herein-described process of uniting or welding plates of metal of different kinds, which consists in cleasing one of the plates from scale, oxide or other impurities, then coating or covering one or more faces of this plate with a metal or an alloy thereof having a lower fusing point, then applying to this coated surface a plate of metal or an alloy of the same character as the coating, but free from any coating, then applying heat to the two plates, and finally uniting by pressure, substantially as described."

Patent No. 893,932, issued to Mr. John F. Monnot on July 21, 1908, contained the following two claims:

"1. As a new article of manufacture, a ferrous base having a welded-on, continuous, poreless, dense coating of copper united therto by a union resisting temperature changes, cutting tools and mechanical stresses, said coating having the properties of metal set from a liquid state.

"2. As a new article of manufacture, an extended metal article comprising a ferrous metal base and a continuous, poreless, dense coating of copper weld-united thereto by a union resisting temperature changes, cutting tools and mechanical stresses, said ferrous base and copper coating having been extended together."

In the article appeared the statement that the "expert for the defendant had testified that the process of manufacturing copper-covered steel wire * * * could not produce a true weld." The expert was Prof. Albert Sauveur of Harvard University, who was called as a witness for the complainant, but testified as stated in the course of his examination by the defendant's counsel.—Eds.]

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*Brush-Contact Resistance.*—ALFRED HAY, M. H. BRATT AND J. M. PARISH.—An illustrated account of experiments on brush-contact resistance, the main object of which was to ascertain how far the brush-contact drop is affected by the rotation of the commutator. In the method used care was taken to eliminate the effect of emf in the armature due to imperfect commutation. The conclusion is reached that the brush-contact loss when a machine is running is, for all practical purposes, identical with that which occurs in a stationary armature, so that the loss can be easily determined by measurement with the armature at rest. This result is in agreement with that of several other experimenters, but differs radically from the results of Gratzmuller.—London *Electrician*, July 4, 1913.

*Commutation Dynamos and Motors.*—A note on a recent British patent (14,236, 1912) of M. Déri. Sparkless commutation is obtained by arranging pairs of brushes so as to prevent the armature coils from being directly short-circuited. The brushes for each pair of poles are kept connected to an external circuit in which are produced alternating pressures of the frequency of commutation. To effect this an auxiliary machine having coils inserted between the two brushes of every pair, and acted on inductively by a field energized from the main circuit, may be used with or without condensers.—London *Elec. Eng'ing*, July 10, 1913.

### Lamps and Lighting

*German Illuminating Engineering Society.*—E. WARBURG AND LIEBENTHAL.—The official report of the first general meeting held in Leipzig, May 31, by the Deutsche Beleuchtungstechnische Gesellschaft. The president, E. Varburg, reported on the negotiations concerning the formation of an international illuminating engineering committee. Papers were presented by Brodhun on units of light, by Lummer on the evaporation temperature of carbon in the arc lamp, by Martens on the reduction of light intensity for photometric purposes, by Lummer on a new method of determining the true temperature of filaments in incandescent lamps, and by Monasch on the present inconveniences in the rating of automobile lamps. Abstracts of some of the papers will be presented elsewhere in the *Digest*.—*Jour. f. Gasbel. u. Wasservers*, July 12, 1913.

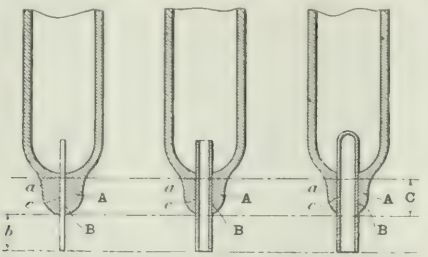
*Units of Light.*—BRODHUN.—An abstract of his paper read before the German Illuminating Engineering Society. There seem to be good prospects of using the thermodynamic black body for defining the rational unit of light. The author also discusses the attempts to arrive at an absolute method of photometry. The scheme is to investigate the distribution of energy in the spectrum of the source of light to be investigated, to determine the sensibility curve of the human eye for different wave-lengths and to calculate therefrom the distribution of light intensity in the spectrum, and to arrive finally at the total candle-power. Several difficulties must be overcome before this scheme can be realized. There must be an international agreement as to the sensibility curve of the average normal eye. Further, suitable apparatus must be devised and tested, and finally an international absolute unit of light must be agreed upon. This means many difficulties to be overcome. A simpler problem which is equally desirable is at present ments. There was an extended discussion of the possibilities of using the black body as the basis of a rational unit of light. The best ways of accomplishing this were discussed and it was emphasized that the black body should be used only in scientific laboratories, while for engineering purposes electric incandescent lamps will be used as heretofore as secondary standards.—*Jour. f. Gasbel. u. Wasservers*, July 12, 1913.

*Temperature of Filaments in Incandescent Lamps.*—LUMMER.—An abstract of a paper read before the German Illuminating Engineering Society on a new method of determining the true temperature of the filaments in incandescent lamps. If the law for the total radiation is known for a substance and the radiation constant is also known in absolute units, it is possible to determine from the Joulean heat the true temperature of a filament of given surface, if the total electrical energy supplied to the filament is changed into radiation. For the absolute black body and for bright platinum the radiation laws are exactly known. For other metals the theory of Aschkinass must be employed. The authors have made experiments with platinum filaments and discuss in this paper the various assumptions made in this method.—*Jour. f. Gasbel. u. Wasservers*, July 12, 1913.

*Reduction of Light for Photometric Purposes.*—MARTENS.—An abstract of a paper read before the German Illuminating Engineering Society. If the light used for illuminating the surface under test is reduced by screening off a certain portion of it by placing in the path of the light a non-transparent disk with an open sector the angle of which may be varied, the light will be reduced properly, but no uniform illumination of the surface is obtained if the disk is stationary. The author, therefore, lets the light passing through the sector in the disk pass into an Ulbricht sphere the white inner surface of which is uniformly illuminated by reflection as far as it is not illuminated directly by the incident light. To complete the arrangement so as to have a portable photometer for white light, a white ring surface is provided on the outside of the sphere with an opening through which the observer looks into the sphere. The observer looks at the white ring with the hole in it and changes the angle of the sector until to the eye the hole in the ring disappears. This gives a measurement of the light by which the white surface with the hole in it is illuminated.—*Jour. f. Gasbel. u. Wasservers*, July 12, 1913.

*Searchlight.*—GOERGES.—An illustrated abstract of a paper read before the Dresden Electrical Society. The author describes tests of a searchlamp with a mirror of 600 mm diameter and 260 mm focus, the arc lamp being operated normally at 80 amp and being provided with horizontal carbons. The searchlamp was tested in an inside room at 85 volts and 80 amp, 100 amp and 120 amp, with carbons of different manufacture and of different diameters. With highest concentration of the light the maximum illumination obtained was 850,000 lux. The author sees no reason why even searchlamps of largest size cannot be tested in inside rooms of sufficient dimensions. Tests of searchlamps in the free air over long distances will always yield uncertain results because the transparency of the air varies greatly.—*Elek. Zeit.*, July 3, 1913.

—Gerald B. Rees.—The method described depends for its success upon the cooling of the conductor and the surrounding glass in such a way that considerable local differences of temperature are avoided. Perfect seals may be effected between the more easily oxidizable metals, such as copper or iron, and glasses having comparatively low fusion points, such as German and lead glasses, and, further, between such metals as platinum and materials having higher fusion points, such as Jena glass and fused quartz. First, the electrical conductor is inserted through an aperture or passage in the glass. The glass around the conductor is then strongly heated by means of a blow-pipe flame until perfect cohesion has been attained between the glass and the conductor. The seal is at this point taken out of the flame, and when it reaches the temperature corresponding to a dull red heat the leading-in wire and the glass surrounding it are cooled by several immersions in a special bath. The bath may consist of sperm or other oil, wax or fat; it is advisable that the cooling bath should be previously warmed slightly. Each immersion should last about two or three seconds. The depth of immersion is increased with each consecutive dip until the seal is completely cooled out. In practice it has been found very convenient to cool the seal by bringing a small vessel of oil up around it and applying this small cooling bath in the manner just described. If desired, the conductor may be coated previous to the sealing-in process, or the sealing-in process may take place in an atmosphere of hydrogen or other inert




FIGS. 1, 2 AND 3—HERMETICALLY SEALED CONDUCTORS

gas, in order to prevent oxidation. If the conductor is required to carry a current of not more than 15 amp, it may consist of a solid wire of circular cross-section. If, however, the current to be carried exceeds 15 amp, the conductor should be tubular, and it may be subsequently filled with an electrically conducting substance. With German and lead glasses, conductors of copper, nickel, platinum, etc., may be used, but with Jena glass and fused quartz it is necessary to employ platinum. In the accompanying drawings Figs. 1, 2 and 3 represent seals made according to this method. Fig. 1 shows a seal of German or lead glass *A*, and a wire *B* of copper or some other metal. In Figs. 2 and 3 the electrical conductor *B* is of tubular form; the tube is shown closed at one end. It is advisable to use the tubular form of conductor when the method is applied to the construction of mercury-vapor lamps and vapor rectifiers; the tubular shell *B* should be made of a substance such as platinum, which does not form an amalgam; it thus acts as a protecting cover to the plug of better-conducting material *D*, which is chemically acted upon by mercury. In the diagrams *C* represents the portion of the seal which is ultimately immersed in the cooling bath during the process of making the seal. The explanation of the success of the method is that the temperatures at *a* and *c* are approximately equal and if there were any difference of temperature at *a* and *c* it would be such that the glass would not contract away from the conductor.—London *Elec-*

*Joining Tungsten to Copper.*—A note on a recent British patent (10,338, 1912) of the British Thomson-Houston Company and the General Electric Company of this country. The copper is purified by treating at a temperature considerably above its melting point with an oxidizing boron compound, and then melted or cast in contact with the tungsten.—London *Elec. Eng'ing*, July 10, 1913.

### Generation, Transmission and Distribution

*Distribution of Energy Over Extended Districts.*—G. Klingenberg.—A continuation of his illustrated paper on the fundamental principles of distribution of electrical energy over extended districts. In the present instalment the design of the insulators, pole construction and other details of transmission lines are discussed.—*Elek. Zeit.*, July 3, 1913.

*Corona Losses.*—Goerges.—An abstract of a paper read before the Dresden Electrical Society on the principles and the measurement of corona losses. In the Lauchhammer-Riesa-Groeba three-phase line, consisting of three seven-strand cables, each of 6 sq. mm, the corona losses are 2.2 kw per kilometer at 100,000 volts and 8.5 kw per kilometer at 110,000 volts. Experimental measurements of corona losses in an artificial high-tension line have been made and are being continued in the electrical laboratory of the Institute of Technology of Dresden.—*Elek. Zeit.*, July 3, 1913.

*Rolling Mill.*—C. Hahn.—A long illustrated article on a reversible rolling mill arranged according to the Ilgner-Leonard principle. The results of extended careful tests of energy consumption are given.—*Elek. Zeit.*, July 3 and 10, 1913.

### Traction

*Multiple-Unit Control.*—An illustrated account of the Thury system of control for multiple-unit trains. The normal controllers on the different cars are utilized and their simultaneous action is obtained by means of small electric motors wound for a low pressure. Regulators are employed which work the controllers, and the current from a battery of about eighteen cells is used. These regulators are placed on the platforms of the coaches. The number of conductors between coaches is only three; they carry small currents of about 1.6 amp, and the pressure between conductors and earth is only from 36 volts to 46 volts. The system is being used in France.—London *Electrician*, July 4, 1913.

*Electric Vehicles.*—D. S. Martin.—An article on further progress in the development of the electric vehicle business in the United States.—London *Elec. Review*, July 11, 1913.

### Installations, Systems and Appliances

*Oil Engines in Small Central Stations.*—An illustrated description of the Epsom electricity works in England, where two small steam sets of 35 kw and 75 kw have recently been replaced by a Diesel engine of 300 hp. The exhaust gases from the engine pass into the flue of one of the existing steam boilers. This boiler is of the dry-back semi-marine type and has an evaporative capacity of 6000 lb. per hour with cold feed. With the Diesel engine running at about three-quarters load, sufficient heat is obtained from the exhaust gases which leave the cylinder at about 750 deg. Fahr. to evaporate 500 lb. or 600 lb. per hour, and to keep steam at a pressure of about 50 lb. per square inch —London *Electrician*, July 11, 1913.

### Wires, Wiring and Conduits

*Laying Single-Phase Mains in Iron Pipes.*—L. Bloch.—A translation in abstract of the author's recent German paper in which he points out that when single-phase cables are laid singly in iron pipes serious troubles are likely to arise if the currents exceed 50 amp, and even at lower limits. The most notable effect is seen in a rise in temperature, added to which the voltage drops and the loss in watts may have a serious effect on the satisfactory working of the installation.—London *Electrician*, July 4, 1913.

*Submarine Power Transmission Cable.*—An illustrate-

article on two submarine high-tension cables laid from the Stralsund power station in Germany through Stralsund Bay to the island of Ruegen. The working pressure is 15,000 volts, the copper cross-section 3 sq. mm by 35 sq. mm; the number of cores three; the insulation impregnated paper; the protection lead sheathing and armor of round iron wires. The cable is in two sections of 335 m and 1350 m respectively. After laying the Stralsund-Ruegen cable, two cables, each 430 m in length, of the same design were installed from the Wittow Ferry to the peninsula of Wittow on the island of Ruegen. The laying of these cables is described in some detail.—London *Elec. Review,* July 11, 1913.

### Electrophysics and Magnetism

*Radiation Pressure.*—Gilbert D. West.—An abstract of a (British) Physical Society paper. The pressure of the radiation emitted by a carbon-filament lamp at a distance of a few centimeters is sufficient to cause a microscopically measurable deflection of the end of a suspended strip of gold or aluminum foil, and by this means the radiation pressure can be calculated, knowing the weight of the strip. The results agree to within about 10 per cent with the energy content per cubic centimeter as measured by the initial rate of rise of temperature of a copper plate exposed to the radiation. The best results are obtained by working in an atmosphere of hydrogen of 1 cm to 2 cm pressure, but good results are obtained with hydrogen at atmospheric pressure. Air at 1 cm to 2 cm pressure also gives good results. The method involves no laborious adjustments, and the apparatus is not seriously affected by vibration.—London *Electrician,* July 4, 1913.

*Tinfoil Contact with Dielectrics.*—G. E. Bairsto.—An abstract of a (British) Physical Society paper in which the author describes some experiments showing how the accuracy of the different kinds of electrical measurements made on condensers is influenced by the use of imperfect tinfoil contacts.—London *Electrician,* July 4, 1913.

### Electrochemistry and Batteries

*Pinch-Effect Furnace.*—Carl Hering.—An illustrated abstract of his Faraday Society lecture in which he demonstrated his pinch-effect furnace with a small model used for melting lead and showing the rapid circulation of the molten lead.—London *Elec. Review,* July 11, 1913.

### Units, Measurements, and Instruments

*Cable Testing Plant.*—Leon Lichtenstein.—A profusely illustrated description of the laboratory and testing plant of the new cable works of the Siemens-Schuckert Company. For the testing of the cables a 40,000-volt testing plant and an 80,000-volt testing plant are provided, while space is left for a 120,000-volt plant to be erected later. The high-tension laboratory contains two transformers, one for 400,000 and the other for 200,000 volts with accessories. The equipment of the testing plant and the laboratory is described in detail and profusely illustrated.—*Elek. Kraftbet. u. Bahnen.* June 4, 1913.

*Effect of Selenium as a Detector of Light.*—E. E. Fournier d'Albe.—A brief note on a recent Royal Society paper. The author remarks that the efficiency of a selenium preparation used as a detector of light is defined as the amount of additional conductivity imparted to it by the unit of incident light. It is best stated in "micromhos" per lumen. Since many factors affect the efficiency of a given selenium bridge, standard conditions are chosen, chief among them being an illumination of one lux. The law of light action is studied, and the total effect is shown to be proportional to the square root of the incident energy, while the instantaneous effect is proportional to the energy. This is verified down to an illumination of 0.00001 meter-candle. It is shown that selenium is the most efficient light detector known, that it is capable of discriminating minute differences of luminous intensity far beyond the [illegible] eye, and that with suitable means of detecting minute currents, it should offer a means of testing the quanta theory of light by direct experiment.—London *Electrician,* July 11, 1913.

*Precision Resistors.*—K. W. Wagner and A. Wertheimer.—The conclusion of their illustrated paper on the construction of precision resistors for high-frequency alternating current at the Reichsanstalt. The authors show how the time constants of the resistors can be reduced to a small fraction of their former value by a suitable arrangement of the winding. In the present instalment they give details of construction of coils for 700 ohms, 200, 100, 70, 20, 10, 1.0, 0.1 and 0.10 ohms.—*Elek Zeit.,* June 5, 1913.

*Ballistic Galvanometer.*—T. J. I'a. Bromwich.—The author gives the mathematical theory of the oscillations of the needle in a ballistic galvanometer and shows that the usual formula is only approximate; a more exact formula is given by the author.—*Philos. Mag.,* July, 1913.

*Calculation of Electromagnets.*—G. Schlee.—In a continuation of his serial on electromechanical calculations the author gives an outline of the calculation of electromagnets with a numerical illustration.—*Zeit. f. Feinmechanik,* April 5, 1913.

*Oscillographic Demonstrations of Damped Oscillations.*—G. Meller and M. Pozaryski.—An illustrated description of a method of demonstrating in the lecture room damped oscillations by means of the oscillograph. Curves are given of condenser discharges and of the damped oscillations in two coupled circuits.—*Elek. Zeit.,* June 19, 1913.

### Telegraphy, Telephony and Signals

*French Wireless Telegraphy Apparatus.*—An illustrated description of various French wireless telegraph apparatus shown at the Eiffel Tower at the recent visit of the (British) Institution of Electrical Engineers to Paris. The Magunna oscillating-current generator is first described. The Magunna generator is based on the employment of tuning forks, which are kept in continuous vibration like the interrupter of an induction coil. These electrical tuning forks in the present case are used as a converter of continuous into oscillating isochronous current, and have so far been improved that they are now capable of breaking and converting a continuous current of 5 amp at 220 volts into alternating current of a frequency of about 375 cycles which remains quite constant. The tuning fork is kept in continuous vibration by putting one of its branches in contact with a belt, which runs, as it were, against the edge of the prong-end so that it is displaced. For this purpose two pulleys, driven by vertical shafts, carry an endless belt and are driven by a 0.025-hp electric motor. A tuning fork fixed rigidly on a support is placed in contact with the belt

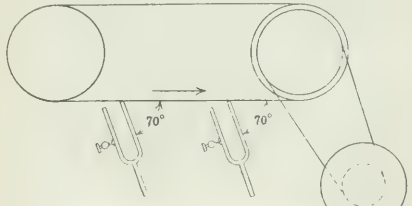



Fig. 4—Tuning Fork in Contact with Belt

when it is at rest as shown in Fig. 4. The tension of the belt may be regulated by displacing one of the pulleys. When the belt is in movement the tuning fork begins to vibrate, making and breaking contact on the free leg, as shown in the diagram. The tuning fork, the primary of the transformer and the Morse key are connected in series

across the terminals of the vibrator, and so suppresses the spark at the moment of breaking. The frequency of the current thus obtained is equal to that of the tuning fork, and is, moreover, rigorously constant and independent of the speed of the belt. The standard type of this apparatus gives two frequencies, namely, 320 cycles and 380 cycles, the frequency of the note being double. One or the other of these



FIG. 5—SINGLE-WAVE OSCILLATOR

two notes can be obtained by simply altering a single-pole switch. The system of the Société Française Radio-Télégraphique, in use at the Eiffel Tower, is next described. One of the essential points of the system is what is termed a single-wave oscillator. The ordinary methods of coupling give rise to two waves in the antenna, and these can only be reduced to a single wave by weakening the coupling to an impracticable extent. The oscillator that is used consists of the primary and secondary windings set at right angles to one another as seen in the illustration, Fig. 5, the two windings being connected together rigidly. It is claimed that by this arrangement the whole system oscillates with a single frequency whatever the degree of coupling.—London *Electrician*, July 11, 1913.

*Printing Telegraph.*—An illustrated article on the new Siemens automatic high-speed printing telegraph which is a machine telegraph with automatic tape transmission. —London *Electrician*, July 11, 1913.

*Telephone Exchange.*—K. Buttler.—An illustrated description of the equipment of the new telephone exchange "Wilhelm" in Charlottenburg near Berlin. The central-battery system with Ericson connections is employed.—*Elek. Zeit.*, June 26 and July 3, 1913.

### Miscellaneous

*Kelvin Memorial.*—Notes on the Kelvin memorial in Westminster Abbey, where the Kelvin window is to be dedicated. This memorial has been subscribed for by British and American engineers.—London *Electrician*, July 11, 1913.

*Electric Accidents.*—An account of the annual report by G. Scott Ram, the electrical inspector of factories in Great Britain. From a table of accidents in British electric stations and substations in 1912 it appears that there were 371 non-electrical accidents, of which eleven were fatal, and seventy-four electrical accidents, of which four were fatal. In factories other than electrical stations there were 283 accidents, of which fifteen were fatal. The reasons of the different electrical accidents are analyzed. Of the eighteen fatalities directly due to electric shock, five were on high-pressure or extra-high-pressure alternating-current systems. Ten were on medium-pressure alternating systems; six of these were from shock to earth on three-phase systems of which the pressure between phases was 440 volts or less, and, as the neutral point was earthed in probably each case, the pressure received would not exceed 350 volts in any instance. One was from a 200-volt single-phase system. Of the two on direct-current systems, one was on a 460-volt three-wire system, but not having the middle wire earthed, and the other on a 220-volt two-wire system. In only nine cases is it clear that any attempt was made to resuscitate the victim by means of artificial respiration. In several it certainly was not attempted. The inspector emphasizes the importance of resorting to artificial respiration immediately and not desisting even should a doctor pronounce the victim to be dead.—London *Electrician*, July 4, 1913.

*Electric Shock.*—H. Gerbis.—A paper on the effect of electric shock on the human body, with advice as to the first help in case of electrical accidents.—*Elek. Zeit.*, July 3, 1913.

## Book Reviews

Engineering Valuation of Public Utilities and Factories. By Horatio A. Foster. New York: D. Van Nostrand Company. 332 pages. Price, $3.

An excellent treatise on theory and practice in the making of engineering valuations, as applied to public utilities, railroads and industries. The author appears to have been inspired by an effort to present both sides of controversial questions. There are fifteen chapters, dealing with definitions of value, purposes of valuation, directions and instructions for valuing tangible property, numerous forms for use in such work, cost of valuation, good will and going value, depreciation, amortization, handling depreciation funds, appreciation, franchises, capitalization, public utility control, court decisions and a short bibliography. The chapter on forms will be very helpful to engineers in this field of work. Perhaps the chapter on depreciation is the most noteworthy of all, especially in its quotation of depreciation rates allowed by various authorities. Among the leading decisions presented are the Consolidated Gas case, the Knoxville Water case, and the Kansas City Waterworks case, which are given in full.

The Regulation of Municipal Utilities. Edited by Clyde Lyndon King. New York: D. Appleton & Company. 391 pages. Price, $1.50.

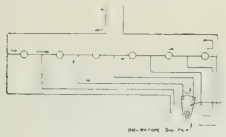
A collection of monographs on utility regulation by numerous authorities, with introductory discussions by the editor, forming an addition to the National Municipal League Series. Some fifteen papers are classed under three divisions—regulation through franchise, through municipal commissions, and through state commissions. In discussing first the question of municipal ownership versus regulation, the editor argues that the tendency toward the former should be checked only in case thorough-going regulation is accepted. The chapter on conclusions recommends the creation of public utility commissions with full and complete regulative powers, that such commissions be isolated and conspicuously responsible, that such commissions be state-wide and supplemented in large cities by subordinate urban commissions, that franchises should be very carefully drawn so as to conserve the public interest and authority, and that provision should be included for municipal ownership and operation in new regulatory laws. Regarded from the broad standpoint of public welfare the main conclusions seem to be sound, particularly the view that municipal operation is an acceptable alternative only in the event that regulation proves a signal failure.

# New Apparatus and Appliances

**An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers**

## Selector Switch for Restoring Series Circuits

In a series circuit such as used for street-car lighting if one lamp burns out the whole series is left in darkness. To find which lamp is burned out it is usually necessary to test out successively each lamp and socket until the right one is found. The selector switch illustrated herewith solves the

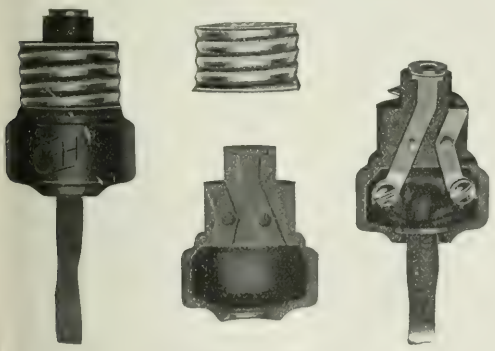


WIRING DIAGRAM FOR SERIES LAMPS

difficulty by quickly throwing into circuit a sixth lamp to take the place of the one burned out. The only manipulation required is the turning of a knob until the lamps light. The selector switch "feels" for the difficulty and immediately remedies it. A device of this kind is especially applicable with the modern tendency toward the use of a single circuit of large-size high-efficiency units for car lighting. The switch described is made by the Nichols-Lintern Company, 8404 Lorain Avenue, Cleveland, Ohio.

## Split Attachment Plug

The saving of time in wiring the split attachment plug now being marketed by the Cutler-Hammer Manufacturing Company, Milwaukee, is of importance to the manufacturer using many plugs with his product. While having the appearance of a solid plug, this device separates into halves to facilitate wiring. Removing the screw shell of the plug



DETAILS OF PLUG

allows it to be separated into two halves, thereby exposing the binding screws for securing the cord. Unlike solid plugs there is a large space for the knot. The bottom of the screw shell has a large number of crescent-shaped perforations, one of which when the shell is screwed in place engages with a latch, securely locking the shell in place, preventing it from being turned backward and holding the plug halves together. A friction-wiping contact independent of the locking latch makes electrical connection with the screw shell.

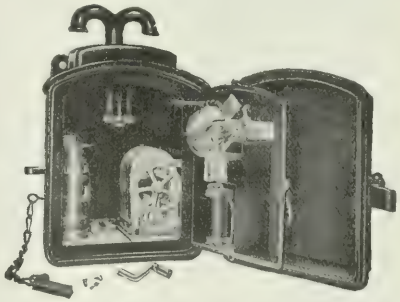
The plug is sent out with the screw shell in place but not locked so that it is only necessary to unscrew the shell and wire the plug, after which the halves are placed together and the shell screwed on until locked. If it is desired to unlock it at any time, a penknife or screwdriver can be used to press down the latch to permit unscrewing the shell.

Black heat-resisting thermoplax is used for the body of the plug. The smallness of the plug makes it at once suitable for a great variety of uses for which separable cap plugs are not required. A reducing bushing is provided so that ordinary, reinforced or silk cord may be used.

## A Telephonic Fire-Alarm System

Ephrata, Pa., a thriving industrial community of approximately 4000 inhabitants, recently completed the installation of a telephonic fire-alarm system. The equipment consists of eighteen fire-alarm telephone stations and a switchboard for headquarters. The telephones are of the iron-box type with double-door construction, especially adapted to out-of-door service. The outer door is kept locked and contains a key placed behind a glass window, which must be broken before the key can be removed and the door opened. The outer door protects the talking apparatus and when opened exposes to view only the receiver and transmitter. These instruments in turn are mounted on an inner door, which can be opened only by a special key and protects the auxiliary apparatus. This double-door construction, combined with the thorough moisture-proofing treatment given to the various metal parts and pieces of apparatus, renders the telephone dust-proof, moisture-proof and weather-proof.

The switchboard is of the sectional-unit lamp-signal type, operating from a central battery. The present board is arranged for a maximum of twenty stations, but as the



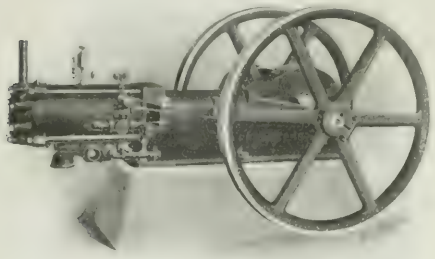
OUT-DOOR TELEPHONE STATION

number of these increases new line sections may be added. When an alarm is sent in and the telephone receiver at the first-alarm station taken off the hook, a lamp, which is numbered to correspond with the station, lights in the face of the switchboard and indicates which box is calling. Associated with all the line signals is a 12-in. gong, which starts ringing whenever one of the signal lamps lights.

As it may happen that the person sending in the alarm becomes too excited to give explicit directions, or else hangs up the receiver without having given any directions at all, the circuits are arranged so that the lamp signal remains lighted and the gong continues to ring until the switchboard attendant plugs into the jack associated with the line lamp, thus extinguishing the lamp and stopping the gong. This circuit arrangement makes it possible for the attendant to know at all times which box has called. The telephones and switchboard were furnished by the Western Electric Company, Chicago, Ill.

## Valveless Gas Engine

Realizing that a large percentage of gas-engine troubles can be traced to the valves, the Producers' Supply Company, of Franklin, Pa., has developed a valveless gas engine. The cylinders of this engine are the three-port type and are made heavy enough to withstand several reborings. Trunk-type pistons with an improved design of piston ring are used. The throttling governor shown in the accompanying illustration is belt-driven and is provided with a device in the shape of an idler pulley and lever which will throttle



VALVELESS GAS ENGINE

the gas supply and stop the engine in case the governor belt should break. The engine may be equipped with either electric or hot-tube ignition, but the manufacturer recommends the electric ignition as much more reliable and safe than the other system.

## Lighting the Modern Circus

Open-flame gasoline torches or gas lamps have lighted circuses for many years, but this season two of the largest tent shows in the world, those of Barnum & Bailey and Ringling Brothers, have their own power plants for lighting the main and smaller tents by electricity.

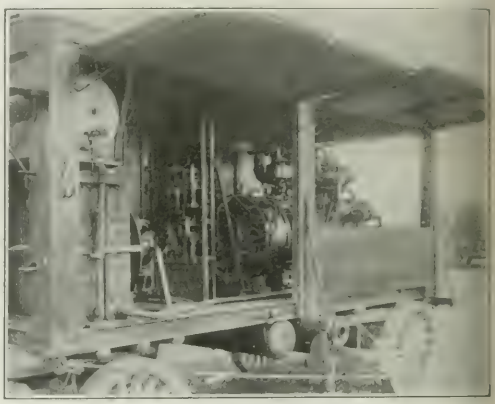
The apparatus consists of portable gasoline-electric sets manufactured by the General Electric Company specially for the purpose. The units are carried in duplicate so that if one should by any chance become disabled while en route the other can supply energy for half the lamps. The units are arranged, however, to operate regularly in multiple, each set furnishing energy for eighteen arc lamps. Two 25-amp spot-lamps for the stage and several strings of incandescent lamps are also operated from the plants in each instance. A third supply wagon used for a workshop is equipped with a powerful electric search-lantern mounted on top, which is directed to different parts of the grounds while taking down tents and loading after the evening performance.

The outfits are very compactly built and are readily portable. They are mounted on one of the ordinary inclosed circus wagons, about 18 ft. long and 7 ft. wide, with the ends and sides of the truck body removable. Each unit is composed of a 25-kw, 125-volt compound-wound, direct-current generator, which is built integral with the frame and directly connected to the shaft of a four-cylinder 560-r.p.m. throttle-governed, vertical gasoline engine.

The set is installed on the rear of the wagon with the flywheel at the outer end. The switchboard for controlling the current is located about 2 ft. from the generator end of the unit. The switchboard is of the slate-panel type with main and feeder switches, instruments, rheostats, etc.

Ignition is effected by a low-tension, automobile-type magneto and induction coil, with an auxiliary battery for starting. The governor is very sensitive and responds quickly to changes in load. It limits the speed variation of the engine from no load to full load within 4 per cent, which with the type of generator employed insures constant voltage. Adequate lubrication is secured by forced circulation from an oil pump.

The generator is of the multipolar continuous-current



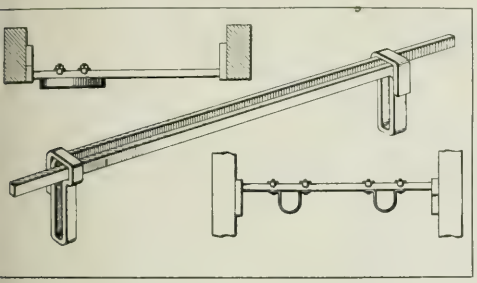
LIGHTING OUTFIT ON CIRCUS WAGON

type designed especially to meet the characteristics of the engine to which it is connected. The field winding is compounded and compensates for the drop in engine speed between no load and full load, thereby maintaining a constant voltage throughout the entire range of operation. All similar parts of these outfits are built so that they are readily interchangeable in so far as is mechanically practicable, which allows replacing with renewals without tedious fitting.

## Adjustable Construction Cleats for Interior Wiring

The accompanying illustrations show a device which can be used to support ceiling outlet plates, wall outlets, brackets, switch boxes and conduits in buildings no matter what the spacing of the floor joists and studdings may be. The construction cleat, as it is called by the manufacturers, consists of two bars of rectangular steel bent into the shapes shown and arranged so that they can slide past each other, making an extensible cleat. The center illustration shows the cleat in the position in which it would be placed to be hung over two floor joists. The legs are to be placed between the joists with the extensions resting on the top of the joists and supporting the weight of the ceiling outlet or fixture. When placed in this position nails are driven through the legs into the joists. To secure the ceiling plate to the cleat, bolts are passed through the ceiling plate, between the parallel bars, and fastened to clamps on the upper side of the cleat as shown in the upper illustration. U-shaped clamps for supporting the conduit may be secured to the cleats in the same manner as shown in the lower corner of the illustration.

Saving in the time of installing electrical equipment is he main advantage of using this type of cleat. Where the ld method of fitting a 2-in. by 4-in. timber between joists nd studdings is used, it is asserted that the cost of install-ng can be cut in half with a slight investment in these



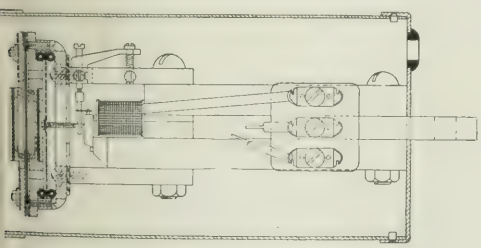
ADJUSTABLE CONSTRUCTION CLEATS

leats. The device is manufactured by Alex. M. Knauber Company, of Chicago, and is sold by the Inland Electric Company, of the same city.

## Loud-Speaking Telephone Enunciators in Baseball Grand Stand

An interesting trial installation of loud-speaking tele-hones, which may be made a permanent feature, has been ade in the Comiskey Baseball Park in Chicago. It consists f a number of the recently developed telephone enunciators nown as "musolaphones" and installed by the Chicago Iusolaphone Company. The reproducers of this system re incased in horns or resonators suspended over both ers of seats in the grand stand. Ultimately about 175 of hese reproducers will be installed and about half of that umber are in use now.

By means of this system the announcement of the bat-eries of the baseball teams, changes in the line-up, or other nnouncements, may be made to the assembled audience. There is one transmitter booth where the operator sits, and n "amplifier," to build up the tone, is used for each five eproducers. Before the game begins the system is utilized o transmit phonographic music from a Victor record. The music" is rather harsh and not particularly pleasant, but he speaking announcements are clear and effective. The nusolaphone people say that the "music" could be toned lown by introducing more resistance into the circuit.



AMPLIFIER USED TO ENERGIZE REPRODUCERS

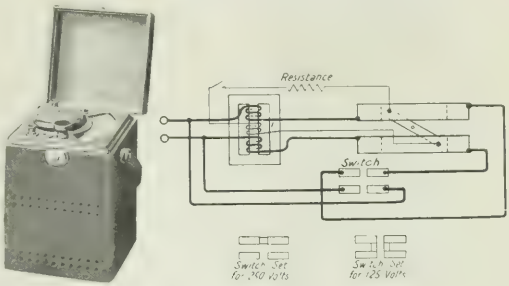
The musolaphone is said to be adapted for announcing argain sales to department-store throngs, giving fire alarms n crowded factories, announcing the departure of trains in ailroad stations or varied purposes of like nature. It can lso be connected with a commercial telephone service to ransmit music to subscribers. An interesting fact, and one hich does not seem to be clearly understood, is that where a quartet is singing in the studio or transmitting booth a better effect is obtained if a separate transmitter and an individual source of electricity are used for each performer. A motor-generator set, consisting of a motor and four small direct-current generators, has been devised for this purpose.

## Iron-Loss Voltmeter

An iron-loss voltmeter for use in connection with a watt-meter for determining the iron loss in transformers on the basis of sine-wave voltage and normal frequency, when the testing is done on a circuit of any wave-shape and frequency approximately normal, has been developed by the Westinghouse Electric & Manufacturing Company.

The iron loss in a transformer varies with the wave-shape and frequency. Guarantees are, therefore, based on sine wave and a normal frequency, but the standard conditions are difficult to obtain in practice. However, for any other wave-shape and frequency there is some equivalent voltage that will produce the same iron loss as would the sine wave of normal frequency at normal voltage. The iron-loss voltmeter enables the tester to adjust to this equivalent voltage for the circuit at hand.

The iron-loss voltmeter consists of a moving element of a wattmeter in series with the winding on an iron core as shown in Fig. 2. With this connection the meter element measures the energy loss in the iron core. The scale is




FIGS. 1 AND 2—IRON-LOSS VOLTMETER AND WIRING DIAGRAM

calibrated on a circuit of sine-wave voltage and is marked in volts. Any circuit that makes the instrument read a certain "voltage," therefore, produces the same iron loss as would a pure sine wave of that voltage. If the voltage or frequency of the circuit on which a transformer test is being made is adjusted until the iron-loss voltmeter indicates the rated sine-wave voltage of the transformer being tested, the iron losses in the transformer will be the same as they would be on a circuit of that voltage and sine-wave shape. The instrument does not indicate the voltage of the circuit, but the voltage of a pure sine wave of normal frequency that would cause the same iron loss in the transformer as the wave of voltage of the testing circuit. There is also a watt scale marked on the meter which indicates the total watts consumed in the meter. This is for the correction of wattmeter readings taken when the voltmeter is in circuit.

In application, the iron-loss voltmeter is connected across the terminals of the transformer under test in the same manner as an ordinary voltmeter. A wattmeter is also connected in the circuit in such a way as to measure the total input of both the transformer and the iron-loss voltmeter. The voltage of the circuit is then adjusted by any convenient means until the voltmeter reads the normal voltage of the transformer. The total power input is read on the wattmeter and the watts input of the instrument is read on the watt scale of the iron-loss voltmeter, the difference being the loss in the transformer.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Boiler Equipment for Soap Company.**—The Procter & Gamble Company is adding to the boiler equipment of its plants at Ivorydale, Ohio, and Port Ivory, N. Y., a total of about 5200 hp of Babcock & Wilcox boilers.

**Additional Equipment for a Cleveland Utility.**—The Cleveland Electric Illuminating Company, of Cleveland, Ohio, is installing at the present time a 15,000-kw Curtis General Electric turbo-generator unit with 4800 hp of Babcock & Wilcox boilers and auxiliary pump and condenser equipment.

**New Holder Coming Out.**—The Plinne & Atwood Manufacturing Company, 30 East Forty-second Street, New York, is to put on the market shortly a new type of screwless socket and globe holder. The device can be used without tools and can be quickly and easily operated. It provides a good grip on the globe without danger of cracking it.

**Turbine Wheel for Niagara Falls.**—The Hydraulic Power Company of Niagara Falls, N. Y., has just awarded to the F. P. Morris Company, of Philadelphia, Pa., the contract for a 10,000-hp turbine wheel to operate under a 210-ft. head at 300 r.p.m in Station No. 3. This is the fourteenth unit of this same type and size furnished by the Morris company for this project.

**Bridgeport Utility Growing.**—The United Illuminating Company, of Bridgeport, Conn., is increasing its plant at the present time. Additions have been made to some of its buildings and five 600-hp Babcock & Wilcox boilers with Taylor stokers have been installed, together with three 2500-kva steam turbo-generator sets and four 500-kw motor-generator sets, the latter for substation work.

**Ohio Battery Company Bought Up.**—The Manhattan Electrical Supply Company has purchased the business and plant of the Rock Island Battery Company, of Cincinnati, of which it took possession on Aug. 1. This move will not mean the discontinuance of the Rock Island dry battery, for this battery will be made in addition to the "Red Seal," "Hi-Up," "Blue Seal" and "Mesco" batteries, now manufactured by the former concern.

**Wagner Electric Manufacturing Company.**—The Dallas (Tex.) office of the Wagner Electric Manufacturing Company has been merged with the Kansas City office of the company, at 1115 Gloyd Building. Mr. P. Loyd Lewis, who has heretofore been Texas representative, will become Kansas City manager, and Mr. J. A. Gelzer, who has been the Kansas City manager, becomes manager of the company's service department, with headquarters in St. Louis. Mr. Lewis personally will continue to cover the Texas territory.

**Hydraulic Turbine Order Placed.**—Boving & Company of Canada, Ltd., who have recently acquired works at Lindsay, Ontario, for manufacturing high-class hydraulic machinery, have had awarded to them by the Hydro-Electric Power Commission of Ontario the contract for large turbines and governors for the Wasdells Falls development on the Severn River. These units will be of similar size to those recently supplied by Boving & Company for Dams Nos. 2 and 5 on the Trent River, which have a combined capacity of 10,000 hp.

**National Tube Company Enters Electrical Conduit Field.**—On Aug. 1 the National Tube Company, of Pittsburgh, Pa., entered the electrical field with its line of wrought-iron conduits for electric-wiring service. This concern has contracted with the National Metal Molding Company and the Safety Armorite Conduit Company, both of the above city, to manufacture and merchandise this product under their several brands, and the sales will be put on the "Pittsburgh basing discount" plan, by which all wrought pipe for other purposes has been sold for the past thirteen years.

**Hot Point Company to Build a Canadian Factory.**—Because of the tariff restrictions which, they claim, almost prohibit the exportation of electrical heating apparatus from the United States to Canada, the Hot Point Electric Heating Company, which now has its central plant at Ontario, Cal., will immediately build a large branch manufacturing plant at Toronto, Canada. Announcement to this effect was made July 25 by Willis Booth, president of the company. Mr. Booth said that this Canadian plant would cost about $250,000 and would employ between 150 and 200 persons.

**Ornamental Bronze Standards for New York Parkway.**—An order for ten reinforced fluted bronze columns of Ionic design has been obtained from the city of New York by the Union Metal Manufacturing Company, of 30 Church Street, New York. These columns will each support a single large globe containing tungsten lamps and will be placed along a large concrete stairway on 215th Street, near the Hudson River. The company recently supplied a number of ornamental three-lamp standards for use in the City Hall Park at Perth Amboy, N. J., and it states that this equipment is giving entire satisfaction.

**Canadian Expansion of the Sturtevant Company.**—The B. F. Sturtevant Company, of Hyde Park, Mass., which is controlled by Governor Foss of that State, has recently acquired the plant of the Canadian Motors Company, at Galt, Ontario, and is preparing to establish there a Canadian branch to handle the large volume of business which it has in the Dominion. The company has taken out a Canadian charter under which these operations will be carried on. The principal reason for establishing a factory in Canada is said to be the desire to escape paying tariff on product shipped across the border, and this action is therefore a direct result of the failure of the Canadian reciprocity measure during the last administration.

**Some Recent De La Vergne Sales.**—The type "F H" oil engine made by the De La Vergne Machine Company, of New York, is enjoying a good degree of popularity. The Electra (Tex.) Electric Company has just purchased one of these engines of 100-hp rating, which will drive a 62½-kw, three-phase, 60-cycle, 2300-volt alternator for municipal power and lighting. Four 60-hp engines of the same type have just been bought by the Marconi Wireless Telegraph Company of America to be installed in its receiving stations, one at Belmar, N. J., one at San Francisco, Cal., and two at Honolulu, H. I. Another firm which has recently bought this type of engine is the Des Moines Bridge & Iron Works, of Des Moines, Ia., which obtained a 60-hp unit to be belted to a 50-kw, three-phase, 60-cycle generator for supplying municipal light and power.

**Recent Stoker Sales.**—The Laclede-Christy Clay Products Company, of St. Louis, Mo., has recently closed contracts for supplying its chain-grate stokers to the University of Missouri, at Columbia, Mo., and to the Kentucky Distilleries & Warehouse Company, of Louisville, Ky. The former installation consists of equipment for two 350-hp and one 250-hp boiler, and in the latter cases there are four 460-hp boilers. The company prides itself on the number of institutions of learning in which its product has been used, among recent buyers being the University of Minnesota, Minneapolis, Minn.; the Christian University, Canton, Mo.; the Bradley Polytechnical Institute, Peoria, Ill.; the Memphis High School, Memphis, Tenn.; the Indiana University, Bloomington, Ind., and the Carter H. Harrison Technical High School, Chicago.

**Newspaper Electric-Service Enterprise.**—The Inter Ocean Newspaper Company, of 57 West Monroe Street, Chicago, is seeking permission from the City Council to transfer its electric-service business to a new company, to be known as the Inter Ocean Light & Power Company. The Inter Ocean company supplies electrical energy and steam to buildings in the block in which it is located, and as it uses streets and alleys for that purpose it operates under a contract ordinance granted by the City Council. It is planned to have a separate company handle this business.

**Electrical Equipment for a Boston Industry.**—The Boston Woven Hose & Rubber Company has just completed the construction of a new mill and power plant at its factory, the first mentioned being of reinforced concrete in keeping with its other mill buildings, and the other being of brick. The power plant equipment was installed by the Stone & Webster Engineering Corporation, of Boston, Mass., and consists of six 600-hp Babcock & Wilcox boilers with Taylor stokers, and a Robins coal-conveying system. The latter feeds an overhead bunker of 500 tons capacity, from which the coal is fed to the hoppers by gravity. One 750-kw, two 1250-kw and one 2000-kw Westinghouse-Parsons turbine directly connected to three-phase, 60-cycle, 600-volt generators of the same make, supply the energy for driving the machinery in the entire factory (including the above-mentioned mill) and for lighting service. General Electric motors will be used for the individual and group drive in the mill building just finished.

**Modern Telephone Service for Constantinople.**—American-made instruments are to be largely used in equipping the modern telephone systems which it is expected will be put into operation shortly in Constantinople. The operating company is to be known as the Société Anonyme Ottomane des Téléphones de Constantinople, and is controlled by Anglo-American interests, including the Western Electric Company, British Insulated & Hellesly Cable Company, Thomson-Houston Company, of Paris, and the National Telephone Company. The service is planned to cover both the European and Asiatic sides of the Bosphorus, and include the Princess Islands in the Straits of Marmoras, about 10 miles from Constantinople. A thirty-year concession has been granted by the Turkish government to cover this work, and it is expected that the government will eventually purchase the system. About 2900 subscribers have been obtained to date, 25 per cent of whom are Turkish householders. A feature of particular interest is the fact that all operators will have to understand French, Turkish and Greek.

**Status of the Edison Storage-Battery Business.**—Mr. Edison recently called together a number of his storage-battery salesmen for a general personal report on trade conditions throughout the coutry and the formation of plans for next season's business. The remarkable increase in sales since Jan. 1—particularly in the types of battery used by manufacturers of delivery wagons and heavy motor trucks—brought out the fact that the alkaline nickel-iron cell is finding favor in this country. The orders for train-lighting outfits and signal service are far above normal. The business in house-lighting sets for country homes where central-station current is not available exceeds already that for any previous season and is increasing daily. Orders for ignition and lighting batteries on pleasure and commercial gas cars show a much larger percentage of "replacements" sold directly to the user. The electric commercial vehicle has established itself in practically every locality and climate, and data are available in all classes of service to furnish facts and figures on the best equipment for any individual installation.

**Big Electrical Manufacturers Working to Capacity.**—That the electrical industry at the present time is enjoying unprecedented prosperity is revealed by the fact that the calendar year 1913 will show more business transacted than ever. Orders have been received during the first half of this year in record-breaking volume by both the Westinghouse Electric & Manufacturing Company and the General Electric Company, the two biggest American manufacturers of electrical apparatus, and for the former concern the month of June produced the largest volume of business in its history. Nearly the same story can be told for the latter company, and the July business of both seems to promise even better. Some idea of what this means can be gained when it is stated that it is taking every bit of the working capital of the Westinghouse company to handle the increased production, while, as noted elsewhere in this issue, the General Electric Company has been forced to borrow in the neighborhood of $4,000,000 on short-term notes to meet these production expenses and has provided for the future sale of $6,000,000 more of these notes in anticipation of a continued period of activity. This large volume of orders is said to be in both cases well distributed and not due to the handling of any specially large individual enterprises. In view of the fact that the electrical industry is now at the height of prosperity, it would seem probable that conditions in other lines of industry are not so bad as many people are saying.

**Harwood Electric Company Improves Plants.**—Extensive improvements have been made recently by the Harwood Electric Company at three of its plants. An addition measuring 44 ft. by 47 ft. has been built to the substation at Hazleton, Pa., and new equipment installed consisting of Westinghouse 500-kw oil-insulated, self-cooled transformers, 11,000-4000 volts, and General Electric solenoid-operated switchboard of twenty-nine panels with type K automatic oil switches on high-tension incoming and outgoing lines and on the high-tension side of transformers. Hand-operated switches of the same type were placed in all feeder circuits. The main switchboard was completely equipped and includes, in addition to the above-mentioned, a totalizing panel. General Electric aluminum-cell lightning arresters with complete auxiliary equipment were placed on all high-tension lines and also on the feeder circuits. All lines enter and leave the station on steel towers. The station was also equipped with a sixty-cell storage battery for operating the switchboard and for emergency station lighting. The two 150-kw motor-generator sets now being installed each consist of two 75-kw direct-current generators directly connected, one to each end of the shaft of a 225-hp synchronous motor. The apparatus is mounted on a common bed-plate and is of Westinghouse make. At Freeland, Pa., a new two-story substation has been built, measuring 34 ft. by 64 ft., and the equipment here is similar to that at Hazleton, except that the switchboard is smaller. The municipal lighting contract in this town carries with it a proviso compelling the electric company to maintain and operate a fire-alarm system, and in this connection there was installed in this station an electrically driven air compressor, tanks and whistles for fire alarm. At Harwood, Pa., the company has recently put in a General Electric 6250-kva, 11,000-volt horizontal Curtis turbine generating set, operated condensing.

**Reconstruction of a Michigan Generating Station.**—Through R. K. Holland, electrical engineer with Gardner S. Williams, Ann Arbor, Mich., it is learned that a contract has been awarded to the Benjamin Douglas Company, Ford Building, Detroit, Mich., for the construction of a reinforced concrete spillway, waste gates and power house for the Argo plant of the Eastern Michigan Edison Company. This construction is located on the Huron River in the city of Ann Arbor, Mich., and is in fact the reconstruction of the present plant although the whole of the old work is being torn out. The spillway will support a footwalk and will be equipped with a manually operated flashboard mechanism. At the end of the spillway there will be a wasteway for taking care of excess flood water and for emptying the pond when desired. The power house will measure about 45 ft. x 95 ft. and will accommodate two vertical directly connected generating units, one a three-phase, 60-cycle, 2300-volt machine and the other a 450-kw, 600-volt direct-current generator, both driven by hydraulic turbines. The turbines, governors and thrust bearings are to be furnished by the Allis-Chalmers Manufacturing Company, of Milwaukee, Wis., while the generators, switchboards and switching gear will be of General Electric make. In the power house building there will be also two motor-generator sets of 500-kw rating each, for use on the street-railway load; also two banks of step-down transformers, 23,000-2300 volts, each bank consisting of three single-phase transformers of 333 kw each. The transformed energy is used for lighting the city of Ann Arbor and supplying power to the motor-generator sets for street-railway service. The

two directly connected units installed in this plant are connected up to the low-tension bus system and the street-railway system respectively. Transmission lines are to be brought into the transformer station from the Barton plant of the Eastern Michigan Edison Company, designed and constructed last year, and also from the Geddes and Superior stations of the same company.

**Diesel Oil-Engine Plant Near St. Louis.**—The Light & Development Company, of St. Louis, Mo., is erecting an isolated Diesel-engine operating plant in St. Louis County just west of the city to furnish electrical energy to the surrounding factory district. This station will be located on the Terminal Railroad Association's belt road, where oil can be shipped in cheaply, and it will replace a 50-hp gasoline engine-driven plant at present operated by the company in the same locality. The equipment of the new station will consist of two 100-kw, 300-volt, three-phase generators directly connected to Diesel oil engines running at 225 r.p.m. and operating on fuel oil. Belt-driven exciters are to be used. The district surrounding the station has excellent transportation facilities and land is cheap, so that it looks like a promising field for factory growth and an increased demand in the future for energy for electric drive.

**Transformer Market Remains Favorable.**—As evidence of the fact that the transformer business remains good the Moloney Electric Company, of St. Louis, Mo., cites an order calling for the shipment of five car-loads of transformers to South America and Spain. This sale comprised a large number of three-phase transformers ranging in rating from 100 kw to 300 kw and in voltage from 6600 to 33,000. All of these are of the oil-cooled type for interior use and will be shipped immediately. Another order of note recently placed with the same company is for eight transformers for use in the new Railway Exchange Building in St. Louis, the purchasers being in this case the Light & Development Company of the same address. Four of these latter are to be 300-kw units for stepping down the voltage of 4150 delivered to the building to 250-125 for lighting and elevator service. The other four will be auto-transformers, also of 300-kw rating and provided with 250-volt taps. These are also of the three-phase, oil-cooled type. It was stated by a representative of the Moloney company that while previously its business has been largely in units of small size there has been a marked demand of late for transformers of larger rating.

**American Water Works & Guarantee Company to Pay Interest Due Aug. 1.**—In response to requests for information from holders of securities of the American Water Works & Guarantee Company and its subsidiaries a statement has been issued by J. B. Van Wagner, treasurer of the company, to the effect that arrangements have been made for the payment of all interest maturing on Aug. 1 on securities of subsidiary companies.

**Proposed Merger of Surface Street Railways in Chicago.**—A sub-committee of five members of the local transportation committee of the City Council of Chicago has been appointed to reopen negotiations having for their object the merger of the surface street-railway companies of Chicago. The sub-committee will try to report to the full committee some time in October a plan by which a satisfactory proposal can be worked out. Negotiations on this subject were begun with the Chicago City Railway Company and the Chicago Railways Company some time ago, but were abandoned because the companies said that they must have a guaranteed return of 7 per cent on their investment. By the traction settlement ordinances of 1907, under which the companies are now working, they are guaranteed 5 per cent on the total valuation. After certain allowances are made for depreciation and other purposes the companies also receive 45 per cent of the "net divisible receipts."

**False Rumors on Insull Stock.**—Under the heading "English Investors Drop Insull Stocks," a Chicago daily newspaper said in a recent issue that "Large blocks of stock in Samuel Insull's utility companies, placed in London less than a year ago, have lately been unloaded on the Chicago market." In accounting for this alleged fact the newspaper writer continued: "Some think Mr. Insull, whose health appears to have broken under the strain, has undertaken to carry a load that is too heavy for him." This statement, which appears to have been also copied in New York and Boston financial papers, is evidently untrustworthy since Mr. Insull is enjoying excellent health. Moreover, the foreign holdings in Commonwealth Edison and Public Service Company of Northern Illinois stock are relatively inconsiderable, although of late foreign holdings have increased rather than diminished. In the Middle West Utilities Company perhaps 25 or 30 per cent of the stock is held by foreign owners. Commonwealth Edison stock has risen from 125½ to 141½ in the last few weeks, apparently on the strength of a rumor that the dividend rate will be increased from 7 to 8 per cent before the year is out.

**General Electric Financing.**—There is something more than extraordinary, during the present period of unrest and financial gloom, in the continued activity of the General Electric Company, which seems to be enjoying a floodtide of business while many other industries are suffering from a severe slump. The company is, in fact, so busy that it has been found necessary to make a note issue to help meet production expenses, and in this connection the following statement was recently given out by C. A. Coffin, chairman of the board of directors of the General Electric Company: "In September, 1912, the General Electric Company sold $10,000,000 of its forty-year 5 per cent debentures out of a total authorized amount of $60,000,000. At that time it was expected that the proceeds of these debentures would be sufficient to provide for the company's capital requirements until late in the present year. Owing, however, to an unprecedented increase in the company's business, this has not been the case, and in preference to issuing more debentures at this time the company is providing for its present needs by borrowing not exceeding $10,000,000 for eight or nine months at 6¼ per cent." It is rumored that between $3,000,000 and $4,000,00 of these notes have been bought by J. P. Morgan & Company, who, with Lee, Higginson & Company, have underwritten the issue.

## Industrial Securities

| Security | Capital Stock Listed | DIVIDEND Per Cent | DIVIDEND Period | QUOTATION July 23 | QUOTATION July 30 |
|---|---|---|---|---|---|
| Allis-Chalmers, t.r., 5th pd | $19,800,000 | ..... | ..... | 7¼* | 9* |
| Allis-Chal., pf.,t.r.,5th pd. | 16,050,000 | ..... | ..... | 15 | 16½* |
| Amalgamated Copper | 153,887,900 | 1¼ | Q | 69¾ | 69⅞ |
| American Tel & Tel. | 344,471,400 | 2 | Q | 128 | 128½ |
| Electric Storage Battery,c. | 16,074,425 | 1 | Q | 47½ | 48½ |
| General Electric | 101,863,600 | 2 | Q | 139¾ | 140* |
| Mackay Cos., c. | 41,380,400 | 1½ | Q | 77¾* | 77¾ |
| Mackay Cos., pf. | 50,000,000 | 1 | Q | 68* | 69½* |
| Western Union Tel. | 99,747,600 | ½ | Q | 63* | 63½* |
| Westinghouse, E. & M., c. | 34,496,400 | 1 | Q | 61½ | 63½ |
| Westinghouse, E. & M., pf. | 3,998,700 | 1½ | Q | 110* | 116* |

*Last price quoted.

### NEW YORK METAL MARKET PRICES

| | July 22 Bid. | July 22 Asked. | July 29 Bid. | July 29 Asked. |
|---|---|---|---|---|
| Copper: | | | | |
| Standard, spot* | 14.00 | ..... | 14.00 | ..... |
| | Selling Prices | | Selling Prices | |
| London, standard, spot* | £ 64 | s 8 d 9 | £ 65 | s 15 d 0 |
| Electrolytic | 14.50 | to 14.60 | 15.00 | to 15.10 |
| Electrolytic | .... | 14.50 | 14.87½ | to 15.00 |
| Casting | 14.25 | to 14.35 | 14.70 | to 14.80 |
| Copper wire base | .... | 15.50 | ..... | 16.00 |
| Lead | 4.35 | ..... | 4.50 | ..... |
| Nickel | 40.00 | to 45.00 | 40.00 | to 45.00 |
| Sheet zinc, f. o. b. smelter | 7.00 | ..... | 7.25 | ..... |
| Spelter, spot | .... | 5.40 | ..... | 5.60 |
| Tin, spot* | 41.00 | to 41.50 | 40.80 | to 41.00 |
| Tin, spot* | | | | |
| Prompt delivery | 23.00 | to 23.50 | 23.00 | to 23.50 |
| Future | 21.00 | to 22.00 | 21.00 | to 22.00 |

### *OLD METALS

| | | |
|---|---|---|
| Heavy copper and wire | 13.25 | 13.75 |
| Brass, heavy | 8.25 | 8.75 |
| Brass, light | 7.25 | 7.75 |
| Lead, heavy | 4.25 | 4.25 |
| Zinc, scrap | 4.25 | 4.25 |

### *COPPER EXPORTS

Total tons to July 29 ..... 25,621

*From daily transactions on the New York Metal Exchange.

## Business Notes

**The Standard Varnish Works,** Chicago, announce that they have opened a branch house on the Pacific Coast at 113 Front Street, San Francisco, Cal., which is equipped with a large and complete stock of their architectural specialties, including Elastica No. 2, Elastica floor finish, Satinette white enamel and Kleartone stains. F. T. McHenry, who has represented the company on the Pacific Coast for many years, will be in charge of the new Western office.

**Changes in Personnel of Baker Motor Vehicle Company.**—At a directors' meeting held July 9, the Baker Motor Vehicle Company, of Cleveland, advanced George H. Kelly from the position of manager of the truck department to the office of secretary and sales director. R. C. Norton, heretofore secretary and treasurer, will continue as treasurer. E. J. Bartlett becomes sales manager of the truck department, and O. B. Henderson continues as sales manager of the pleasure-car department.

**Goulds Manufacturing Company.**—Mr. F. Z. Nedden, of London, Eng., has been appointed engineer in charge of the centrifugal-pump department of the Goulds Manufacturing Company, Seneca Falls, N. Y. Mr. Nedden was graduated from the technical university at Charlottenburg, Germany, and later served as assistant professor of gas and rotary engines at the technical university in Aix-la-Chapelle. He is the author of a textbook for engineering students which has been published in both German and English

**Steel City Electric Company.**—In our issue dated July 12, on page 107, it was stated that the Steel City Electric Company, of Pittsburgh, Pa., had been incorporated and that Horace S. Gould was one of the incorporators. The company referred to was incorporated in 1904 and has an authorized capital stock of $35,000. The action referred to as a recent incorporation was in fact the filing of papers by the company in the office of the Secretary of State, at Albany, N. Y., and receiving by it of authority to transact business in the State of New York on July 2, 1913. Horace S. Gould, 37 Wall Street, New York, was designated as the person to receive process against the corporation in the State of New York.

## New Industrial Companies

**The National Electric Construction Company,** of Kansas City, Mo., has been incorporated with a capital stock of $5,000 by H. P. Fisher, R. O. Wing and J. M. Deacy.

**The Trinity Electraphone Company** has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $100,000. The incorporators are: A. D. Jones, F. Lyster, of Philadelphia, Pa., and E. B. Waples, of Wilmington, Del.

**The Beacon Miniature Electric Company,** of New York, N. Y., has been incorporated by Leon Cooper, Abraham I. Wolf and Bernard Tauber, 56 West 112th Street, New York. The company is capitalized at $25,000 and proposes to deal in electrical supplies.

**The Rothenbucher Equipment Company,** of New York, N. Y., has been incorporated with a capital stock of $10,000 to manufacture and deal in engines, boilers and machinery. The incorporators are: George E. R. Rothenbucher, Alfred G. Tim and David Tim, 280 Broadway, New York.

**The Wright Storage Battery Company,** of Poughkeepsie, N. Y., has been incorporated with a capital stock of $100,000 to manufacture and deal in storage batteries. The incorporators are: Ralph H. Raphael, Marie F. Wainwright, R. H. Hammond, of 507 West 184th Street, New York.

**The Hoppie Electrical Company,** of Salt Lake City, Utah, has been incorporated with a capital stock of $500,000 for the purpose of manufacturing audiographs and telephone repeaters, which are the invention of William Hoppie. The officers of the company are: Curtis Hawley, president; L. S. May, vice-president, and Murray C. Godbe, secretary and treasurer.

## Trade Publications

**Clay Products.**—The Laclede-Christy Clay Products Company, Manchester and Sulphur Avenues, St. Louis, is mailing large cards which tell of the infinite care used in the preparation of its products.

**Automatic Voltage Regulators.**—The General Electric Company has just issued an attractive 44-page bulletin, No. A4123, describing automatic voltage regulators for the regulation of generator voltage, for use with both alternating and direct current.

**Porcelain Insulators.**—Folder 4255 issued recently by the Westinghouse Electric & Manufacturing Company describes its type PG porcelain insulators. These are insulators with high mechanical strength, suitable for use on 1500-volt direct-current railway work and 2200-volt transmission lines.

**Electricity in the Jewelry Industry.**—In Circular No. 30,701 issued by the Holtzer-Cabot Electric Company, Boston, electricity in the jewelry industry is fully treated. A number of suggested electric drives for polishing, buffing and grinding are given, and various types of motors suitable for these classes of work are shown.

**Air Brake Equipment.**—Bulletin No. A4127 of the General Electric Company describes a straight and automatic air brake equipment for use on either single cars or trains of three or more cars. Cars provided with this equipment may be used as locomotives for switching service, and for operating interchangeably with steam railroad cars.

**Window Searchlamps.**—The National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, issues a 16-page pamphlet referring to show-window searchlamps, in which is illustrated and described recent practice in lighting show windows. Illustrations are shown of some successful installations in which X-Ray window reflectors were used.

**Insulators.**—In Catalog No. 28 of the Hemingray Glass Company, Covington, Ky., are illustrated various types of insulators and their constructive features. The catalog contains fifty-four pages and has a striking cover. Each illustration is accompanied by brief information as to the weight per piece, approximate weight per 1000 packed and standard package quality.

**Centrifugal Pumps.**—Henry R. Worthington, 115 Broadway, New York, has issued an attractive 62-page catalog which illustrates and describes different types of volute centrifugal pumps. The volute pump derives its name from the form of casing, which is similar in shape to the involute curve. The catalog contains some useful tables, one showing the cost of pumping by electric energy.

**Battery-Charging Switchboards and Motor-Generator Sets.**—The Westinghouse Electric & Manufacturing Company has issued Descriptive Leaflet No. 3679, covering electric-vehicle battery-charging switchboards and motor-generator sets. These devices are described and illustrated in detail. Special mention is made of the sectional switchboard, which has proved very satisfactory for this class of work, enabling additions to be made to the outfit from time to time with slight expense.

**Insulating and Impregnating Compounds.**—The Condensite Company of America, Glen Ridge, N. J., has set forth in a 16-page pamphlet the uses of Halowax oil and Halowax (synthetic oil and waxes). These are chlorine substitution products having the properties of non-inflammability, high boiling points, and a wide range of melting points. They are used for impregnating paper and wood, fire-proofing fabrics, protecting cathodes, electrical coil impregnations, for belt dressing, and many other purposes.

**Ball Bearings.**—Bulletin No. 102 of the Norma Company of America, 20 Vesey Street, New York, refers to its annular bearings, double annular bearings and combined annular and ball thrust bearings. Bulletin No. 103 is devoted to roller bearings and combined roller and ball thrust bearings. Single ball thrust bearings and double ball thrust bearings are the subject of Bulletin No. 104. Each bulletin contains descriptions and illustrations of its subject matter and a number of tables giving dimension data and rated load.

# Personal Mention

**Mr. A. L. Brownell** has been appointed superintendent of the Marquette County Gas & Electric Company of Ishpeming, Mich.

**Mr. E. D. Blynn, Jr.**, has been elected vice-president of the Lincoln (Ill.) Railway & Light Company to succeed Mr. E. D. Blynn, Sr.

**Mr. J. E. Webb** has been appointed superintendent of the Parsons (Kan.) Railway & Light Company to succeed Mr. Theodore Dienst.

**Mr. W. L. McKee** has been elected vice-president of the Trinidad (Col.) Electric Transmission, Railway & Gas Company to succeed Mr. J. F. Wessel.

**Mr. C. R. Laub** has been appointed superintendent of the Public Service Company of Northern Illinois at Streator to succeed Mr. R. B. Basham.

**Mr. Frank Morrison** has been appointed chief engineer of the power station of the Union Traction Company, Coffeyville, Kan., to succeed Mr. O. E. Polk.

**Mr. A. J. Bemis** has been appointed general manager of the Vicksburg (Miss.) Light & Traction Company to succeed Mr. W. B. Moorman. Mr. Bemis was formerly chief engineer of the company.

**Mr. R. J. Russell,** secretary of the Century Electric Company, of St. Louis, Mo., will sail for an extended business trip to England and the Continent on Aug. 7, taking the steamer *Empress of Britain* from Quebec.

**Mr. Edward M. Graham** has been appointed assistant to the president of the Bangor (Me.) Railway & Electric Company. Mr. Graham was formerly assistant to the general manager of the Cumberland County Power & Light Company.

**Mr. J. W. Cowles,** of the Edison Electric Illuminating Company of Boston, sailed July 12 on the Hamburg-American S.S. *Cincinnati* for a seven weeks' trip through Germany, France and England. Mr. Cowles is accompanied by Mr. S. G. Rhodes, of the New York Edison Company.

**Colonel George W. Goethals,** chairman of the Isthmian Canal Commission and chief engineer of the Panama Canal, has consented to accept the honorary presidency of the International Engineering Congress and will preside in person over the general sessions to be held in San Francisco Sept. 20-25, 1915.

**Mr. A. S. Nichols** has been appointed manager of the Fort Madison (Ia.) Electric Company and the Dallas City Electric Light Company, two newly acquired Stone & Webster properties located about 25 miles from the Keokuk water-power development. Mr. Nichols was formerly assistant treasurer of the Mississippi River Power Company.

**Mr. A. C. Blinn,** president of the Evansville (Ind.) Public Service Company and vice-president of the Public Utilities Company of the same city, sailed on July 31 from New York City for Europe on the steamship *Cedric*. Mr. Blinn intends visiting London, Paris and several points in Switzerland, but has set no definite limit on the length of his trip, which will be devoted entirely to pleasure.

**Mr. R. B. Hull** has been made acting manager of the Edison Electric Company of Lancaster, Pa., and of the Lancaster County Railway & Light Company to succeed the late C. E. Titzel. Mr. Hull entered the service of the Lancaster company as an electrician in 1900 and in 1903 was appointed foreman of the meter department. On Oct. 1, 1910, he was promoted and made superintendent of the overhead department, and two years later he was made superintendent of the company.

**Mr. A. T. Macdonald,** formerly head of the new-business department of the Louisville Lighting Company, is now chairman of a special committee of Louisville manufacturers who are planning a "Made-in-Louisville" week for the latter part of August, when all downtown stores are to exhibit in their windows the products of Louisville factories. Mr. Macdonald was formerly secretary of the Louisville Commercial Club and for many years before that was engaged in newspaper work in Louisville. He also managed the Southern Electrical Exposition held in Louisville.

**Mr. Holton H. Scott,** who was elected a vice-president of the National Electric Light Association for the second time at its recent convention, was born in Orillia, Canada, Sept. 14, 1874. He was educated in the Ashland (Wis.) High School and the University of Wisconsin, graduating from the latter with the degree of B.S. in 1896. His first position was with the Madison (Wis.) Gas & Electric Company, where he was employed in general work. In 1901 he became superintendent of the Lincoln (Neb.) Gas & Electric Light Company and in the following year went to San Antonio, Tex., as engineer for the San Antonio Gas & Electric Company and the San Antonio Traction Company. He subsequently became general superintendent of the former and assistant to the president of the latter. In the spring of 1905 he returned to Madison, Wis., as general superintendent of the Madison Gas & Electric Company and in 1906 he came to New York City with H. L. Doherty & Company as chief engineer, examining all the properties taken over and owned by that company. He is at present general manager of the Doherty Operating Company, which operates 104 public-utility plants in all parts of the country, and is also a director in many of the corporations owned or controlled by H. L. Doherty & Company. Mr. Scott is a member of the National Commercial Gas Association, the New York Electrical Society and the National Electric Light Association and is an associate member of the American Institute of Electrical Engineers. He has been chairman of the membership committee of the N. E. L. A. for the past four years.



HOLTON H. SCOTT

**Mr. W. H. Morton,** who resigned as secretary of the National Electrical Contractors' Association at the Chattanooga convention last week, the resignation to become effective Sept. 1, was born in Springfield, Mass., in 1869. His father is Judge James H. Morton, of that city. Educated in the public schools of Springfield, Mr. Morton afterward took a two years' course in the Gunnery Preparatory School of Washington, Conn., and the first three years after leaving school were spent in the woolen business at Ware, Mass., with the Gilbert Manufacturing Company. Mr. Morton early evinced an inclination toward electricity, and in 1890 took up the two years' students' course at the works of the General Electric Company at Schenectady. After completing this course he was placed in charge of the testing department of the Schenectady works until 1895, at which time he went to Utica, his present home, to enter the electrical contracting business. He continued in this business until 1905, at the same time carrying on the continually increasing duties of secretary of the National Electrical Contractors' Association. Since 1905, however, he has devoted all of his time to the latter work. In addition to his many important duties as secretary of the National Electrical Contractors' Association Mr. Morton has also managed the *National Electrical Contractor*, the official monthly magazine of the association. From 1898 to 1902 Mr. Morton was secretary of the New York State Electrical Contractors' Association. He was also secretary of the Knit Goods Manufacturers' Association, the Utica Employers' Association and the Park Board of the city of Utica. Mr. Morton recently purchased a large tract of land in Porto Rico for the purpose of growing grapefruit, and he has resigned from the National Electrical Contractors' Association to devote his time to this business.



W. H. MORTON

# Construction

## New England

BRADFORD, VT.—The Bradford El. Lt. Co. has decided to make two new extensions of about 1 mile each to its lighting service (2200 volts) in Newbury. A. F. Dickey is manager.

ESSEX JUNCTION, VT.—The Burlington Lt. & Pwr. Co. is building a new power plant at Essex Junction, which will use the entire power of the Winooski River under a 65-ft. head. The work is being done by the Snare & Triest Co., Woolworth Building, New York, N. Y., which is also replacing an old timber dam at the Burlington Lt. & Pwr. Co.'s present station near Winooski with a concrete dam. J. J. Kennedy, 52 Broadway, New York, N. Y., is consulting engineer.

FAIRHAVEN, VT.—The Western Vermont Pwr. & Lt. Co., of Fairhaven, has applied to the Public Service Commission of New York for permission to erect a transmission line to Granville for the purpose of furnishing electricity for lamps and motors in that place.

MONTPELIER, VT.—The Waterbury Lt. & Pwr. Co. of Montpelier, successor to Moody & Allen, expects to purchase within the next 30 days one 500-hp water-tube boiler and a 500-hp engine with condenser, etc. G. H. Almon is manager.

WINDSOR, VT.—The Windsor El. Lt. Co contemplates a general reconstruction of its older lines and would like to communicate with dealers in new chestnut poles. The company has just completed about 2 miles of rural lines on the River Road in Cornish, N. H., toward the Claremont line. Richard P. Osgood is superintendent.

LENOX, MASS.—The Lenox El. Co. has begun work on the installation of a new street-lighting system, consisting of 100 tungsten lamps of 32 cp erected on ornamental posts and maintained by underground cables. Contracts have already been placed for materials. The Rogers El. Co., of Lenox, Joseph Franz, engineer, will have charge of the work.

PAXTON, MASS.—A warrant calling for a special town meeting has been drawn by the Selectmen to vote on the proposition to erect an electric-light system, the cost not to exceed $5,000; also to appoint a committee to have charge of building the plant and to authorize this committee to enter into a contract for not more than 10 years with some electrical company to furnish energy to operate the system.

WARE, MASS.—The Ware El. Co. has nearly completed the installation at the Ware substation of three 1500-kva, 66,000-11,000-22,000-volt transformers. When this installation is completed the 14 towns now supplied by the Ware El. Co., the North Brookfield El. Lt. & Pwr. Co. and the Central Massachusetts El. Co. will be furnished with current from the lines of the Connecticut River Transmission Co. The substation is the property of the Ware El. Co. The 22,000-volt lines which traverse the territory have been erected during the past year. H. W. Parsons is manager.

HARTFORD, CONN.—The contract for furnishing 100 single and 100 double iron lamp standards for the ornamental street-lighting has been awarded to Story & Stephens Co., of New York, N. Y. The price paid for the double standards was $3,400 and for the single standards $3,100.

## Middle Atlantic

ELMIRA, N. Y.—The Elmira Wtr., Lt. & Pwr. Co. is building a 10,000-kw power plant. Contracts have been placed for the entire plant. J. H. Hill is acting general manager.

GROTON, N. Y.—The Board of Water & Light Commissioners expects to purchase within the next few months materials for distribution system to replace wires now in use. Charles O. Rhodes is clerk.

MORRISTOWN, N. Y.—The Gregory El. Co., Inc., successor to the Northern Lt. Co., has purchased and will soon install Garton & Daniels lightning arresters as a further protection to its distributing system. A. M. Gregory is manager.

NEW YORK, N. Y.—Bids will be received at the office of the Armory Board, Hall of Records, Chambers and Centre Streets, New York, until Aug. 7, for electrical equipment for Twelfth Infantry Armory, Sixty-second Street and Columbus Avenue, borough of Manhattan. Bidders are requested to make their bids upon blank forms prepared by the Armory Board, a copy of which may be obtained, together with a copy of contract, including specifications, upon application to the above office.

ROCHESTER, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 20 for additional conduit and wiring, plumbing, heating, lighting fixtures, etc., in the first story of the United States court house and post office in Rochester, in accordance with plans and specifications, copies of which may be had at the above office or at the office of the custodian, Rochester. O. Wenderoth is supervising architect.

ROCHESTER, N. Y.—The Rochester Ry. & Lt. Co. is installing additional boilers for supplying two 2700-kw turbo-generators. Three 1000-kw rotary converters will be installed for the Edison system, together with considerable new switchboard equipment. The company is also making extensions throughout the city for both factory and residential lighting, and is placing approximately 300 of the new inverted magnetite-arc lamps in the business section. T. H. Yawger is superintendent of the electrical department.

ROUSES POINT, N. Y.—A new 150-hp boiler is now being installed in the municipal electric-light plant. A new switchboard and tungsten street lamps have just been installed. H. A. Sabourin is manager.

SYRACUSE, N. Y.—The Board of Contract and Supply has rejected the proposal submitted by the Syracuse Ltg. Co. for street-lighting, ornamental lighting for the city buildings and energy for motors for a period of five years. The board has instructed R. D. Roney, secretary, to re-advertise proposals for lighting the city.

UNION SPRINGS, N. Y.—The Union Springs Lt. & Pwr. Co. is starting a campaign to wire up and connect 50 houses in this town, and expects to purchase a few meters. George W. Hull is general manager.

UTICA, N. Y.—The Utica Gas & El. Co. has applied to the public Service Commission for permission to erect electric transmission lines and to exercise franchises in the village of Holland Patent and in the hamlet of Sauquoit, town of Paris, Oneida County.

WEEDSPORT, N. Y.—The Board of Trustees of the village of Weedsport has applied to the Public Service Commission for permission to install an electric plant to furnish electricity for lamps and motors to residents in Weedsport.

FREELAND, PA.—The Harwood El. Co., of Hazleton, has recently completed the construction of a new brick and steel substation, having an output of 3000 kw. The station is equipped with General Electric switchboard equipment, step-down transformers, etc.; also two 50-lamp Westinghouse mercury arc rectifiers, supplying energy to Westinghouse series metallic flame-arc lamps for municipal lighting. John S. Wise, Jr., is manager.

GETTYSBURG, PA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 3, for completion, including plumbing, gas piping, heating apparatus, electric conduits and wiring and lighting fixtures, of the United States post office at Gettysburg, in accordance with drawings and specifications, copies of which may be obtained from the superintendent of construction at Gettysburg or from the above office. O. Wenderoth is supervising architect.

PHILADELPHIA, PA.—The Philadelphia Rapid Transit Co. has recently awarded a contract for the construction of a new steel and concrete power house at the corner of Thirty-second and Dauphin Streets, at a cost of $15,000.

PHILADELPHIA, PA.—Bids will be received at the office of the commanding officer, Frankford Arsenal, Philadelphia, Pa., until Aug. 5, under circular No. 15 for the installation of underfeed mechanical stokers in the boiler room of the power plant at the Frankford Arsenal, Philadelphia. Further information may be obtained upon application to the commanding officer.

HAMMONTON, N. J.—The Council recently authorized Mayor Burt and Town Clerk Seely to sign a contract with the Hammontown Tel. & Teleg. Co. for the installation of a fire alarm system in the homes of the volunteer firemen.

CUMBERLAND, MD.—The Edison El. Illg. Co., of Cumberland, it is reported, contemplates the installation of a 1000-kw turbine.

ALDERSON, W. VA.—The Alderson Lt. & Pwr. Co. is rebuilding and equipping its old plant. The company will furnish electricity for lamps and motors in Alderson.

CULPEPER, VA.—The Culpeper Lt. & Ice Co. expects to purchase within the next few months a Babcock & Wilcox boiler, a 10-in. by 30-in. Corliss engine and a 75-kw General Electric direct-current generator, also one panel for switchboard, three switches with inclosed fuses and an ammeter and voltmeter. Within the next few weeks the company will establish day service for motors. G. F. Major is manager.

FREDERICKSBURG, VA.—The Rappahannock El. Lt. & Pwr. Co., of Fredericksburg, expects to erect within the next three months 4 miles of 6600-volt rural distribution lines and rebuild 9 miles of distributing lines in the city, and also expects to purchase within the next three months two 200-kw alternators (belted), 5 miles of weather-proof wire, 300 poles, 2000 insulators, cross-arms, etc. S. C. Foster is superintendent.

ROCKY MOUNT, VA.—Bonds to the amount of $50,000 have been voted for the installation of water, light and sewer systems. J. L. Ludlow, of Winston-Salem, N. C., is engineer. W. A. Belcher is recorder.

WASHINGTON, D. C.—Bids will be received by the Secretary of the Interior, Department of the Interior, Washington, D. C., until Aug. 13, for furnishing material and labor (unless otherwise specified) required for rewiring the third floor and galleries of the Patent Office Building, Washington, D. C., in accordance with plans and specifications, copies of which may be obtained upon application to the chief clerk of this department. Lewis C. Laylin is assistant secretary.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 5 for miscellaneous wire to be delivered at the Brooklyn navy yard as follows: Schedule 5650—6000 ft. plain interior communication cable, 200,000 ft. plain double flexible portable conductor, 100,000 ft. double flexible silk conductor, 50,000 ft. telephone cord, 250,000 ft. bell wire; Schedule 5649—42,000 ft. duplex rubber-insulated lighting and power wire, 166,000 ft. single rubber-insulated lighting and power wire, 10,000 ft. twisted telephone wire (No. 14). T. J. Cowie is paymaster-general, United States Navy.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until Aug. 8, as follows: Item (1) 1200 ft. rubber-insulated power cable, similar to type 650, specification No. 432-D, except that it shall be three-conductor, each conductor [illegible] and an insulation; (2) 1500 ft. rubber-insulated, lead-covered and armored one-conductor cable, specification No. 580; (3) 1300 ft. rubber-insulated, lead-covered and armored four-conductor cable, specification No. 580; (4) 1000 ft. rubber-insulated, lead-covered and armored two-conductor cable, specification No. 580; each of the above items (2, 3 and 4) to be delivered in one length on one reel; cost of reel to be submitted separately; (5) 18,000 ft. submarine cable, type 325, specification 427-F; (6) 1000 ft. submarine cable, type 325, specification 427-F, same as item 5, except that it shall have a double armor; the outer armor should be of the same size as the other and to be laid on as prescribed in specification 431-C for double-armored cable; items 5 and 6 to be supplied in one length of 19,000 ft. and properly cribbed on a ship in New York Harbor. Major W. L. Clarke is disbursing officer.

## North Central

BAD AXE, MICH.—The managers of the municipal light and water plant expect to purchase within the next three months one 72-in. by 16-ft. boiler complete, with all fittings, for the municipal electric plant. William H. Niswanger is superintendent.

BAY CITY, MICH.—The lighting committee of the Common Council has recommended the adoption of the luminous-arc-lamp system for street-lighting. The cost of installing the system is estimated at $27,000.

DETROIT, MICH.—The Ford Motor Co., it is reported, will soon install a 3000-kw low-pressure turbine in its power plant. Edward Gray is chief engineer.

DEXTER, MICH.—The Eastern Michigan Edison Co., of Detroit, will supply electricity for lamps and motors in Dexter from its plant in Ann Arbor. The company has made arrangements with the Village Board to purchase the local municipal electric-light plant for $9,000, subject to the vote of the people.

GRAND RAPIDS, MICH.—Contracts will soon be awarded by Messrs Brown, Billings and Averill, county poor superintendents, for the installation of a small power plant at the county farm, to cost about $1,000.

NEWBERRY, MICH.—Arrangements, it is reported, are being made by William Horner for the construction of a hardwood flooring mill, which will be equipped with electrically operated machinery. Electricity will be generated by the power plant connected with the mill.

SAULT STE. MARIE, MICH.—The Edison Sault El. Co., of Sault Ste. Marie, expects to erect an addition to its power house within the next six or eight months to provide space for one 500-kw generator and waterwheel, orders for which have been placed; also to make some additions to distribution system, material for which is on hand. William Chandler is vice-president and general manager.

THREE RIVERS, MICH.—The Constantine Hydraulic Co., of Three Rivers, expects to purchase within the next two months recording instruments for station, wattmeters, etc. The company is contemplating the purchase of lamp standards, carrying three and four-lamp clusters; nothing definite has yet been decided upon. H. C. Sterling is manager.

BARBERTON, OHIO.—The City Council has adopted a resolution authorizing the director of public service to engage H. Whitford Jones, 1114 Citizens' Building, Cleveland, as consulting engineer in connection with the construction of the proposed municipal electric-light plant.

BRYAN, OHIO.—The contract for furnishing material and installing the ornamental street-lighting system has been awarded to the Kokomo El. Const. Co., of Kokomo, Ind., to cost about $5,000. The contract provides for the erection of 70 lamp standards, carrying five-lamp (Mazda) clusters. S. E. Folk is superintendent of the municipal light and water plant; John A. Neil city clerk.

COLUMBUS, OHIO.—The City Council has passed an ordinance appropriating $25,000 for extensions to the municipal electric-light plant and lighting system. H. E. Eichhorn is superintendent of municipal plant.

KENT, OHIO.—During the past year the Kent Wtr., Lt. & Pwr. Co. has been changed from 1100-volt, 133-cycle, single-phase, to 2200-volt, 60-cycle, three-phase operation, and new equipment purchased. For the past nine months the plant has been furnishing energy for motor service as well as lighting. S. F. Messer, superintendent.

BURNSIDE, KY.—The Kentucky Utilities Co., of Lexington, which recently purchased the property of the Burnside El. Lt. Co., is erecting a transmission line from Somerset to Burnside, a distance of 9 miles. When completed a 24-hour service will be established.

CALHOUN, KY.—The Green River Lt. & Wtr. Co., of Calhoun, expects to purchase within the next few months a direct-connected generator and will have one for sale (Ball engine and General Electric generator, belted). C. G. Gilmore is manager.

CENTRAL CITY, KY.—The Central City Lt. & Pwr. Co. expects to purchase within the next two months one 150-hp boiler. I. V. Fortney is secretary.

COVINGTON, KY.—Bids will be received by H. G. Klosterman, city clerk, until Sept. 26 for a franchise to construct and operate a street railway system in the city of Covington by electricity or motive power other than steam for a period of 20 years. Approximately 25 miles of track are authorized within the city limits. Further information may be obtained upon application to the city clerk.

EARLINGTON, KY.—Foundations are being laid at Earlington, it is reported, for the new plant of the Central El. Co.

GLASGOW, KY.—The Glasgow El. Lt. & Ice Co. expects to purchase within the next 12 months one 150-kva turbo-generator. B. G. Dickinson is president.

HARDINSBURG, KY.—Prominent citizens, it is reported, are behind a project to organize a company to furnish electricity for the town.

LA GRANGE, KY.—The La Grange Lt. & Pwr. Co. is reported to be contemplating the installation of a street-lighting system.

MORGANFIELD, KY.—The Morganfield Lt. & Pwr. Co. expects to erect within the next six months a new brick power house and to purchase two 200-hp internally fired boilers, two three-phase, 60-cycle, 2300-volt revolving-field belted alternators, one 200-hp engine and main switchboard. F. W. Gilbert is president.

NEWPORT, KY.—The City Commissioners have started a campaign for additional boulevard lamps. The present plan provides for the cost of installation to be paid by the merchants.

CENTERVILLE, IND.—Bids will be received by the Board of Trustees of the town of Centerville until Aug. 8 for the installation of a high-tension transformer station and electric distribution system for the town of Centerville, according to plans and specifications on file in the office of the town clerk, Centerville, and at the office of the *Electrical World*, 239 West Thirty-ninth Street, New York, N. Y. Benjamin C. Gaiser is president of board and Wilbert A. Bertsch town clerk.

INDIANAPOLIS, IND.—Improvements, it is reported, are contemplated by the Merchants' Ht. & Lt. Co., of Indianapolis, to its local plants, involving an expenditure of $100,000. The work will include the installation of a large turbine engine at the West Washington Street power plant. Additional equipment will be installed at the South Jersey Street station, including boilers, increasing the output of the plant by 3000 hp, automatic stokers and other smoke-consuming devices, and also a new switchboard. The company is reported to have closed a contract to furnish energy for the Federal Building. Eleazor Darrow is manager.

KNOX, IND.—The Knox El. Lt. & Pwr. Co. has purchased and expects to install one 16-in by 36-in. Corliss engine within the next two months. The company also expects to change the present street-lighting system to incandescent Mazda lamps before fall. Thomas A. Grist is owner.

NEWCASTLE, IND.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 8, for the construction complete (including mechanical equipment, interior lighting fixtures and approaches) of the United States post office at Newcastle. Drawings and specifications may be obtained at the above office or from the custodian of site at Newcastle, O. Wenderoth is supervising architect.

PERU, IND.—The managers of the municipal electric-light plant expect to erect a distribution line to include the suburb of Oakdale, a distance of about 1½ miles, to furnish energy for manufacturing purposes, and also to purchase within the next few months a water-softening system and six 20-kva, three 10-kva and two 5-kva transformers. G. C. Anderson is manager.

PORTLAND, IND.—The City Council expects within the next 60 days to erect a power house, 40 ft. by 58 ft., for the municipal electric-light plant, and within the next 30 days to purchase one 750-hp Corliss engine and one 500-kw generator, directly connected. Ornamental lamp posts will be erected in the city, doing away with the arc system. At present the wires are being transferred from the streets to alleys. Fred Drury is city electrician.

SCOTTSBURG, IND.—The Indianapolis & Louisville Trac. Co. is contemplating the installation of a complete commercial system in Scottsburg. The municipal plant operates the street-lighting system only, consisting of 80 tungsten lamps of 60 cp, for which energy is supplied by the Indianapolis & Louisville Ry. Co.

TIPTON, IND.—Extensive improvements have been made to the municipal electric-light plant, including the installation of 500-hp boilers and accessories, with building and ground, also other improvements, involving an expenditure of about $20,000. Plans are now being considered to rebuild thoroughly the entire wiring system and to renew the lighting system within the next 12 months. Arthur C. Herrin is superintendent.

BARRY, ILL.—The city of Barry is considering the installation of a municipal electric-light plant. G. W. Nations is engineer. T. M. Dwyer is chairman of light committee.

CANTON, ILL.—Extensive improvements, it is reported, are contemplated by the Canton Gas & El. Co., including the installation of a 1500-kw turbo-generator set. Work will soon begin on the erection of a high-tension line transmission to Glasford to furnish electrical service there.

ELGIN, ILL.—The Chicago Tel. Co. contemplates placing its wires underground and transferring all pole lines in alleys before 1919. The cost of the work is estimated at about $100,000.

HILLVIEW, ILL.—The commissioners of the Hartwell drainage and levee district contemplate the erection of a pumping plant with electrical equipment to operate three 30-in. pumps. Energy will be supplied by the Central Illinois Pub. Ser. Co., of Mattoon.

KEWANEE, ILL.—The Spring Valley Gas & El. Co., which operates in Spring Valley and Versailles, it is reported, will ask the City Council for a franchise to supply electricity for lamps and motors in Kewanee. The installation of an ornamental street-lighting system is contemplated. If granted a franchise, the company will extend its lines from Neponset.

MONMOUTH, ILL.—Petitions are being circulated asking that a special election be called to vote on the proposition to grant the Monmouth Pwr. & Lt. Co. a franchise to operate an electric-lighting system in Monmouth.

NOKOMIS, ILL.—The installation of a municipal electric-light plant in Nokomis is under consideration by the City Council.

STREATOR, ILL.—The Public Ser. Co. of Northern Illinois, it is reported, will erect a large power plant at Spring Lake, near Streator, plans for which are now being prepared.

BEAVER DAM, WIS.—The Beaver Dam Lt. & Pwr. Co. has recently purchased water meters, steam separator, materials for resetting boilers, also poles, wire, hardware, etc., for street-lighting at Horicon. D. C. West is president.

HAMMOND, WIS.—Plans are being considered to discontinue the local gas plant and secure energy for lighting the town from the Burkhardt Milling & El. Pwr. Co., of Burkhardt.

NEW LONDON, WIS.—The managers of the municipal electric-light plant and water-works system expect to erect within the next six months a concrete reservoir and pumping station and lay about 40,000 ft. of 6-in. water mains and about 1200 ft. of 8-in. mains; also to purchase one 150-hp boiler, an engine and generator and one electrically operated pump. O. H. Pribnow is superintendent.

PARDEEVILLE, WIS.—The owners of the local electric-light plant expect to purchase within the next six months six street-lighting fixtures and some washing machines. Joseph Chandler is treasurer and manager.

SPRING VALLEY, WIS.—The Chippewa Valley Ry., Lt. & Pwr. Co., of Eau Claire, has purchased the property of the Spring Valley Lt. & Pwr. Co. A transmission line has been erected from Elmwood to Spring Valley, a distance of 8 miles, and energy from the Menomonie Red Wing line will be used to operate the system here. The local steam plant will be used as an auxiliary.

AURORA, MINN.—The Village Council is considering the installation of additional equipment for the municipal electric-light plant.

BREWSTER, MINN.—The proposition to issue bonds for the installation of a municipal electric-light plant was defeated at an election held recently. W. N. Reestroffe is clerk.

ELIZABETH, MINN.—We are informed that the proposition of installing an electric-light plant in Elizabeth has been abandoned for the present. Joseph C. Rian is clerk.

FARMINGTON, MINN.—The Farmington El. Lt. & Pwr. Co. has recently installed a 240-amp-hr. storage battery at a cost of $3,000 and has established a 24-hour service. F. H. Eddy is manager.

FREEPORT, MINN.—At an election held July 15 the proposition to issue $6,000 in bonds for the construction of a municipal electric-light plant was carried.

HUTCHINSON, MINN.—The Hutchinson Ltg. & Mfg. Co. is making extensive improvements to its properties in Hutchinson and Glencoe as follows: At the Hutchinson plant one 75-kw and one 200-kw General Electric three-phase generator and a 200-kw steam unit will be installed in the near future; also three generator panels, one double-circuit feeder panel, a Tirrill regulator, three General Electric feed regulators and three 40-kva, 13,300-2300-volt transformers. At the Glencoe station one 50-kva General Electric synchronous condenser, one three-phase generator panel for same, one double-circuit feeder panel, one Tirrill regulator panel and three General Electric 40-kva, 13,200-2300-volt transformers will be installed. A three-phase, 60-cycle, 13,200-volt transmission line from Hutchinson to Glencoe, passing through Biscay, 17½ miles long, will be erected. Cedar poles, 42 to the mile, and No. 6 copper wire with ground wire and telephone circuit will be used, and General Electric aluminum-cell lightning arresters. The work is now in progress except the transmission line, for which contract will soon be let. Thomas Pitts is manager of both properties.

OWATONNA, MINN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 1, for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Owatonna. Drawings and specifications may be obtained from the custodian of site at Owatonna, or at the above office. O. Wenderoth is supervising architect.

PAYNESVILLE, MINN.—The town of Paynesville expects to install an ornamental lighting system on about two blocks, using five-lamp clusters. Roy R. Spindler is superintendent of the municipal electric plant.

SAUK CENTER, MINN.—Bids will be received by the State Board of Control, State Capitol Building, St. Paul, until Aug. 13 for erection complete of two cottages at the Home School for Girls, Sauk Center, including the general contract work, heating and ventilating, plumbing and the electrical work and fixtures in accordance with plans and specifications prepared by C. H. Johnson, architect, 715 Capital Bank Building, St. Paul. Copies of plans and specifications may be seen at the Builders' Exchange, St. Paul and Minneapolis, at the superintendent's office at the Home School for Girls, Sauk Center, and at the office of the State Board of Control, State Capitol Building, St. Paul.

SPRING VALLEY, MINN.—The new owner of the Spring Valley electric plant, it is reported, is preparing plans for rebuilding the entire plant.

WOODLAKE, MINN.—A special election will be called to vote on the proposition to issue $9,900 in bonds to establish an electric-light and power plant, including the erection of a transmission line connecting this village with Granite Falls.

CEDAR FALLS, IA.—Contracts for construction of the municipal electric-light and power plant have been awarded to the Murray Iron Works Co., of Burlington, Ia., and the Fort Wayne El. Works. C. H. Streeter is city engineer.

CEDAR RAPIDS, IA.—The Quaker Oats Co., of Cedar Rapids, has awarded a contract to the Iowa Ry. & Lt. Co., of Cedar Rapids, to furnish energy to operate its plant for a period of 50 years. The Iowa Ry. & Lt. Co. is reported to have ordered a new 1500-hp boiler and will soon place contract for a 4000-kw generator. The plant of the Quaker Oats Co. will be dismantled. The contract provides for 3000 hp. The power company is also to furnish steam to the cereal mills for all purposes. A high-pressure main will be built from the power house to the cereal plant.

FONDA, IA.—At an election held recently the proposition to issue bonds to construct a municipal electric-light plant was carried.

GILBERTVILLE, IA.—Steps have been taken by a number of prominent residents of Gilbertville toward the organization of a company to erect an electric-lighting system here. It is proposed to erect a transmission line through the principal streets of the village, connecting with the Waterloo, Cedar Falls & Northern Ry. Co.'s power house near here. The company will be known as the Gilbertville Ltg. Co., and will be capitalized at $2,000. John Nemmers is interested in the project.

MARENGO, IA.—The Marengo Lt. & Pwr. Co. was recently purchased by the Iowa Ry. & Lt. Co., of Cedar Rapids. V. T. Matthews is manager at Marengo.

MAXWELL, IA.—The City Council has passed an ordinance granting C. E. Lookingbill and W. C. Enfield, of the Maxwell El. Lt. & Pwr. Co., a franchise to construct and operate an electric-light plant in Maxwell. A special election has been called for Aug. 5 to ratify the franchise.

MONTEZUMA, IA.—At an election held recently the citizens voted to grant the Oskaloosa Trac. & Lt. Co., of Oskaloosa, recently taken over by the McKinley interests, a 25-year franchise to furnish electricity here. A transmission line will be erected from Oskaloosa to Montezuma. The company agrees to furnish a 24-hour service.

NEW HARTFORD, IA.—A 20-year franchise has been granted to local parties for the installation of an electric-light plant in New Hartford. The contract for equipment, wiring and installing plant has been awarded to Charles Simonsen, of Cedar Falls. The cost of plant is estimated at $10,000.

OSAGE, IA.—The Osage El. Lt., Ht. & Pwr. Co., it is reported, will build a new concrete dam on Cedar River. Additional machinery costing $15,000 will be installed in the electric-light plant. W. J. Ferris is president of the company and Robert Ferris is secretary and treasurer.

POMEROY, IA.—Bonds to the amount of $15,000 have been voted for the installation of an electric-lighting system here. A transmission line will be erected to connect with the Northern Iowa Pwr. Co.'s line near Pocahontas.

SHELDON, IA.—The Sheldon Lt. & Pwr. Co. erected last year 1.5 miles of line for pumping the city water, installing a 25-hp Century motor. The company is now installing 32 five-lamp electroliers, using 2400 ft. of steel-taped cable. O. E. Logan, owner.

SIOUX CITY, IA.—The Sioux City Service Co. is erecting an addition to its power plant and has purchased two 400-hp Stirling boilers, two Green grate stokers, a 3000-ft. air-compressor, two 16-in. wells and a new 18-panel Westinghouse switchboard. E. L. Kirk is general manager.

VALLEY JUNCTION, IA.—The City Council has adopted a resolution authorizing the purchase of the local electric plant for $10,000. Nothing definite on construction has been decided upon.

VILLISCA, IA.—An agreement has been reached by the City Council and the Villisca Public Service Company whereby the company is granted a 25-year franchise, subject to the approval of the voters. Energy for operating the system, it is reported, will be furnished by the Red Oak El. Co.

WINTERSET, IA.—Two new engines, 72 in. by 18 ft., high-pressure tubular boilers, are being installed in the municipal electric-light plant. L. O. Klein is superintendent.

BLACKWATER, MO.—The installation of a municipal electric-light plant in Blackwater is under consideration.

ELSINORE, MO.—The McDonald Charcoal Co., of Elsinore, is reported to be contemplating the installation of an electric plant in connection with its proposed furnace and chemical plant. L. W. Searles, Woodward Building, Birmingham, Ala., is engineer and general manager of the company.

MARCELINE, MO.—Bonds to the amount of $10,000 have been voted, the proceeds to be used for improvements to the municipal electric-light plant.

SLATER, MO.—The managers of the municipal electric-light plant expect to purchase within the next few months one 350-kw water turbine or Corliss engine. L. E. Shepherd is superintendent.

BOWBELLS, N. D.—The City Council has granted J. M. Bearden, of Grayville, Minn., a franchise to erect and maintain an electric-light plant in Bowbells.

MAYVILLE, N. D.—Bids will be received at the office of the State Normal School at Mayville until Aug. 19 for the installation, including labor and materials, of a system of automatic temperature regulation in the main building. Separate bids will be received at the same time and place for rewiring by conduit system, including all work and materials, except fixtures, of the same building for electric lighting. Thomas A. Hillyer, of Mayville, is president.

MAYVILLE, N. D.—Contracts for construction of a water, light and power plant at Mayville have been awarded as follows: For power house to the Boyd Construction Co., of St. Paul, Minn., at $8,108; reinforced concrete stack to the Concrete Metal Chimney Co., of St. Louis, Mo., at $1,435; boilers, engines, generators and pumps installed complete to the Northwestern El. Equipment Co., of St. Paul, Minn., for $19,383, and for sewer and water connections to M. Barr, of Mayville, at $3,074. The Oscar Claussen Engineering Co., of St. Paul, Minn., is consulting engineer.

MOBRIDGE, S. D.—Bids will be received by the city auditor of the city of Mobridge until Aug. 11 for the installation of an electric-lighting system as follows: (1) For furnishing all material and labor for installing 12 Cutter's Riverside ornamental lamp-posts, three lamps to post, with bulbs and globes complete, to be connected up with underground lacquered conduit, No. 6 copper wire, all to be attached ready for service; (2) separate bids for material f.o.b. Mobridge, as in proposition 1, and for installing said material; (3) for furnishing and installing electric lamps at 12 different points, more or less, on Grand Crossing Avenue, cedar poles, 7-in. tops, equal to those now in use by the electric-light company, each lamp to be equipped with material equal to the one standard Cutter's street hood (three 60-watt Mazda lamps); separate bids for material and installation as in proposition 3. Material f.o.b. Mobridge. Charles H. Smith is Mayor and W. L. Youngman is city clerk.

ALMA, NEB.—Bids will be received until Aug. 12 by J. B. Billings, Mayor, or A. H. Reed, city clerk, for two 100-hp tubular boilers, one 80-hp and one 75-hp Corliss engine, one 50-kva, 60-cycle, 2300-volt generator and one 2-kw, 125-volt generator with accessories.

DAVID CITY, NEB.—The city of David City is contemplating the construction of a municipal electric-light plant. The proposed plant will be driven by a gas engine. The work will also include the construction of four blocks of subsurface conduits. L. L. Thompson is city clerk.

DESHLER, NEB.—The Deshler Lt. & Pwr. Co., it is reported, contemplates the installation of a large steam engine. The company is planning to increase the output of its plant in order to supply energy to all towns in Thayer County.

HOWELL, NEB.—The electric light commission expects to purchase about $300 worth of incandescent lamps. George Lodes is village clerk.

OSMOND, NEB.—The Leedom-Coons-Leedom El. Co., of Osmond, expects to purchase within the next six months storage batteries for 110-volt service on day circuit. J. W. Leedom is manager.

PRAGUE, NEB.—Within the next three months the managers of the municipal electric-light plant expect to erect a new cement-block power house for a water and electric-light plant, and within the next two months they expect to purchase Mazda lamps, for which contract has been placed. For further information address Anton Kasper. Milo Fabian is engineer.

SALEM, NEB.—The installation of a municipal electric-light plant in Salem is under consideration.

UNIVERSITY PLACE, NEB.—The municipal electric-light commission expects to purchase within the next year one deep-well pump, and within the next six months some plant devices, line material and lamp-posts. F. Harbican is a member of the committee.

VERDON, NEB.—The installation of a municipal electric-light plant in Verdon is under consideration.

ARMA, KAN.—The Commercial Club has instructed the executive committee to look into the matter of installing an electric-light and power plant and water-works system in Arma. A. E. Sellsman is secretary of the club.

CAWKER CITY, KAN.—The power plant of the El. Lt. & Pwr. Co. of Cawker City is reported to have been destroyed by fire, causing a loss of from $12,000 to $14,000.

CLAY CENTER, KAN.—The installation of the new ornamental street-lighting system (five-lamp clusters) in connection with the municipal electric-light plant is nearly completed.

COLDWATER, KAN.—The managers of the municipal electric-light plant expect to purchase within the next three months one 100-hp to 150-hp oil engine, one 75-kw to 100-kw, three-phase, 60-cycle, 2300-volt generator, switchboard for 75-kw to 100-kw generator and material for extension to water and light mains. L. A. Baldwin is superintendent.

DODGE CITY, KAN.—The Midland Wtr., Lt. & Ice Co., of Dodge City, expects to purchase within the next two months one 200-kw generating unit complete, either turbine or engine driven. The present plant generates three-phase, 60-cycle, 2300 volts.

EL DORADO, KAN.—The El Dorado El. & Refrigerating Co. expects to purchase within the next three months a synchronizing set for two two-phase, 2400-volt, belt-driven alternators. F. A. Pielsticker is manager.

ELLIS, KAN.—Within the next six months the town of Ellis expects to purchase for the municipal electric-light plant one 50-kw, three-phase, 2300-volt alternator, one 80-hp oil engine and one single-panel board for above unit. D. C. Watkins is superintendent.

HANOVER, KAN.—The managers of the municipal electric-light plant expect to purchase within the next four months incandescent lamps, some household labor-saving devices and wiring supplies. J. G. Granzer is superintendent.

JETMORE, KAN.—Bonds to the amount of $10,000 have been issued for the installation of water and light systems. Arrangements are being made to raise the issue to $16,000. Materials and supplies have not yet been purchased. Worley & Black, Reliance Building, Kansas City, Mo., are consulting engineers. L. W. Hubbell is city clerk.

LEBANON, KAN.—The installation of a municipal electric-light plant is under consideration.

MARION, KAN.—The city of Marion is contemplating the installation of steam engines and boilers in the municipal electric-light and water plant. H. A. Rowland, of McPherson, is engineer.

SHADY BEND, KAN.—The Shady Bend Milling & Pwr. Co. expects to erect within the next 12 months transmission lines to the towns of Beverly, 2½ miles distant; thence to Tescott and Culver. The three towns are within 15 miles, all on the same line.

SOUTH HAVEN, KAN.—The South Haven El. Lt. Co. expects to purchase within the next six months one 50-hp internal-combustion engine with generator directly connected. J. R. Britton is manager.

ST. PAUL, KAN.—At an election held recently the proposition to issue bonds to the amount of $12,000 for the installation of a municipal electric-light plant was carried.

STERLING, KAN.—The Morris Electrical Pwr. Co., of Sterling, expects to purchase within the next 30 days one 50-kw generator and one 60-hp oil engine and switching equipment for same. C. H. Love is manager.

TOPEKA, KAN.—The city of Topeka expects to purchase within the next six months one 500-hp exhaust-steam, open feed-water heater for the municipal electric-light plant. The installation of a 500-kva, 60-cycle, 2200-volt generator has just been completed. The contract for extension to the ornamental street-lighting system has been awarded to the Tucker Electrical Co., of Topeka, for $15,000. The contract provides for the installation of 92 ornamental lamp standards, carrying five-lamp clusters. Elmer G. Stahl is superintendent.

WAMEGO, KAN.—The managers of the municipal electric-light and water plant expect to purchase within the next three months one Tirrill regulator for voltage regulation of two alternating-current generators. D. A. Course is superintendent.

## Southern States

RANDLEMAN, N. C.—The Randolph Pwr. Co., of Randleman, has recently installed a 50-hp Adams oil engine to carry the plant during light-load periods. C. W. Petty is secretary and treasurer.

ST. PAULS, N. C.—The St. Pauls Lt. & Pwr. Co. expects to purchase within the next two months No. 8 weatherproof wire, transformers and tungsten lamps.

LAKE CITY, S. C.—Bonds to the amount of $7,500 have been voted for the installation of an electric-light system here.

SENECA, S. C.—The Seneca Oil Mill, it is reported, is planning to install one 100-hp and three 75-hp induction motors, for use on three-phase, 40-cycle, 2300-volt circuit, to operate oil mill and ginnery.

REIDSVILLE, GA.—The City Council has awarded contract to the Modern Equipment Co., of Savannah, for the installation of a municipal electric-light plant, to cost about $6,000.

SOUTH JACKSONVILLE, FLA.—Bonds to the amount of $65,000 have been voted, the proceeds to be used for extension of water, sewer and electric-light systems, street paving, building city hall, etc. E. M. Gibbons, of South Jacksonville, is designing engineer.

DAYTON, TENN.—The Rhea County court has granted franchises to the Tennessee Pwr. Co., to J. W. Adams and associates for the interurban line through Rhea County from Chattanooga to Knoxville, and to the Rhea County El. Lt. Co.

LEBANON, TENN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 25 for construction (including mechanical equipment, interior lighting fixtures and approaches) of the United States post office at Lebanon, Tenn., Drawings and specifications may be obtained at the above office or from the custodian of site at Lebanon. O. Wenderoth is supervising architect.

MEMPHIS, TENN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 7, for conduit and wiring system in the United States Marine Hospital, Memphis, Tenn., in accordance with drawing and specification, copies of which may be obtained at the above office or at the office of custodian, Memphis. O. Wenderoth is supervising architect.

ATHENS, ALA.—At an election to be held Aug. 4 the proposition to sell the municipal electric-light plant to the Alabama Pwr. Co. will be submitted to the voters. The company offers $12,000 for the plant, franchise, etc.

MAGNOLIA, ARK.—The Standard Ice & Lt. Co., of Magnolia, expects to purchase within the next two months incandescent lamps and within the next three months miscellaneous wiring supplies. A. J. Carter is president.

WELSH, LA.—We are informed that the Council is contemplating the installation of a municipal electric-light plant, but as yet no engineer has been engaged. L. E. Robinson is chairman of the special committee appointed to look into the matter.

DARLINGTON, OKLA.—The industrial building at the Masonic Orphans' Home, near Darlington, was recently destroyed by fire, causing a loss of about $30,000. The loss on the light and power equipment is estimated at $8,000.

GOTEBO, OKLA.—The local electric-light plant, owned by H. Weiss, was recently destroyed by fire.

PAWHUSKA, OKLA.—The alfalfa mill, which furnished energy for operating the municipal electric-light and water-works system, was recently destroyed by fire. At present the town is without electrical service. Efforts will be made to rebuild the mill at once.

BUDA, TEX.—It is reported that J. E. Watkins, of Buda, contemplates the installation of a hydroelectric power plant. Mr. Watkins would like to receive catalogs and estimates on water turbines, dynamo and motor equipment for proposed plant.

DALLAS, TEX.—The Texas Trac. Co., it is reported, will soon begin the erection of its large shops near Trinity Heights, in Dallas. The company is now erecting an electric substation near the site of the proposed shops.

DALLAS, TEX.—The Dallas Southwestern Trac. Co., recently organized, contemplates the construction of an electric interurban railway from Dallas to Glen Rose, via Cleburne, a distance of 80 miles, and a branch line from Eagle Ford to Irvin, 10 miles long. The same interests are organizing the Dallas Northwestern Trac. Co., which proposes to construct an interurban electric railway from Dallas to Krum, via Benton, a distance of about 46 miles. Surveys for the proposed lines, it is said, are nearly completed and financial arrangements are reported to have been made. Among the directors are: E. P. Turner, John T. Witt, of Dallas; W. B. Knight, of Mansfield; W. Poindexter and D. Strickland, of Cleburne, and B. M. Sansom of Alvarado.

FORT WORTH, TEX.—The Fort Worth Pwr. & Lt. Co. has increased its capital stock from $3,560,000 to $3,860,000. The company, it is understood, will make improvements to its plant.

HOUSTON, TEX.—The Texas Pub. Ser. Co., of Houston, recently organized to operate in Gilmer, Mount Pleasant, Bay City and Vernon, Tex., contemplates the construction of a power plant. Equipment for the proposed plant has not yet been decided upon. The company will furnish electricity, gas and water. The Robert McCandlish Engineering Co., of Kansas City., Mo., has charge of the engineering work. The Texas company is managed by the Albert Emanuel Co., of Dayton, Ohio.

LULING, TEX.—The City Council is negotiating for the purchase of the local electric-light plant and water-works system. Both plants will be improved, it is said, if taken over by the city.

MARBLE FALLS, TEX.—The city of Marble Falls is contemplating the installation of a municipal electric-light plant and water-works system. The proposed electric plant will have sufficient output to furnish energy for street-lighting, residential and commercial lighting (about 500 houses), and about 300 hp for manufacturing purposes. As yet an engineer has not been appointed. R. E. Johnson is Mayor.

MARFA, TEX.—The Marfa Lt. & Ice Co. is reported to be contemplating the installation of an auxiliary electric-light and power plant in Marfa.

MASON, TEX.—The Mason Ice & Pwr. Co. expects to purchase within the next ten months some wiring supplies. F. C. Beyer is manager.

McGREGOR, TEX.—The McGregor Wtr. & Lt. Co. expects to expend within the next 12 months $300 for meters, $300 in lamps and $100 for electrical appliances and supplies.

PENIEL, TEX.—Arrangements have been made whereby electricity will be secured for operating the local system from the municipal plant at Greenville.

PLANO, TEX.—The Wilcox Lt. & Pwr. Co., of Plano, will do considerable line improvement work in Plano, also in Melisa, Anna and Howard before the winter season. The company has recently installed an electric system in Richardson, furnishing electricity for both lamps and motors. Energy is secured from the Texas Trac. Co., through 19,000-volt, three-phase, 25-cycle Moloney transformers of 75-kva capacity. C. W. Potts is manager.

PLEASANTON, TEX.—The Pleasanton El. Lt. & Pwr. Co. is erecting an electric-light plant here.

ROCKPORT, TEX.—The Rockport Ice & Lt. Co. expects to purchase within the next 12 months poles and wire for its electric system. G. E. Fussell is president and general manager.

SHERMAN, TEX.—Plans and specifications for the new power house to be erected on Austin College campus are reported to have been accepted and work will begin as soon as contract is awarded. Plans are nearly completed for the new administration building, contract for which will soon be let. These buildings are to replace the ones burned last fall.

WEST, TEX.—The Brazos Valley Tel. Co. is contemplating improvements to its system, involving an expenditure of about $10,000.

## Pacific States

BELLINGHAM, WASH.—We are informed that the city of Bellingham has entered into a contract with the Puget Sound Trac., Lt. & Pwr. Co. for lighting the streets of the city for a period of three years. The city was recently reported to have voted in favor of the construction of a municipal electric-light plant.

CRESTON, WASH.—The Washington Wtr. Pwr. Co., of Spokane, it is said, will erect at once a transmission line from Davenport to Wilbur, Almira, Hartline, Coulee, Ephrata and Creston.

KIRKLAND, WASH.—The City Council has granted the Puget Sound Trac., Lt. & Pwr. Co., of Seattle, a franchise to furnish electricity for lamps and motors in Kirkland for a period of 50 years. A transmission line will be erected into the city at once, and, it is understood, a substation will be erected near here.

MONTESANO, WASH.—The City Council has granted F. Norton Babo and F. L. Harung a franchise to construct and operate an electric-light plant and water system here. For further information address F. Norton Babo, of Montesano.

MONTE CRISTO, WASH.—The American Mining Co. will soon install a hydroelectric plant (60.-ft. head) in Monte Cristo. Daniel Keyes, of Monte Cristo, is superintendent.

NORTH YAKIMA, WASH.—The Portland Pwr. & Lt. Co., of Portland, Ore., it is reported, will build a 3500-hp auxiliary power plant in the Naches Valley, near its large power plant there, which will soon be placed in operation. D. F. McGee, of Portland, Ore., is chief engineer.

SEATTLE, WASH.—The County Commissioners of Kings County have granted the Puget Sound Trac., Lt. & Pwr. Co., of Seattle, a 50-year franchise to erect transmission lines along the county roads to Kirkland and Redmond, also over certain streets in this city north of Eighty-fifth Street.

SPOKANE, WASH.—Contracts for the electrical installation, wiring, etc., for the Davenport Hotel, now under construction, have been awarded to the Spokane Engineering Co., of Spokane, and to the NePage & McKenna Co., of Seattle, for $21,000.

SPOKANE, WASH.—A special committee has been appointed by the City Council to look into the matter of acquisition by purchase or condemnation of a power site on the Spokane River for a municipal electric-light plant. The cost of building plant and distributing system is estimated at about $2,000,000. C. M. Fassett, Commissioner of Public Utilities, is a member of the special committee.

SPOKANE, WASH.—The Washington Wtr. Pwr. Co., of Spokane, is reported to have purchased the properties of the Idaho-Washington Lt. & Wtr. Co. in St. Maries, Moscow, Troy and Genesee, in Idaho, Tekoa, Farmington, Pullman, Palouse, Garfield, Uniontown, Oaksdale and Colton, in Washington. It is understood that extensions and improvements will be made to the properties. D. L. Huntington, of Spokane, is president of the Washington Wtr. Pwr. Co.

WOODLAND, WASH.—The local electric-light plant, owned by William Lawler, was recently purchased by the Washington-Oregon Corpn., of Chehalis. The new owners, it is understood, will make improvements to the plant.

COQUILLE, ORE.—The Oregon Pwr. Co., of Albany, which was recently granted a 20-year franchise by the City Council, it is reported, will soon begin work on the erection of a transmission line to Coquille. A substation will be erected here.

CORVALLIS, ORE.—At an election held recently the proposition to build a municipal electric-light plant in Corvallis was carried.

ELGIN, ORE.—The Eastern Oregon Co-operative Tel. Association contemplates the erection of several new telephone lines in this territory in the near future. The company, it is said, will issue $30,000 in bonds to carry out the proposed work. J. McKinnis is president of the company.

PORTLAND, ORE.—The City Council has instructed City Commissioner Deick to prepare plans and specifications for lighting the streets of the city. The Portland Ry., Lt. & Pwr. Co. has the present contract for lighting the city, which will soon expire.

SALEM, ORE.—The State Engineering Department has recently announced filings for water rights as follows: To B. T. McBain, of Oregon City, calling for the development of 12,000 hp on the Clackamas River; to the Dry Gulch Co., of Richland, appropriating the water of Eagle Creek for the development of 16,000 hp, and to B. F. Jones, who contemplates the development of 1000 hp on the Siletz River, Lincoln County. Further information may be obtained regarding the above filings by addressing State Engineer Lewis, Salem, Ore.

FORT BIDWELL, CAL.—The installation of an electric-light and power system in Fort Bidwell, to cost about $7,500, is under consideration.

PASADENA, CAL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 11, for construction (including mechanical equipment, interior lighting and approaches) of the United States post office at Pasadena. Drawings and specifications may be obtained from the custodian at Pasadena or from the above office. O. Wenderoth is supervising architect.

QUINCY, CAL.—The local electric-light plant, owned by the Quincy El. Lt. & Pwr. Co., was recently destroyed by fire. It is understood that the plant will be rebuilt at once. F. G. Gansner is manager.

SAN FRANCISCO, CAL.—The State Railroad Commission has granted the Electric Gas & E[illegible] authority to purchase the lands and water rights from the United Wtr. & Pwr. Co. The water rights thus acquired are to be used for further developments of the Bear River hydroelectric projects in Placer County.

SAN FRANCISCO, CAL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 2, for construction (including mechanical equipment, interior lighting fixtures and electric protection) of two interior money vaults for the new building for the United States Sub-treasury at San Francisco. Drawings and specifications may be obtained from the superintendent of construction, San Francisco, or at the above office. O. Wenderoth is supervising architect.

HAILEY, IDAHO.—The Cramer El. Co., of Hailey, expects to erect within the next two months a 6600-volt transmission line north to Ketchem, a distance of 2 miles, and west to mines now using steam, about 4 miles distant. M. B. Herron is superintendent.

MINIDOKA, IDAHO.—The Secretary of the Interior has directed the Reclamation Service to execute a contract with the Standard Underground Cable Co., of Los Angeles, for furnishing copper wire for the Minidoka irrigation project. The contract amounts to $14,056.

MOUNT PLEASANT, UTAH.—The city of Mount Pleasant is building a new power plant, which will probably be completed in about two months. The city, it is understood, will take over the electric plant of the Mount Pleasant Mill & Pwr. Co. in August. A. C. Wall is manager of the Mount Pleasant company.

ST. GEORGE, UTAH.—Within the next two months two blocks of high-voltage distribution line will be erected to furnish energy to the Nelson Mercantile Co., the St. George Ice Co. and the St. George Amusement Co. The city expects to purchase within the next six months 1000 ft. of 12-in. penstock for the municipal power plant, one high-pressure governor and 12 5-amp meters. M. Kemp is city electrician.

PHOENIX, ARIZ.—The board of governors of the Salt River Valley Water Users' Association has awarded the contract for construction of a new electric-power station at the Hole-in-the-Rock to Marin & Gallis, of Phoenix.

PHOENIX, ARIZ.—The Salt River Valley Water Users' Association, of Phoenix, expects to erect within the next nine months a power house for a 6000-hp hydroelectric power plant. All equipment for proposed plant has been purchased. The association sells energy at wholesale.

GRAND JUNCTION, COL.—The Grand Junction El. Gas & Mfg. Co. and the Grand Junction & Grand River Valley Ry. Co. have offered their entire holdings, which include the electric, gas and ice plants, the city street-car system and the interurban railway to Fruita, to the city of Grand Junction for $1,333,000. Eugene A. Sunderlin, of Colorado Springs, is president of both companies.

RICO, COL.—The Rico Mining Co. has just installed three 60-hp boilers, one 125-hp Ideal steam engine, and one 200-hp waterwheel, giving the plant a total output (steam and hydroelectric power) of 350 hp. The company furnishes electricity to a quartz mill operated by the Rico Wellington Co., of Provo, Utah. George E. Hicks is superintendent of power station.

## Canada

EDMONTON, ALTA.—The Canadian government, it is said, will erect 2400 miles of rural telephone lines during the remainder of the year. The cost of the work is estimated at $2,000,000. For further information address W. J. Harmer, deputy minister of telephones.

MEDICINE HAT, ALTA.—By-laws have been voted for municipal improvements as follows: For extensions to water-works system, $85,000; for new water-works south of the town, $225,000; for fire apparatus, $17,000, and for electric-light plant, $67,000.

REVELSTOKE, B. C.—The municipal lighting plant is erecting a 10-wire lead 1½ miles long and is installing a tungsten street-lighting system, for which the material has been purchased. C. North, superintendent electrical department.

VANCOUVER, B. C.—The British Columbia El. Ry. Co. experts to complete within the next four months two hydroelectric generating stations and one 17-mile 60,000-volt transmission line, one 60,000-11,000-volt transformer station and three sub-stations. W. V. Hunt is electrical engineer.

FREDERICTON, N. B.—The Fredericton Gas Lt. Co. has purchased and expects to install within the next three months a 375-kw Westinghouse Parsons turbine and Wheeler condensing apparatus, exciter set, air pump, circulating pump, etc., and switching equipment for above equipment. Luke S. Morrison is secretary.

AMHERST, N. S.—The contract for the extension to the South Park Street transformer station of the Maritime Coal, Ry. & Pwr. Co. has been awarded to Rhodes, Curry & Co.

CHIGNECTO, N. S.—The Maritime Coal, Ry. & Pwr. Co. has awarded the contract for extension to its electric power station in Chignecto, to J. N. Page, of Amherst. It is understood that steam and electric equipment will be required.

AURORA, ONT.—On Aug. 4 by-laws will be submitted to the ratepayers asking for an appropriation of $15,000 to provide for the purchase of pumps at a cost of $5,000 and $10,000 for improvements to the electrical distributing system. The ratepayers recently voted to secure energy from the Toronto & York Radial Ry. Co.

GODERICH, ONT.—The Town Council contemplates installing a lighting system for parks and bridges.

LONDON, ONT.—The townships of McGillivray and East and West Williams, in Middlesex County, and Hay, Stephen and Bosanquet, in South Huron, are considering the development of a hydroelectric plant on the Au Sable River, to cost about $100,000.

NORTH TORONTO, ONT.—Arrangements are being made to discard the present street-lighting system and install lamps similar to those in use in the city of Toronto, at a cost of about $40,000.

OTTAWA, ONT.—Tenders will be received by the city of Ottawa until Aug. 14 for furnishing 47,000 ft. of underground lead-covered cables and 14 induction regulators. Specifications may be obtained from J. E. Brown, electrical superintendent.

TORONTO, ONT.—The ratepayers of Ayr and the neighboring villages of Princeton, Drumbo and Plattsville on July 21 voted in favor of by-laws to contract with the Hydro-Electric Power Commission for electrical service.

TORONTO, ONT.—The Hydro-Electric Power Commission of Ontario has decided upon immediate development and expansion of the hydroelectric system. Contracts have been awarded for the construction and equipment of the plant at Wasdell's Falls, where the commission will undertake its initial project of generating its own power. Contracts have also been awarded for the enlargement of the Dundas, London and St. Johns stations and for the construction of Prescott transformer station.

WALLACEBURG, ONT.—The Premier El. Lt. & Pwr. Co., of Wallaceburg, is erecting a 150-hp gas engine and a 250-kva alternator, driven by gas engine on one side and steam engine on the other. The plant is being changed from 133 to 60 cycles. The company has amalgamated with the gas company and is now known as the Wallaceburg Gas Co., Ltd. W. R. Waghorne is manager.

BUCKINGHAM, QUE.—The Electric Reduction Co., Ltd., of Buckingham, is installing a hydraulic development of about 3200 hp. It is understood that about one-half of the power will be utilized to generate electrical energy. W. A. Williams is managing director of the company.

WOLSELEY, SASK.—The Central Lt. & Pwr. Co., of Wolseley, expects to erect within the next two months one 30-kw, 60-cycle, 2300-volt generator in connection with its auxiliary 50-hp oil engine, belt-driven, to relieve the 50-kw generator now in use; also to purchase within the next three months 50 electric irons and 20 washing machines, and to furnish a day service two mornings per week for same. Within the next two months it is expected that a by-law will be voted authorizing the purchase of this plant by the town. Charles Stengal is manager of the company.

YORKTON, SASK.—The managers of the municipal electric-light plant expect to erect within the next three months one 500-hp Diesel engine directly connected to a 400-kva, three-phase Siemens & Halske alternator and Westinghouse switchboard; also to purchase within the next six months a 500-hp direct-connected unit (Diesel engine), Tirrill regulator and 65 lamp standards (five-lamp clusters). M. M. Inglis is superintendent.

## Miscellaneous

CIENFUEGOS, CUBA.—The Cienfuegos El. Lt. & Pwr. Co. has purchased the property and franchises of Octavio M. Font & Co., who owned and operated the local electric-light plant. Octavio M. Font has been appointed general manager of the company.

MELBOURNE, AUSTRALIA.—The Postmaster General at Melbourne, Australia, invites tenders for cables, telephones, switchboards, etc., as follows: For 105 miles of paper-insulated, lead-covered cable (Schedule 906); 300 coin collecting devices, electrically controlled (Schedule 916); telephones (Schedule 301); switchboards (Schedule 302) and electric lamps (Schedule 304). Particulars may be obtained of the High Commissioner for the Commonwealth of Australia, 72 Victoria Street, London, Eng.

MELBOURNE, AUSTRALIA.—Tenders will be received at the office of the Deputy Postmaster-General, Melbourne, Australia, until Sept. 16, for switchboards and telephone parts as follows: (1) An automatic or semi-automatic switchboard and parts (Schedule 859); a common-battery multiple switchboard (Schedule 860). Copies of specifications and forms of tender may be obtained from the High Commissioner for the Commonwealth of Australia, 72 Victoria Street, London, Eng.

# New Incorporations

DOVER, DEL.—The Rising Sun Water, Lt. & Pwr. Co., of Dover, has been incorporated with a capital stock of $15,000. M. Hirons, of Dover, is principal incorporator.

[illegible] N. Y. has been incorporated with a capital stock of $5,000.

# Directory of Electrical Associations, Societies, Etc.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, H. O. nson, Mobile, Ala.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Permanent cretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTRIC RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary-easurer, Matthew R. Boylan, Public Service Railway Co., Newark, N. J. nnual convention, Atlantic City, N. J., Oct. 13-17.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, H. C. Donecker, West 39th St., New York. Annual convention, Atlantic City, N. J., ct. 13-17.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION. Secretary, . C. Donecker, 29 West 39th St., New York. Annual convention, At-tic City, N. J., Oct. 13-17.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, ehigh University, South Bethlehem, Pa. Semi-annual meeting, Denver, pt. 9-11.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. J. Wil-d Travell, 27 East 11th St., New York.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary, Eugene . Stern, 101 Park Ave., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. itchinson, 33 West 39th St., New York. Board of directors meets onthly. Sections and branches in the principal electrical centers roughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State niversity, Columbus, Ohio. Annual meeting, Atlanta, Ga., December.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, dgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secre-ry, Edwin A. Scott, 29 West 39th St., New York.

AMERICAN WATER WORKS ASSOCIATION. Secretary, J. M. Diven, 47 ate St., Troy, N. Y. Annual meeting, May, 1914.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, W. Tharp, Little Rock, Ark. Annual meeting, May, 1914.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Geo. C. olberton, Pacific Gas & Electric Co., San Francisco, Cal. Annual meet-g, Cooperstown, N. Y., Sept. 8-11.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, mes Farrington, Steubenville, Ohio. Annual meeting, New York, Sept. -27.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, s. A. Andreucetti, Chicago & Northwestern Railway, Chicago. Annual eeting, Chicago, Oct. 20-24.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. . Drew, 112 West Adams St., Chicago. Annual meeting, New Orleans, ay 19-22, 1914.

CALIFORNIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, W. S. anbridge, 1408 Merchants' National Bank Building, Los Angeles, Cal. nnual convention, Santa Barbara, Aug. 16.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, H. G. Martin, Toronto lectric Light Co., Ltd., Toronto, Can.

COLORADO ELECTRIC CLUB. Secretary, C. F. Oehlmann. Meets every hursday at Albany Hotel, Denver, Col. Annual meeting, Denver, Oct. 6.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secre-ry, Thomas F. Kennedy, 900 15th St., Denver, Col. Annual meeting, enver, Oct. 6.

ELECTRIC CLUB OF CHICAGO. Secretary, Fred M. Rosseland, Monadnock lock, Chicago. Meets every Thursday noon at Hotel Sherman.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secre-ry, Geo. W. Russell, Jr., 25 West 42d St., New York.

ELECTRICAL CONTRACTORS' ASSOCIATION OF THE CITY OF CHICAGO. Sec-tary, M. N. Blumenthal, 179 West Washington Street. Meets at noon on the second and fourth Wednesday of each month at 424 South Wabash Ave.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secre-ry, Ernest S. Cowie, 1613 Grand Ave., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert eitermann, 626 Lloyd St., Milwaukee, Wis. Annual meeting, Aug. 7-12.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederick P. ose, 1343 Marquette Building, Chicago. Annual meeting, Chicago, ovember.

ELECTRICAL CREDIT ASSOCIATION OF PHILADELPHIA. Secretary, John W. rum, 1324 Land Title Building, Philadelphia, Pa.

ELECTRICAL DEVELOPMENT ASSOCIATION, INC. Secretary, Zenas W. arter, 53 State St., Boston, Mass.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 ichigan Ave., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Frank-n Overbagh, 411 South Clinton St., Chicago, Ill. Annual meeting, ebruary or March, 1914.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. tavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, lbert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. leeting, San Francisco, second Thursday of each month.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, Harvey Rob-inson, 124 West 42d Street, New York. Annual convention, Chicago, Oct. 27 and 28.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA, NEW ENGLAND SECTION. Secretary, L. L. Edgar, 39 Boylston St., Boston.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York. Annual meeting, New York, October.

FARADAY ELECTRICAL ASSOCIATION. Secretary, W. J. Collins, 1129 Masonic Temple. Meets at noon on the first and third Wednesday of each month at Planters' Hotel.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla. Annual meeting, May, 1914.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, J. D. Israel, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia, Chicago and Pittsburgh. Annual meeting, Pittsburgh, Sept. 22-26.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, A. Newburger, 1153 Myrtle Ave., Brooklyn, N. Y.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary and treasurer, J. V. Zartman, 49 Lombard Building, Indianapolis, Ind. Annual meeting, Indianapolis, Sept. 24 and 25.

INSTITUTE OF OPERATING ENGINEERS. Secretary, L. Houmiller, 29 West 39th St., New York. Annual meeting, New York, Sept. 5.

INSTITUTE OF RADIO ENGINEERS. Secretary, E. J. Simon, 81 New St., New York. Annual meeting, New York, January, 1914.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex. Annual meeting, Watertown, N. Y., Aug. 19-22.

INTERNATIONAL COMBUSTION ENGINEERS' ASSOCIATION. President, Charles Kratsch, 416 West Indiana St., Chicago. Meeting second Friday of each month at Lewis Institute.

INTERNATIONAL ELECTRICAL CONGRESS. Secretary, J. A. Barr, Exposition Building, San Francisco, Cal. San Francisco, Sept. 13-18, 1915.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England. Next plenary meeting, Berlin, Sept. 2-6, 1913. Meeting at San Francisco, Sept, 6-11, 1915.

IOWA ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Secretary, H. B. Maynard, Waterloo, Ia.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia. Annual meeting, Cedar Rapids, April 23, 1914.

JOVIAN ORDER. Jupiter (president), F. E. Watts, 239 West 39th St., New York; Mercury (secretary), E. C. Bennett, St. Louis, Mo. Annual meeting, Hotel Astor, New York, Oct. 14-16.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary-treasurer, Ivor Thomas, 237 South Main St., Wichita, Kan.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, W. H. Bower Spangenberg, 625 Poydras St., New Orleans, La. Meets second Thursday of each month.

MAINE ELECTRIC ASSOCIATION. Secretary, Walter S. Wyman, Waterville, Maine.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary-treasurer, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION (affiliated with the National Electric Light Association). Secretary-treasurer, Frank J. Duffy, Natchez, Miss.

MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATER WORKS ASSOCIATION. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis. Annual meeting, May, 1914.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, Wm. L. Smith, Concord, Mass.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago. Annual meeting, June, 1914.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION, COMMERCIAL SECTION. Secretary, E. L. Callahan, 29 West 39th St., New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION, EASTERN NEW YORK SECTION. Secretary, R. E. Russell, Schenectady, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION, SOUTHEASTERN SECTION. Secretary-treasurer, M. H. Hendee, Augusta, Ga. Annual meeting, Macon, Aug. 14-16.

NATIONAL ELECTRIC LIGHT ASSOCIATION, HYDROELECTRIC AND POWER TRANSMISSION SECTION. Secretary, L. H. Conklin, Scranton, Pa.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MICHIGAN SECTION. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich. Annual meeting, Ottawa Beach, Aug. 19-21.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEBRASKA SECTION. Secretary-treasurer, S. J. Bell, David City, Neb.

National Electric Light Association, New England Section. Secretary, [illegible]. Annual convention, Burlington, Vt., Sept. 17, 18, 19.

National Electric Light Association, Northwest Section. Secretary, [illegible]. Annual meeting, Seattle, Wash., Sept. 10-12.

National Fire Protection Association. Secretary of electrical committee, Ralph Sweetland, 141 Milk Street, Boston, Mass. Open meeting, New York, May [illegible].

National Independent Telephone Association. Secretary-treasurer, Richard Valentine, Janesville, Wis.

New England Electrical Credit Association. Secretary, Alton F. Tupper, 60 State St., Boston, Mass. Directors meet first Wednesday of each month.

New England Street Railway Club. Secretary, H. A. Faulkner, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

New Orleans Electrical Contractors' Association. Secretary, S. J. Stewart, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

New York Electrical Credit Association (affiliated with the National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Annual meeting, Dec. 9.

New York Electrical Society. Secretary, G. H. Guy, 33 West 39th St., New York. Annual meeting, New York, June, 1914.

New York Electric Railway Association. Secretary, Charles C. Dietz, 598 Broadway, Albany, N. Y.

Northwestern Cedarmen's Association. Secretary, N. E. Boucher, 743 Lumber Exchange, Minneapolis, Minn. Annual meeting, Jan. 6, 1914.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio.

Ohio Society of Mechanical, Electrical and Steam Engineers. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio. Annual meeting, Columbus, Ohio, Nov. 20-22.

Oregon Electrical Contractors' Association. Secretary, J. E. Kilkenny, St. John's, Ore.

Pennsylvania Electric Association (State Section N. E. L. A.). Secretary-treasurer, Walter E. Long, 100 Chestnut St., Philadelphia, Pa. Annual convention, Delaware Water Gap, Sept. 16-18.

Railway Signal Association. Secretary, C. E. Rosenberg, Bethlehem, Pa.

Society for Electrical Development, Inc. Secretary-treasurer, Philip S. Dodd, 29 West 39th St., New York.

Society for the Promotion of Engineering Education. Secretary, Prof. H. H. Norris, Ithaca, N. Y. Annual meeting, Princeton, N. J., June, 1914.

Southwestern Electrical and Gas Association. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

Vermont Electrical Association. Secretary-treasurer, A. B. Marsden, Manchester, Vt. Annual meeting, Burlington, Vt., Sept. 18.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 76 West Monroe St., Chicago, Ill. Annual meeting, Cincinnati, Jan. 27-29.

Western Society of Engineers, Electrical Section. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

Wisconsin Electrical Association. Secretary, George Allison, Stephenson Building, Milwaukee, Wis. Annual meeting, Jan 15 and 16, 1914.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JULY 22, 1913.

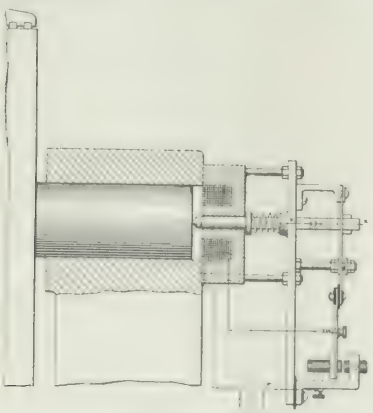
[Prepared by Robert Starr Allyn, 15 Exchange Place, New York.]

1,067,795. FURNACE; J. W. Brown, Lakewood, Ohio. App. filed Dec. 1, 1911. While one body of material is being heated, an additional body is passed around the chamber containing the first body so as to absorb some of the heat thereof. Chambers concentric with electrodes in the different chambers.

1,067,817. TIRE-HEATING FORGE; N. L. Jones, Temperanceville, Va. App. filed April 28, 1913. Plurality of fire pots with a bellows supplying air equally to all fire pots.

1,067,823. RESONATING RELAY; H. Von Kramer and G. Kapp, Birmingham, Eng. App. filed April 11, 1912. Has vibratory steel reed tuned to periodicity of the alternating current in the controlling circuit.

1,067,864. END-PLAY DEVICE; G. W. Christians, New York, N. Y. App. filed Jan. 30, 1913. Natural reciprocation of the shaft of the machine is utilized to close a circuit through a magnet which amplifies the shaft movement.



1,067,864.—End-play Device.

1,067,869. ELECTRIC-HEATING UNIT; B. Falkenberg, Ontario, Cal. App. filed May 27, 1912. Thin, flat electrical resistance is held between two flat plates having interfitting flanged edges.

1,067,880. RESISTANCE INCLOSURE; C. A. Rhine and C. H. Keeney, Milwaukee, Wis. App. filed Aug. 20, 1910. For starters, controllers, etc.; provides ample ventilation for the resistance but prevents issuance of spark or flame from the inclosure.

1,067,936. ELECTRIC SWITCH; H. R. Mitchell, North Yakima, Wash. App. filed Feb. 15, 1912. Combination of locking bolt and signaling switch for mail boxes and the like.

1,067,951. COVERING FOR ELECTRIC CONDUCTORS AND METHOD OF PREPARING THE SAME; E. T. Trotter, Brooklyn, N. Y. App. filed Nov. 8, 1910. Treats the insulation of an ordinary insulated conductor with stearine pitch and manganese oxide.

1,067,974. METHOD OF DISCHARGE OF ELECTRICITY INTO GASES; F. G. Cotterell, Berkeley, Cal. App. filed Nov. 6, 1911. Exposes to the gas a surface facilitating a non-disruptive discharge and applies a negative potential to such surface.

1,068,010. SOSTENUTO DEVICE FOR MUSICAL INSTRUMENTS; M. L. Severy and G. B. Sinclair, Winthrop, Mass. App. filed May 3, 1907. For causing one or more actuated springs to remain sounding as long as desired; may be mounted at will into and out of control of the keys.

1,068,023. RAILWAY-TRAIN-CONTROL APPARATUS; J. T. Thompson, Chicago, Ill. App. filed March 18, 1910. Track-in-circuit system for controlling and automatically stopping train.

1,068,024. SIGNAL OR CONTROL MECHANISM FOR RAILWAY TRAINS; J. T. Thompson, Chicago, Ill. App. filed Jan. 5, 1912. Train will not be stopped when running below a certain speed.

1,068,065. HEATING APPARATUS; G. F. Machlet, Jr., Elizabeth, N. J. App. filed Jan. 27, 1908. Furnace-regulating device with a galvanometer whose needle is operated by the heat of the furnace, the galvanometer serving as an indicating device as well as a circuit controller.

1,068,076. RECEIVER FOR ELECTROCHEMICAL TELEGRAPH SYSTEMS; W. K. Queen and T. F. Pickett, Needham Heights, Mass. App. filed June 10, 1910. For ship telegraph systems between pilot house and engine room; receiver is controlled electrically and actuated mechanically.

1,068,082. DANGER SIGNAL; J. H. Sanor, Canton, Ohio. App. filed Nov. 28, 1908. Wheel-actuated spring contacts bridge the insulated joints of the rails.

1,068,148. ELECTRODE HOLDER FOR ELECTRIC FURNACES; D. A. Lyon and E. R. Cox, Jr., Heroult, Cal. App. filed Oct. 8, 1910. Gas-tight compressible clamp for the electrode.

1,068,192. CASE FOR INCANDESCENT-ELECTRIC-LAMP SOCKETS; A. Weber, Sr., and J. Weber, Schenectady, N. Y. App. filed Jan. 16, 1909. Multiple lock for cap and shell of a lamp socket.

1,068,216. AUTOMATIC HEAT REGULATOR; A. P. Broomell, York, Pa. App. filed Oct. 4, 1912. Thermally controlled electromagnet for operating a valve.

1,068,233. THIRD-RAIL SUPPORT OR CHAIR; J. S. Fox, Jackson, Mich. App. filed Dec. 27, 1912. Curved flexible holder is drawn up into the curved head of the supporting standard thereby to clamp against the conductor rail.

1,068,255. SIGNALING DEVICE; M. J. Mandelbaum, New York, N. Y. App. filed Nov. 7, 1912. Manually operated electrically lighted stop and turn-out signals mounted at rear of automobile.

1,068,322. HEATER; L. E. Church and J. A. Cooney, Bartlesville, Okla. App. filed Oct. 22, 1912. Electrical heater interposed in the intake manifold of a gas engine.

1,068,335. BRUSH HOLDER FOR DYNAMO ELECTRIC GENERATORS OR ELECTRIC MOTORS; J. E. Grant, Battersea, London, Eng. App. filed Nov. 5, 1912. Copper "flexible" of the carbon brush is secured in a spring clamp carried by the brush holder.

1,068,341. FUSIBLE CUT-OUT FOR CONTROLLING ELECTRIC CIRCUITS; V. Hope, Manchester, Eng. App. filed June 13, 1912. Fuse consisting of a copper core with a sheathing therefor of tin-lead alloy.

1,068,343. ELECTRICALLY HEATED GLUE POT; A. C. Hulbert, San Francisco, Cal. App. filed April 17, 1912. Combined steam and electrical controlling apparatus maintains substance heated at a given temperature.

1,068,387. ELECTRIC SIGNALING; F. B. Herzog (deceased), New York, N. Y. App. filed July 20, 1889. Single-line signaling system in which interference between simultaneously operated substations is prevented.

1,068,388. APPARATUS FOR CLEANING GOLD, SILVER AND OTHER METAL WARE; J. M. Hotchkiss, Burlington, Vt. App. filed April 12, 1912. Zinc tray with utensil-supporting copper rack disposed in a sodium-chloride electrolyte.

# Electrical World

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**s the Arc Lamp Doomed?**

The announcement by the leading manufacturer of tungsten-filament incandescent lamps that a series lamp as been developed with a specific consumption of 0.5 watt per candle and a life of 1000 hours naturally prompts the uestion "Is the arc lamp doomed?" The tungsten lamp as already displaced the ordinary inclosed arc lamp in nany sections of the country on the score of better effiiency and service, not to mention lower maintenance, and ow that the tungsten lamp itself has been improved by he application of an inert gas under pressure so that its pecific consumption is cut in half, it becomes a serious ompetitor of the flaming-arc lamp. For the present at east, the lamp can only be made in large sizes with thick laments for series service, and inasmuch as street-lighting ontracts are usually based on a flat rate per lamp per anum, the substitution of the improved tungsten lamp for the nclosed arc lamp in public street lighting will doubtless ollow quickly after the commercial introduction of the mp. That it will supplant the flaming-arc lamp is problemtical and that it will long dominate the public lighting field also questionable. There is too much money invested in he arc-lamp industry to permit the contest to go by default, nd developments, particularly in the flaming-arc field, ught to follow very quickly.

**overnmental Indorsement of C. G. S.**

Hereafter the diamond carat, instead of being a nondescript unit that only a few esoteric persons understand, will e a fifth of the international gram which civilized people nderstand. It is to be hoped that this much-needed reform ay speedily be extended to other departments of the nited States government service. We are weary of being he laughing-stock of Europe for maintaining, in conjuncon with Great Britain, the existing jumble of weights and easures that costs so much of intellectual labor to keep p. It is high time that the United States, which so early dopted a simple decimal currency, should also adopt the mple international decimal metric system.

**he Fight for atent Reform**

On former occasions we have advocated the appointment of a broadly organized, liberal-minded patent commission to make a searching investigation of the patent stem of the United States. In another column we preent the last set of resolutions adopted by the Inventors' uild, and in particular we would draw attention to the emarks attributed to President Woodrow Wilson that here is no hospitality for invention nowadays and that therefore mankind has been deprived of many comforts and conveniences, as well as the opportunity of buying at lower prices. There is said to be no serious probability of action during the present extra session of Congress upon the patent bills before it, yet this is certainly an opportune time to ask Congress for a real commission, with full powers, to commence the great task which the friends of true reform have insistently demanded be undertaken. The passage of an act authorizing the commission is a detail, but it ought to be attended to without delay, so that the selection of members of the commission may be taken up with that careful deliberation it needs.

**White Salmon River Development**

The article descriptive of the hydroelectric station of the Northwestern Electric Company of Portland, Ore., appearing in this issue is another indication of the rapidity with which one hydroelectric development has followed another in that section of the country in the past few years. The station in question is interesting as a type, rather than for any exceptional feature which it possesses, although the wood-stave-pipe line is said to be unparalleled in size among conduits of its kind. Cradles resting on heavy mud sills running the length of the line were employed to support the pipe, because when filled with water the static load is approximately 4 tons per foot of length and this is greater than the weight per foot of length of the heaviest locomotive. Hence the need of an excellent foundation. Like most hydroelectric plants, the system will be insured against complete shut-down by the installation of an auxiliary steam station. This will be located in Portland at the end of the transmission line and will be used to advantage during cold weather by carrying a heating load. The rainfall in the Pacific Northwest is heaviest in winter, as is also the demand for electricity, owing to the length of the nights, so that good service ought to obtain with both the hydraulic and steam stations in operation. In the late summer, when the water is not so plentiful, the steam station can be used to help out the the hydraulic station at a time when the heating load is not very great. Advantage was taken of natural conditions in the construction of the head-works when preparing and pouring the concrete, showing that the engineers were also economists; for almost all the work was done by gravity. Evidently the promoters of the enterprise had abundant faith in the future of the district in which it is located, for it would seem that with the numerous electric developments which have been started in the Pacific Northwest within the past two years the market for electrical energy would be flooded; but apparently new territory and new industries are opening up fast enough to absorb it.

## Transmission Span Design

The design of a long span is always interesting, and especially if the stresses on the end towers are included. We print this week an article by Mr. K. Nogami giving the detailed computations for a span of 1180 ft. at Hiroshima, Japan, across the famed straits of Ondo. The actual breadth of the straits at the crossing is only about 500 ft., but to erect towers on the banks would mean raising them to a height of nearly 150 ft. in order to provide the required clearance of 130 ft. for vessels beneath the span. Consequently, the towers were erected farther apart on more elevated ground.

Hiroshima is fortunate in having no sleet problem to consider, a circumstance which greatly adds to the available factor of safety. Use is to be made of stranded steel wires nearly ½ in. in diameter. The annual temperature range is given as from 10 deg. to 100 deg. Fahr. According to the data given, the sag will range from 9 ft. to 23 ft., varying with the temperature. The details for the stability of the higher tower are of special interest. It is to be hoped that after the lines have been placed in position data will be presented indicating the actual behavior of the stresses, the maximum stress observed, and a comparison between the observed results and the design.

## The Visibility of Light Sources

An important paper on the visibility of point sources of light by Messrs. Paterson and Duddington, of the National Physical Laboratory, has recently been published in England. It bears directly on some of the fundamental matters with respect to the photometry of light sources, particularly emphasizing certain matters which have been rather generally misunderstood. The authors deal particularly with point sources of light, touching therefore such important practical matters as the visibility of signal lamps at long distances and the examination of distant light sources by extinction instruments. The point source was assumed for the purpose of the investigation to be one subtending about thirty seconds of arc at the distance view, in other words, an angle considerably smaller than that which corresponds to the ordinary resolving power of the eye. To anticipate a bit, however, it was found that the area of the aperture observed could be increased considerably beyond the nominal angle representing the resolving power of the eye without material change in the results. It is of course known that conditions of visibility are materially altered when large areas are observed, but the critical area is considerably larger than is generally supposed. The observations were made with small illuminated apertures of various sizes, the actual light from which was varied either by sector disk or by absorption wedges until they matched the suitable comparison source.

The first conspicuous fact brought to the surface in the investigation was that the visibility of the small source of light, or what amounts to the same thing, its apparent brilliancy, is proportional to the total candle-power of the source and is independent of its intrinsic brightness. This law was found to hold for sources subtending an apparent angle of nearly 2.0 deg., although most of the areas involved were considerably smaller. This means that after a source is at so considerable a distance that it corresponds to a point as here described its intrinsic brilliancy, in its effect on the eye, is a matter of no consequence whatever. This fact is thoroughly reinforced by experience in street lighting, in which one cannot distinguish between the light from a bare arc and that through a diffusing globe when the distance from the illuminant is sufficiently great. It is only at relatively short distances that the serious phenomena of glare enter. And, second, it was found that the visibility of the source varied actually, as it should in theory, as the inverse square of the distance. In other words, for distance sources the only thing that counts is the distance and the total candle-power, and one can photometer by an extinction instrument, or one allowing point comparisons, such distant sources utterly irrespective of what their intrinsic brilliancy may be. This accounts for the sometimes wonderfully consistent results which can be obtained by comparing two light sources by the simplest kind of extinction photometer.

These fundamental facts were pointed out some twenty years ago by Charpentier as a result of his own careful experiments, but the present thorough study should leave the whole matter beyond the possibility of dispute and should make the facts known to a far greater public than was reached by the French investigator, whose admirable work seems to have been half forgotten. Some extremely interesting tests were made on the effect of color in the point sources and of the results of using spectacles in observing. It was found that the effect of color on the visibility of the points was marked, particularly when spectacles were used, the differences being apparently due to the diffusion of the point image on the retina owing to the chromatic aberrations of the eye or the variation of focus produced by the spectacles. It is to be noted in this particular that when the pupil is widened in very dim light, as is usually the case in such experiments, the correction required for sharpest definition is changed, the ordinary eye becoming somewhat short-sighted in very weak light, so that persons requiring considerable correction of vision by spectacles may be handicapped in seeing distant signals or attempting to photometer point sources.

## A New Notion in Ventilation

The haze of honest doubt that has surrounded the ozone machine in some quarters should be largely dispelled by the results of the ventilation tests reported before the Buffalo meeting of the Society of Heating and Ventilating Engineers by trained physiological and psychological experts, who point out, as reported in an earlier issue, that an ozonizer performed important service in keeping sweet and wholesome for three hours at a time schoolroom air which was being simply recirculated without the introduction of outside oxygen. These experiments place on a scientific basis the fact long suspected that the usual empirical allowance for ventilation has no relation whatsoever to the actual physiological needs of the human system. And they prove with finality that even a roomful of school children can work at full efficiency and comfort, breathing the same air three hours or more at a time, if that air is

properly "renewed" and deodorized. The psychological tests were continued over a period long enough to prove that no after-effects were to be felt. The efficacy of the ozonizer was also demonstrated on the occasions when its operation was interrupted for a half hour or so, the resulting "stuffiness" of the air in the room making itself at once apparent to teacher and pupils. And if we have now proved that instead of unnecessarily burning tons of coal to heat large cubic sections of cold outdoors which are simply passed through our buildings and discharged back to the winter breezes, it is only necessary to consume a negligible number of watt-hours to keep fresh and sweet, air that has already once been brought to the temperature of comfort, it looks as if the scouted ozone machine were really one of the greatest little engines of conservation of this prodigal age.

## Cheap Line Construction

In organizing a small energy-transmission plant one meets now and then conditions which call for a special study of cheap—sometimes even temporary—line construction. The present tendency—sound and generally to be encouraged—is toward thoroughly good construction, the erection, in fact, of a line which is put up to stay, not at all regardless of expense, but without the necessity for extreme economy. Nevertheless, there are classes of instances in which economy is of paramount importance, and it takes no small amount of finesse to know just how to keep down expense without imparing efficiency for the purpose in hand. For instance, a contractor may desire to extend a line for a few score rods or even a few miles in order to obtain energy from an existing line, or it may be necessary to put in a line to meet the needs of a temporary customer or to deliver energy for only two or three months per year for pumping or furnishing light to a summer or winter colony. In work of this sort one cannot afford to expend much money on construction without robbing the proposition of all its profit. Hence one has to make a special study of those points at which economy can be secured most safely.

In electrical energy transmission there are three directions in which one can work with comparative safety by departing a little from ordinary routine practice. The first of these is the matter of the height of poles. Transmission lines are usually on 35-ft. or 40-ft. poles, and the construction of the pole line is based on the theory that every pole and every wire must have an ample factor of safety above the worst conceivable combination of sleet and wind. Now, when two or three relatively light wires are to be used for a temporary or intermittent supply there is no possible need of resorting to main-line construction. It is astonishing how much energy can be transmitted over three wires even as small as No. 6. The poles may advantageously be only 30 ft. or even 25 ft. in clear country, the 30-ft. size being in some ways advantageous. For such work a somewhat large and stubby pole, which would not ordinarily be picked out for permanent line construction, can be efficiently utilized. One short cross-arm and a top insulator furnish ample accommodation for the wires at such voltages as are commonly used.

The second point at which economy may be gained is in increasing the average spacing. A line of stocky 30-ft. poles may well be spaced from 150 ft. to 200 ft. in clear country with positive advantage from every point of view. Ordinary lines are built on the precedent of old telephone and telegraph practice, where many cross-arms had to be carried on a single pole. To continue this practice where only three small wires are to be erected represents simply a foolish waste of money. It has taken a good many years to wean electrical line contractors away from telephone and telegraph precedents, but often on the Pacific Coast, and now and then elsewhere, really sensible spacing is to be found.

The third matter in economy is that of voltage, which is closely allied with the two things already discussed. The tendency is to work short and temporary lines at too low a voltage when the lines are of fair length. One often sees a 2300-volt branch line through a perfectly clear country where 10,000 or 12,000 volts might be used just as well with very slight added expense for insulators. When one uses the higher voltage there is no need for heavy wires and a correspondingly heavy structure to support them. In fact, it is often a question whether a good steel wire construction is not worth while where the amount of energy to be transmitted is not considerable; it has been tried now and then with excellent results. A 10,000-volt line with poles spaced a couple of hundred feet and cheap steel wires giving the necessary strength will deliver a good deal of energy without an impracticable drop and at a cost much below that of so-called standard construction.

## Fans for Invalids

Comfort and efficiency are promoted by the use of the electric fan during ordinary summer weather; but in the case of the sick tossing on restless beds of fever or pain the electric fan becomes a veritable necessity during such extremely warm weather as has been experienced in many localities this summer. The breeze from an electric fan is a distinct alleviation of the distress of invalids when the thermometer stands at 90 or above, and it is almost cruel to fail to provide it. This fact is often realized too late where houses are not wired for electricity although electrical facilities might be had. Sometimes it is possible to make a temporary connection with a more fortunate neighbor's house through lamp-cord extending from window to window. Sometimes even this makeshift cannot be resorted to, and it is of real importance that householders should be prepared for this emergency. Electric-service companies in some cities have offered to install electric fans on a doctor's prescription, without charge, where the patient was unable to pay and where electric service was available. Probably all hospitals are equipped with the soothing hot-weather ministration of the noiseless whirring blades; but there are tens of thousands of well-to-do householders who would hardly fail to provide a source of electricity in their homes if they fully realized the great comfort of the fan in cases of illness. It is a humane privilege as well as good commercial practice for the central-station company to make clear this often-neglected opportunity.

# The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

### Wisconsin Water-Power Bill Signed

Governor Francis E. McGovern of Wisconsin on Monday affixed his signature to the water-power bill, which in substance provides for the complete public control of water-power by the State Railroad Commission. No material alterations were made to the bill in the Assembly so that the measure reported in our issue of July 26 remains virtually as published.

### Municipal Railways Proposed for Philadelphia

Construction by the city of Philadelphia, Pa., of a subway line on Broad Street and of elevated lines to outlying sections was recommended by City Transit Director Taylor in a voluminous report made public on July 31. Director Taylor, who has been engaged for more than a year in an exhaustive study of the rapid transit problems of Philadelphia, estimates that the total cost of the improvements recommended would be $57,587,000. The city would pay $34,682,000 and the companies leasing the lines $22,896,000.

### Exhibition of Electrical Appliances at Glasgow

The Corporation of Glasgow, Scotland, has made definite arrangements for the exhibition of electrical appliances which will be held in the city from Oct. 23 to Nov. 15 to bring before the public generally the advantages of electricity for many purposes. There will be shown appliances for domestic heating, stoves of all kinds, cooking and laundry appliances, water heaters, circulators and geysers, appliances for the generation, transmission and utilization of electricity, elevators and hoists, fans and other ventilating apparatus, mechanism for preventing the emission of dust and dirt from chimneys, show-window lighting and illustrations of the use of electricity for cinematograph purposes. Two exhibitions of this kind have been held in London and one in Manchester within the past ten years, but this will be the first exhibition which has been arranged in Glasgow for the display of purely electrical appliances.

### Single-Phase System Adopted by Norfolk & Western

At the recommendaton of Messrs. Gibbs & Hill, consulting engineers, New York, the Norfolk & Western Railway Company has adopted the single-phase system for the electrification of the Elkhorn Grade-Bluefield section of its main line. The intention is to use energy having a frequency of 25 cycles and a potential of 11,000 volts at the trolley. The electricity will be supplied from a 27,000-kw generating station to be erected by the company at Bluestone, W. Va., and for transmission purposes the potential will be raised to 33,000 volts and the transmission line will be carried mainly on the catenary bridges. Feeding points will be established at suitable locations along the line sufficiently close to minimize the voltage drop and inductive disturbances. In view of the fact that freight trains only will be handled, the locomotives, of which there will be twenty-four, are to be equipped with motors of the induction type and the control and connections are to be arranged to give running speeds of approximately 7, 14 and 28 miles an hour respectively. Special attention is being given to the queston of regeneration and electric braking at grades, which would decrease the wear and tear on train equipment, and also, under favorable conditions, tend to reduce the demand on the generating system. The engineers concluded to recommend the single-phase system after an exhaustive analysis of the various systems now in use in this country and abroad. A careful study was also made of the local conditions involved, and comparisons were made of the capital and operating costs based on operating data and manufacturers' bids for equipment.

### Double-Unit Turbo-Alternators for New York Subway

The Interborough Rapid Transit Company has awarded to the Westinghouse Machine Company the contract for three 30,000-kw steam turbo-generator units for installation in the Seventy-fourth Street station to assist in supplying energy for operaing the enlarged New York subway. Each unit will consist of a high-pressure and a low-pressure element, each element comprising an independent steam turbine driving a synchronous alternator. The high-pressure and low-pressure turbine of each unit will be governed simultaneously in order that the load on the unit may be divided properly between the two elements.

### Convention of Edison Illuminating Company Sales Managers

The fourth annual convention of sales managers connected with the larger Edison companies was held at Association Island, Henderson Harbor, N. Y., Aug. 4, 5 and 6. Following a general discussion on rates and isolated plants, papers were read and discussed on the following topics: "Organization of an Unused Meter Bureau," by Mr. J. F. Becker, of the United Electric Light & Power Company, New York; "Baltimore Practice of Following Up Unused Meters," by Mr. R. F. Bonsall, of the Consolidated Gas, Electric Light & Power Company, Baltimore; "Wiring Existing Buildings," by Mr. C. E. Robertson, of the Consolidated Gas, Electric Light & Power Company, Baltimore; "Co-operation of Other Departments with Salesmen," by Miss S. M. Sheridan, of the Detroit Edison Company; "Illuminating Engineering," by Mr. J. D. Israel, of the Philadelphia Electric Company; "White-Way Lighting," by Mr. F. D. Beardsley, of the Union Electric Light & Power Company, St. Louis; "Limitation of the Electric Vehicle," by Mr. C. M. Marsh, of the Potomac Electric Power Company, Washington, D. C.; "Suggestions for Building Up an Electric Vehicle Load," by Mr. Harvey Robinson, of the New York Edison Company; "Work of Power Engineering Bureau," by Mr. C. H. Stevens, of the Edison Electric Illuminating Company of Brooklyn; "Unity Load-Factor Cooking Apparatus," by Mr. Mathias Turner, of the Cleveland Electric Illuminating Company; "Notes on Cooking by Electricity and Other Methods," by Mr. L. R. Wallis of the Edison Electric Illuminating Company of Boston; "Selling Electrical Appliances," by Mr. F. D. Pembleton

f the Public Service Electric Company, Newark, N. J. There was a very lively discussion on all of the papers, that n Miss Sheridan's paper being exceptionally good. On Vednesday afternoon the rest of the electrical men on the sland defeated the sales managers in a game of baseball.

The meeting this year was under the chairmanship of Mr. . F. Hale, of the Boston Edison company. The committee elected for next year is composed of the following: Mr. E. W. Lloyd, of the Commonwealth Edison Company f Chicago, chairman, and Messrs. A. A. Pope, of the New York Edison Company, and J. D. Israel, of the Philadelphia Electric Company. The sessions of the sales managers are ot open to the public and very little of what transpires is rinted, although some of the papers later find their way nto publicity through other conventions. Those attending he convention were Messrs. R. F. Hale, W. G. Stetson nd L. R. Wallis, of Boston; E. W. Lloyd and J. G. Learned, f Chicago; Douglass Burnett, C. E. Robertson and R. F. Bonsal, of Baltimore; F. E. Beardsley, of St. Louis; Parker H. Kemble, of Cincinnati; H. K. Mohr, R. B. Ely and J. Meyer, of Philadelphia; C. A. Littlefield, A. A. Pope, W. Gould, H. Robinson, J. Becker, A. F. Berry and D. V. Smith, of New York; F. E. Pembleton, of Newark; M. Turner and R. H. Wright, of Cleveland; Miss S. M. Sheridan, Miss F. Norwell, Messrs. R. F. Duncan and E. Crosby, f Detroit; Messrs C. M. Marsh and J. C. McLoughlin, of Washington; T. I. Jones and C. H. Stevens, of Brooklyn.

## Pittsburgh Convention I. E. S.

On page 168 of our issue dated July 26 there was given preliminary list of papers to be presented at the convention of the Illuminating Engineering Society to be held n Pittsburgh, Pa., from Sept. 22 to 26. The committee on apers has arranged for the following additional papers: 'Some Theoretical Considerations of Light Production," y Mr. W. A. Darrah, of Pittsburgh; "Conduction Losses n Series Tungsten Lamps," by Mr. Armine, of Harrison, N. J.; "Church Lighting," by Mr. R. B. Ely, of Philadelphia; "Factory Lighting," by Messrs. Flexner and Dicker, f Chicago; "Modern Practice in Street-Railway Illumination," by Mr. S. G. Hibben, of Pittsburgh; "Hospital Lighting," by Mr. M. J. Kilmer, of New York; "The Use f Nitrogen at Low Pressures in Tungsten Lamps," by Mr. G. M. J. McKay, of Schenectady; "The Illuminating Engineering Laboratory of the General Electric Company," y Mr. S. L. E. Rose, of Schenectady, N. Y., and "Window Lighting," by Mr. H. B. Wheeler, of Chicago.

It is also expected that the following papers will be presented: "Store Lighting," by Messrs. Clarence L. Law and A. L. Powell, of New York (this paper is to be a continuation of the subject discussed by these authors at he Niagara Falls convention last year); "Some Commercial Aspects of Gas Lighting," by Messrs. Witte and Philbrick; "The Efficiency of the Eye Under Different Systems of Illumination," by Dr. C. E. Ferree, of Bryn Mawr, Pa.; "Physiological Aspects of Illumination," by Dr. F. Park Lewis, of Buffalo; "Errors of Photometric Measurements" nd "The Commercial Fields Opened by Recent Developments in Lamp Manufacture," by representatives of the engineering department of the National Electric Lamp Association, Cleveland, and "Spectacular Lighting During he Knights Templar Conclave in Denver," by Mr. G. E. Williamson, of Denver. A lecture on "The Developments f the Alternating-Current Luminous-Arc Lamp" will be lelivered by Dr. C. P. Steinmetz, of Schenectady.

During the week beginning Sept. 22 there will be held n Pittsburgh a meeting of the American Mine Safety Association, devoted, as its name indicates, to the promotion f safety in mines. During the sessions of this assocition the Bureau of Mines, located in Pittsburgh, will conuct several interesting experiments in mine explosions. These experiments will afford an excellent opportunity for those interested in the illumination of mines to investigate this phase of the subject under actual operating conditions.

## Philadelphia Convention of N. E. L. A.

At a meeting of the executive committee of the National Electric Light Association at its headquarters in New York on July 23 President J. B. McCall stated that invitations had been received from New York City, Milwaukee, Atlantic City, Asheville and New Orleans, each suggesting that the next convention be held in that city. At the request of Mr. C. L. Edgar, of the Edison Electric Illuminating Company of Boston, President McCall expressed his own wish to have the next convention in Philadelphia, stating that some 2300 hotel rooms would be available. He also gave details as to other needed convention facilities, whereupon it was unanimously voted to hold the next convention at Philadelphia. There has been no convention of the association held in that city since 1887.

## L. A. Osborne on Manufacturers and the Society for Electrical Development

Certain striking statements made by the vice-president of the Westinghouse Electric & Manufacturing Company concerning the aims of the Society for Electrical Development are given in the following paragraphs.

It may appear unusual to some that the electrical manufacturers should have so readily agreed to make liberal contributions to the funds of the Society for Electrical Development. In fact, the readiness of the manufacturer to support the movement has led some to suspect that it was planned primarily in his interests. Reflection, however, will show that the attitude of the manufacturer is merely co-operative in the broadest sense of the word and is an evidence of his appreciation that that which is truly co-operative is, in the last analysis, profitable.

Speaking as a manufacturer, we expect that our return will accrue after the central station, jobbers, dealers and contractors have begun to enjoy a measure of return as a result of the activities of the society.

It goes without saying that the success of the movement will largely depend upon the spontaneity with which the different branches of the industry respond. There is a psychological moment when a movement of this character should be launched, and that is that moment when all are of the same mind as to its importance. Let that moment pass without definite action and there is danger of a weakening of that sustaining power of co-operation which is needed. If the different branches of the industry are willing in spirit but lacking in financial help, those intrusted with the responsibility of making the work of the society successful will not be encouraged to proceed with the confidence and enthusiasm which is so necessary in an undertaking of this kind. Neither should they be handicapped by the necessity of seeking members, but they should be permitted to exercise their talents in the legitimate activities of the society, which are broadly to impress upon the public at large the desirability of "doing it electrically."

The ideals of the society are ambitious but attainable and when carried out should, within a reasonable time, bring measurable returns to all branches of the industry.

The campaign planned by the society to awaken an interest in things electrical should very early have an appreciable effect upon the trade of central stations, jobbers, dealers and contractors.

If, through co-operative advertising, the architect, the contractor and the builder might be educated to such a point that in all dwellings, regardless of cost, outlets for the use of electrical appliances should be plentifully provided, the

[illegible] of the [illegible] electrical appliances would be increased as well as the work of the electrical contractor, and it goes without saying that there would be a corresponding increase in the demand for electrical energy through wires of the central station would profit. The manufacturer secures his reward through an increased demand for his manufactured products, and, in the broader aspect of the case, in the ultimate increase in generating and distributing apparatus.

The general education of the people in the use of electrical vehicles brings its reward to the manufacturer of the vehicle, as well as to the makers of the motor and battery which propel it, and continuously to the central station providing energy for its operation.

When real-estate dealers and investors are educated by co-operative advertising to make capital of electrically lighted and electrically equipped homes, then naturally an increase in business is bound to result therefrom, and as the ideas of men enlarge the volume of increase will multiply rapidly. It is to our interest to educate the public to the feeling that what yesterday was merely an electrical luxury is to-day a necessity.

When we can familiarize men in the professions—dentists, surgeons, doctors, etc.—and in the multiplicity of trades, even the smallest and least important, with the value of doing things electrically and make such men understand about things electrical, great will be the profit to the electrical business, and we shall have realized, in part at least, one of the ambitions of the society.

Especially should this movement appeal to central stations, even more than to the manufacturer, for each customer of the central station is a continuing customer and a source of continued profit and revenue, whereas to the manufacturer each sale is a transaction complete in itself.

Altogether a movement having such useful and beneficial aims should receive the generous support of all in the industry, at least until such time as the soundness of the idea can be tested, and particularly of those branches of the industry which are obviously most likely to receive the most immediate returns from the movement.

## Meeting of Executive Committee of the N. E. L. A.

The first meeting of the new executive committee of the National Electric Light Association was held at the association's headquarters in New York on July 23. Executive appointments for the ensuing year were made and confirmed as follows: Mr. T. C. Martin, secretary; Mr. A. S. Sewall, assistant to the secretary; Miss Harriet Billings, assistant secretary; Mr. E. W. Burdette, counsel; Mr. W. H. Blood, Jr., insurance expert; Miss Gladys Burkhalter, assistant secretary of the Commercial Section. The resignation of Mr. C. A. Stone, of Boston, as member of the executive committee, was presented and accepted with regret, and Mr. H. G. Bradlee, of the Stone & Webster Corporation, was elected to succeed him. President McCall presented a very full list of the new chairmen of the regular committees and of the membership of each. A new committee on educational relationships was created, with Mr. J. F. Gilchrist as chairman, and also a new committee on safety, with Mr. Martin J. Insull as chairman.

The membership now totals 12,676, and is apportioned as follows: Class A, 1104; Class B, 10,430; Class C, 55; Class D, 243, and Class E, 844. Of the 518 new members elected, forty were Class A and eleven Class D.

Colonel Street, the newly elected president of the Canadian Electrical Association, gave an interesting account of the situation in Canada and asked that the Canadian body should have full representation on all committees so that it could co-operate thoroughly in all association work. Mr. T. [illegible], of Brooklyn, chairman of the Commercial Section, brought up the question of the continuance of the old "Electrical Solicitor's Handbook," which has not been revised for about two years, and it was voted to turn this publication over to the Commercial Section for such revision and use as it saw fit to make.

Secretary T. C. Martin stated that the *Bulletin* of the National Electric Light Association had had second-class mail privileges accorded to it by the post office authorities, so that a saving of approximately $3,000 a year would be effected. Mr. E. W. Lloyd, of Chicago, having consented to serve again as chairman of the research committee, it was voted to continue the publication of *Rate Research* under the direction of the committee. Mr. W. C. L. Elgin, of Philadelphia, as a member of the resuscitation commission, was requested to look into the matter of a motion-picture film illustrating the adopted prone-pressure method of resuscitation from electric shock.

## Resolution of Inventors' Guild on Patent Reform

Under recent date the Inventors' Guild circulated a set of resolutions urging the co-operation of chambers of commerce and similar bodies throughout the country in securing the appointment of a patent commission to study the whole subject and report. The resolutions follow:

"Whereas the fact that certain trusts and large corporate manufacturers have been accused of using patents improperly, both offensively and defensively, to aid them in effectually stifling competition, has resulted in the introduction of bills before Congress intended to regulate such abuses by making radical changes in the United States patent system;

"Whereas the hearings on the Oldfield bill (H. R. 23,417) in the spring of 1912 demonstrated that there were marked differences of individual opinion among inventors, legislators, manufacturers and patent lawyers as to the changes in our patent system which would be desirable to subserve the best interests of the United States;

"Whereas there is now pending before the Sixty-third Congress in the House of Representatives a bill (H. R. 1700) introduced by Mr. Oldfield, Representative from Arkansas, which provides for radical changes in the United States patent system fraught with the most serious consequences to the people of the United States, and especially to independent and competitive manufacturers and inventors;

"Whereas the intention of the United States Constitution to stimulate the publication of valuable inventive thought by granting and securing an exclusive right to the inventor who first publishes his invention through the agency of a patent of the United States seems to have been lost sight of in said Oldfield bill (H. R. 1700), and said proposed law would tend to reduce instead of tending to increase the creation and publication of inventions valuable to the people of the United States;

"Whereas President Wilson has recently given warning to the people of the United States of the importance of these questions in the following language:

"'Do you know, have you had occasion to learn, that there is no hospitality for invention nowadays?

"'I am not saying that all invention has been stopped by the growth of trusts, but I think it is perfectly clear that invention in many fields has been discouraged, that inventors have been prevented from reaping the full fruits of their ingenuity and industry, and that mankind has been deprived of many comforts and conveniences, as well as the opportunity of buying at lower prices.

"'One of the reforms waiting to be undertaken is a revision of our patent laws.'*

"Whereas the Inventors' Guild, composed exclusively of

[illegible]

dependent inventors, petitioned President Taft on Nov. 4, 1911, for his aid in securing the appointment of a patents commission to investigate and report upon the subject f possible improvement of the patent system for the benefit f the United States;

"Whereas the various chambers of commerce in the principal cities of the United States are fairly representative f all the interests concerned in this matter, including manufacturers, inventors and the people generally;

"Be it resolved, That the Inventors' Guild does hereby nvite each of the chambers of commerce and similar representative organizations throughout the United States to id the Guild in its efforts to secure the appointment of a atents commission by urging the Congress of the United States that it provide for such a commission made up of nbiased, independent, non-partisan men of such national tanding as will command the respect and confidence of the vhole country, chosen from different walks of life and erving without pay. Said commission to hold public hearngs and otherwise, as may appear to it best, to make a horough and careful study of the American patent situaion, and to prepare and submit a comprehensive report and ecommendations to Congress for such changes as may, as he result of its study, appear to it expedient, whether in he Patent Office, in the method of court procedure or in he organic patent law, and to submit recommendations as o the legislation it would propose for effecting such hanges. And the Guild further requests the several chamers of commerce to urge the Congress that it make ample rovision for the expenses of such a commission, and that : hold in abeyance all proposed legislation affecting the atent system in whatsoever way until such time as the aid commission shall have had ample opportunity to hold he said hearings and make the said study and report."

## Ontario Hydroelectric System to Be Enlarged

At a session of the Hydro-Electric Power Commission of Ontario held in Toronto, Ont., July 30, it was decided to nlarge the transformer station at Niagara Falls, Ont., and o double the line between Dundas and Niagara Falls. This vill give the engineers the equipment to double the lines etween London and Dundas. The towers are already built nd the stringing of the double line to supply the western ortion of Ontario with Niagara energy will be commenced t once. The estimated cost of the work is $300,000.

## Michigan Electrical Convention

The annual convention of the Michigan Section of the National Electric Light Association will be held in the Hotel Ottawa at Ottawa Beach, Mich., on Aug. 19, 20 and 21. While the program has not been definitely fixed in all details, many of the speakers and topics have already been selected. The opening address will be made by President F. B. Drees, Lansing, Mich.

The following papers will be read: "Relation Between Central Station and Electrical Contractor," Mr. C. J. Litscher, of the C. J. Litscher Electric Company, Grand Rapids; "Electrical Heating Devices," by a writer not definitely chosen; "Indirect and Semi-Indirect Lighting," Mr. James R. Cravath, consulting engineer, Chicago; "The American Kicker," Mr. D. B. South, Edison Illuminating Company of Detroit; "Two Epochs of Rate Regulation," Mr. W. J. Norton, of Chicago, secretary rate research committee, N. E. L. A.; address by Mr. James V. Oxtoby, a Detroit lawyer; address by Hon. Lawton Heemans, member of the Railroad Commission of Michigan; address by Mr. T. C. Martin, secretary of the N. E. L. A.; address by a member of the Industrial Accident Board of Michigan; "High-Tension Distribution to Small Communities," Mr. T. A. Kenney, Au Sable Power Company, Kalamazoo; "Au Sable Power Plant and Transmission Line," by an employee of the Commonwealth Power Company, Jackson, Mich.; "High-Tension Distribution by One-Wire Grounded System," Mr. J. A. Cavanaugh, Benton Harbor Electric Light & Railway Company; "Automatic Pumping Station at Farmington, Mich.," Mr. Addison Cary, Eastern Michigan Edison Company, Rochester, Mich.; "Efficient Application of Motor Drive," Mr. W. J. Fitzgerald, Edison Illuminating Company of Detroit; "Street Lighting," Mr. D. W. Hayes, Eastern Michigan Edison Company, Ann Arbor; "Wiring Campaigns," by an employee of the Eastern Michigan Edison Company. Mr. William Trott, of Grand Rapids, will supervise a rejuvenation of the Jovian Order on the evening of Aug. 20. Mr. Herbert Silvester, 18 Washington Boulevard, Detroit, is secretary of the association.

## Opposition to Camden Municipal Plant

On account of the fact that the estimate prepared by Runyan & Cary, the city engineers, for a municipal electric-lighting plant at Camden, N. J., showed the cost of erection to exceed $500,000, while the original estimate was less than $200,000 when the citizens voted in favor of a municipal plant in 1906, the City Council called a meeting of the citizens on July 31, 1913, in order to determine the present sentiment concerning the proposition. As a result of this meeting the Council voted not to authorize the erection of the plant at present but to resubmit the proposition to the voters at the election in November, 1913.

Opposition to the proposed municipal plant was led by the Camden Board of Trade, which had made a special investigation of a large number of municipal plants throughout the country. In its communication to the citizens the Board of Trade claimed that it had failed to find any municipal plant giving satisfaction to the people, but, on the other hand, had found them greatly overmanned, usually for political reasons, and heavy tax burdens on the people, and it argued that this would prove true in Camden should such a plant be built.

The committee of the Board of Trade having the investigation in charge opposed the scheme because it would increase the taxes very materially, the burden of which the business man would have to pay. The board opposed the city plant also because there has been a reduction of $29.50 per lamp since the vote was taken seven years ago and according to a schedule issued in 1912 this amount can be further reduced. A report recently issued by the Board of Trade demonstrated that the city can purchase street lighting for $33,780 less than it can operate a plant exclusively for this purpose, according to the city's own experts.

The most effective argument against the proposed plant was presented by Mr. Frederick A. Finkeldey, chairman of the municipal electric-light committee, who explained that he had brought the subject forward at this time as a means rather than an end. His opposition to a municipal plant was based on the impossibility of divorcing its management from politics. He asked the councilmen if they believed that the various city departments were as well managed as their own individual businesses, and stated emphatically that city employees selected under political influence cannot possibly operate a plant requiring engineering training and experience so well as it can be operated by a private company that selects and promotes its employees solely on merit. The object in agitating the subject—namely, to obtain a suitable reduction in the charges for lighting service—having been accomplished, Mr. Finkeldey urged the councilmen to cast their votes against the municipal plant.

The ordinance appropriating $540,000 for the municipal electric-lighting plant was thereupon rejected by a vote of 13 to 10.

### Canadian Railway Commission to Regulate Rates

The newly consolidated railway act, which has just been completed by Mr. Samuel Price, of St. Thomas, Ont., embracing all amendments since the original act was passed, and which will be introduced at the next session of the Canadian Parliament, contains important provisions for the protection of public and municipal rights. Henceforth no company can erect telephone, telegraph or electric wires without the consent of the municipality, and rates must be approved by the Railway Commission. Heavy penalties are provided for companies and their officers, as well as mayors and other municipal officials, who disobey the orders of the Railway Commission.

### Canadian Conservation Commission Opposed to Private Development at Long Sault

The report of the Canadian Conservation Commission on the Long Sault power development scheme on the St. Lawrence will shortly be ready for submission to the government. It will declare emphatically against such an undertaking being turned over to any company, and that if the power is harnessed it should be done by the government. The engineers have found the scheme quite feasible from their standpoint, but there would be danger to navigation as well as risk of flooding adjacent territory. The immense value of the power as a natural resource will be emphasized, together with a declaration that its export from the country should not be permitted. The report is now being revised by Hon. Clifford Sifton, chairman of the commission. It will be recalled that the Aluminum Company of America's charter granted by the State of New York authorizing it to make the development at the Long Sault Rapids in the St. Lawrence River was declared void by Attorney-General Carmody of New York on Jan. 1.

### Dominion Water-Power Investigations

The Canadian government has retained Mr. C. S. McInnes, of Toronto, Ont., to represent it in preparing the case to be submitted to the International Waterways Commission with reference to the projected damming of St. Mary's River at Sault Ste. Marie by the Michigan Lake Superior Power Company. A commission of engineers, consisting of Messrs. W. A. Bowden, of the Railway Department; Jefferson Chapleau, of the Public Works Department, and W. J. Stewart, of the Hydrographic Survey, has been appointed to secure data upon which the case will be based.

Messrs. J. B. Challies, superintendent of the Dominion Water Powers Branch, and S. J. Robins, assistant private secretary to the Minister of the Interior, have been sent to Victoria, B. C., by the Canadian government to consult with the British Columbia government with regard to water-powers in the railway belt. The ownership of certain water-powers there has not yet been clearly defined. Both the federal and the provincial governments claim ownership, and a discussion has been going on for some time, more particularly as to whether the Dominion or the provincial government has jurisdiction over the Hudson Hope Power Company.

### Complaint of Slowness of Electrical Inspection in Louisville, Ky.

Electrical contractors and central-station men in Louisville, Ky., are interested in the inspection situation, because of complaints of real-estate men that the work was not being done rapidly enough by the city inspectors. This brought out the fact that the Kentucky Actuarial Bureau, the rating organization of the fire underwriters, is no longer making inspections free of charge, but has put the work on a fee basis. This has resulted in the work being offered to the city inspectors in greater volume than heretofore, the inspectors of the bureau, whose reports are accepted by the central stations and the city, being called on for service only in connection with the more remote installations. It is said that the city inspectors are six weeks behind in their work, and as the lighting companies will not give service until after the installations have been passed on by the inspectors, considerable inconvenience has been caused. The Actuarial Bureau is developing its electrical inspection work out in the State, where little attention has been paid to the inspection of wiring by city and town authorities, and will appoint several more men and put a chief in charge of that department of its work.

### Kansas Cities Reject Condemnation for Public Ownership

The mayors of twenty-three eastern Kansas cities, called to Topeka, Kan., for a conference with the Governor on July 31, refused to indorse a proposal for a campaign of public ownership for municipal gas service and pipe lines for natural gas through condemnation proceedings. The Kansas Natural Gas Company, which furnishes forty cities with gas, is now in the hands of receivers and no gas contracts with producers are being made for next winter because the Public Utilities Commission refuses to permit an increase in price. The administration proposes to call the Legislature and pass special enabling acts to allow the condemnation of $30,000,000 worth of gas-company properties. After some discussion the mayors rejected the public-ownership proposal and adopted resolutions petitioning the federal court to turn the Kansas Gas properties over to State receivers and permit them to make arrangements for next winter's gas supply.

### Minnesota to Consider Public Utility Bill

Governor A. O. Eberhart of Minnesota has completed his keynote speech on the public utilities question, and it is expected that he will deliver it in St. Paul about Aug. 15. No announcement has been made as to when the Governor will call a special session of the Legislature to consider a public utilities measure, but it has generally been supposed that the law-making body will convene in October.

### Maine to Vote on Utility Board

The acceptance or rejection of the act passed at the last Legislature providing for a Board of Public Utilities will be determined by a referendum at the next general election in September, 1914. Governor Haines set the date in a proclamation issued July 29. The law, which would have gone into effect on July 12 last, was automatically suspended when a petition with more than 10,000 signatures demanded a referendum.

### Appointments to Pennsylvania's Public Service Commission

The members of Pennsylvania's Public Service Commission, which is to supersede the State Railroad Commission have been appointed by Governor Tener. The commission is made up of the following: Messrs. Nathaniel Ewing Fayette County, chairman, ten-year term; S. L. Tone, Allegheny County, nine-year term; Samuel W. Pennypacker former Governor, eight-year term; Emory R. Johnson Philadelphia, professor of transportation and commerce expert, University of Pennsylvania, seven-year term; Mi-

on J. Brecht, Lancaster County, six-year term; Charles Frederick Wright, Susquehanna, five-year term; Frank M. Wallace, Erie, four-year term. There are three members of the new commission that served upon the State Railroad Commission, Messrs. Ewing, Pennypacker and Brecht.

## Oklahoma Demands Telephone Trunk-Line Connections

Oklahoma filed on Aug. 1 with the Interstate Commerce Commission at Washington a complaint against the monopolistic practices of the American Telephone & Telegraph Company. The complaint was brought by the Corporation Commission of Oklahoma in behalf of the Arnett Telephone Company, an independent organization in that State, and it was asserted that since July 12, 1912, the American Telephone & Telegraph Company has refused to grant connections to the Arnett Telephone Company with its subsidiaries in Oklahoma and adjoining states. The Interstate Commerce Commission was petitioned to investigate the matter and force the American Telephone & Telegraph Company to grant through routes in connection with the Arnett company from points in Oklahoma to interstate points.

## Public Service Commission News

### New York Commissions

The Public Service Commission for the First District has executed a contract with the E. E. Smith Contracting Company, the lowest bidder, for the construction of that section of the Broadway (Manhattan) subway lying between Union Square and Twenty-sixth Street. The total amount of the Smith company's bid was $2,056,702.50. The plans call for a four-track underground railroad with one-half of the express station at Union Square and a local station at Twenty-third Street and Madison Square.

### Massachusetts Commission

The Massachusetts Gas and Electric Light Commission has issued a decision, on the petition of consumers of the Edison Electric Illuminating Company of Brockton, reducing the maximum net price of electricity from 15 to 12 cents per kw-hr. The company is one of the Stone & Webster properties. The previous price applied to residence and office lighting and covered the first thirty hours' monthly use of the connected load, all energy in excess of such use being billed at 9 cents net. The rates for factory lighting ranged from 10.8 cents net to 9 cents net, depending upon the connected motor load. The company also had various other rates not bearing closely upon the points before the board. The complainants at the hearings were mainly lighting customers using electricity in small amounts and the company's use of the connected load as the basis of its demand charge was criticised. By the rate system previously in force, as the ratio of consumption to connected load increased the average price per kilowatt-hour decreased. In its opinion the board states that lengthy use of a given demand has an influence upon the company's costs, but that a mere difference in the quantity used does not justify a difference in price, and that differences in lamp installations are exceedingly unreliable indications of actual differences in demand. Nearly 90 per cent of the company's customers were interested in the maximum net price of 15 cents and more than half of these did not secure the secondary rate. Even those business and residence customers entitled to the secondary rate paid average prices exceeding 11 and 12 cents respectively. The board is of the opinion that the customers who are dependent upon the company for their supply do not use electricity under conditions so unlike as to make a uniform meter rate work any injustice to them and that there is not sufficient advantage in the present two-rate system for small users to compensate for the complications introduced, especially when the basis for its application is the connected load determined by the watts of the installed lamps. The commission contends that the value of the small user to the company, particularly in residence lighting, and the importance of lower prices to develop this class of business, have been underestimated.

In 1908 the company erected a new generating plant, and since then the volume of its annual output has increased from 2,795,824 kw-hr. to 7,586,582 kw-hr., while its net earnings from the sale of electricity have increased from $82,823 to $131,825. Its interest and dividends have increased from $44,649 to $93,194, and the dividend rate from 6 to 8 per cent. In reducing the maximum net price to 12 cents, dating from Aug. 1, 1913, the board holds that, after the payment of reasonable operating expenses and depreciation, the revenue will yield a fair return upon the value of the property.

### Wisconsin Commission

A decision in the case of the city of Green Bay versus the Green Bay Gas & Electric Company has been issued by the commission. In this case, the properties of the defendant and its associated companies, the Green Bay Traction Company, the Northern Hydro-Electric Company and the Wisconsin Public Service Company, were considered together in arriving at a uniform and reasonable rate schedule in lieu of the several schedules in controversy. The present value of the total property was fixed by the commission at $2,373,457 and the cost of reproduction at $2,788,875. After allowing a fair rate for interest and depreciation, the commission found that the total cost of operating the hydroelectric plant is more than the present revenue and more than it usually costs to produce the service by steam power. It was pointed out that, although the load factor of the electric service is good as a whole, the amount of business that the respondent now has is not sufficient in comparison with the size of the plant to reduce the unit fixed costs to an amount that can properly be considered the basis for fixing rates. An estimate was made of the expenses of the plant using steam power, which costs were found to be lower and about the same as the present revenues. The commission, therefore, held that no changes should be made in the present revenue of the electric department but that certain changes should be made in the schedule of charges. The various schedules for electric service now in effect were ordered abandoned and the following uniform schedule substituted: Primary rate, 10 cents net per kw-hr. for the first 30 hours' use per month of the active connected load; secondary rate, 8 cents net for the next 60 hours' use; excess rate, 4 cents. The gross rate is to be one cent higher, the difference constituting a discount for prompt payment. The minimum bill is to be $1 per month. The rate for all sign and window lighting will consist of a charge of 5 cents net per active 50-watt lamp or its equivalent per month plus a charge of 4 cents net per kw-hr. for energy consumed, and all lamps are considered active. The classification of consumers according to the percentage of active connected load is essentially the same as that in the Lake Geneva decision.

From the investigation of the gas department it appeared that certain reductions could be made in the schedule of charges. The present practice of charging different rates for gas when used for fuel or illuminating purposes, necessitating the use of two meters, was ordered abolished and the following schedule prescribed: First 1000 cu. ft. per month, $1.15 net; second 1000 cu. ft., $1.05 net; next 3000 cu. ft., $0.95 net; all over 5000 cu. ft., $0.90 net. The minimum bill will be 40 cents. No change was ordered in the rates for motor service nor the rates for street lighting.

# Current News Notes

Camping at Electrical.—A central station in an English seashore town has put in practice this summer a plan that makes tenting on the seashore more of a joy than ever. Service wires have been run to the best locations for camping to provide for electric cooking and electric light. A flat charge of $2.50 is made for all-summer service at each tent, and for this charge a limited number of lamps may be used as much as is desired and all the cooking may be done on electric stoves.

* * *

International Conference on Engineering Standards.—A conference will be held between representatives of the Engineering Standards Committee of Great Britain, of the standards committee of the American Institute of Electrical Engineers, and of the United States committee of the International Electrotechnical Commission, looking toward co-operation between these committees, on Saturday, Aug. 23, at the London office of the Engineering Standards Committee of Great Britain, 28 Victoria Street, Westminster, S. W., London, England.

* * *

May Vote by Electricity.—Representative Walsh has suggested a voting scheme to the House rules committee of Congress which will do away with the dreary and protracted roll call. Mr. Walsh would have an electric bulletin board installed with an alphabetical list of the names of all the members posted, each of which will have two bull's-eye lamps—one red, which, when flashed, would indicate that the member has voted yea, and the other blue, which would signal the intention of the member to vote nay. The total on the board would be automatically added and the House could see at a glance how every member voted, together with the result.

* * *

Railway Appraisal Costly.—Physical valuation of the railroads of the United States by the Interstate Commerce Commission will occupy from five to seven years and will cost the government from $10,000,000 to $15,000,000, according to the plans that the commission has presented to the House appropriations committee. The commission has asked for an immediate appropriation of $1,500,000 for the organization of the corps of engineers to undertake the work, and Commissioners Clements and Prouty have stated that a carefully worked-out estimate places the cost of the field work at $1,921,500 a year throughout the period. The plan is to divide the country into five districts, each containing approximately 50,000 miles of railroad.

* * *

Sandusky Defeats Proposed Bond Issue for Municipal Lighting Plant.—A proposal that bonds to the amount of $200,000 be issued to provide for a municipal electric-light plant was defeated by the voters of Sandusky, Ohio, at a special election on July 30. The Sandusky Gas & Electric Company, under the direction of Vice-president C. B. Wilcox, made a campaign against the proposed bond issue, and its arguments prevailed with the electorate. The rates in Sandusky are 8 cents and 5 cents per kw-hr. for lighting and motor service, respectively. The company refused to accept rates of 5 cents and 3 cents as proposed by a recent ordinance. It appealed to the Public Service Commission of Ohio. The city retaliated by the municipal-ownership proposition which the citizens have just voted down.

* * *

German Restrictions on Private Wireless.—The German Post Office and Interior Departments have promulgated elaborate regulations in order to prevent owners of private wireless-telegraph stations from engaging in traffic which might injure the interests of the national defense. Private stations may be erected only on condition that the government have the right at any time to order their demolition. The owners must pledge themselves to guarantee the absolute secrecy of any messages their stations may happen to pick up and must agree to render special service whenever they intercept messages relating to disasters. Officers of the army and the navy are to have the privilege at any time to inspect stations and order a temporary cessation of activities, and the stations themselves must be placed at the disposal of the government as often as occasion demands.

* * *

## SOCIETY MEETINGS

Annual Convention of the Indiana Association.—The Indiana Electric Light Association will hold its next annual meeting at Indianapolis Sept. 24 and 25. Mr. J. V. Zartman, 49 Lombard Building, Indianapolis, Ind., is secretary of the society.

* * *

Pennsylvania Section, N. E. L. A., Annual Meeting.—The sixth annual convention of the Pennsylvania Electric Association (State branch of the N. E. L. A.) will be held at the Water Gap House, Delaware Water Gap, from Sept. 15 to 18. An attractive program has been arranged, and indications point to an unusually large attendance. Mr. Walter E. Long, 1000 Chestnut Street, Philadelphia, is secretary of the Pennsylvania Section.

* * *

Officers of Missouri Electrical Contractors' Association.—At the recent St. Louis meeting of the Electrical Contractors' Association of the State of Missouri, reported in these columns July 19, the officers of the association were re-elected for the ensuing year. They are as follows: President, Mr. L. E. Reed, St. Joseph; vice-president, Mr. William F. Koeneman, St. Louis; secretary, Mr. A. J. Burns, Kansas City; treasurer, Mr. A. Penn Denton, Kansas City; sergeant-at-arms, Mr. W. T. Davies, Kansas City; director, Mr. Ernest S. Cowie, Kansas City.

* * *

Municipal Electricians to Convene.—The eighteenth annual convention of the International Association of Municipal Electricians will be held at Watertown, N. Y., from Aug. 19 to 22, with headquarters at the New Woodruff Hotel. The exhibits will be made in the Odd Fellows' Temple. Many subjects of wide interest will be discussed at this meeting, such as electrical inspection, municipal street lighting, fire-alarm and police signaling, joint use of poles, permissible voltage on overhead wires in cities, municipal ownership and electrolysis. Mr. Clarence R. George, Houston, Tex., is secretary of the association. Mr. H. C. Bundy, superintendent of fire alarm, of Watertown, N. Y., is chairman of the executive committee.

* * *

Detroit Engineering Society.—The Industrial Electrical Engineering Society of Detroit, Mich., was organized last winter. The membership comprises the chief electricians and their assistants at the various electrical plants in Detroit and salesmen doing business with the various industrial plants. The society has now about 100 members. Meetings are held twice a month. The aim of the society is social and educational. At the meeting held Aug. 1 Mr. A. E. Meyer, assistant electrical engineer of the Edison Illuminating Company, presented a paper entitled "Some Phases of Alternating-Current Machinery." The officers of the association are: President, Mr. F. Allison, chief electrician Ford Motor Company; vice-president, Mr. A. E. Roach, Edison Illuminating Company; secretary, Mr. C. E. Wise, district manager Cutter Electrical & Manufacturing Company; assistant secretary, Mr. G. R. Clover, district manager Cooper Hewitt Electric Company; financial secretary, Mr. J. G. Plasko, chief electrician Parke, Davis & Company, and treasurer, Mr. C. W. Krause, chief electrician Packard Motor Car Company. The offices of the society are in the Stevens Building, Detroit.

# Hydroelectric Plant on White Salmon River

**System of Northwestern Electric Company—Immense wood-stave pipe employed—Company to supply electricity and steam heat in Portland, Ore. By Wilbur B. Foshay**

THE Northwestern Electric Company, a corporation made up of San Francisco and Portland capitalists, with the control of the company in the hands of Messrs. Mortimer and Herbert Fleishhacker, of San Francisco, and with main offices in Portland, Ore., has completed and put in operation a power plant on the White Salmon River, at a point about 3 miles above the mouth of the river where it empties into the Columbia.

In arranging for making this development one of the first engineering feats was that the Stone & Webster Engineering Corporation, which constructed the plant, had to overcome was that of preparing a suitable road for a distance of some 3 miles from Underwood station, on the Spokane, Portland & Seattle Railway, to the site of the power house and dam. This road had to cross the White Salmon River, and to do so a bridge of about 115 ft. in length and some 90 ft. above the river had to be constructed and made strong enough to carry all the heavy material needed in the building of the plant. When it is taken into consideration that the rotors for the 6000-kva machines installed in this plant had to be hauled across this bridge, some idea can be formed of the strength necessary in the structure.

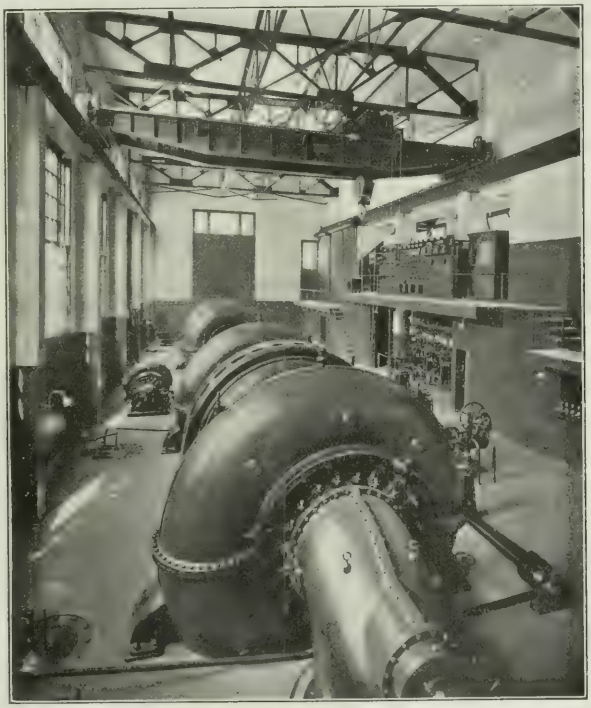


FIG. 1—CONDIT STATION OF THE NORTHWESTERN ELECTRIC COMPANY

The dam proper is about a mile above the power-house site and is constructed between two stone walls of natural formation at a point where the river flows through a deep cut. This dam is 60 ft. long at the bottom and 470 ft. at the top. It is 96 ft. through at the bottom and 15 ft. at the top. The height of the dam from bedrock is 125 ft. and it contains about 30,000 cu. yd. of concrete. During the construction of the dam there were placed rock crushers and sand machines on the hillside above the dam site, the rock being hauled with a Bagley scraper into the rock crusher and ground to the proper size, a portion of this rock then passing by gravity into the sand machine and being pounded into sand, which in turn was carried into the mixer by gravity. Here cement and water were added to the sand and crushed rock, and the resulting concrete was carried by gravity to its proper place in the dam 100 ft. below. In this way after the material entered the rock crusher it was not touched by human hands again, but traveled of its own weight through the various processes in troughs until it reached its proper place in the dam.

From the dam site to the power house a mile below the water is carried in a wood-stave pipe 13.5 ft. in diameter. This is said to be the largest wood-stave pipe of which any record can be found. The pipe was constructed and installed by the Pacific Coast Pipe Company. This large wood-stave flume is constructed on a hydraulic grade, the pipe resting in cradles set on concrete foundations, these cradles being about 4.5 ft. apart. At a point about 700 ft. from the power house it is reduced to two 9-ft. pipes, and at a point some few hundred feet nearer the power house steel-riveted pipes are employed which continue to the power house proper. An illustration is given herewith of the interior of this 13.5-ft. wood-stave pipe. In planning the pipe the greatest difficulty to be overcome was that of protecting against any chance of the pipe flattening when filled with water at a low pressure. To prevent this, cradles were placed along the pipe, as mentioned above, and no trouble has arisen due to the size of the pipe and the low pressure of the water carried therein. From the illustration showing this pipe line the cradles referred to can be easily distinguished.

### Generating Station

The power house itself is located directly on the river bank and a working head of 177 ft. is secured. The structure proper is built of concrete and steel, the building being approximately 70 ft. by 150 ft.

The waterwheels are of the Francis type, manufactured by the Allis-Chalmers Company. There are two to each generator, one turbine being located on either side of the generator. The entire unit made up of the two turbines

and a generator, which is also of Allis-Chalmers manufacture, is carried on two bearings, one each side of the generator, the shaft extending through the discharge pipes of the turbines, which are one-quarter turns. In the discharge pipes there are thrust bearings, and while these bearings carry no weight in the operating of the units, in case it is



FIG. 2—DAM AND GATEHOUSE ON WHITE SALMON RIVER

necessary either turbine can be taken down and the other unit used to operate the generator, so that during a repair to one turbine unit the generator will be operated at half load. There are two units with a rating of about 10,000 hp each installed, and with the generating units made up as explained, the plant can be operated at the greatest efficiency at one-quarter, one-half, three-quarters or full load.

In the same power house are the transformers for stepping the potential up from 2300 volts, at which it is generated, to 66,000 volts for transmission to the city of Portland. The switching apparatus, etc., is also situated in the power house. The transformers and switching apparatus were furnished by the General Electric Company.

### Auxiliary Steam Station

From the plant to the river crossing the pole line is completed and in operation as far as Camas, at which point 4000 hp is now being served to the Crown Columbia Paper



FIG. 3—WOOD-STAVE PIPE LINE

Mill, one of the largest paper mills on the Pacific Coast. At Camas the pole line will cross the Columbia River, the towers for this line now being in place and completed. The tower crossing consists of five supporting towers and four strain towers, the height of the towers being 140 ft. The material for the construction of the line into the city of Portland has all been ordered and is in the course of shipment at the present time, as is also the equipment for a steam auxiliary plant to be located in the new Pittock Block, in the heart of the city of Portland, where will also be located the direct-current converting station. The steam auxiliary plant will have boiler equipment sufficient to carry

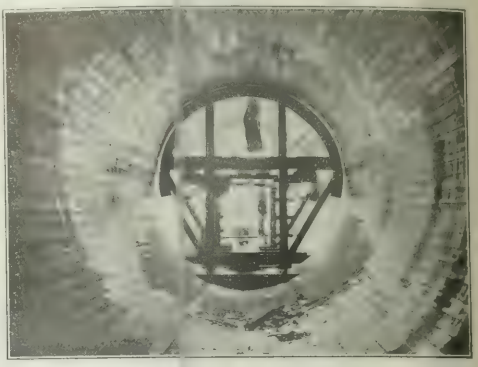


FIG. 4—INTERIOR OF STAVE-PIPE LINE

the two 3750-kw General Electric turbines that have been ordered.

The Northwestern Electric Company has obtained a steam-heating franchise from the city of Portland, and a contract has been given to the American District Steam Company, of North Tonawanda, N. Y., for the construction of the steam-heating mains. This work will proceed

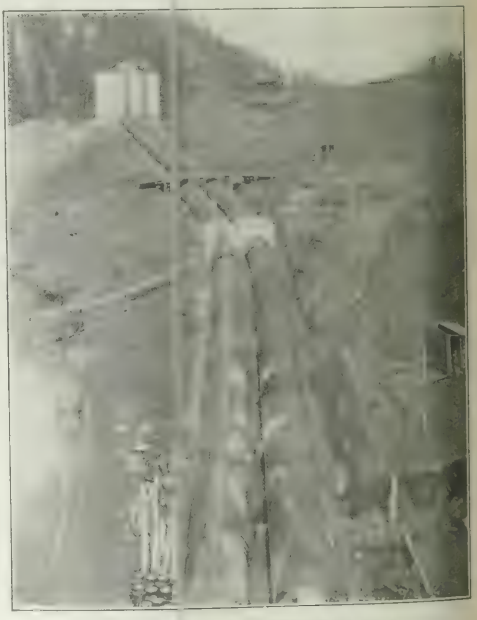


FIG. 5—FOREBAY AND STEEL PIPE LINE

with the installation of an underground conduit system for the use of the electric department of the company in its underground distributing system.

The entire system including power site, pole line and steam plant in Portland, has been located and designed under the direction of Mr. B. C. Condit, a San Francisco

ngineer, who has been connected wh the Fleishhacker nterests for many years, and in hone of whom the hyroelectric station is named. The hyraulic development vas made by the Stone & Webster Egineering Corporaion on contract and was in charge of Mr. J. H. Manning, f that company. The vice-presiden and general manger of the Northwestern Electric Company is Mr. Wilbur E. Coman.

## Design of an 1180-Ft. Transmision-Line Span

By K. Nogami

The Ondo section of the city of Hoshima in southern apan is to be lighted by the Chugoku Electric Light Comany, whose transmission circuits will be required to cross he famous strait of Ondo Kaikyo with a single span 180 ft. in length. Navigation regulations specify that the owest point of the span wire shall be t least 130 ft. above he highest tide, affording ample clearnce for the passage f vessels.

Following are the calculations for tis installation based on the formula of Mr. Harold Pener appearing in the *Proceedings* of the American Institute of Electrical Engineers for June, 1911. Snow is rare in southern Japan, so n this case possible effects of sleet and ice were neglected. Under the requirements of the Japanese government, however, allowance was made for such severe wind forces as 40 lb. per sq. ft.

In the formula

$w$ = weight of wire per foot in pouds.

$d$ = diameter of wire in inches.

$i$ = thickness of ice in inches.

$v$ = wind pressure in pounds per quare foot perpendicular to the wire.

$K$ = ratio of total force on the wir to weight of wire nder these conditions.

Then

$$K = \sqrt{\left\{1 + \frac{1.24\, i\,(d+i)}{w}\right\}^2 + \left\{\frac{v\,(d+2i)}{12\,w}\right\}^2}.$$

If the effect of ice be neglected, the

$$K = \sqrt{1 + \left(\frac{vd}{12\,w}\right)^2}$$

$m$ = weight in pounds of bar of conductor, 1 ft. long and of 1 sq. in. section.

$T$ = tension of wire in thousand pouds per square inch at the lowest point.

$L$ = length of span in feet, i. e., hozontal distance between the points of supports.

$l_o$ = distance of the lowest point fm one of the supports.

$D$ = deflection in feet of the lowest point from the horizontal line through the two points of apport, when points of supports are at the same level.

$p = \frac{100\,D}{L}$ percentage deflection wh the supports are at the same level.

$K'$ = the value of $K$ when there is n wind: in this case $K' = 1$.

$h$ = difference in elevation in feet f the two points of supports.

$D_1$ = deflection in feet of the lowest oint in the direction of resultant force from the horizontal ine passing through the lower support.

$s_1$ = vertical sag corresponding to th deflection $D_1$.

$M$ = modulus of elasticity.

$a$ = coefficient of expansion.

$t_0$ = lowest temperature in winter.

$t$ = highest temperature in summer.

When the supports are at the same level, then

$$D = \frac{K\,m\,L^2}{8000\,T} \qquad (1)$$

$$p = \frac{K\,m\,L}{80\,T}$$

When the supports are at the different level, then

$$D_1 = D\left(1 - \frac{K'h}{4KD}\right)^2 \qquad (2)$$

The vertical sag corresponding to $D_1$ is

$$s_1 = \frac{K'D_1}{K} \qquad (3)$$

$$L_o = \frac{L}{2}\left(1 - \frac{K'h}{4KD}\right) \qquad (4)$$

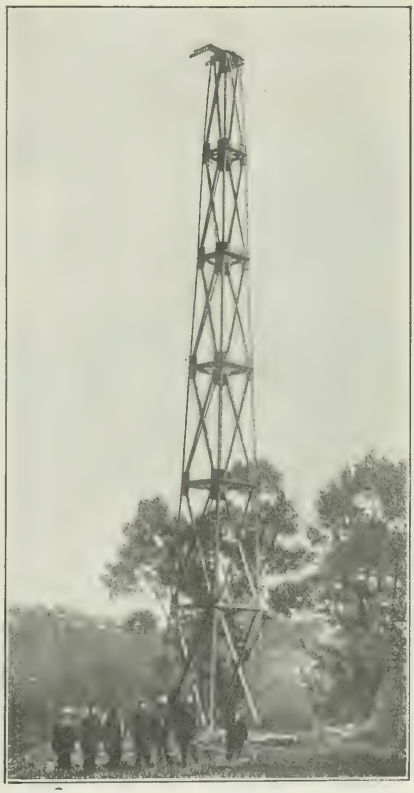


FIG. 1—STEEL TOWER AND SECTION OF SPAN

For tracing the curve, we have

$$Y = \frac{Kmx^2}{2000\,T} \qquad (5)$$

Taking into consideration the effect of temperature, we have the following formula:

$$\left(p^2 - \frac{3.75 \times 10^6 T}{M}\right) - \left(p_o^2 - \frac{3.75 \times 10^6 T_o}{M}\right)$$

$$= 3750\,a\left\{(t - t_0) - \frac{h^2}{2\,aL^2}\left[\left(\frac{K'}{K}\right)^2 - \left(\frac{K_o'}{K_o}\right)^2\right]\right\} \qquad (6)$$

Whence, when the tension $T_o$ at temperature $t_o$ and loading $K_o$ are given, the tension $T$ at any other temperature $t$ and

loading factor $K$ can be determined by solving this equation after substituting:

$$f = \frac{KmL}{8sT} \qquad \text{and} \qquad f_0 = \frac{K_0 mL}{8sT_0}$$

In the case of the Ondo Kaikyo span, the distance from shore to shore is pretty long, and a straight stranded steel wire was used. The data given follow:

Span, 1180 ft.

Difference in elevation of supports, 47.2 ft.

Steel wire, stranded:

- Diameter, 7/16 in.
- Weight per foot, 0.30 lb.
- Breaking strain, 150,000 lb.
- Weight of steel bar, 1 ft. long and 1 sq. in., 3.4 lb.
- Modulus of elasticity, $30 \times 10^6$.

Weather conditions:

- Wind pressure, 40 lb. per sq. ft.
- Ice, none.

According to Japanese government regulations, the wire must be stretched with only such tension that the safety factor shall be more than five when the temperature is the lowest.

In our case the safety factor is taken as ten, therefore, using a tension of 15,000 lb. per sq. in., the lowest temperature will be 10 deg. Fahr. and the wind pressure zero.

Then we have

$$K = K' = 1.$$

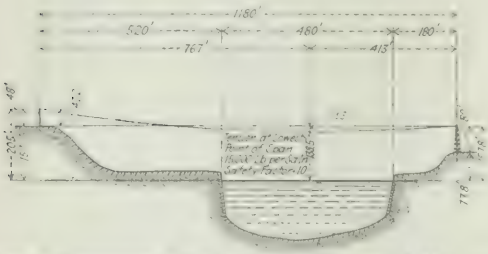



FIG. 2—ELEVATION ON SPAN WINTER—[illegible] WIND.

The sag when the supports are at the same level,

$$D = \frac{KmL^2}{8000\,T} = \frac{3.4 \times 1180^2}{8000 \times 15} = 39.4 \text{ (see 1)}$$

The sag in our case,

$$D_1 = D\left(1 - \frac{K'h}{K \times 4 \times D}\right) = 39.4\left(1 - \frac{47.2}{4 \times 39.4}\right) = 10.3$$

(see 2).

$$L_0 = \frac{L}{2}\left(1 - \frac{K'h}{4 \times K \times D}\right) = \frac{1180}{2}\left(1 - \frac{47.2}{4 \times 39.4}\right)$$

$= 413$ (see 4).

For tracing the curve,

$$Y = \frac{KmX^2}{2000\,T} = \frac{3.4 \times X^2}{2000 \times 15} = 0.000113\,X^2 \text{ (see 5).}$$

The height of the lowest point above the sea level at highest tide,

$$(157 + 48) - (47.2 + 19.3) = 138.5.$$

If the wind pressure be taken into consideration, the calculation becomes as follows:

$$K = \sqrt{1 + \left(\frac{pd}{12 \times W}\right)^2} = \sqrt{1 + \left(\frac{40 \times 0.437}{12 \times 0.30}\right)^2} = 4.9$$

In the formula (6),

$$\left(\frac{K'}{K}\right) - \left(\frac{K_0'}{K_0}\right) = \left(\frac{1}{4.9}\right) - 1 = -0.80$$

$$\left(\frac{1.45}{s} - \frac{3.75 \times 10^6}{30 \times 10^6} \times T\right) - \left(3.34 \times \frac{3.75 \times 10^6}{30 \times 10^6} \times 15\right)$$

$$= \frac{47.2^2}{2 \times 118} \times (-0.06) \times 3750$$

$$\frac{60,025}{T} + 0.125 \times T = 9.455$$

From which we see $T$ is approximately equal to 60.

$$\text{The safety factor } \frac{150}{60} = 2.5.$$

If the wind pressure be taken into account, the tension increases and the safety factor reduces to 2.5.

But, by the foreign practice, momentary maximum allowable tension is usually taken at one-half of the ultimate strength of the wire. (See Dr. Harold Pender's paper *Proceedings*, A. I. E. E., June, 1911.) Even in heavy wind pressures of 40 lb. per sq. ft. (which seldom occur), the tension of the wire in this case would be far within the safety limit.

Sag when the supports are at the same level,

$$D = \frac{KmL^2}{8000\,T} = \frac{3.4 \times 1180^2 \times 4.9}{8000 \times 600} = 48.2$$

In our case,

$$D_1 = D\left(1 - \frac{K'h}{4KD}\right) = 48.2\left(1 - \frac{47.2}{4.9 \times 4 \times 48.2}\right)^2 = 43.6$$

Vertical sag corresponding to this sag:

$$\frac{KD_1}{K} = \frac{1}{4.9} \times 43.6 = 8.9$$

Inclination of the wire to the vertical plane:

$$\text{Cos } \varphi = \frac{8.9}{43.6} = 0.22,$$

or

$$\varphi = 77 \text{ deg. } 15 \text{ min.}$$

$$L = \frac{l}{2}\left(1 - \frac{47.2}{4 \times 4.9 \times 48.2}\right) = 500 \times 0.95 = 560.5$$

In the summer time we shall see how much the tension reduces and the safety factor increases:

Maximum temperature, 100 deg. Fahr. Wind pressure, 0

In the formula (6),

$$K = K_0 = 1$$

and

$$f = \frac{KmL}{8T} = \frac{3.4 \times 1180}{8 \times T} = \frac{500}{T}$$

$$f_0 = \frac{K_0 mL}{8T_0} = \frac{3.4 \times 1180}{8 \times 15} = 3.34$$

The formula becomes:

$$\frac{500}{T} - 0.125\,T = 12.005$$

From which we see $T$ is approximately equal to 13.5

$$\text{The safety factor } \frac{150}{13.5} = 11.$$

The sag when the supports are at the same level,

$$D = \frac{KmL^2}{8000\,T} = \frac{3.4 \times 1180^2}{8000 \times 13.5} = 43.8.$$

ag in our case,

$$D\left(1-\frac{K'h}{4\times K\times D}\right)^2=43.8\left(1-\frac{47.2}{4\times 43.8}\right)^2=23.4.$$

is the maximum sag in the whole year.

$$=\frac{L}{2}\left(1-\frac{47.2}{4\times 43.8}\right)=\frac{1180}{2}\left(1-\frac{47.2}{4\times 43.8}\right)=432.$$

eight of the lowest point above the sea level at the t tide,

$$(157+48)-(47.2+23.4)=134.4$$

wind pressure be taken into account, the calculation es as follows:

ximum temperature, 100 deg. Fahr. Wind pressure, per sq. ft.

$K=4.9.$ $K_0=1.$ $t_0=-10.$ $T_0=15.$

formula (6),

$$p=\frac{KmL}{80\,T}=\frac{4.9\times 3.4\times 1180}{80\,T}=\frac{245}{T}$$

$$p_0=\frac{K_0mL}{80\,T_0}=\frac{3.4\times 1180}{80\times 15}=3.34$$

$$t-t_0=100-(-10)=110$$

$$\left(\frac{K'}{K}\right)^2-\left(\frac{K_0'}{K_0}\right)^2=\left(\frac{1}{4.9}\right)^2-(1)^2=-0.06$$

rmula becomes,

$$\frac{60{,}025}{T^2}-0.125\,T=12.135.$$

which we see $T$ is approximately equal to 56.

fety factor $=\frac{150}{56}=2.7.$

g when the supports are at the same level,

$$D_1=\frac{KmL^2}{8000\,T}=\frac{3.4\times 1180^2\times 4.9}{8000\times 56}=51.6.$$

g in our case,

$$D\left(1-\frac{K'h}{4KD}\right)^2=51.6\left(1-\frac{47.2}{4.9\times 4\times 51.6}\right)^2=46.5$$

rtical sag corresponding to $D_1$,

$$s_1=\frac{46.5}{4.9}=9.53.$$

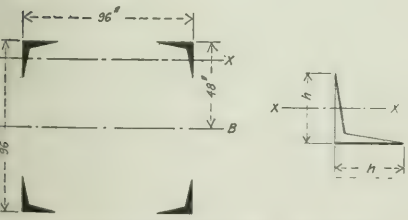



FIG. 3—SECTION THROUGH TOWER AND ANGLES

clination of the wire to the vertical plane is:

$$\text{Cos}\,\varphi=\frac{9.53}{51.6}$$

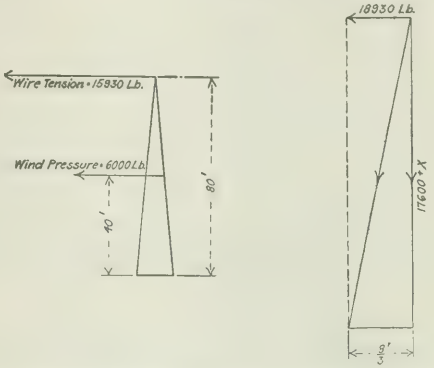
e

$$\varphi=79\text{ deg. }30\text{ min.}$$

$$\frac{L}{2}\left(1-\frac{K'h}{4\times KD}\right)=590\left(1-\frac{47.2}{4\times 4.9\times 51.6}\right)=563.$$

evident that maximum tension will occur during the lowest temperature in winter and maximum sag during the highest temperature in summer. In winter, the maximum permanent tension will be 15,000 lb., and the maximum momentary tension 60,000 lb. In summer, the maximum vertical sag will be 23.4 ft.

We shall calculate the strength of the steel tower under the worst condition; that is, when the wind pressure acts




FIGS. 4 AND 5—TENSION ON TOWER AND STABILITY DIAGRAM

on the tower with the same direction as the tension of the stretched wires. By the government's regulations the safety factor shall be more than three under these conditions.

Height of the tower, excepting the top arm, 80 ft.

Dimensions at bottom, 96 in. by 96 in.

Dimensions at top, 32 in. by 32 in.

Following are the sizes of angle steel used for the main corner members: Lowest part, 4 in. by 4 in. by 0.75 in.; middle part, 3.5 in. by 3.5 in. by 0.75 in. and 3.5 in. by 3.5 in. by 0.625 in.; upper part, 3.5 in. by 3.5 in. by 0.5 in. The total tension of the wire $3\times 60{,}000\times 0.0885=15{,}930$ lb. where 0.0885 sq. in. is the actual area of the stranded wires. This tension acts nearly horizontally at the top of the tower and the bending moment is

$$PL=15{,}930\times 80\times 12=15{,}292{,}000\text{ in.-lb.}$$

The wind pressure is about 6000 lb., which may be supposed to act on the middle point of the tower, and its bending moment is

$$6000\times 40\times 12=2{,}880{,}000\text{ in.-lb.}$$

The total maximum bending moment at the lowest part of the tower is 18,170,000 in.-lb. But from the structure of the tower (Fig. 3) the moment of inertia of the angle-iron through the $X-X$ axis

$$=\frac{Ah^2}{10.2}=I,$$

and the moment of inertia of the structure through the $A-B$ axis.

$I'=4\times[I+\text{area}\times(\text{distance between }XX\text{ and }AB)^2]$

In our case, for the 4-in. by 4-in. by 0.75-in. angle,

$$I=\frac{Ah^2}{10.2}=\frac{5.44\times 4^2}{10.2}=8.12$$

For the structure,

$$I'=(8.12+5.44\times 48^2)\times 4=50{,}032$$

But the relation between bending moment and the moment of inertia is

$$M=\frac{I}{n}f.$$

Where $n$ is the distance of the extreme fiber from the neutral axis, $f$ is the extreme fiber stress.

In our case the bending moment due to the wire tension and the wind pressure is

$$18,170,000 = \frac{I}{48} \times f.$$

Hence:

$$I = \frac{18,170,000}{f} \times 48.$$

which must be equal to the $I'$; that is:

$$\frac{18,170,000}{f} \times 48 = 50,032.$$

Whence

$$f = \frac{18,170,000}{50,032} \times 48 = 17,424 \text{ lb.}$$

Taking the ultimate tensile strength as 60,000 lb., the safety factor will be

$$= \frac{60,000}{17,424} = 3.4.$$

Thus the structure is well within the required safety limit.

To determine the weight of the foundation concrete, the weight of the tower being 8 tons, the total force at the top of the tower, from Fig. 4,

$$= 15,930 + 3000 = 18,930 \text{ lb.}$$

$X$ = the weight of concrete.

Then, to get the stability of the tower, the point of application of the resultant force is to be within a third of the base from the vertical axis.

$$\frac{18,930}{17,600 + X} = \frac{\frac{8}{3}}{80}$$

$$\therefore 18,930 \times 80 = \frac{8}{3}(17,600 + X)$$

$$\therefore \frac{18,930 \times 80 \times 3}{8} - 17,600 = X$$

$$X = 557,900 \text{ lb.}$$

## Submarine Transmission Line in the Baltic Sea

The recent contract of a large Swedish central-station company to furnish energy to a Danish electric power and railway company through a submarine cable laid in the Baltic Sea recalls the 12,000-volt, three-phase cable, 18,800 ft. in length, across the San Francisco Bay, which was noticed on page 1193 of our issue dated June 1, 1912, and the more recently completed Stralsund Channel project—the early high-tension submarine transmission systems of the world.

The two 15,000-volt, three-phase cables for the Stralsund Channel project were laid between the generating station at Stralsund and the island of Rügen for the purpose of supplying energy to the inhabitants of the island of Rügen and also with the view of extending the system across the island to the peninsula of Wittow.

In crossing the straits between the island of Rügen and the mainland the cables were laid across the small island of Dänholm in order that electric service might be furnished on this island. The distance from the mainland to Dänholm was 1100 ft. and from Dänholm to the island of Rügen the distance was 4500 ft. In order to facilitate the process of manufacture and to reduce the cost of transportation, the cable for the 4500-ft. span was made in two sections, one of which was 2500 ft. and the other 2000 ft. in length. The largest reels were 9.75 ft. in diameter and 6 ft. wide and weighed 42,000 lb.

A steamer and three scows were chartered to lay the cable. Two of the scows were fastened together by means of I-beams and chains and the cable reels were set up in bearings on the decks of these scows. It was thought best to use the ship's engines for propelling the scows while the cable was being laid, as it would have been impossible to control the motion of the barges with sufficient precision. Accordingly, all movement of the barges while paying out cable was accomplished by means of steam winches acting upon anchors which had previously been sunk in the line of travel. Side anchors were used to prevent drifting. When the end of the 2500-ft. cable was reached the third scow was anchored and the end of the



FIG. 1—CABLE DRUMS IN TRANSIT

cable lashed to its deck. The 2000-ft. length of cable was then laid from the anchored scow to the island. A weatherproof tent, erected over the end of the cables and electrically lighted from the ship's generating equipment, furnished a place for the workmen to splice the cables in spite of the inclement weather.

It is a notable fact that this was the first time submarine high-tension cables have been spliced at sea. The cable connections were soldered and saturated with insulating compound, after which the compound was allowed to cool for several hours. Iron sleeves were used as armor, and they, too, were filled with insulating compound and were sealed. When the splices had been made they were lowered over the side of the barges by means of ropes and



FIG. 2—ARRANGEMENT OF CABLE ON DECK

windlasses into the water, which was at that place about 30 ft. deep.

One of the accompanying illustrations shows a huge pile of cable laid on the decks of the scows in the form of a figure eight. As it was impossible for the scows to approach closer than within 200 yd. of the shore, this means was resorted to in order that the end of the cable might be reached and taken upon the shores of the island. It i

tated that the services of twenty men were required to ile the cable in the shape in which it is here shown. Near ne shore and in places where the water was shallow the able was laid in trenches 3 ft. deep which had been redged for the purpose.

In laying the two cables to the peninsula of Wittow a ifferent method was adopted. The reels were set up on the nore and a steel hawser was strung across the strait, over



FIG. 3—ARRANGEMENT OF CABLE REELS

pulley on the bank opposite the reels, and out again to the teamer on the water. By connecting the hawser to a team winch the cables were dragged across the inter- ening water with the assistance of small boats placed 75 t. apart to keep them off the muddy bottom of the sea. This method obstructed all traffic in the channel and during ne night search-lamps were employed to illuminate the nall boats and to warn other vessels that the passage was mporarily closed. The channel at this point is about 1500 t. wide.

Another instance of submarine energy transmission is that cross the Straits of Fehmarn. A large section of Holstein supplied with energy from the generating station at the iemens factory. Use is made of two lead-covered, iron- ire-armored, paper-insulated 11,000-volt cables, 3 by 2.5



FIG. 4—SPLICING THE CABLES

5 mm in cross-section, to connect the island of Fehmarn ,th the Siemens system. Overhead lines lead from the ntral station at Goehl to a cable-terminal station at the fore. From this place the cables extend a distance of 50 ft. across the sound to a second cable-terminal station om which overhead lines distribute energy over the island. Each cable was arranged in two sections each mounted a drum, weighing with its cable about 20 tons. They were laid by means of cable boats moved by winches to pay out the cable when near the shore. In mid-stream the cable ships were towed by a steamer which proceeded at a speed of about 100 ft. per minute. The two ends of the cable thus laid out were fixed on the boat and a tent was erected for making connections between them and the other cable ends

## 60,000-Volt Steel-Tower Line Construction in Southern California

By Harry W. Dennis

In the spring of 1912 construction was started on a steel-tower line for the transmission of electricity at 60,000 volts between certain of the main stations of the Southern California Edison Company. This company operates extensively in southern California and has a transmission system as shown on the accompanying map. A brief synopsis descriptive of the system of the company will explain the reasons for the new tower-line construction and will be of assistance in following the description of the new work.

### Plants and Transmission Lines

The transmission system interconnects all of the generating plants and substations and leads, naturally, to three primary centers of distribution, Los Angeles, Colton and Santa Ana. The generating plants comprise both hydraulic and steam power and include the following stations:

| | Kw. |
|---|---|
| Hydroelectric: | |
| Kern River No. 1 | 20,000 |
| Santa Ana River No. 1 | 3,000 |
| Santa Ana River No. 2 | 1,000 |
| Mill Creek No. 1 | 750 |
| Mill Creek Nos. 2 and 3 | 3,250 |
| Lytle Creek | 500 |
| Steam: | |
| Redlands | 600 |
| Los Angeles No. 3 | 10,000 |
| Long Beach (including No. 3 unit now in course of construction) | 47,000 |
| Total | 86,100 |

The hydraulic stations, with the exception of Kern River plant No. 1, are relatively close to Redlands and, taken with the Redlands steam plant, may be considered as one unit of the generating system, with a principal receiving substation in the city of Colton. This Colton group is widely separated from the other generating stations, although there is now a steel-tower line connecting the Colton substation with Los Angeles No. 3, Long Beach and Kern River. The transmission line between Kern River No. 1 and Los Angeles, a distance of approximately 118 miles, was built in 1907 and consists of a single line of steel towers carrying two circuits of No. 0000 stranded copper cable supported on pin-type insulators.

The original transmission line between Colton and Los Angeles was constructed in 1897 and consisted of two circuits of No. 1 copper wire supported by wooden poles. In the latter part of 1909 it became obvious that it would soon be necessary to arrange for replacing this wooden-pole line, both because the wooden poles were rapidly giving out and because the wire was too small for the requirements of the load which it was called upon to transmit. It is a matter of interest to note that this wooden-pole line was constructed for the primary purpose of transmitting hydraulic power of the Colton group of stations to Los Angeles for market, and that the load in the vicinity of Colton had reached such proportions that not only did it require all of the generating capacity of the Colton group but it was also necessary to transmit power from Los Angeles. The original line operated at 30,000 volts, and it was determined to plan the new line for 60,000 volts, with long spans supported by steel towers and suspension insulators.

About this time, also, it became necessary for the Southern California Edison Company to provide for additional generating equipment, and the construction of the steam plant at Long Beach was started, unit No. 1 of this plant being put in operation in August, 1911.

### Provisions for Towers

The towers which were erected in 1907 for the Kern



FIG. 1—MAP SHOWING LOCATION OF TRANSMISSION LINES

River line were intended for three circuits, being arranged to support five wires on the upper cross-arm and four wires on the lower arm, the three wires of each circuit forming an equilateral triangle. For the new line a similar tower was designed. Competitive bids were secured, however, as a result of which a tower was chosen to carry two circuits, the wires for both being arranged in a plane nearly vertical and supported at the ends of the cross-arms. On account of right-of-way restrictions, it was determined that the towers should be made self-supporting without placing any reliance upon the use of side guys. Accordingly several sizes of towers were adopted, all, however, conforming to the same general design, the heavier towers being made up of heavier sections and being so designed as to provide for a range in angles. The standard tower was intended for use only on straight-line work and deflection angles not exceeding 1 deg. There were eight special towers of the same height as the standard tower but designed for angles so as to cover the whole range of deflection up to a full right angle. It also became necessary to have three other special towers conforming to the general design, but made higher to give the necessary clearance in certain special cases. The accompanying illustrations show the design of these towers, and the table gives the deflection angles, approximate weights and sizes of members.

The climatic conditions obtaining in southern California made it unnecessary to consider any ice or sleet load upon the wires, and the controlling elements of the design, therefore, were:

(1) Range of temperature, from 20 deg. Fahr. to 110 deg. Fahr.

(2) Wind, for which the possibility was considered of an actual velocity of 60 miles per hour occurring at 40 deg. Fahr.

(3) One broken wire.

(4) Maximum strain in stranded copper cable, 22,000 lb. per sq. in.

(5) Maximum tension in steel, 30,000 lb. per sq. in.

(6) Maximum compression for tower legs according to the following formula,

$$p = \frac{21{,}500}{1 + \frac{l^2}{36{,}000\, r^2}}$$

in which $p$ is allowable compression in pounds per square inch, $l$ is unsupported length in inches, and $r$ is least radius of gyration in inches, the ratio $\frac{l}{r}$ being limited to 150.

(7) The holding-down effect of earth taken at 45 lb per cu. ft., including the weight of the frustum of a cone the angle of whose sides with the vertical is 45 deg. This requirement is equivalent to a factor of safety of two, with 90 lb. per cu. ft. for actual weight of earth.

### Steel-Tower Location and Right-of-Way

The towers were purchased from the Riter-Conley Manufacturing Company under specification which required a shop load test for the standard towers. All members were required to be hot-galvanized and all bolts to be sherardized. The height of the towers was determined by consideration of minimum clearance of 33 ft. above the surface of the ground and 8 ft. between cables, and the tower locations were adopted in accordance with a standard spacing of 700 ft., the variation in this spacing being made where towers were located on ridges permitting ample sag and the maximum spacing between any two towers as erected was 1874 ft. The line was located upon a private right-of-way for the entire distance of approximately 7 miles, with the exception of a distance of 1.94 miles upon the streets of the city of Los Angeles, and although the tower as described was used for the major portion of the line, it was necessary to adopt a smaller structure for certain pieces of right-of-way.

For a distance of 7 miles the line is located through valuable ranch property, where it became necessary to con

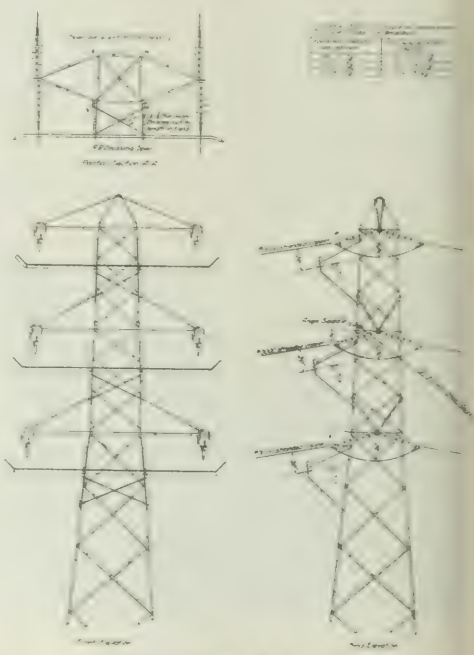


FIG. 2—DETAILS OF TOWER TOP

struct a pole not more than 3 ft. square, and this pole was erected, requiring a standard spacing of 660 ft.

In the city streets of Los Angeles still another design was made necessary, where the supporting structures were required to provide 45 ft. clearance under the line and a maximum dimension of 18 in. square at the ground. For this part of the line most of the spans are about 200 ft.

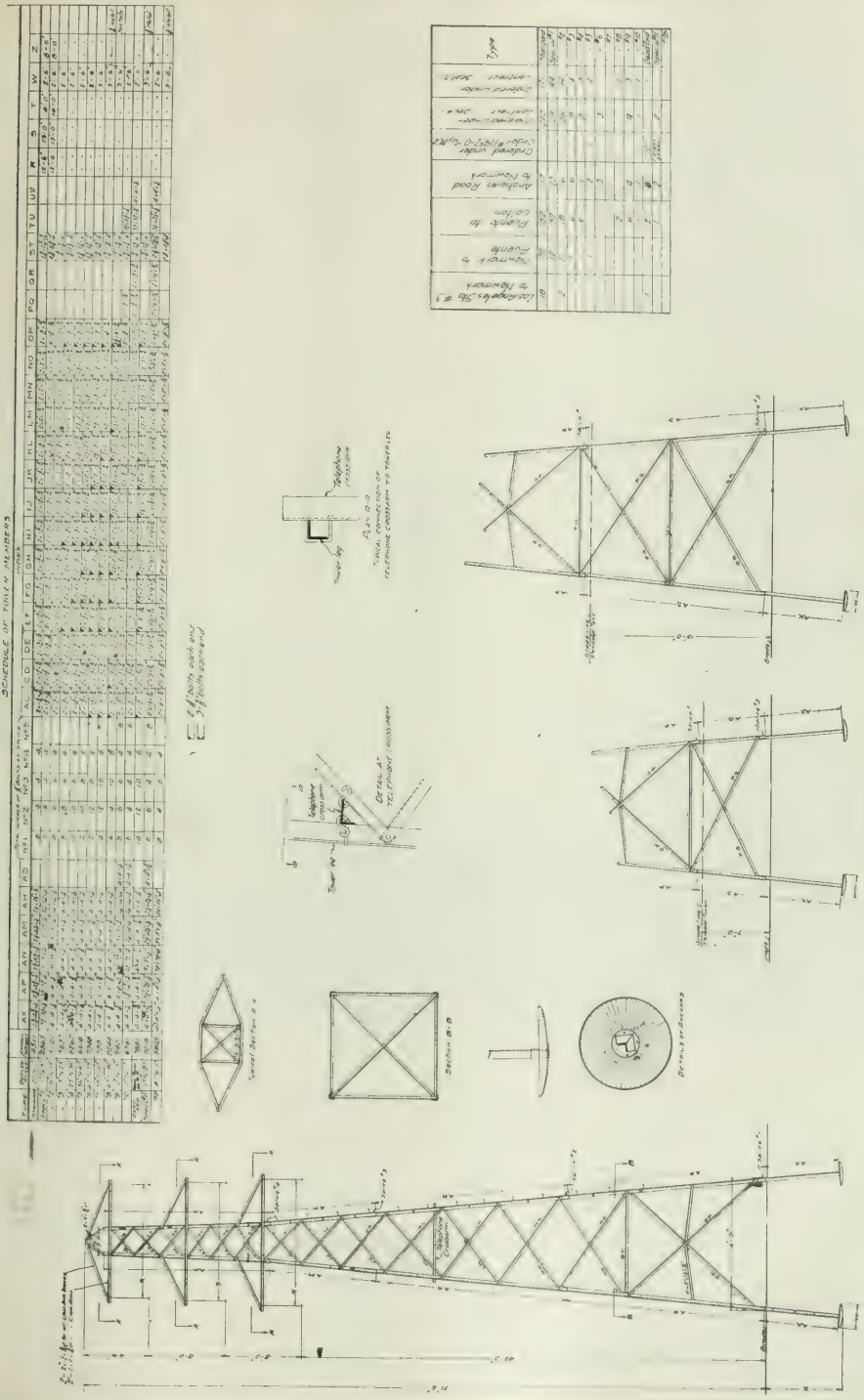


FIG. 3—DESIGN DETAILS OF TOWER STRUCTURE, SHOWING WEIGHTS AND DIMENSIONS OF ALL MEMBERS

Reference to the construction drawings shows that each oting of the towers consists of a single angle bolted to a shed plate 2 ft. 6 in. in diameter, excepting for some of e special towers and for the dead-end, for which the disk 3 ft. 6 in. in diameter. Concrete was used in this foot- g only to provide uniform bearing under the disk, and at e crossings of railroads, where the requirement was made at the angles should be incased in concrete up to the round line so as to prevent rusting. Although due con- deration was given to the matter of preparing concrete undations to a point above the ground line, cost made this ohibitive, owing largely to the fact that much of the line as built through desert country where it would have been cessary to haul materials and water a long distance in der to prepare such concrete footings. The company's evious experience on the Kern River towers, where no ncrete was used, had also been such as to warrant the petition of the same kind of construction.

For the steel poles having bases 36 in. square a spread ncrete footing was prepared, although for the steel poles hose base was 18 in. square the character of the soil was ch as to render a spread footing unnecessary, and the ck-fill only was made of concrete.

### Suspension-Type Insulators

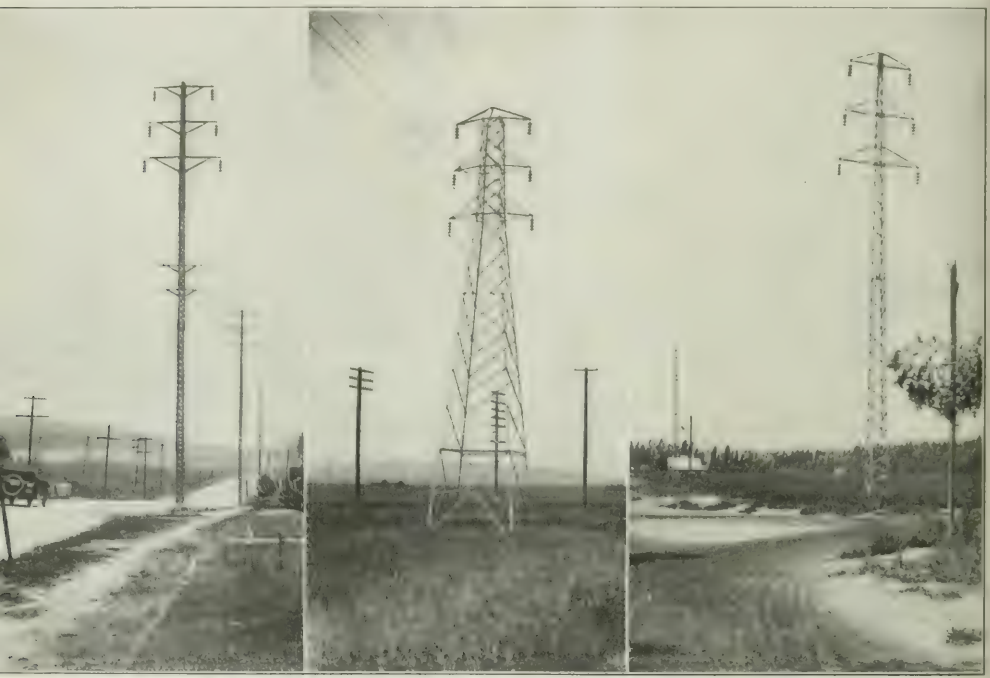
Suspension-type insulators are used throughout on this ansmission line, those chosen being of the Locke No. 2565 -in. type. Although these insulators were purchased der specifications which required successfully withstand- g tests of 90,000 volts, four units in series are used at all pporting points other than points where strain in the di- ction of the line occurs, at which points five units in series e installed. The wisdom of providing one extra unit at rain points is apparent when consideration is given to the fficulty involved in replacing one of these strain untis. y having the extra insulator one unit may fail electrically without causing a shut-down of the line and the tedious operation of replacing the broken unit.

Dead-end construction is used at all angle points where the deflection is more than 1 deg., and the cable is placed, without splicing, in a loop so as to give a clearance of 30 in. from the tower structure. This type of construction is also adopted at crossings of steam railroads in accordance with the railroad companies' specification that the conductor should be dead-ended at the tower on each side of the crossing span.

The railroad specifications also require that suitable grounding arms be erected under the wires so that in the event of mechanical failure of the insulator the live transmission conductor would not fall on to the railroad tracks. Fig. 2 shows the grounding brackets and the method of dead-end construction.

### Setting Stubs for Towers

The setting of the stubs for the towers is one of the dis-



IG. 4, 5 AND 6—VIEWS ALONG THE TRANSMISSION LINE, SHOWING MINIMUM, STANDARD AND MEDIUM WIDTH TOWERS

tinct operations carried on by a separate squad of men, independent of the gang engaged in other operations incidental to the construction of the steel-tower line. In order to accomplish this work satisfactorily the essential elements are: Securing proper back-fill under and around the stubs and, in fact, filling the entire hole up to the surface of the ground, and the assurance that when this back-fill is complete the bolt holes through which the tower legs are secured to the stubs will be at proper elevation and location to conform to the shape of the base of the assembled tower. In the first towers which were erected on the lines here described there was a considerable amount of time lost owing to the failure to secure these objects, and as a result of subsequent experience the following procedure was adopted:

It being apparent that the original soil would be disturbed for at least a short distance under the stubs, and that difficulty would exist in securing compact back-fill of

earth under the disks, concrete was used for the back-fill under the anchor plates. This concrete was in general carried only up to the top of the anchor plate, and the remainder of the hole was filled with excavated material. At angle towers, however, the entire hole for about 18 in above the disk was filled with concrete, the bottom of the hole having been enlarged so that it would be impossible for the tension stubs to pull out except by lifting the adjacent earth. In order to secure the proper final position of the bolt holes, there was used a wooden templet in connection with nine stakes, one at the center of the tower and two adjacent to each hole. The templet chosen consisted of a piece of 2-in. by 4-in. lumber, at one end of which was securely fastened a piece of 2-in. by 2-in. at the proper bevel, so that when the main member of the templet was horizontal and one end correctly located at the center of the tower, the other member of the templet was in a position to lie inside of the angle which formed the tower stub. The templet accordingly rested upon the center stake and one of the above-mentioned stakes near the hole for the leg, which, of course, was so set as to give the proper direction for the templet relative to the tower base. The other stake to which reference has been made was placed wtihin 24 in. of the location of the stub, so as to be within reach of a carpenter's level, and with the combined use of the templet and this level the stub could be properly located to conform to the foregoing requirements. On certain side-hill work it was necessary to do some trenching, so that the templet could be conveniently used, but the expense of such extra excavation was considered preferable to arranging for special tower members which would conform with the actual ground conditions.

On account of the improper setting of some of the tower stubs and the failure of the sub-foreman to appreciate the necessity for extreme accuracy, an experiment was made by using another type of templet upon which two stubs, diagonally opposite one from the other, could be suspended, in the hope that this method would secure the desired result without the extreme care made necessary by the method above described. In the construction work, however, it was found that this templet was too long and bulky to be handled readily and transported between towers and that it lacked sufficient rigidity. To overcome this would have required that it be made heavier and more unwieldy, and accordingly the original method was adopted for the remainder of the work.

### Assembling and Erecting Towers

The assembling of the towers was carried on by a crew of eight men and a sub-foreman. Except in special cases, the towers were erected on the ground so that the vertical axis of the tower lay in the direction of the line. The tower material was spread out on the ground in the proper position, so that after the members forming the two sides were fully bolted together they were tipped up into vertical position and held, while certain of the cross-members of the other sides were securely fastened to the leg members. After the tower was fully assembled, all of the bolts were tightened, but the final tightening was deferred until after the tower was erected. In special cases it became necessary to assemble the tower in places where local conditions were such that a large amount of benching would have been required for assembling the tower on the ground, or where other conditions made the usual procedure impossible.

The erection of the towers was accomplished by a gang of eight men and a foreman and one team, the process being shown in the accompanying illustration. A sling was fastened to the tower at the lower cross-arm and carried over a gin-pole to a set of blocks, one end of which was in turn anchored to a dead-man buried in the ground about 70 ft. from the base of the gin-pole. Fastened to the foot of the tower, at the holes provided for the splice between tower legs and the stubs, there was temporarily secured a 6-in. wrought-iron pipe, each end of which was securely snubbed back by chains to three long steel pins driven in the ground. Temporary struts were used between the ends of adjacent tower legs. The pipe also served as a convenience in securing the lower end of the gin-pole. Side guys for the gin-pole were of course provided, these guys being snubbed to pins driven into the ground, care being taken that the guys were directly opposite and at right angles to the axis of the tower. No side guys were provided for the tower itself, inasmuch as the width of the base is approximately 14 ft. and the pipe was securely supported at either end. A back guy for the tower was, however, provided. The gin-pole is at all times at right angles to the axis of the tower, so that when the tower reaches the vertical position the gin-pole is upon the ground.

Under the ends of the pipe planks were provided so that the tower may be conveniently pinched in any direction to bring the holes in the legs of the tower fair with the holes in the stubs, and after two of the legs are bolted an additional strain is taken in the hoisting line, so that the legs carrying the pipe are somewhat elevated and the pipe itself is removed, whereupon the tower can be slacked back and the two connections made. Although the actual operation of raising the tower from the time the upper cross-arm left the ground until the tower stood in a vertical position was usually accomplished in a very short time, the time involved in the operations of digging holes for dead-men, arranging slings and pipe, placing gin-pole, hoisting line and back guys, bolting tower legs to stubs, assembling, loading and transporting equipment to the next tower, amounted to something over an hour. The best day's work accomplished by the tower-erecting crew consisted in the complete erection of ten towers in an eight-hour working day.

After the towers were fully erected and before any strain was brought upon them by stringing wire, a separate crew of men tightened all of the bolts so as to develop as much pressure as possible between adjacent tower members, and in order to prevent a subsequent loosening of the bolts by vibration or other agencies, each bolt was "center-punched" so as to injure the thread of both the bolt and the nut.

### Preparation for Stringing Wire

The wire used on this transmission line was No. 0000 copper cable, having seven strands. It was furnished in reels, each having a total weight of approximately 2000 lb. and containing nominal lengths of one-half mile per reel. The cable was delivered to the company at various convenient railroad sidings, from which points it was distributed along the line. For unreeling the wire the method first employed involved using a heavy wagon having specially constructed framework with provision for hoisting three reels and slinging these on steel rollers through the centers of the reels, the end of each wire being spliced to the wire already strung out. The wagon was then taken along the line, unreeling the wire between the towers. This method was possible because all of the wires were supported at points outside of the frame of the tower, but it was subsequently abandoned on account of the facts (1) that in various locations the ground was so rough that hauling the wire in this way was impracticable, (2) that part of the towers were erected parallel to property fences, so that there was insufficient room to haul the wagon between these fences and the towers, and (3) that it became necessary to take down whatever fences were crossed by the line to allow the wagon to pull through.

The principal advantage in this method of unreeling the wire lies in the fact that the wire was not dragged over the ground, although it must be borne in mind that where the ground conditions were such as would harm the wire they were in general so rough as to make it impossible to use this method at all. The method finally adopted as being more flexible and suitable for all occasions was that of supporting the reels on standards and dragging one or more wires into position.

As mentioned, the insulators were 10 in. in diameter and were manufactured by the Locke Insulator Manufacturing Company. They were bought subject to test and acceptance at the company's test department at Los Angeles. As there were no means of testing these units after leaving the company's warehouse, special precautions were adopted to transport them safely from the warehouse to the site of the work. This transportation was accomplished by means of an automobile truck, and special crates were built to eliminate as far as possible any accident to the insulators after leaving the test. For the standard towers there were required four for each point of support, a total of twenty-four units. The crates were built accordingly, each crate providing for three strings of four units each, to be supported top and bottom, and to be clear so that the porcelain would not be in contact with any part of the crate. It was the intention to leave these insulators in the crates until the linemen could swing them into position on the towers, but for certain reasons the method was given up and the insulators, after being tested, were again packed in the original crates for shipment to the work, it having been found that irregularity in construction progress coupled with the extremely long haul—in some instances nearly 60 miles—made it impossible to supply the insulators in proper time for construction, and that the method of supporting the insulators in the new crates subjected them to severe mechanical strain, involving in many instances loosening of the hardware of the insulator units.

To hang the wire to the insulators involved the use of the ordinary suspension-type hardware with a malleable-iron clevis furnished with the insulators. To hang the insulators from the cross-arms there was used a forged clevis having an opening corresponding to the combined thickness of gusset plate and down-standing legs of the tower cross-arms. By this means a universal joint was secured so that any string of insulators might move in a direction either longitudinal or transverse with the line. For the dead-end construction at all angles where the deflection was more than 1 deg., as well as at railroad crossings, there was used the Locke No. 2383 dead-end hardware, together with a string of five insulator units fastened by means of a forged clevis to an eye-bolt carried through a hole in the down-standing legs of the tower cross-arm.

After the insulators with their hardware were hung in their proper position on the tower, the wire was strung through snatch blocks hung by chains as nearly as possible at the proper elevation, so that no further lifting of the wire would be required when proper tension had been secured. Everything was then in readiness to transfer the wire to the insulators.

### Pulling the Wire to Tension

Although there were numerous angles in the right-of-way for the line here described, practical conditions made it possible to pull to tension at one operation, even on straight-line work, more than seven spans of wire, representing a distance of approximately 4900 ft., it being found by experiment that even with this number of spans there was sufficient loss in tension at each snatch-block support to give a very large difference in sag in the first span as compared with the last. Accordingly the center span was observed in determining the proper sag for any one pull. The major part of the slack was pulled by the team and a final adjustment made by the use of blocks. A special come-along was adopted consisting of two pieces of wrought iron in which grooves of suitable size had been machined. To one of these was forged an eye of ample size, and the two pieces were bolted together over the wire by the use of four cap screws. The length of the bearing secured upon the wire was approximately 6 in., which was found to be ample to develop sufficient friction for making the required pull without slipping or injuring the wire. The grooves in this come-along were rounded on all edges and the cap screws were of such size that the heads would fit the flat wrenches carried by the linemen for making up the insulator hardware, thereby reducing to a minimum the necessary tools required for the working outfit.

Although the proper tension in the wire was for a time determined by the use of dynamometers, this method was subsequently abandoned in favor of the sag method, and the curves representing the proper sag for various conditions of temperature and span were for convenience on the part of the inspectors reduced to the accompanying table.

In the use of the table the temperature taken must be that in the air itself, on account of the variation due to even slight elevations above the ground. This is emphasized by a set of observations taken as follows:

Time—10:40 a. m.

Location—Long Beach line about 3 miles from the ocean.

Temperature at elevation 45 ft. above the ground—75 deg. Fahr.

Temperature 4 ft. above the ground—80 deg. Fahr.

Temperature with thermometer lying on ground (clean, dry sand)—116 deg. Fahr.

Temperature with thermometer lying on ground with bulb covered with sand—127 deg. Fahr.

TABLE OF PROPER SAG, DEPENDENT UPON TEMPERATURE AND SPAN

(No. 0000 copper cable, maximum working stress, 22,000 lb. per sq. in., controlling conditions, 20 deg. Fahr. and no wind, or 40 deg. and 60-mile wind.)

| Span, Ft. | 20 DEG. FAHR | | 40 DEG. FAHR | | 60 DEG. FAHR. | | 80 DEG. FAHR | | 100 DEG. FAHR. | | 120 DEG. FAHR | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sag, Ft. | Stress, Lb. | Sag, Ft. | Stress, Lb. | Sag, Ft. | Stress, Lb. | Sag, Ft. | Stress, Lb. | Sag, Ft. | Stress, Lb. | Sag, Ft | Stress, Lb. |
| 200 | 0.85 | 3655 | 1.00 | 3185 | 1.15 | 2740 | 1.37 | 2325 | 1.65 | 1960 | 1.95 | 1650 |
| 250 | 1.35 | 3655 | 1.60 | 3215 | 1.80 | 2795 | 2.10 | 2410 | 2.44 | 2075 | 2.80 | 1770 |
| 300 | 1.97 | 3655 | 2.25 | 3245 | 2.55 | 2850 | 2.93 | 2490 | 3.33 | 2185 | 3.77 | 1925 |
| 350 | 2.70 | 3655 | 3.03 | 3270 | 3.40 | 2900 | 3.85 | 2565 | 4.30 | 2285 | 4.83 | 2050 |
| 400 | 3.55 | 3655 | 3.95 | 3295 | 4.35 | 2950 | 4.85 | 2640 | 5.42 | 2380 | 6.07 | 2160 |
| 450 | 4.47 | 3655 | 4.93 | 3315 | 5.47 | 2990 | 6.00 | 2710 | 6.60 | 2465 | 7.23 | 2260 |
| 500 | 5.52 | 3655 | 6.05 | 3335 | 6.65 | 3035 | 7.25 | 2770 | 7.90 | 2545 | 8.56 | 2350 |
| 550 | 6.70 | 3655 | 7.27 | 3350 | 7.95 | 3070 | 8.60 | 2830 | 9.30 | 2620 | 10.00 | 2430 |
| 600 | 7.95 | 3655 | 8.62 | 3365 | 9.35 | 3110 | 10.05 | 2890 | 10.80 | 2690 | 11.55 | 2510 |
| 650 | 9.35 | 3655 | 10.10 | 3370 | 10.80 | 3135 | 11.60 | 2920 | 12.40 | 2740 | 13.20 | 2575 |
| 700 | 11.05 | 3580 | 11.85 | 3335 | 12.65 | 3120 | 13.45 | 2930 | 14.30 | 2765 | 15.15 | 2610 |
| 750 | 12.80 | 3535 | 13.65 | 3310 | 14.55 | 3120 | 15.40 | 2940 | 16.25 | 2785 | 17.10 | 2645 |
| 800 | 14.75 | 3500 | 15.65 | 3295 | 16.65 | 3115 | 17.50 | 2950 | 18.45 | 2810 | 19.25 | 2680 |
| 850 | 16.75 | 3465 | 17.70 | 3270 | 18.70 | 3115 | 19.60 | 2965 | 20.50 | 2830 | 21.50 | 2710 |
| 900 | 18.95 | 3440 | 19.95 | 3260 | 20.95 | 3115 | 21.95 | 2975 | 22.90 | 2850 | 23.85 | 2735 |
| 950 | 21.25 | 3415 | 22.25 | 3255 | 23.25 | 3110 | 24.30 | 2990 | 25.30 | 2865 | 26.30 | 2760 |
| 1000 | 23.80 | 3395 | 24.85 | 3240 | 25.90 | 3110 | 26.90 | 3000 | 27.95 | 2885 | 28.95 | 2785 |
| 1050 | 26.30 | 3375 | 27.45 | 3230 | 28.50 | 3110 | 29.55 | 3010 | 30.60 | 2900 | 31.65 | 2810 |
| 1100 | 29.05 | 3355 | 30.15 | 3220 | 31.25 | 3110 | 32.25 | 3020 | 33.40 | 2915 | 34.50 | 2830 |
| 1150 | 31.90 | 3340 | 33.05 | 3215 | 34.20 | 3110 | 35.30 | 3025 | 36.40 | 2930 | 37.50 | 2845 |
| 1200 | 34.95 | 3325 | 36.10 | 3210 | 37.25 | 3110 | 38.41 | 3030 | 39.50 | 2940 | 40.60 | 2860 |
| 1300 | 41.20 | 3310 | 42.30 | 3210 | 43.50 | 3120 | 44.70 | 3050 | 45.80 | 2960 | 46.90 | 2900 |

Where straight-line construction occurred for more than seven spans temporary dead-end connection was made by carrying the cables to the basket of the tower and securing them by chains and come-alongs, and when the proper tension had been taken in the spans ahead the strain in the chains would be relieved, and they could readily be removed and the wire transferred into the suspension hardware.



FIG. 7—"WORM'S-EYE" VIEW OF TOWER

On account of the fact that the standard towers were designed for the unbalanced pull of only one wire, and the further fact that even with this unbalanced pull there was a slight deflection of the tower, head guys were used to take up the strain. Whenever on angle towers the strain was finally imposed, the wires on opposite ends of the same cross-arm were slacked off simultaneously to avoid any possible twist in the tower. Wherever permanent dead-end construction was used, the cable of course was pulled past the tower, and after having been made up the wire ahead was pulled back by the use of blocks so as to give the requisite loop under the dead-end insulators. By this method no splicing was required.

In the operation of making up the dead-end clamp in its proper position a gage was used corresponding in length to the combined lengths of clevis, insulators and dead-end shoe, thereby assuring the proper location of the dead-end clamp. The wire was then pulled above tension a sufficient amount to allow for slack in the insulator units, which was required owing to the weight of the insulators and the necessarily awkward position which the lineman must adopt in holding the insulator. After the shoe had been made up and the insulators placed, the wire was slacked off by hand, the necessary amount of wire in the loop measured and the opposite shoe located and hung to the cross-arm, whereupon the wire in the next span was pulled as before.

In certain special cases it became necessary to make a splice in the loop at the tower, and in all these instances the strands were separated and interlocked with the strands of the other section and fully served out.

As has been mentioned, dead-end construction was required by the specifications of the railroad lines where transmission-line crossings were made necessary, and the tower itself was required to be self-supporting under conditions of broken wires on spans adjacent to the railroad. At certain of these crossings dead-end towers were used and at other crossings standard towers with back guys, this latter construction having been chosen wherever right-of-way restrictions did not prohibit the use of such guys. At one of these crossings, where a short span was made necessary, it was found that the deflection of the towers was such that the tension in the crossing span exceeded that in the adjacent spans due to the tension of the back guys. On account of change in temperature, the tension developed in this short span became sufficient to rupture mechanically one of the strain insulators, and as a remedy for this condition the following construction was adopted:

Guy cables were strung between the baskets of the towers on opposite sides of the railroad and drawn to such tension as to take all of the strain of the opposing back guys, and in addition thereto some of the strain of the transmission wires in the adjacent spans, whereupon the tension in the crossing span was reduced to such a point as to eliminate the possibility of further trouble.

### Telephone System

The Southern California Edison Company, in line with the practice of most operating companies, has its own private telephone line interconnecting all of the generating stations and the principal substations. Although the telephone line is primarily intended for use in operating the system, for which use it would fulfil its purpose in any location, it must be remembered that there are long stretches of the transmission line here described which are not adjacent to any public highway, and accordingly it was decided to erect the telephone upon the same towers with the transmission line, so that the patrolmen could readily report the location of trouble and likewise report clearance promptly after the trouble had been remedied. In general, one telephone pole is used in each span, it being the intention to limit the length of telephone spans to 350 ft. There were many spans, however, wherein it was impracticable to locate this intermediate pole, and the telephone wire was required to make the same span as the transmission cables. The wire adopted for the telephone system was No. 6 B. & S. gage Phono-electric wire, and in order to minimize the induction on the line a telephone transposition was made at every tower. Dead-end construction was adopted for the towers, using Thomas suspension insulator No. 1074, with 4-in. petticoat.

The insulator is secured to the steel cross-arm by the use of an "S" hook. The Phono-electric wire is made up by the use of a special two-bolt cast-iron clamp, a thimble being used where the wire hooks to the insulator. Weather-proof wire is used for the transposition, and the joint between the Phono-electric wire and the weather-proof copper wire is soldered. The plate shows the construction as adopted on one of the steel poles, but the same details were followed on the towers, a single cross-arm being used on straight-line towers and sight deflection angles, and two cross-arms, one on either face of the tower, being used where angles were so great as to cause interference with the cross-bracing of the tower. For that part of the line between the Los Angeles No. 3 station and the Newmark substation there are three telephone circuits; between the Newmarq and Colton substations there are two, and between Newmark substation and the Long Beach steam plant there is one circuit.



FIG. 8—METHOD OF LIFTING TOWER IN PLACE

The officers of the Southern California Edison Company, for which the work here described was carried out, are Mr. John B. Miller, president; Mr. W. A. Brackenridge, vice-president and general manager, and Mr. R. H. Ballard, secretary and assistant general manager. The work was done under the personal supervision of the writer as construction engineer for the above company.

# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Billboard Advertising in Toronto

The accompanying illustration shows one of twenty similar billboards used by the Toronto Electric Light Company, Ltd., in advertising electric fans. The design, which was produced by the company's publicity department, is a composite effect derived from the cover design of two fan catalogs issued by the Westinghouse Electric & Manufacturing Company. The object sought was to produce a sign which at first glance would impress the observer with a sense of coolness, and without doubt this object has been achieved in the present instance. The artists who executed the design were very successful in getting the wave effect, which with the blue-sky background sets off the rest of the sign very effectively. The electric fan, which is painted in its true colors, is of such size as to be visible at a considerable distance from the billboard.




A "FAN-TIME" BILLBOARD

## Electrical Refrigeration Used for Tempering Steel

Although the applications of electricity in steel making are numerous, the use of electrical energy in connection with the tempering of steel is not so widely known. The Pauly Jail Building Company, of St. Louis, which manufactures steel bars, gratings and jail equipment in general, employs an electrically driven refrigerating plant for keeping at a uniform temperature the water used for tempering steel. Since the installation of this system the output has both increased in quantity and improved in quality.

An ammonia system is used for cooling the tempering water. Some slight trouble was experienced at first on account of the cooling coils becoming coated with ice, thus reducing the efficiency of the system. The trouble was eliminated by raising the expansion pressure.

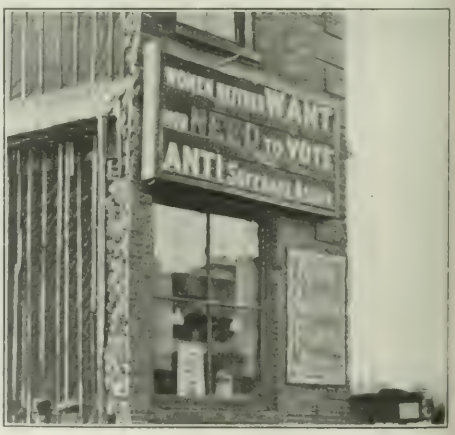
Two tanks, capable of holding 70 cu. ft. and 130 cu. ft. of water respectively, are used for tempering the steel. The water is circulated through the tanks and over ammonia cooling coils by a centrifugal pump driven by a 3-hp, three-phase Wagner motor which operates at 1720 r.p.m. About 40 gal. of water is circulated per minute.

"Heats," each consisting of eight bars of steel at 1500 deg. to 1600 deg. Fahr., are drawn from the furnace every ten minutes and immersed in the smaller tempering tank, the water in which is kept at about 35 deg. Fahr. The bars, which weigh about 22 lb. apiece, are cool enough to handle with the bare hands one minute after immersion. When tempering steel plates it is not necessary to maintain such a low temperature, and slightly more tonnage is turned out per day. The large tank is generally used for plate work. About 33.3 per cent more material is tempered with this system than with the old plan where the water was allowed to cool by natural means. Before the refrigeration system was adopted the slow cooling allowed the bars to become partially annealed. This trouble is not experienced now.

A 12.5-ton double-cylinder Maynard ammonia compressor furnishes the refrigeration for cooling the water. It is driven by a 25-hp, three-phase Westinghouse wound-rotor motor which is equipped with a Westinghouse starter. Electrical drive is used for all the machinery throughout the plant. In general group drive is used for the machine-shop tools, but the larger punching and shearing machines have individual motors. The shop is also equipped with a Toledo electric welder capable of accommodating two 0.25-in. plates. By means of a switch on the side of the welder the energy developed in the welding arc can be regulated. Flame-arc and tungsten lamps are used for illuminating the shop.

## An Electric Anti-Suffrage Sign

Electricity is being pressed into effective service in the aristocratic town of Brookline, Mass., by the Woman's Anti-Suffrage Association of that famous Boston suburb, through the medium of a 4-ft. by 9-ft. illuminated sign facing the Village Square transfer station of the Boston Elevated Railway Company. The sign, which is shown in the accompanying illustration, is equipped with eighteen 25-watt tungsten lamps run upon a 110-volt circuit through an automatic time switch in an adjacent printing office, energy being supplied by the Edison Electric Illuminating Company of Boston. Every evening at sundown the sign goes on duty, setting forth in somewhat negative terms its opposition to the ballot for the fair sex, but attracting the attention of thousands of travelers on the rapid transit lines and receiving comments both sacred and profane.




ANTI-SUFFRAGE ELECTRIC SIGN

## An Electric Vehicle in Emergency Fire-Alarm Service

At Huntington, W. Va., the fire-alarm system is operated by central-station energy. When the power house was put out of commission by the flood the company was confronted by the problem of keeping the fire-alarm circuits in operation. Mr. William R. Power, manager of the commercial department of the Consolidated Light, Heat & Power Company, ran an electric vehicle up to the fire "central" and connected enough cells to the alarm system to provide the proper voltage. Within ten minutes after the service was renewed a "three-alarm" call came in from the business district. The enterprising central station which uses electric vehicles never seems to be at a loss to keep its rolling stock in action, and in times of emergency the vehicles seem to be the most reliable of all central-station auxiliaries.

## Rehabilitating a Small Central Station

The maintenance of high standards of operation in very small central stations is often a difficult problem, but experience shows that unless good service is rendered within wide limits, a little company serving one or two villages is liable to become ruined financially just as a city plant of poor design and operated in a slipshod manner is in danger of going to the wall. In view of the thousands of small plants still in service in the country districts, the following critical study of a 60-kw installation at East Haddam, Conn., may be suggestive to the operating man.

The generating equipment consisted of a vertical waterwheel rated at 170 hp under a head of 20 ft., but on account of the bad condition of the dam the working head did not materially exceed 15 ft. By means of bevel gears the power was transmitted from the turbine shaft to a horizontal shaft and pulley in turn, belted to a main countershaft, from which was driven the 60-kw, 2300-volt generator with exciter. As an auxiliary source of power in times of low water or accident to the water-power, a 35-hp gasoline engine was so placed that it could be belted to the main shaft.

On account of the combined belting and shafting losses, the central station could not supply power even at its normal rating for more than half the capacity of the generator. The interior of the station was both inconvenient and unsafe on account of the mechanical complications existing. The water privilege was unquestionably valuable, but the outflow from the turbine was seriously retarded by rocks and sedimentation in the tailrace, so that a further loss of about 2 ft. in working head was encountered.

The electric distribution system was of the two-wire, single-phase type and in good repair, but the transformers appeared to be placed more with an eye to economy in first cost than with regard to location, spacing and load requirements for good service. Some of the branch lines supplying small single transformers were too long for their size of wire, and the local transformers in some cases were too small for properly carrying their loads. From eight tests made in various houses and stores it appeared that the pressure ran from 10 volts to a maximum of 26.5 volts below the standard, 110 volts, at which the secondary services were rated, resulting in dim lighting and a loss of about one-third to nearly half the rated candle-power of commercial and residential customers' lamps. Faulty joints and connections were found, besides high-resistance leaks in transmission lines and transformers. Speed regulation was by hand only, at the wheel.

The improvements recommended were the installation of additional transformer capacity, the better spacing and selection of transformers, increased capacity of lines found inadequate on test, reduction in belting and elimination of one shaft and belt drive, installation of an automatic governor, provision of an automatic voltage regulator, ultimate provision of duplicate three-phase generators, one to be direct-connected to its waterwheel, repairs at the dam, remaking of all poor joints, and the cleaning and deepening of the tailrace.

This called for what was practically the rebuilding of the plant, but the service was so poor and the cost of operation so great a proportion of the income that the engineers making the examination recognized that the only salvation of the plant lay in its complete modernization within the possible hydraulic limits of the property.

## Electric Float in Seattle's "Golden Potlatch" Celebration

The float shown herewith was entered in the recent "Golden Potlatch" parade, held in Seattle, Wash, July 19, by the Puget Sound Traction, Light & Power Company. A "dad's day" parade was included in this year's "Potlatch" antics. Floats showing "dad" attending to affairs of the home, washing dishes, mending, taking care of the babies during the matutinal hours, sitting up with sick friends, etc., were exhibited. Bringing up the rear was the float "Elec-




ELECTRIC FLOAT AT SEATTLE

tricity, Dad's Salvation." "Dad" in this case was one of the oldest employees of the Puget Sound Traction, Light & Power Company and had been with the company and its predecessors since their inception. An electric motor operated the washing machine in the picture and the ironing was done with an electric iron.

## Limits of Error for English Watt-Hour Meters

The British Board of Trade, which passes on electrical construction and supply matters, has fixed the following limits of error for watt-hour meters measuring direct current and single-phase alternating current:

"Meters in which the maximum current for full load—

"(*a*) does not exceed 3 amp—the error at any point from one-tenth load to full load must not exceed 3½ per cent plus or minus;

"(*b*) exceeds 3 amp but does not exceed 50 amp—the error at any point from one-tenth load to full load must not exceed 2½ per cent plus or minus;

"(*c*) exceeds 50 amp—the error at any point from one-twentieth load to one-tenth load must not exceed 2½ per cent plus, and at any point from one-tenth load to full load must not exceed 2½ per cent plus or minus."

# Illumination and Wiring

## Spectacular Sign for San Antonio

The largest electric sign south of the Mason and Dixon line has just been erected in San Antonio, Texas. It has the distinction of being one of the most elaborate spectacular displays ever made. It measures 50 ft. high and 85 ft. wide, and contains 6500 lamps. The effect depicted is a man on horseback roping a steer with a lasso. The animals are first shown running and then the steer falls and struggles as he is tripping the rope. The sign was erected by A. H. Cadwallader, San Antonio, the flasher mechanism and color caps being furnished by Betts & Betts, New York.

## Cost of Street Lighting in Chicago

In the course of a talk before the City Club of Chicago recently on "Street Lighting in Chicago—Accomplishments and Proposals," Mr. Ray Palmer, the city electrician, gave some interesting figures on the cost of the new street lighting of that city. He exhibited a wall map of Chicago, colored to show the work done or in progress in electric street lighting in various parts of Chicago under the existing contract with the Sanitary District of Chicago. That contract was executed in October, 1910, and at the time the city of Chicago had 12,200 street arc lamps. These were taken over by the Sanitary District, which also agreed to install 10,000 additional 10-amp flame-arc lamps, or their equivalent, within three years. At the present time, Mr. Palmer said, there are in service on the streets of Chicago 16,200 arc lamps or their equivalent. The remaining 6000 will be in service within a year. The energy is furnished to the city on the basis of $15 per hp-year of 4000 lamp-hours, or approximately 0.5 per cent per kw-hr.

Recently, as the result of a report made to Mayor Harrison by Mr. Palmer, there have been conferences with the Sanitary District trustees in the endeavor to negotiate a supplementary contract whereby 15,000 arc lamps could be added to those now under contract and the 7-amp alternating-current arc lamps could be replaced by 10-amp flame-arc lamps or series-tungsten lamps. This proposed extension would cost between $3,000,000 and $4,000,000. On July 10 the Sanitary District trustees reported that they would be unable to accept this new contract until the government granted an increased flow from Lake Michigan through the various channels of the Chicago Drainage Canal. At the present time the district is allowed to take 4167 cu. ft. per second from the lake. This proposed addition of 15,000 arc lamps is therefore held in abeyance.

To light one mile of street, using twenty-three flame-arc lamps, with underground wires, costs about $9,000, while if the wires are placed overhead the cost is only about $4,000. These figures include substation and feeder distribution costs. On some of the older residence streets, where the trees are well-grown and act as an obstruction to the light from arc lamps, a system of underground cables and tungsten lamps mounted in opalescent globes on the old gas posts has been installed. This type of construction costs about $8,000 per mile of street lighted, using seventy-five of the tungsten lamps staggered on both sides of the street and about 150 ft. apart, measuring on one side of the street.

Flame-arc lamps on underground circuits cost in 1912 $39.91 a year to maintain. To this should be added an interest charge on investment of $19.16 and a depreciation charge of $13.67, making the total yearly cost, according to Mr. Palmer's figures, $72.74 per lamp. While the lamps on overhead circuits cost as much to maintain the interest and depreciation costs are lower, bringing the total yearly cost down to $54.57.

The underground-cable tungsten-lamp street lighting is the most expensive form of public street lighting used in Chicago except gasoline lighting. The cost per unit is only $13.36 for cash maintenance of this type of lamp, but the interest and depreciation bring the total amount to $24.27 per lamp per year. As there are seventy-five lamps to a street mile, this means $1,820 a year to light one mile of street with series tungsten lamps as against $1,673 for flame-arc lamps on underground circuits and $1,255 for flame arcs on overhead circuits. The corresponding figure for gasoline lighting is $2,343.75.

Mr. Palmer made an interesting comparison between street-lighting conditions in Philadelphia and Chicago. Philadelphia has a population of 1,549,000 (1910), an area of 129 square miles with 1752 miles of streets and alleys. Chicago has a population of 2,185,000, an area of 194 square miles with 4400 miles of streets and alleys. The annual cost of street lighting in Philadelphia is put at $2,472,000, or $1,412 per mile of streets and alleys. The corresponding figure for Chicago is $1,038,700, or $234 per mile of streets and alleys for public lighting. According to these figures, Chicago spends less than 20 per cent (per year per mile of street and alley lighting) of the similar expenditure in Philadelphia.

Attention has been given recently to the lighting of street crossings under the elevated-railroad tracks, or subway crossings, as they are called. There are about 625 of these subways in Chicago. The railroad companies will be forced to install and maintain lamps in 275 of these subways, the city being required to light the remaining 350. After an investigation a standard of one 16-cp lamp for each 400 sq. ft. of inclosed subway area was decided upon as sufficient. The railroad companies have been trying to reduce this standard to one 16-cp lamp for each 800 sq. ft., but the Department of Electricity has refused to agree to this.

Supplementing the above in his recently issued annual report, Mr. Palmer asserts that the city of Chicago was operating on Dec. 31, 1912, 13,830 arc lamps and 862 series tungsten lamps. The city also rented 920 arc lamps and sixty-three tungsten lamps from the Commonwealth Edison Company. The average number of arc lamps owned and operated wholly by the city during the year was 12,735. The average cash cost of the operation and maintenance of these 12,735 lamps is given as $34.26 per lamp per year. This sum does not include interest, depreciation, lost taxes, rent of offices in the City Hall, rental of poles belonging to other companies, nor the cost of work done for the Department of Electricity by other branches of the city government. Adding these to the "cash cost," the total cost per lamp per year is placed at $60.32. Of this $13.52 is credited to depreciation and $7.65 to interest. The contract price of rented arc lamps is $75 a year.

Analyzing the $34.26 given as the cash cost for operation and maintenance the largest item is $10.60 paid for electrical energy to the Sanitary District. The next largest item of cost is $9.39 for lamp trimming, while repairs to circuits, conduits and posts cost $6.59, and carbons $2.84. The total cost of maintaining the municipal electric street-lighting system of the city in 1912 was $432,335.

Depreciation is figured at the following rates applied to original cost: Buildings, 1.08 per cent; steam equipment, 4.1 per cent; electrical equipment, 4.7 per cent; repair-shop equipment, 10 per cent; lamps, 6.66 per cent; circuits, 4 per cent; conduits, 3 per cent; posts, 3.5 per cent. The general interest charge is figured at 4 per cent on the value of the electric-light system less the amount payable to the Sanitary District.

The number of gas lamps in use for street lighting on Dec. 31, 1912, was 15,740 and the number of gasoline lamps 8678. The total number of municipal street lamps of all kinds in service in Chicago on Dec. 31, 1912, was 40,259. The city electrician recommends that gasoline street lamps be discontinued as fast as it is practicable to make extensions of electric or gas service.

## Support of Cables for Interior Work

It frequently happens that cables have to be supported beneath ceilings having arched construction, and supports at the drop beams are too far apart to keep the cable from sagging considerably. A simple device is used by the Freeman-Sweet Company of Chicago to avoid this difficulty. As shown in the accompanying illustration, the cable is

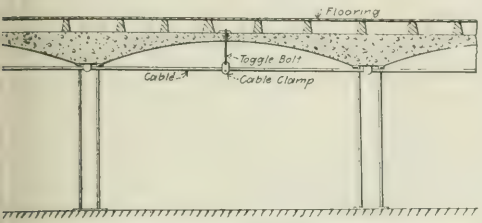



DIAGRAM SHOWING METHOD OF SUPPORTING CABLES

supported at the drop beams in the ordinary manner. Between the drop beams and beneath the crest of the arch a cable clamp is secured to the cable and also to a toggle-bolt which may be shoved through a small hole in the arch above. The toggle-bolt is of the collapsible type, and all that is necessary to install it is to drill a hole just large enough to allow the head of the toggle to slip through, the bolt being moved around until the toggle opens. This method has been found satisfactory both as to ease of installation and as to the result obtained.

## Distribution Line Records—I

By H. A. Holmes

While central stations are usually careful in the keeping of records of their equipment, quite a few companies do not possess an adequate method of keeping track of their distribution lines, both underground and overhead, especially as regards the size of lines and their exact location in ducts or on poles. The object of the writer is to outline a system which may easily be kept up and which will enable vital information to be obtained immediately. Maps similar to those described have been in use by many companies for a long time. For some of the valuable features of them the writer is indebted to the Chesapeake & Potomac Telephone Company, of Washington, D. C.; for others to the Potomac Electric Power Company, also of Washington. Other features of the system, it is believed, originated with the writer.

The basis of the system lies in the maps referred to above. A feature of these maps is that all streets except those necessary to identify the lines have been omitted. This relieves the map of considerable unnecessary and confusing detail. This plan is followed by the Chesapeake & Potomac Telephone Company. Another feature is that instead of using drawing ink for showing the various lines water colors are used. These are mixed in a small water-color pan and used with a ruling pen for lines or with an ordinary pen for lettering. When a change is to be made a wet brush is passed over the lines, thereby removing them. Colors which will remove easily should be chosen and should be mixed so that only a faint line is produced, just heavy enough to be clear and distinct. The first three illustrations represent a series of maps such as are used by the Potomac Electric Power Company. It should be stated that the feeders and circuits shown are mythical and for illustration only. The scale of the maps should be made generous so that there will be no crowding such as is apparent in the illustrations, which are much reduced.

Fig. 1 shows the high-tension feeders from the main station to substations, the lengths and sizes of the lines being given with such other data as are desirable.

Fig. 2 shows the primary lines from substations and main station to the transformers. On this map are indicated only the poles and manholes where transformers, lightning arresters, section switches, etc., are installed. Distances between taps in manholes or on poles shown on the drawing are given, no allowance for the cable in the manholes being made. In the illustration distances are not always written directly on the wire to which they refer because of lack of space. In the map any chance for confusion should be eliminated. Sizes of wire are also indicated. Different colors should be used for the lines from each substation. Poles are indicated by a dot (dots on the underground system, however, indicate taps; these dots have been omitted from the illustrations because of the small scale); transformers by a circle, more than one transformer by concentric circles, and manholes by a small square. Overhead lines are dotted. Underground lines are solid. Where the greater part of the system is overhead these symbols should be reversed, and where transformers are mounted on poles the circle should surround the dot indicating the pole. Lightning arresters are indicated by a square surrounding the pole. Where a transformer bank is fed from more than one substation the circle is made solid, half one color and half the other. The number, make and size of the transformer are indicated consecutively on the drawing. Manhole numbers have been omitted from all of the illustrations, as the illustrations do not have any colors to help in distinguishing various lines and figures.

With a direct-current system this series would give the feeders from the substations and main stations to the point of attachment to the distributing mains, which is indicated by a solid circle. The same procedure is followed as above when one distribution main is fed from two substations.

Fig. 3 represents a series of maps of various districts showing the secondary distribution, the manholes and pole location. For direct-current systems this series shows the distribution mains from the point where the feeder connects. The wire sizes should be shown as in Figs. 1 and 2. They have been omitted in the illustration because of the work involved in selecting sizes which would not seem ridiculous. When colors are used the lines from various substations can be easily distinguished.




FIG. 1—HIGH-TENSION FEEDERS TO SUBSTATIONS

Fig. 4 represents a series of individual maps for each primary or feeder and the secondary or distributing mains from that primary or feeder. All manholes and poles on the circuit and their numbers are shown and the distances between manholes given. Some companies might wish to have the data represented on these drawings Figs. 1 to 4 tabulated in a book. Instead of this, the use of cards

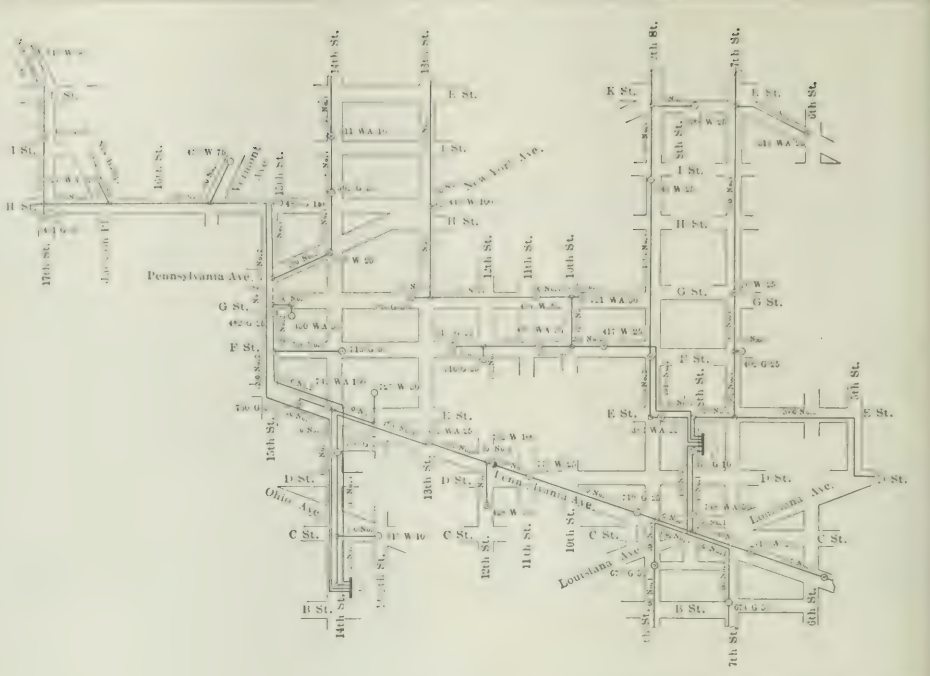



FIG. 2—PRIMARY LINES TO TRANSFORMERS

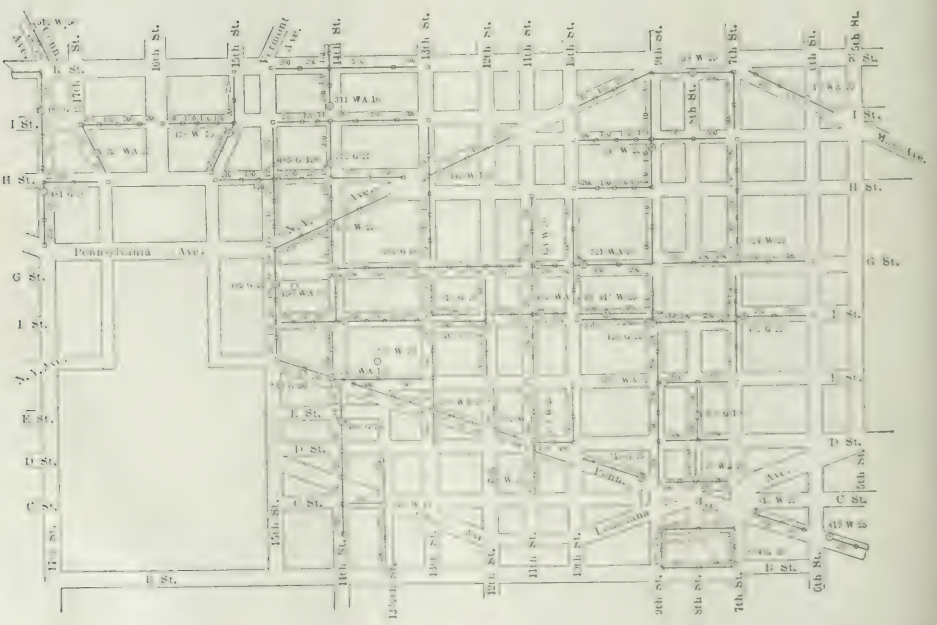



FIG. 3—MAP OF SECONDARY LINES, SHOWING MANHOLES AND POLES

s suggested. The writer prefers the map method. Wire sizes should be shown, although they have been omitted from the drawing for the same reason as in Fig. 3.

Fig. 5 represents a series of drawings of the duct lines and connections, prepared at the time of installation. These should give the location of the duct line in the street, the elevation of the street and the depth of the top of the

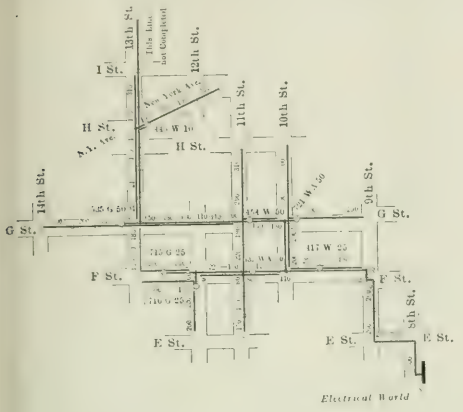



FIG. 4—PRIMARY AND SECONDARY MAINS

duct below the surface or cover, denoted by *c;* location of manholes, handholes and their size (if not standard), and service connections to buildings.

Service connections have been omitted from the illustration. In this series there would also be included any drawings of standard and special manholes and handholes required. For these drawings it is recommended that standard sizes be chosen, each an even multiple of the next smaller size and each having a type letter besides being numbered serially. A card index should be provided and the drawings filed by street name or number. Drawings of any particular service should be filed under the number of that building also. For instance, if Drawing C 1431

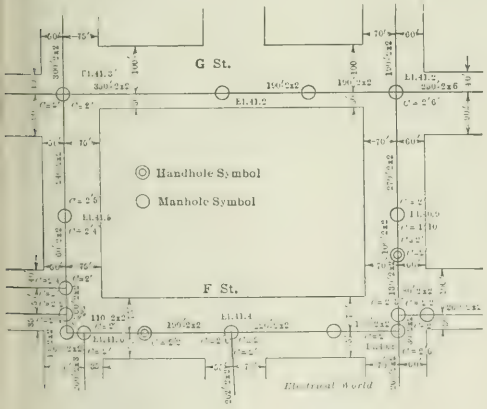



FIG. 5—DUCT LINES AND CONNECTIONS

shows the portion of D, E, F and G Streets between Seventh and Tenth Streets, the following cards should then be prepared to index this drawing: D Street between Seventh and Tenth Streets, Drawing C 1431; E Street between Seventh and Tenth Streets, Drawing C 1431; F Street between Seventh and Tenth Streets, Drawing C 1431; G Street between Seventh and Tenth Streets, Drawing C 1431; Seventh Street between D and G Streets, Drawing C 1431; Eighth Street between D and G Streets, Drawing C 1431; Ninth Street, between D and G Streets, Drawing C 1431; Tenth Street between D and G Streets, Drawing C 1431.

From these cards the proper drawings can readily be located. This method of filing drawings is in use by the Chesapeake & Potomac Telephone Company.

A continuation of this article, with illustrations of the card system of records, will appear in a subsequent issue.

## Recent Telephone Patents

A high-powered transmitter has been patented by Mr. R. S. M. Mitchell, of Syracuse, N. Y. Instead of the usual granular microphone button he has provided spiral cylinders of carbon or other suitable material. These are symmetrically placed within a cylindrical box. A circular diaphragm closes the face of the box. A stud is attached to the diaphragm and from it a lever extends to each of the carbon cylinders. Spring fulcrums are attached to the levers at suitable positions between the central stud and the cylinders. As the convolutions of the cylinders close the resistance becomes rapidly lessened.

Mr. M. Weil, of New York City, has termed his invention a telephone muffler. It consists of a hood attachment adapted to clamp over the face of the transmitter in such a way as to inclose the mouthpiece. The front of the hood is shaped so that the edge will conform to the contour of the face of the user, the lips of the user being within the lips of the hood. The novelty in this muffler lies in using double walls for the hood, the space between the walls being exhausted sufficiently to serve as a non-conductor of sound.

Messrs. A. B. Allen and Leonard Day, of New York City, have designed and patented a desk-stand set with a view to its being readily made ornate. This desk stand has no hook switch of the usual type but instead carries a plate surmounting the circular base upon which the receiver is to be laid when not in use. The weight of the receiver causes a depression of the plate and thereby operates the switch contacts.

# Letter to the Editors

## A Step Toward the Metric System

*To the Editors of the Electrical World:*

SIRS:—It may be of interest to your readers to learn that the unit of length for all electrical measurements now made in the factory of the Simplex Wire & Cable Company is 1000 ft., which since May 14, 1913, has been substituted for the earlier unit, 5280 ft.—the mile. Since the date mentioned insulation resistance has been measured in megohms per 1000 ft.; conductor resistance in ohms per 1000 ft.; capacity in microfarads per 1000 ft., and inductance in henrys per 1000 ft.

The change in the unit of length will save much time in making calculations, of which about 1000 are required in the factory daily. The change is on the lines of simplicity and efficiency, and there is apparently nothing but inertia to prevent its adoption.

It is worthy of note that an error of less than 6 per cent is involved when the values for the mile length are multiplied or divided by five to obtain the values for the 1000-ft. length. For insulation resistance, at least, the error is well within the limits of manufacture.

EVERETT MORSS,
*Boston, Mass.* *President Simplex Wire & Cable Company.*

# Field of the Operating Engineer

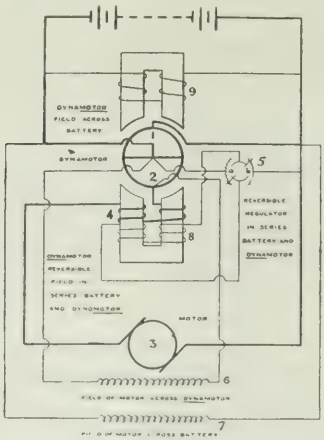
**A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers**

## A Battery-Conserving Vehicle Transmission System

The Crompton "electric valve" for controlling the discharge rate of vehicle batteries to a predetermined maximum accomplishes three results:

Firstly, the life of the battery is increased, resulting in lower upkeep and more uniform reliability; secondly, the battery will give its maximum output of work, and, thirdly, a reduction in weight can be gained for any required service conditions as compared with the weight of a straight-battery equipment.

The so-called "electric valve" as described by Messrs. W. H. Watson and R. J. Mitchell before the British Municipal Electrical Association, London, is really a special form of dynamotor which operates in connection with a compound-wound motor, the field of which is designed to strengthen up as the motor speed falls. The torque-speed characteristic of this machine is of the same form as that




AN ECONOMICAL VEHICLE TRANSMISSION SYSTEM

of a series motor; hence, a heavy current at low voltage can be used to maximum advantage at starting, a feature essential for rapid acceleration and which makes regenerative speed control of the car a successful possibility.

Referring to the diagram, the machine 1, 2 has really two functions—one being that of a motor across the battery terminals, the other that of a dynamo connected in series with the motor 3, which can thus receive a maximum voltage equal to the dynamo voltage plus the battery voltage. In this design the limit of maximum voltage across motor 3 is twice the battery voltage. The motor part of 1, 2 is excited at constant potential by a shunt coil across the battery terminals. The excitation of the dynamo part is provided by coil 8, which is in series with a reversible regulator 5 and the battery, so that it is thus possible to vary the excitation due to this coil between wide limits. Thus, with the battery voltage opposing dynamo voltage, the field would be full negative, while when the battery and dynamo voltages are added the field would be full positive. The controller arm will therefore on one side cause the dynamo voltage to be added, and on the other side subtracted, from the volt age due to the battery. The dynamo is also provided with coil 4, in series with the motor 3, and opposing coil 8 whe motor 3 is taking energy from the dynamo.

The excitation of the motor 3 is effected by two shun coils, one, 7, being across the battery, while the other, 6, i across the dynamo 2. These coils are so arranged that dur ing starting and subsequent acceleration the field of moto 3 is due almost entirely to coil 7. As speed increases th field due to coil 6 increases, and thus opposes winding 7 the field finally attaining a value which is the difference be tween the stronger field induced by coil 7 and that induce by 6. Thus when decelerating, due to increase of load o motor 3, the field of the dynamo will be weakened, due t the increase of current in series coils 4. This will caus an automatic limitation of the current possible to be take from the dynamo, since, at the same time, the voltage acros coil 6 will be reduced, thus strengthening the motor 3 fiel owing to the difference between the excitation from wind ings 7 and 6 becoming greater. But with a stronger fiel the torque of motor 3 increases, while speed tends to de crease, due to the fall in voltage across the dynamo occa sioned by a heavier current in winding 4. The motor is designed to deliver a torque nearly proportional to th square of the current; thus a quick start can be made fron standstill involving a current only 2.5 times normal curren for level running. The resistance losses are therefore low An average acceleration of 4.5 ft. per second is obtainabl under normal level running conditions.

The operation of the system will be clearer if a sequenc of operations be followed in detail as they would occur o the road. When the vehicle—in this case a thirty-four passenger bus—is at rest the reversible controller will b in the position *a b*, so that there is full negative excitatio of machine 2. Current having been turned on to machin 1, the controller is now turned toward the side correspond ing to full positive field on machine 2, say to the left. As suming the torque on the motor to be sufficient to move th bus and that the controller handle be not touched, the cur rent flowing in coil 4 will reduce the field of 2, hence it voltage will fall and the strength of motor 3 field will in crease, thus tending to slow up the motor. Meanwhile however, the bus is accelerating and will continue to do s until uniform speed is attained. A further movement of th controller handle increases the field due to winding 8, thu allowing more current to flow through the motor 3, an weakening its field because of the increased current through the winding 6. Finally the motor is rotating at maximum speed for the particular conditions. The action of braking the bus is achieved by reversing the handle of controller 5 This has the effect of reducing the voltage of the dynam to a point lower than the back emf of the motor 3. Hence current flows back into the battery. The amount of thi regenerative changing current is regulated automatically by the field coil 4, which increases the value of the back emf of the machine 2, thus preventing the possibility of doing damage.

Obviously the chief part of the driver's work is simply t press a single pedal, which controls speed and braking a already noted. It would be possible to drive without usin a mechanical brake; in fact, recourse to a brake other than electrical is necessary only in an emergency. By suitably

proportioning the resistance of 5 a small negative current is caused to circulate in the driving motor 3, giving the armature a slight torque in the reverse direction. This useful property enables the Crompton 'bus to stand on a hill with a "backward" declinity of 1 in 28.

Experiments made recently in London streets under similar conditions to those existent in practice showed that over a city route of 11 miles 17 per cent of the battery energy withdrawn was returned to the cells owing to the regenerative action of braking—mainly on account of the numerous traffic stoppages.

## Method of Locating Grounds in Armatures

It is often very difficult to locate a low-resistance or "dead ground" in a low-voltage armature owing to the very low resistance of the windings themselves. In such cases, however, the following method can be employed with very good success:

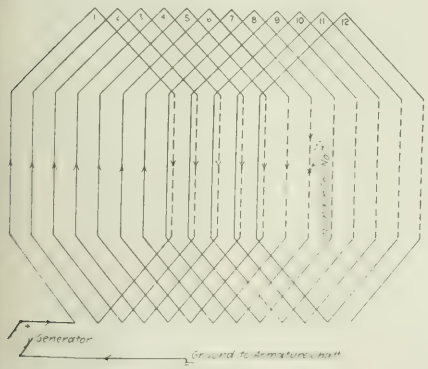
First, short-circuit all commutator bars by winding several turns of bare copper wire around them; then apply a source of energy, direct current preferred, to the commutator and shaft. The voltage to be used depends upon the resistance of the "ground."

This produces a circuit from the commutator through the grounded coil to the ground and out through the shaft, thus setting up a field around the conductors in this coil. By applying a small piece of iron to the surface of the armature core and gradually moving it around, one can readily locate the grounded coil by means of its field, which attracts the iron.

The same method can also be applied to alternating-current apparatus, although not quite so readily. For example, in the case of a three-phase, single-circuit, Y-connected armature, first disconnect the Y, splitting the winding up into three separate circuits. Then test out each circuit with a magneto or some similar source with which the ground can be located.

Next apply a current to one end of the grounded circuit and to the shaft. Assume that there are twelve coils in this circuit, coil No. 7 being the grounded coil, while coil No. 1 is connected to the line as shown in the accompanying sketch.

There will then be a circuit through coils Nos. 1, 2, 3, 4,



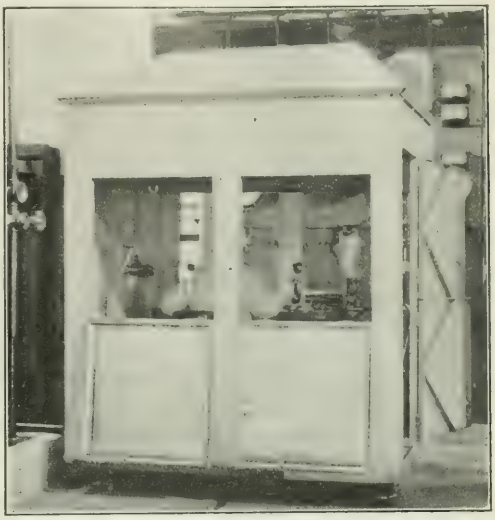

METHOD OF LOCATING GROUNDS

5, 6 and 7 which can be readily detected with a piece of iron as previously explained, while coils Nos. 8, 9, 10, 11 and 12 are dead.

It is then, of course, obvious that if coils 1, 2, 3, 4, 5, 6 and 7 carry a current while coils 8, 9, 10, 11 and 12 carry no current, the ground must be in some section of coil No. 7, the circuit being completed at this point.

## Cutting Substation Coal Bills

An effective method of cutting down coal bills and also providing for the comfort of the operating staff in the winter season is shown in the accompanying photograph. The scheme consists of installing a 5-ft. by 6-ft. portable tin house in the main substation transformer room, the house forming a convenient little office where all the tele-



COLD-WEATHER INSTALLATION

phone and clerical work which is necessary can be performed.

This "house within a house" contains a desk, two chairs, two telephones, a 330-watt home-made electric heater, side door, front and rear windows; has a 1¾-in. slate floor, and stands upon six 13,000-volt insulators 6 in. above the main operating-room floor. It faces the switchboard and the general indicators of the instruments can be seen from the interior. The substation contains six transformers of 9000-kw combined rating and is steam-heated in very cold weather; but throughout the greater part of the year the use of the small electric heater in the portable office, where work is done seated, is sufficient to maintain comfortable conditions for the operators and at far less cost than by the usual coal-heating method.

## Meaning of Kilovolt-Ampere and Kilowatt

Will you kindly give a short concise definition of the term kilovolt-ampere and explain its relation to the similar term kilowatt? J. B. C.

As its name implies, the kilovolt-ampere, abbreviated kva, is the product of volts times 1000, times amperes, the word kilovolt meaning 1000 volts. The term kilowatt, abbreviated kw, in alternating-current practice is understood to mean volts times 1000, times amperes, times power-factor. Hence a machine might have all or any one of the following ratings on its name plate and still be correctly rated: 200 kva; 200 kw at unity power-factor; 160 kw at 80 per cent power-factor, and so on. Thus it will be seen that the advantage of rating a dynamo-electric machine in kva instead of kw lies in the fact that a kva rating tells what load the machine will carry under all conditions, whereas if a kw rating is given, other facts must be stated before it will be known what the machine will be able to do under all conditions of load and power-factor.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*High-Speed Generators.*—Maurice Leblanc.—The conclusion of his illustrated article on the design of direct-current generators for very high speed. The general construction of the machine is outlined with the aid of diagrams. Its theory is given with special reference to self-excitation and the possibility of producing currents of [illegible].—*Rev. Gén. Elec.*, July 19, 1913.

*Three-Phase Commutator Motors.*—Rudenberg.—A paper illustrated by diagrams presented before the Leipzig Electrical Society. The author describes the different types of three-phase commutator motors, gives the circular diagram and discusses cascade connections.—*Elek. Zeit.*, July 10, 1913.

*Mercury Vapor Converters.*—Maurice Leblanc.—The author first deals with the principle of mercury-vapor converters and their capacity and efficiency. He next takes up the question of the operation of this apparatus from the theoretical side and describes the uses of the converter. Metal converters are briefly mentioned.—*London Electrician*, July 18, 1913.

### Lamps and Lighting

*Evaporation Temperature of Carbon in the Arc Lamp.*—Lummer.—An abstract of a paper read before the German Illuminating Engineering Society. If the carbon in the arc lamp has a temperature of evaporation, the temperature of the carbon must be independent of the arc length and of the current, but must change with the atmospheric pressure like the evaporation temperature of any substance. From tests made by the author it appears that the temperature is independent of the current (the variation being less than 1 per cent if the current is varied between 6 amp and 60 amp). Further, the temperature of the positive crater decreases from 4000 deg. absolute temperature to 3800 deg. if the pressure is reduced from 1 atmosphere to 0.25 atmosphere. This seems to prove conclusively that the atmosphere of the crater is really the boiling temperature of carbon. The tests are to be repeated and extended to higher pressures up to 30 atmospheres. The negative crater has in general a lower temperature than the positive crater. A peculiar phenomenon is that the positive crater seems to begin to boil at pressures below atmosphere. The whole surface gives the impression of a boiling film of liquid. This "liquid" condition begins at the pressure of 0.666 atmosphere and appears to disappear again at a pressure of 0.333 atmosphere. This is to be further investigated.—[illegible]—*Jour. Gasbeleuchtung*, June 12, 1913.

*Arcs and Electrodes.*—S. D. [illegible] and L. H. [illegible].—Electric arcs are of two kinds, those that owe their light-giving properties to incandescence of the electrodes and those that give light by reason of the luminosity of their arc streams. Under the heading of the first come [illegible] and under the latter are the direct-current and alternating-current types, while classified under the latter are the mercury-vapor and the modern "luminous" and flame-arc lamps. The distinction between the last two lies almost wholly in the manner in which the light-giving material is introduced into the arc stream, whether by electro-conduction or by heat evaporation. Equally difficult with determining the proper substance to use for the light-giving elements or designing the lamp mechanism has been the production of satisfactory electrodes, even for the original open carbon lamps. The electrodes that were suitable for the open arc were too impure and imperfectly formed for the inclosed lamp, and so it has been in each instance of the development of a new arc, new substance for the electrodes, new structure, new diameter and length.—*Gen. Elec. Rev.*, July, 1913.

*Boron-Tungsten Compound for Filaments.*—A note on a recent British patent (No. 3525, 1913) of F. Hansen and W. F. Mohr. Tungstic trioxide is saturated with a solution of boric acid and then dried and heated in a neutral atmosphere. It is next mixed with zinc powder and reduced by heat. The zinc is removed by hydrochloric acid and the residue thoroughly washed.—*London Elect. Eng'ing*, July 7, 1913.

*Electric Light as a Luxury.*—E. Schneider.—The author protests against the statement of L. Mantius to the effect that electric light is a luxury. That this is not true is proved by the number of electric lamps in existence in Germany (68,000,000 electric lamps against 25,800,000 gas lamps and 23,000,000 kerosene lamps) and by the rapid rate of increase of the use of electric light. Under the usual conditions kerosene light costs about twice as much as electric light. The author deplores that not all houses, residences and flats in the district of an electric station are connected to the station just as all of them are connected to the water department.—*Elek. Zeit.*, July 10, 1913.

*Causes of Voltage Variation in the Operation of Lighting Systems.*—J. J. Sullivan.—The maximum degree of satisfactory service is obtained from a lamp when it is burned at its highest efficiency, and for this condition an unvarying "label" voltage is the principal requirement. The author states briefly the causes of unsatisfactory voltage supply and points out where in the system, from generator to lamp, the sources of trouble occur.—*Gen. Elec. Rev.*, August, 1913.

*Lamp Laboratory.*—E. P. Hyde.—A Franklin Institute paper giving a résumé of the activities of the physical laboratory of the National Electric Lamp Association in the development of the modern science of illumination.—*Jour. Franklin Inst.*, July, 1913.

*Motor-Cycle Lighting.*—The author states that when a suitable battery and electric lamp are available the electric-lighting outfit for motorcycles is more desirable than the gas equipments now in use, with respect to weight, dimensions, simplicity, convenience and illumination.—*Gen. El[illegible]* [illegible] 1913.

### Generation, Transmission and Distribution

*Compensation Induction Coils in High-Tension Cables.*—J. Kühle.—An article illustrated by diagrams discussing the compensation of the charging currents in high-tension cables by means of induction coils connected in parallel. In order to obtain an efficiency of transmission as high as possible it is most important to arrange the induction at the proper places in the cable and to dimension them correctly. It is shown that even for the longest cable lines now in use one or two induction coils are sufficient. With a strongly inductive load the parallel connection of induction coils permits, of course, only small advantages,

if any. A detailed numerical example is given, the results being shown in three diagrams. Finally, the author shows how the use of special induction coils may be avoided if the magnetization current of the transformers connected to the cable line be artificially increased.—*Elek. Zeit.*, June 26, 1913.

*Distribution Networks.*—G. KLINGENBERG.—The conclusion of his very long paper presented before the German Association of Electrical Engineers on the distribution of electric energy over extended districts. In the present instalment the determinaton of the best distance between poles is discussed and the results are given in various diagrams and tables both for copper and aluminum conductors. —*Elek. Zeit.*, July 17, 1913.

*Inductance and Capacities of Three-Phase Transmission Lines.*—LOUIS COHEN.—A mathematical paper on the determination of the inductance and capacity of three-phase transmission lines for any spacings between wires and any voltage distribution on the lines.—London *Electrician*, July 18, 1913.

*Supplying Energy to Isolated Consumers from Transmission Lines of Moderate Voltage.*—E. B. MERRIAM.—The author deals first with the reasons underlying the present-day demand for cheap and reliable substation apparatus for connecting up the isolated consumer with the central-station system. Then, with seven outline drawings, the author presents a specification of the pole or tower structures for distributing various quantities of energy at given voltages from the main line to the consumer, and afterward deals with the different parts of the equipment making up these outfits. The latter part of the article describes and illustrates a number of installations of this character in successful operation.—*Gen. Elec. Rev.*, August, 1913.

*Electric Power in Sugar Manufacture.*—P. S. SMITH.—The author outlines the processes followed in the modern "central" for the production of refined sugar from the raw cane and lays stress on the imperative demands for the most efficient form of mechanical operation consequent upon the rising cost of producing raw sugar and the decreasing price at which the finished product can be sold. In meeting the demand, the system which will win out is the one in which the fuel bill for the power plant is cut down to the minimum, and this viewpoint puts the electric system in its most favorable light, as it should be possible to raise all the steam for a good turbo-electric station from the refuse cane which is a by-product of the mill. For the rest the article deals succinctly with the suitability of the electric drive for operating the various machines in the mills.—*Gen. Elec. Rev.*, August, 1913.

### Traction

*Automatic Block Signals.*—O. WEHLAND.—An article, illustrated by diagrams, on the automatic block-signal systems and its application on the Berlin elevated railways which are to be electrified.—*Elek. Zeit.*, July 17, 1913.

### Installations, Systems and Appliances

*Württemberg.*—H. KLAIBER.—In Württemberg the government carried out in 1911 an investigation of the money value of all electric installations, including private plants. The author describes the method by which the government proceeded and by which missing data not replied to in the official inquiry were obtained. The value of all electric distribution systems and installations in Württemberg (excluding house installations) is $28,000,000.—*Elek. Zeit.*, July, 1913.

*Transformers for Induction-Motor Load.*—J. L. MOON. —An article giving rules and tabulated data for determining approximately the size of transformer which must be used for taking care of an induction-motor load of given voltage and horse-power. The latter section specifies and illustrates the wiring connections of transformers and motors which are followed in cases likely to be met with in practice for connecting induction motors to two-phase and three-phase systems.—*Gen. Elec. Rev.*, July, 1913.

*European and American Practice in Lightning Arresters.* —E. E. F. CREIGHTON.—Practice in lightning arresters in Europe and America has developed along somewhat different lines. In America some of the European practice has been used. In Europe a considerable number of arresters, especially of the aluminum-cell type, have been installed, some of which have been built in America and others in Europe—probably most of them in Europe. The aluminum arrester was developed entirely in America by the author. Its success depends much on the care in manufacture, especially if charging resistors are not used. The same degree of satisfaction has not been found in Europe as in America, and this has apparently produced there a wave of preference for the resistor type of arrester. The object of the present paper is to compare the several forms of arresters that are used in Europe and not in America.—*Gen. Elec. Rev.*, August, 1913.

*Passenger Elevator.*—E. F. TWEEDY.—The author first outlines the development of all the successful types of passenger elevator, namely, steam, hydraulic (water-balance, vertical and horizontal cylinder), electric (single and variable speed), and drum and traction suspensions. The merits and demerits of each type of drive and suspension are discussed. Curves are included which show the effect upon energy consumption of different counter-weighting, the schedule relation between number of stories and linear speed of travel, and the difference in the time characteristic of two classes of traffic. A two-page tabulation gives complete data of representative installations. The second part of the article explains the method of arriving at the number and size of elevators necessary to fulfil the given requirements of a proposed building, use being made of a curve chart which practically eliminates all computation. In conclusion, the construction and operation of the automatic signal-lamp system are described in detail.—*Gen. Elec. Rev.*, July, 1913.

*Electric Cooking.*—W. SCHULZ.—An illustrated article on electric cooking on a large scale which describes the electric kitchen of the North-German Lloyd company in Bremen and the apparatus used in it. The kitchen supplies lunch for the 500 employees. The buildings are electrically lighted, and electricity is also used for various purposes, but the load during the day is low so that the energy used in the kitchen may be figured simply as the cost of the fuel, that is, from 0.5 cent to 0.75 cent per kw-hr. The total rating of kitchen apparatus is 194 kw. The average power consumption in the kitchen is from 40 kw to 60 kw.—*Elek. Zeit.*, July 17, 1913.

*Mechanical Refrigeration.*—E. T. TWEEDY.—An article on mechanical refrigeration from a central-station point of view, with reference to ice-cream making, cold storage of furs and fabrics, and ice-making.—*Gen. Elec. Rev.*, August, 1913.

### Wires, Wiring and Conduits

*Cable Construction.*—C. J. BEAVER.—An illustrated article pointing out the very high electrical and mechanical factors of safety in vulcanized bitumen mining cables.—London *Electrician*, July 18, 1913.

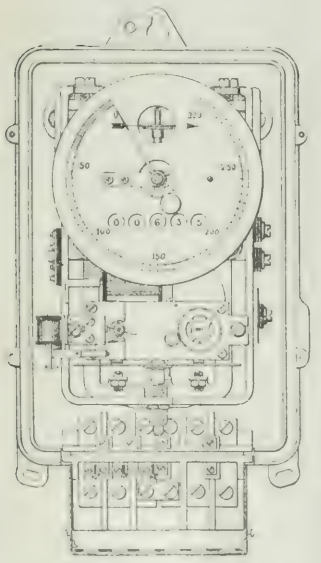
### Electrophysics and Magnetism

*Electric Field Distribution.*—W. S. FRANKLIN.—A discussion of C. Fortescue's A. I. E. E. paper on insulation problems, with a simple demonstration of some fundamental principles of electrostatic theory. The author explains the method of electric images, discusses the possibility of producing any desired field distribution in a region by the creation of proper potential values everywhere over the boundary of the region and explains it by examples. He then discusses the modification of a uniform electric field by a cylindrical conductor. He thinks the word "potential" is an obsession and prefers the ideas of field, strength and

lines of force as being more distinctly physical.—*Jour. Franklin Inst.*, July, 1913.

### Units, Measurements, and Instruments

*Combined Kilowatt Hour and Demand Meter.*—An illustrated description of a meter which has been designed to enable central-station engineers to charge consumers, particularly motor users, on a load-factor basis, the load recorded being an average load taken over fifteen, thirty or sixty minutes. Thus, in addition to the ordinary unit dials, there is a load pointer moving over a divided scale of 300 deg. The diagrams (Figs. 1, 2 and 3) refer to a three phase three-wire meter; Fig. 3 is a diagrammatic sketch showing only the essential parts and their relations in order to make the construction and operation clear. In this diagram the induction meter system of a single-phase or polyphase meter will be recognized in the spindle and disk, magnet and counter system. *A*, $M_a$, $S_1$, $S_2$, *W*. A pinion on $S_2$ drives through *V*, wheel *B*, which normally gears with wheel *M*, forming the connecting link between the meter and demand indicator pointer *Z*. Turning to the lower part of the diagram, the induction motor element *E*, armature disk $B_1$, wheel-train and tripping cam *C*, controlled by a hairspring and escapement $H_s$, form a timing gear, which, through a trip rod, momentarily lifts $A_b$ at predetermined intervals of time, thus disengaging *B* from *M* for the instant. *M* carries a pin $S_t$, which in moving pushes the demand pointer *Z* round until the tripping action takes place when spring *F* retains the pointer—which is otherwise free on its fulcrum—in its then position while at the same time the spring *R* returns wheel *M* and pin $S_t$ to its zero position ready for the cycle of operations during the next time interval. Obviously, if the average load of the next time interval is greater, the demand pointer *Z* will be carried a little further over the scale, and in fact it will remain at the highest average load indicated until reset. The position of pointer *Z* is directly dependent on the revolutions which are made by the meter armature in the chosen time period.—London *Elec. Review*, July 18, 1913.



FIGS. 1 AND 2—FRONT AND SIDE VIEWS OF METER.

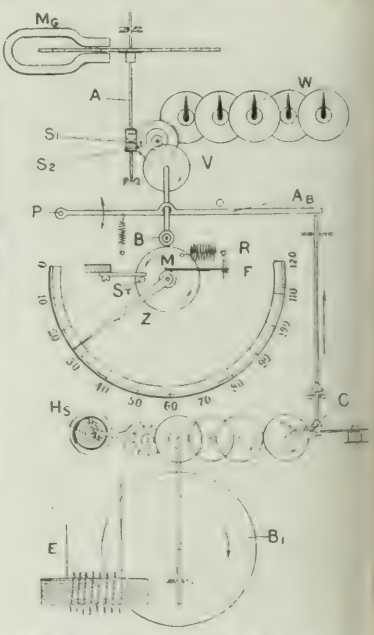



FIG. 3—OPERATING DETAILS OF METER.

### Telegraphy, Telephony and Signals

*Earth Antennas.*—F. KIEBITZ.—An illustrated description of the results of careful measurements made in various wireless-telegraph installations with earth antennas.—*Jahrbuch d. drahtlosen Telegraphie;* translated and slightly abbreviated in London *Electrician*, July 18, 1913.

*Fire Alarm.*—E. E. MOORE.—A detailed illustrated description of the Knight public fire-alarm system.—London *Electrician*, July 18, 1913.

## Book Review

THE UNIVERSAL ELECTRICAL DIRECTORY. Compiled by J. A. Berly. Containing a complete record of all the industries directly or indirectly connected with electricity and magnetism and the names and addresses of manufacturers in Great Britain, India, the Continent, etc. London: H. Alabaster, Gatehouse & Company. 1556 pages. Price, £1 1s.

The contents of this book are divided into four sections—the British, with 14,040 names; the colonial and general, with 6550 names; the Continental, with 7640 names, and the United States, with 6255. The entries total 34,485 names, although unimportant names are omitted. Each section is subdivided into alphabetical and classified sections, while in the case of the British portion a geographical section has been added which is a necessity for travelers. Any section can at once be referred to by means of a thumb index. The lists of electric undertakings in the United Kingdom, the British colonies and some other countries include the following details: The nature of the supply, system of distribution, rating of plant, voltage and chief engineer's name, and in the case of alternating current the phase and periodicity are included. A list of electrical specialties appears in the British section, arranged alphabetically according to the name of the article, followed by the maker's or agent's name and address.

# New Apparatus and Appliances

**An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers**

## Electrically Operated Water System of the Chevy Chase Club

The private water-supply system of the Chevy Chase Club, Washington, D. C., is said to be one of the best in the United States. It comprises two separate systems, one for water supply for the clubhouse and another for irrigating the eighteen-hole golf course. For the latter service there is nearly 5 miles of 2.5-in. water pipe laid throughout the grounds.

The water used in the club house is supplied from drilled wells at various points about the grounds. These wells average about 100 ft. in depth. The illustration shows one of the four deep-well pumps made by the Goulds Manufacturing Company, Seneca Falls, N. Y., for pumping water from these wells. The working head shown is driven by a 2-hp electric motor and operates a 3.75-in. by 10-in. cylinder which is located 90 ft. below the surface. There are two 10-in.-stroke equipments like this one and a third 16-in.-stroke head. The fourth equipment is driven by a 3-hp motor.

The water is delivered through 2.5-in. piping to a storage tank having a capacity of 14,000 gal. in the basement of the club house. To keep the desired level in this tank the motors driving the working heads are automatically stopped

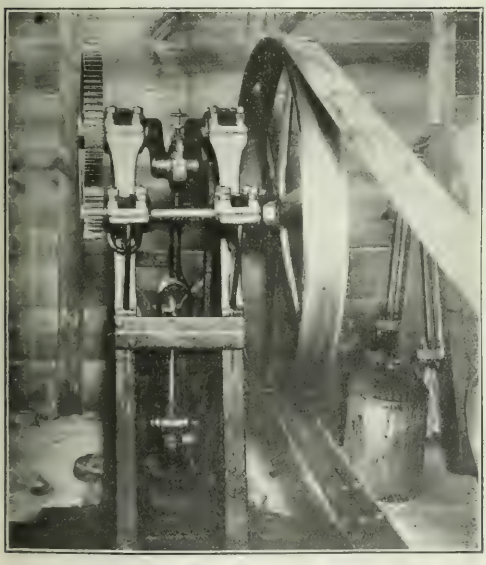


FIG. 1—MOTOR-DRIVEN WORKING HEAD

and started by controllers operated by a float switch in the tank. Disconnecting switches are placed on each of the lines so that in case any one of the wells fails the outfit at this well may be stopped while the others continue to operate.

From the main storage tank in the basement of the club house the water is pumped into two 14,000-gal. compression tanks by a 4-in. by 4-in. horizontal duplex pump, belt-driven by a 5-hp motor and arranged with automatic control to maintain a pressure of from 44 lb. to 60 lb. in the tanks. To replenish the air lost in these tanks by leakage through the water, a 2-in. by 3-in. air pump, belt-driven by a 1-hp motor, is used. There is also a 5.25-in. by 5-in. by 4-in.

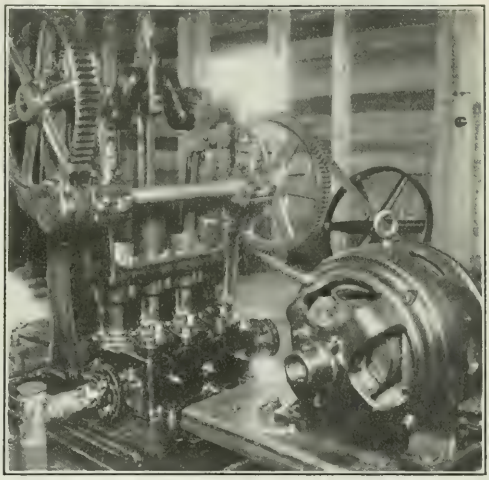


FIG. 2—MOTOR-DRIVEN PUMP

duplex steam pump on this system which is not now used regularly, but is held as a reserve unit.

To furnish the water for irrigation, a pneumatic pressure-tank system is installed near the golf course. The water is pumped from a spring by a 4-in. by 6-in. Goulds triplex pump driven by a 4-hp Wagner motor connected to the pump by a silent chain drive. Automatic control on the motor keeps the pressure in the tank at 55 lb. to 75 lb. The electrical energy for this installation, which was designed by Mr. W. A. McFarland, superintendent of waterworks of the District of Columbia, is being supplied by the Potomac Electric Power Company.

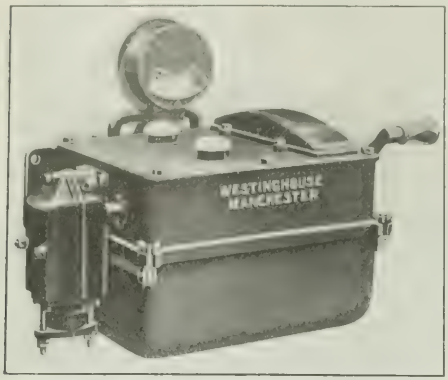
## Oil-Immersed Drum-Type Motor Starter

A new design of star-delta induction-motor starter has been placed on the market by the British Westinghouse Electric & Manufacturing Company, Ltd., Manchester, England, embodying some interesting features in its construction.

The internal parts are mounted in a cast-iron frame. The oil tank below forms the lower half of the starter. The contact drum, made on the metal and mica principle, consists of a mica-insulated square steel shaft on which are securely clamped spider castings carrying renewable segmental copper contact strips. All circuits are broken under oil. The no-volt and overload release devices are fitted in the starter above the oil tank. The no-volt coil is connected

across one phase and is so arranged that the circuit to the motor can be closed only when there is voltage on the line. This release is worked by gravity and acts quite independently of the overload release. The overload coil is connected in two phases and is cut out in the star position.

The operating mechanism is so arranged as to make a slight pause necessary at the "star" position before it is




INDUCTION-MOTOR STARTER EQUIPPED WITH AMMETER

possible to move the starting handle through to the "delta" position. The handle cannot be left in the "star" position, since when it is released it flies back to the "off" position. The contact drum is returned to the off position (thus stopping the motor) in the event of an overload on "no-volt" occurring, and it cannot be held either in the star or delta position in such a case.

## Motor-Driven Hoist Used as a Scraper

In order to remove the worthless soil above a valuable deposit of clay, the Twin City Brick Company, St. Paul, Minn., uses a drag bucket operated by a motor-driven hoist. The clay deposit forms a bluff above the plant and the bucket is dragged over the surface, removing the soil on its down trip and returning empty. The bucket handles about 300 cu. ft. of soil and makes a trip every two min-



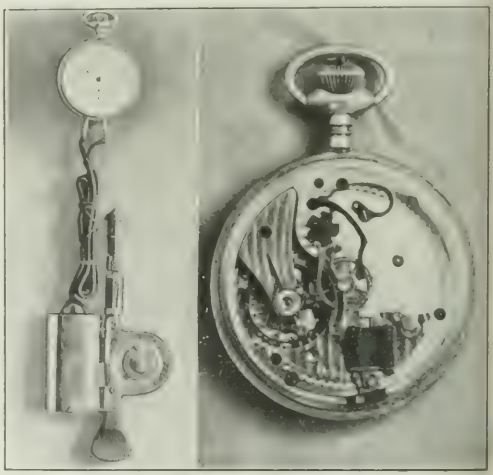
ELECTRIC HOIST OPERATING DRAG BUCKET

utes. A double-drum American hoist driven by a 75-hp Westinghouse induction motor is used to drag the bucket. The use of electric drive is especially desirable for such an operation because it eliminates the hauling of fuel and water, enables one man to handle the entire machine, and involves no delays while steaming up. The hoist, being without a boiler, is also much easier to re-locate.

## Electrically Operated Stop-Watch and Revolution Counter

Illustrated herewith is an electrically operated stop-watch and revolution counter invented by Mr. Frederic A. De Lay, an electrical engineer, of 350 Linden Avenue, Aurora, Ill. The stop-watch and counter operate as a unit, starting and stopping simultaneously. A small electromagnet is mounted in the case of the stop-watch and is placed so that when the magnet is energized it will hold the armature in a position such that a small pinion is held out of mesh against the tension of a spring. When the magnet is de-energized the pinion is released and meshes with a gear which is mounted on the spindle of the large second-hand of the watch. The second-hand then continues to run until the pinion is thrown out of mesh, when the magnet is again energized. This electrical equipment does not interfere with the mechanical stem control of the watch, so the latter can be used in the ordinary way.

The complete cycle of operations in using the device in connection with the revolution counter is as follows: First, the electric circuit is closed, thus energizing the magnet and placing the stop-watch under electrical control. Next,



ELECTRIC STOP-WATCH AND REVOLUTION COUNTER

the mechanical control of the stop-watch is released by pressing the stem. The mechanism is then ready for use, and as soon as the electric circuit is opened the long second-hand will start and continue running until the circuit is again closed. The opening and closing of the circuit is accomplished by the revolution counter. The counter carries a free-turning tip which, by a slight pressure toward the shaft, is made to engage a spring the instant the counter dial starts to turn. As soon as the spring is engaged, it is deflected slightly, thereby opening the circuit of the magnet and starting the watch. This circuit remains open as long as the counter is in use. As soon as the counter is withdrawn the spring returns at once to its normal position, thus closing the circuit and simultaneously stopping the watch.

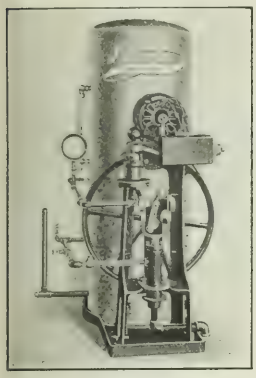
It is to be noted that for each revolution shown on the counter there is a corresponding time interval shown on the watch. This makes it possible to take a few revolutions at intervals—samples, so to speak—and the final reading will give the time corresponding to the total number of revolutions shown by the counter, thus giving a good average. No matter how long the counter is left in the shaft, the revolutions per minute can be easily and accurately determined from the reading. Where the speed of a machine

varies greatly and it is desirable to have a speed reading to correspond to instantaneous readings of other instruments (as, for instance, in a series-motor test), the speed reading may be taken over a short interval, say one of five or ten seconds.

Repeated tests show the accuracy of the apparatus. Readings taken on motors running at constant speed check with one another within 0.005 per cent. The inventor of this device has made arrangements with the Central Scientific Company of Chicago to supply college and other laboratories with this new device.

## Motor-Driven Water-Supply System

Where electrical energy is available in rural communities motor-driven pumping outfits are rapidly replacing the water motors or hydraulic rams formerly used. Grit, alkali and sulphur in the water supply usually necessitated that considerable attention be given to these lifts. The presence of these impurities in the water supply is said not to affect the operation of the motor-driven pumping outfit illustrated herewith.



MOTOR-DRIVEN PUMP

This particular type of pump is used for supplying water to closed pressure tanks, the pressure being regulated automatically. The motor is started by an automatic switch which closes the pump motor circuit when the pressure gets low and stops the pump when the pressure reaches a certain predetermined value. This pump, which is a product of the Dayton Pump Company of Dayton, Ohio, is driven through a belt by a small Westinghouse motor taking energy from a lighting circuit.

## Porcelain Strain Insulator

A porcelain strain insulator placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is intended for use on 1500-volt direct-current railway work as well as on 2200-volt transmission lines.

It is claimed that the insulators will withstand more strain than any cable used in line construction that will pass through the hole. They are of the interlinking type which



PORCELAIN STRAIN INSULATOR

makes it impossible for cables to separate even if the insulator should become shattered.

The smallest size of these insulators has a flash-over voltage on rain test of over 13,000 volts, and the larger size over 20,000 volts. The tensile strength of the larger size insulator is said to be more than 23,000 lb. Its dimensions are 5 in. by 4.5 in. by 4.5 in.

## Snap Switch with Round Handle

One of the most recent changes in snap-switch design was made by the Trumbull Electric Manufacturing Company, Plainville, Conn., in bringing out a switch with a round handle instead of the ordinary wing handle which has so long been in vogue. The switch, illustrated herewith, does not differ in any of its essentials from the regular line of snap switches handled by this company and is made in all styles or sizes in which the other switches are built. It is stated that this type of switch has been giving thoroughly satisfactory service and that it permits choice of design with no loss of efficiency.

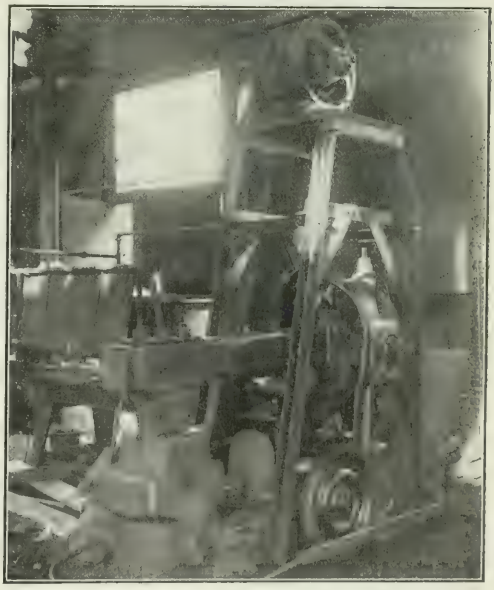


ROUND - HANDLE SNAP SWITCH

## Motor Support for Overhead Drive

When a prominent railroad machine shop was recently changed from group drive to individual-motor drive the problem of placing a motor to drive the hammer shown herewith proved to be a perplexing one. Owing to the conditions it was impossible to put up an overhead platform swung from the ceiling, and it was equally impracticable to fasten the motor to the wall. Moving the large hammer was suggested, but it was decided that such action would seriously impair the efficiency of the shop.

The solution of the difficulty was found in erecting a frame of angle-irons and firmly bolting them to the base of the machine on both sides. About 2 ft. above the top of the hammer and 10 ft. from the floor a platform was laid



MOTOR SUPPORT FOR OVERHEAD DRIVE

across the angle-iron braces. The motor was then mounted on the platform, giving it a place out of the way and also enabling it to furnish the required overhead drive.

The motor in the accompanying illustration, which was supplied by the Diehl Manufacturing Company, Elizabethport, N. J., is of the 220-volt direct-current type and operates at 650 r.p.m.

## Moving Pictures as Targets for Marksmen

A method recently developed for using motion pictures as targets for marksmen differs considerably from the one described briefly in the *Electrical World* of July 26. With the type of apparatus now referred to as soon as the marksman fires his gun the motion of the film is instantaneously arrested and a bright spot appears where the bullet struck the screen. After an interval of a few seconds the spot is extinguished and the picture moves on again ready for the next shot.

The heart of this mechanism is the Kramer-Kapp relay, which has been used abroad in connection with automatic signaling on railway trains. A telephone receiver is placed well up between the firing line and the target. When the shot is fired the sound acts upon the telephone receiver operating the relay, which controls the cinematograph machine by means of a band brake and a magnetic clutch. Thus, at the instant the shot is fired the clutch is released and the brake is applied, thereby bringing the picture immediately to a standstill. In order to keep the film cool at all times and prevent it from catching fire while it is stationary in the machine, a small motor-driven air-compressor is slung under the machine. This compressor maintains a constant blast of cold air on the film and thus keeps it cool.

On the board which carries the relay with its batteries is mounted the dash-pot which controls the spot-extinguishing movement of the screen and the restarting of the machine. The screen itself is formed by two sheets of stout paper, on horizontal rollers, and a third sheet, forming a stay on vertical rollers. The vertical screen is arranged to move a fraction of an inch (roughly the diameter of a shot-hole) after each shot, thus obliterating the hole. The horizontal screen is shifted about once a day. The vertical screen which is selected for regular movement is operated by a ratchet actuated by a solenoid. When the relay is brought into action by the sound of a shot, it closes the circuit of a timing dash-pot, which rises slowly until the upper contacts close the circuit of the screen solenoid. During this interval the shot-hole remains visible, but when the solenoid circuit is closed the hole on the two screens disappears and the moving-picture machine is started again. The screen is illuminated from behind by several flame-arc lamps which are hung so as to be entirely clear of the firing line, thus being secured against being broken by the flying bullets.

Although this apparatus is only now being put on the market, it has been exhaustively tested for the past year. The electrical arrangements, while they appear complex on the surface, operate with certainty. The apparatus has been demonstrated to a number of English military authorities, with excellent effect upon their preliminary skepticism.



FIG. 2—ARRANGEMENT OF SCREENS

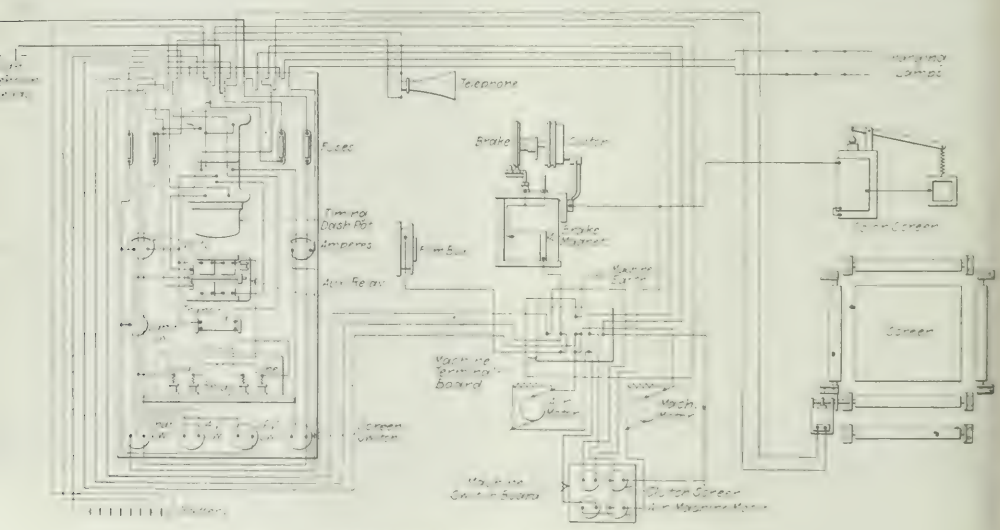



FIG. 1—DIAGRAMMATIC LAYOUT OF CIRCUITS AND APPARATUS

This mechanism is said to be protected by patents. The interests of the shooting-moving-picture company in the United States are under the management of Mr. A. H. Woods, of the Eltinge Theater, New York City.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**The Gee Electric Company,** of Wheeling, W. Va., which deals in electrical supplies and machinery and does electrical repair work of various kinds, mainly in connection with mining machinery, has recently added about 5000 sq. ft. of floor space to its establishment and installed new machinery, enabling it to handle a greater volume of business than previously.

**New Make of Diesel Engine Introduced.**—The American Krupp-Diesel Engine Company was recently incorporated under the Delaware laws to manufacture and sell the Krupp system Diesel engine in this country. This company has, it is understood, the complete American rights to this form of prime mover, which will be marketed in several types and sizes to suit various conditions of service.

**Small Maine Hydroelectric Project.**—B. W. Page, of Skowhegan, Maine, and others are interested in the construction of a hydroelectric generating station at Jackman, Maine. Working with a 230-ft. head, a penstock 3700 ft. long and 26 in. in diameter has been built and a Smith turbine of 180 hp and 900 r.p.m. installed directly connected to a General Electric alternator of 125-kva, 2300-volt rating. Arrangements for the addition of another similar unit in the future are being made.

**Further Sales of York Refrigerating Machines.**—An aggregate capacity of 1240 tons in refrigerating machines and accessories has been installed during the past month by the York Manufacturing Company, of York, Pa. The North Atlantic Fisheries, at Port Hawkesbury, N. S., with two 125-ton machines, the Tidewater Oil Company, of New York, with one of 150-ton rating, and the Southern Utilities Company, Fort Myers, Fla., with a 90-ton machine, were among the larger individual purchasers.

**Large Electric Riveter Order.**—The entire year's production of electric riveters—valued at approximately $1,500,000—of the Eveland Engineering & Manufacturing Company, Philadelphia, Pa., has been sold to the large machinery dealers Manning, Maxwell & Moore, of 85 Liberty Street, New York. The Eveland company is installing a large amount of new machinery to increase its output and will manufacture transformers and electric tempering and hardening machines in addition to the riveters.

**Cotton Mills Install Electric Drive Equipment.**—The Lancaster Cotton Mills, of Lancaster, S. C., have recently placed contracts for the installation of electric generating and drive equipment at their factory. The Westinghouse Machine Company will supply the turbine and the General Electric Company the motors. Of the latter there will be 270 of 5-hp rating, two of 10-hp, two of 25-hp and one each of 50-hp, 100-hp and 150-hp rating. The installation will include also three 7½-kw transformers and auxiliary switching gear.

**Bids for Flame-Arc Lamps.**—On July 24 the trustees of the Sanitary District of Chicago opened bids for electrical material to be used in the contract with the city of Chicago for street lighting. Among other things 4000 10-amp long-burning flame-arc lamps will be required. The General Electric Company and the Westinghouse Electric & Manufacturing Company were the only bidders on the lamp contract. They both named the same figure, $31 a lamp. The lowest bidder for underground cable was the General Electric Company.

**Trackless-Trolley Line Proposed.**—There is a project on foot for running a trackless trolley line between Summit and Bernardsville, N. J., a distance of approximately 25 miles. The application for the necessary franchise is now before the governing boards of the various towns affected, and it is expected that the franchise situation will be settled within the next three or four weeks. The Trackless Trolley Company of America, with headquarters at 30 Church Street, New York City, is back of this movement and will supply the equipment for the service when installed.

**Chamber of Commerce to Aid New Industrial Companies.**—The members of the Cleveland (Ohio) Chamber of Commerce have authorized the organization of an Industrial Investments Corporation which will investigate and assist financially manufacturing plants locating in that city. The enterprise will be privately controlled, although backed largely by the Chamber of Commerce. It is expected that this plan will draw to Cleveland numerous small manufacturing concerns whose financial requirements, although none the less real to them, are too small individually to interest banks and large capitalists.

**Westinghouse Industrial Sales.**—A large volume of orders for industrial-drive equipment have been received lately by the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa. All the brick machinery in the plant of the West Virginia Fire Clay Company, at Empire, Ohio, is to be driven by electric motors, as is that of the Keystone Brick Company and the Ferro Brick Company, both of Watsontown, Pa. Other recent purchasers of equipment are the Kosmos Portland Cement Company, Louisville, Ky., the Goodyear Tire & Rubber Company, Akron, Ohio, and the Fiske Rubber Company, Chelsea, Mass.

**Equipment for a Kansas Street Railway.**—The Manhattan City & Interurban Railway Company, of Manhattan, Kan., has been a large buyer of Westinghouse apparatus during the past month or two. The equipment purchased consists of two 600-volt, three-phase, direct-current, 60-cycle, 1200-r.p.m. self-starting rotary converters, one of 300-kw and one of 200-kw rating; nine 33,000-volt, single-phase, 60-cycle transformers of the oil-insulated, self-cooled type, three of 110-kva, three of 75-kva and three of 37½-kva rating, and two two-panel switchboards. The three smaller transformers will be mounted on a steel tower to form an outdoor-type transformer substation.

**Pacific Gas & Electric Company Installing Generating Equipment.**—The Pacific Gas & Electric Company is at present engaged in preparing foundations for the installation of an 18,750-kva General Electric vertical ten-stage turbine. Two 100-kw General Electric turbine exciter sets and complete switchboard equipment are included in the order. The turbine is of the condenser-base type, and the condenser will have 29,000 sq. ft. of 1-in. tubes, contained entirely within the base. This is a special design built from the company's own specifications. The condenser will be furnished by the Wheeler Condenser & Manufacturing Company, which will also supply a steam and a motor-driven hot-well pump, a dry-vacuum pump and a free atmospheric exhaust valve in the same order.

**Discontent Regarding the Mica Schedule.**—Some opposition has developed among manufacturers of electrical apparatus and other users of mica in its various crude and fabricated forms to the rates proposed for this product in the tariff bill now under discussion by Congress. Whether or not there is actually an acute injury to be inflicted on these interests by the present rates, if adopted, is a matter for investigation. It seems as if these rates are an improvement over those of the Payne-Aldrich bill and previous tariff measures since mica was first scheduled and importers (whose interests are to some extent similar, in this case, to those of the manufacturers of electrical equipment), when interviewed following the announcement of the rates on mica proposed by the Senate bill expressed

themselves as also to feel that they would be slightly benefited by the change from the schedule now in effect. [illegible] an improvement over those in previous bills, and that is in the fact that a graduated duty is planned, varying according to the unit values of the different grades of mica imported.

**Immense Turbo-Generator Sets Ordered for Philadelphia.**—Two [illegible] units have been ordered recently by the Philadelphia (Pa.) Electric Company to take care of the rapidly growing demand for electric energy in the district served by it. The larger of these sets, rated at 35,000 kva, represents in one machine a capacity equivalent to that of the combined generating equipment of the company a decade ago. The other unit, although of about the same size and weight as the first—65 ft. long and weighing about 600 tons—is rated at 30,000 kva. The installation of these immense units will necessitate the construction of a new generating station, which will be built adjoining the present main station of the company at Christian Street and the Schuylkill River, Philadelphia. The General Electric Company, Schenectady, N. Y., is to build these two big generating units.

**A Sign of Prosperity.**—Contrary to prevailing opinions on conditions throughout the country, some manufacturers are almost overwhelmed with business. The Terry Steam Turbine Company, Hartford, Conn., has just started operating on a twenty-three-hour per day basis, the one hour of idleness being from 6 to 7 o'clock in the morning. It is found necessary to do this in order to clear the shop from its present crowded condition, due to congestion of orders during the past few months. June is reported to have been the biggest month ever experienced by the company. Supplementing the note in the July 26 issue of the *Electrical World* regarding the recent purchase of Terry turbines and pumps by the Milwaukee Electric Railway & Light Company, comes information that the latter company has just ordered two more turbo-blower sets of the same make for its plant at Milwaukee, Wis.

**Profit-Sharing Percentage Increased.**—The Youngstown Sheet & Tube Company, of Youngstown, Ohio, writes as follows concerning its profit-sharing plan: "For three years we have paid our employees 5 per cent annually on their earnings during the year; this year we will pay them 6 per cent, as we had a rather prosperous year. We do not know that we are securing any better work than our neighbors who do not pay this bonus, but we believe that the more intelligent of our employees appreciate it, and we do it because we think it is only fair to them to prosper when the company prospers. It has been a failure in almost every place that it has been tried, probably because the employers expected too much. We do not look for much from it in the way of added efficiency and for that reason are not disappointed. We have had no labor troubles, however, for several years. How much this contributed to that condition we cannot tell. The plan looks good at a long range, but it is unsatisfactory in some respects."

**Electrical Equipment of a New York Armory.**—The contract for the electrical equipment and wiring in the new armory of the Eighth Regiment, Coast Artillery, to be built at the corner of Kingsbridge Road and Jerome Avenue, New York, will be let shortly. New York Edison energy will be used for the lighting, single-phase, 104-208-volt, 60-cycle current being supplied, while for motor purposes two-phase, 200-volt, 60-cycle current will be furnished. The lighting feeders will be installed as a three-wire system and branches will be put in on the two-wire system. Both branches and feeders on the motor circuits will be installed on the four-wire plan. All branch circuits are to be wired on the loop system. Concealed iron-pipe conduits of "sherarduct" or "galvaduct" or equal will be placed to carry the various circuits and will be embedded in cinder fill. The regular rubber-covered double-braided wire will be used. The main switchboard will be of black marbleized slate and will consist of two motor and five lighting panels, two sections to each panel. The power-station switchboard of the same material will have one panel each for lighting and motor switching. The panel boards used throughout will also be black marbleized slate. Lugs and Dossert connectors will be used on all wiring connections. There are several classes of lighting, including ceiling, floor and side-wall outlets, and illumination for the drill hall, for the cooking-range hoods and for the rifle ranges, and the highest grade receptacles have been specified for each. A call-bell signaling and interior telephone system will be installed on the small-arms range. The transformers will be supplied and installed by the New York Edison Company. The architects for this building are Pilcher & Tachau, 109 Lexington Avenue, New York, and the R. D. Kimball Company, of Boston and New York, is the engineer.

**Electrical-Vehicle Growth in New York.**—According to figures obtained from the Electric Vehicle Association of America, 124 West Forty-second Street, New York, there were in operation and garaged in the boroughs of Manhattan and the Bronx on July 26 of this year no less than 2150 electric vehicles, as compared with 1750 for July 27, 1912. The largest single users seem to be the brewers, with 322 vehicles in service, while department stores, with 262, are a close second. Of those having in operation more than 100 such cars, express companies, bakers and central stations must be mentioned in the order named. Other branches of business which are particularly large users are wholesale meat markets, jewelers, wholesale dry-goods merchants and the vehicle manufacturers themselves, who by their use of the vehicles achieve the double object of advertising their cars and at the same time securing the advantages of reducing trucking expenses. The list of users of electric vehicles in New York alone includes seventy-six different kinds of businesses, and the number is constantly increasing. This growth is viewed with satisfaction not only by the makers of the cars but also by the storage-battery makers and by the central stations, to both of which it means a steady, dependable source of income.

**Western Electric Sales Conference in Chicago.**—The second annual conference of Western Electric telephone sales specialists was held in the La Salle Hotel, Chicago, during the week of Aug. 4 and was attended by thirty-one of the company's representatives from different parts of the country. These men are responsible for the sales of the Western Electric telephones to railroads and industrial concerns which operate private exchanges and the convention was primarily for the purpose of discussing sales campaigns. E. A. Hawkins, of Chicago, presided at all the sessions, these being held daily (excepting on Aug. 5, when the delegates visited the Hawthorne plant) and also on the evenings of Aug. 4 and 6. The entire session each day was given up to the reading and discussing of papers on sales conditions and methods and in all about eighty such papers were rendered. These will be assembled in pamphlet form shortly and issued to the company's salesmen as a telephone salesmen's manual. In order to prevent the reading of any one paper from infringing on the time allotted to the next one and thereby interfering with the entire program a novel method was employed. Two miniature incandescent lamps were fixed to the chairman's table, from which the papers were read, and connected to a double plug switch on the table of the secretary, W. D. Lindsey, of New York. Three minutes before the time limit a green lamp was lighted and when the time was up a red lamp was lighted. This scheme proved an effective, dignified means for conveying the message without hurt to the speaker's feelings and without distracting the audience as a buzzer device invariably does

**Commercial Activity of the Republic Railway & Light Company.**—Active campaigns for domestic customers are being conducted in all the cities served by this company. The Electric Shop which opened in Youngstown, Ohio, in August of last year has been of great assistance in the sale of electric-heating devices and in the campaign for the wiring of houses that had not contemplated the use of electricity when building. During the first five months of this year the power department closed eighty-one contracts for electric power with a total connected horse-power in motors exceeding 5500. A large number of these customers are now connected and are being served with electric energy. The remainder will be connected as soon as the necessary motor equipment is obtained from the manufacturers. Negotiations are now under way for the electrification of several large industrial plants, and it is expected that contracts will be closed within a short time. In May

he Carbon Limestone Company signed a contract for the omplete electrification of its large quarries near Hillsville, 'a. This contract requires a total of 800 hp in electric iotors. In February the company began to supply power o the Bessemer Limestone Company, which has one of the argest brick plants in the United States, with a capacity of ,200,000 bricks per week. This plant requires a total of 50 hp in motors. In addition, the Bessemer company perates large limestone quarries requiring 1200 hp, making total required of 1950 hp. At present the Republic company is supplying it with 1000 hp in motors. Plans are ow being completed for the substitution of electric motors or the steam drive in the remainder of the brick plants and uarries. In addition the Bessemer Limestone Company is reparing to let contracts for the erection of an extension o its brick plant which will double the present capacity. The new plans call for the use of electric motors.

**Automobile Accessory Factory for Cambridge, Mass.**—Gray & Davis, makers of electric starters and electric-ighting generators and lamps for automobiles, are completing the construction of a new factory for the manufacture of their product on the Charles River Parkway at Cambridge, Mass. The building is six stories in height nd measures 380 ft. by 60 ft. It is of reinforced concrete hroughout and has a tapestry brick exterior. Seventy per ent of the wall area is taken up by windows. The ground oor contains a service garage, large showroom and various epartments, the general offices being on the second floor. The ceilings are built without beams and the company plans o operate all its machinery by electricity. Among the eatures of the establishment are electric drying ovens, a niniature interior railway transportation system, extensive iotor-driven compressed-air system, vacuum cleaners, anitary drinking fountains and complete lighting installaion.

**Foreign Field for American-Made Household Appliances.**—German manufacturers of electrical appliances are proucing numerous articles for household use, but not nearly o the same extent as American concerns. Because of the erman import tax, however, their product is able to comete with American-made appliances. The articles of this lass which have been most largely exported from this ountry to Germany are vacuum cleaners and electrical ppliances for washing and cleaning. Of the former class ily the more expensive varieties are offered for sale, the xcellent vacuum cleaners which retail in the United States r $25 or less being unknown. There is a market in Gerany for these low-priced cleaners, although it is limited y the fact that comparatively few German houses are red for electricity. Large portable outfits can be hired moderate terms and are very generally used. The United tates supplied in both 1911 and 1912 a large proportion of he total German imports of electric washing and cleaning achines, but during the latter year the English manufacturers seemed to increase their sales at the expense of the merican product. In Norway only a comparatively small umber of electric cooking appliances are used at the present time, but they are growing in popularity. American ranges have not been introduced, but there is a field for them. It is almost impossible to sell such apparatus from catalogs, as Norwegian dealers will not buy goods which they have not seen. They can probably be sold from samples. While electric irons are not used to the same extent in England as in the United States, there is an increasing demand for them, now supplied chiefly by English manufacturers and by one or two German companies. In Greater London there are some thirty electric companies, supplying energy at voltages ranging from 100 volts to 240 volts. The most popular English and German makes of iron meet this difficulty by arranging for a variation of the operating voltage within the iron itself, and to compete with them any American iron would have to be similarly designed, so as to operate satisfactorily on a wide range of voltages. There is a field for an American iron of low price which will meet these conditions. In the Liverpool district there is a particularly good and increasing demand for this class of appliances, and attempts have been made to introduce the American makes, but these have been so far unsuccessful owing to the unfavorable prices as compared with the English product. Other electrical appliances are in demand to some extent. The use of electricity for heating and cooking in the International Settlement at Shanghai, China, was introduced less than three years ago, and heating and cooking outfits are rented out by the electricity department of the Shanghai Municipal Council at a monthly charge of about 33 cents. Both American and European makes are in use, and the average connected load of such apparatus in 1912 was about 300 kw. Alternating current at 50 cycles and 200 volts is the supply on which these appliances are operated, and the rates of 6 cents per kw-hr. for lighting and 1 2/3 cents per kw-hr. for power uses compare favorably with American rates and make the use of these appliances seem less a luxury.

**Barcelona Preferred Stock Issue.**—Stockholders of the Barcelona Traction, Light & Power Company, Ltd., have recently authorized the issue of $12,500,000 of 7 per cent noncumulative preferred stock, of which $10,000,000 worth has been sold to a French syndicate at par, the remainder being held in the treasury for future needs. The proceeds of the sale are to be used for financing further work in and around Barcelona, Spain, where all the electric traction, light and power properties are controlled by the company.

**American Water Works & Guarantee Protective Plan.**—The committee formed to protect the interests of the common and preferred stockholders of the American Water Works & Guarantee Company has issued a protective agreement to stockholders under which holdings may be deposited with the committee, the Bankers' Trust Company acting as depositary. This committee will have full power to undertake any refinancing or reorganization work deemed expedient in connection with this company or any of its subsidiaries. Copies of any such plan adopted will be sent to the depositors, and any one of them who does not approve of the same may within thirty days after receiving notice withdraw from the agreement by filing with the depositary written notice of his dissent.

## Industrial Securities

| Security | Capital Stock Listed | DIVIDEND Per Cent | DIVIDEND Period | QUOTATION July 30 | QUOTATION Aug. 6 |
|---|---|---|---|---|---|
| Allis-Chalmers, t.r., 5th pd | $19,800,000 | ..... | ..... | 9* | 9 |
| Allis-Chal., pf.,t.r.,5th pd.. | 16,050,000 | ..... | ..... | 16½* | 16½ |
| Amalgamated Copper..... | 153,887,900 | 1½ | Q | 69⅞ | 70⅛ |
| American Tel. & Tel..... | 344,471,400 | 2 | Q | 128⅛ | 128⅜ |
| Electric Storage Battery,c. | 16,074,425 | 1 | Q | 48½ | 48 |
| General Electric..... | 101,363,600 | 2 | Q | 140* | 141 |
| Mackay Cos., c..... | 41,380,400 | 1½ | Q | 77½ | 89 |
| Mackay Cos., pf..... | 50,000,000 | 1 | Q | 69½* | 66 |
| Western Union Tel..... | 99,747,600 | ¾ | Q | 67½* | 67 |
| Westinghouse, E. & M., c. | 34,496,400 | 1 | Q | 63⅞ | 63½ |
| Westinghouse, E. & M., pf. | 3,998,700 | 1¾ | Q | 116* | 114 |

*Last price quoted.

### NEW YORK METAL MARKET PRICES

| | July 29 Bid. | July 29 Asked. | Aug. 5 Bid | Aug. 5 Asked |
|---|---|---|---|---|
| Copper: | | | | |
| Standard, spot* | 14.00 | ..... | 14.37½ | ..... |
| | Selling Prices | | Selling Prices | |
| | £ s d | | £ s d | |
| London, standard, spot* | 65 15 0 | | 67 17 6 | |
| Prime Lake | 15.00 | to 15.10 | 15.25 | to 15.37½ |
| Electrolytic | 14.87½ | to 15.00 | 15.12½ | to 15.25 |
| Casting | 14.70 | to 14.80 | 14.87½ | to 15.00 |
| Copper wire base | .... | 16.00 | 16.25 | to 16.37½ |
| Lead | | 4.50 | | 4.50 |
| Nickel | 40.00 | to 45.00 | 40.00 | to 45.00 |
| Sheet zinc, f. o. b. smelter | | 7.25 | | 7.50 |
| Spelter, spot | .... | 5.60 | 5.60 | 5.65 |
| Tin, spot* | 40.80 | to 41.00 | 40.80 | to 40.87½ |
| Aluminum: | | | | |
| Prompt delivery | 23.00 | to 23.50 | 22.75 | to 23.25 |
| Future | 21.00 | to 22.00 | 21.00 | to 22.00 |

### *OLD METALS

| | | | | |
|---|---|---|---|---|
| Heavy copper and wire | | 13.75 | | 13.75 |
| Brass, heavy | | 8.75 | | 8.75 |
| Brass, light | | 7.75 | | 7.75 |
| Lead, heavy | | 4.25 | | 4.40 |
| Zinc, scrap | | 4.25 | | 4.25 |

### *COPPER EXPORTS

| | |
|---|---|
| Total tons to Aug. 5 | 487⅛ |

*From daily transactions on the New York Metal Exchange.

## Business Notes

**The Ohio Electric Car Company** is increasing its facilities for manufacturing electric pleasure vehicles in order to double its present output.

**Terry Steam Turbine Company.**—Hoshall, Simmons & Company, 20 Randolph Building, Memphis, Tenn., have been appointed agents for that city and the territory of Tennessee, Arkansas and the northern part of Mississippi for the Terry Steam Turbine Company, Hartford, Conn.

**Tungstolier Works.**—The general offices of the Tungstolier Works of the General Electric Company have been moved from Conneaut, Ohio, to the Euclid Building, Cleveland, Ohio, where a salesroom for wholesale business will be maintained.

## New Industrial Companies

**The H. P. B. Electric Company,** of Philadelphia, was incorporated under the laws of Delaware recently, with a capital of $50,000. Lansing W. Powers, Rye, N. Y., chief incorporator.

**The Illinois Storage Battery Business of Chicago,** of Chicago, Ill., has been chartered with a capital stock of $25,000 to deal in electric batteries. The incorporators are: Paul Larmer, William J. Bryan and Joseph J. Herbert.

**The Merrill Electric Manufacturing Company,** of Chicago, Ill., has been incorporated with a capital stock of $2,500 by F. W. Merrill, J. L. Arthur and L. A. Nelson. The company proposes to deal in electric machinery and appliances.

**The John W. Cronk Company,** of Chicago, Ill., has been incorporated with a capital stock of $5,000 by John W. Cronk, E. L. Kramer and George Meyer. The company proposes to deal in electrical supplies and to do an electrical contracting business.

**The Leavitt-Jackson Engineering Company,** of Brooklyn, N. Y., has been incorporated with a capital stock of $50,000 to manufacture mechanical and engineering instruments. The incorporators are: Frank M. Leavitt, William F. Kip and Daniel D. Jackson, 30 East Forty-second Street, New York, N. Y.

## Trade Publications

**Insulators.**—Forty-three different designs of insulators are illustrated in a folder recently issued by the Brookfield Glass Company, 2 Rector Street, New York. Some of the types are new.

**Meters.**—The graphic meters of the Esterline Company, Indianapolis, Ind., are illustrated and briefly described in a folder recently issued, No. 272. Many applications for these instruments are shown.

**Belt Dressing.**—An eight-page booklet has been issued by the Cling-Surface Company, Buffalo, referring to the use of "cling-surface" in railroad shops. Five installations where this material was employed are illustrated.

**Hoists.**—A large variety of hoists adapted for many duties and some interesting examples of electric hoists are described and effectively illustrated in Bulletin No. 12, recently issued by the Lidgerwood Manufacturing Company, 96 Liberty Street, New York.

**High-Tension Fuses.**—The Delta-Star Electric Company, Chicago, Ill., is distributing a bulletin descriptive of S & C carbon-tetrachloride fuses for all potentials up to 110,000 volts. Numerous illustrations showing actual installations in commercial operation are given.

**Appliance Catalogs.**—The Manhattan Electrical Supply Company, of 17 Park Place, New York, has recently issued two publications of interest to the electrical trade. The first is a fan motor booklet of unique size and design and the other is a very complete commercial booklet on vibratory massage, describing the "Premier" vibrator, which is of the company's manufacture.

**Generating Sets.**—In an eight-page pamphlet recently published by the Engberg's Electrical & Mechanical Works, St. Joseph, Mich., directly connected generating sets of from 2.5-kw to 50-kw rating are illustrated and described.

**Electrical Supplies.**—A price list and discount sheet covering its lines of electrical supplies and apparatus has recently been put out by the Union Electric Company, of Pittsburgh, Pa. The booklet is well printed and the arrangement of headings excellent.

**Electric Vehicles.**—An article from the May *Power Wagon* has been reprinted in the form of a leaflet by the General Vehicle Company, Long Island City, N. Y., which contains reports on the work of the three electric trucks of the J. A. Mercier Company and on the two of the A. A. Albrecht Company.

**Exhaust Fans.**—Bulletin No. 246 of the Sprague Electric Works of General Electric Company refers to motor-driven exhaust-fan outfits, direct and alternating current. Descriptive matter, halftone illustrations and diagrams showing constructive features combine to give considerable information on this type of apparatus.

**Insulators.**—An illustrated folder has been issued by the Line Material Company, South Milwaukee, Wis., referring to the Kyle line non-drop arc-lamp hangers and insulators. Three other leaflets in the series give brief information with reference to indestructible malleable-iron brackets, pole-line hardware and construction material, and flexible insulator clips.

**Engineering Facilities.**—In a recently distributed folder entitled "Have You Ever Considered This Method of Cutting Costs?" the Providence Engineering Works, Providence, R. I., set forth their facilities for producing anything in the line of machined parts, where the making of such parts might entail a large investment to a company for buildings and special machinery.

**Electrical Specialties.**—Catalog 6 of the Machen & Mayer Electrical Manufacturing Company, 21st Street & Fairmount Avenue, Philadelphia, Pa., describes and illustrates the various electrical specialties made by this company, which include, among others, flush switches, flush brass switch plates, flush receptacles, steel wall boxes, iron switch boxes, indicating heater receptacles, remote control stations and panel boards.

**Pumps.**—Three new bulletins in an attractive binder arranged for future additions have been issued by the Dayton Pump & Manufacturing Company, Dayton, Ohio. No. 15 gives information respecting the Dayton duplex double-acting power pumps and water supply systems. No. 22 refers to deep-well systems. Bulletin No. 30-A has for its subject electric house pump and automatic water lift for bathroom supply.

**Telephones.**—Pamphlet No. 41, issued by the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., refers to its "Central Energy" telephones, including in addition to the regular line some new and improved instruments. In Pamphlet No. 42 standard local-battery telephones, wall and desk and combination-phone types are shown. The new harmonic party-line telephone is described in this circular.

**Adaptiboxes.**—The Adapti Manufacturing Company, Winter and Leonard Streets, Cleveland, Ohio, has issued two catalogs, one size 10 in. by 8.5 in., and the other in pocket edition size, both containing the same reading matter. In these are listed "adaptiboxes" in complete units assembled to make the various types most commonly used. The company states that with a selected stock of the complete units and a small assortment of covers and extra lugs the contractor has a stock of fittings that will meet any emergency. The catalogs are fully illustrated.

**Stage-Lighting Apparatus.**—The latest catalog of the Universal Electric Stage Lighting Company, 240 West Fiftieth Street, New York, contains within its eighty pages descriptions and illustrations of its stage-lighting apparatus and effects. The most up-to-date electrical devices in switchboards, border lamps, stage pockets, dimmers and other stage apparatus are presented in this new publication. It also contains an interesting outline of a modern theater installation in New York, that of the Metropolitan Opera House, which was installed by the Universal company.

# Personal Mention

**Ir. F. W. Hunter** has succeeded Mr. G. W. Russell as erintendent of the light and water department at etha, Kan.

**r. C. P. Steinmetz**, consulting engineer of the General ctric Company, has been nominated for president of the nmon Council of Schenectady, N. Y., on the Socialist et.

**Ir. Philip S. Dodd** has resigned as secretary-treasurer he Society for Electrical Development, and it is under- d will leave the electrical industry, in which he is so ely known. Mr. Dodd was formerly director of public- of the National Electric Lamp Association and prior hat time was business manager of the *Electrical Review.*

**Ir. Irwin McNiece**, formerly on the erecting engineer- staff of the Allis-Chalmers Manufacturing Company, been transferred to the Salt Lake City office of that pany, in the capacity of hydroelectric sales engineer. McNiece was connected with the old Telluride Power pany (now the Utah Power & Light Company) for a ber of years. He was engaged in electric erecting k out of Milwaukee prior to his transfer.

**Ir. Norman Read** has resigned as electrical engineer of Denver (Col.) City Tramway to become assistant gen- manager of the Central Colorado Power Company, in ge of all Colorado properties. The power department he Denver City Tramway will hereafter be included in engineering department, reporting to the chief engineer. position of electrical engineer will remain unfilled for time being. Mr. J. F. Warner, superintendent of power ion, will have charge of the operation and maintenance he generating station. Mr. W. E. Casey, electrician, have charge of the maintenance and operation of the tations.

**rof. Vladimir Karapetoff**, professor of electrical engi- ing at Cornell University, started Aug. 6 on an ex- ed trip West for the purpose of visiting the principal roelectric developments and high-tension transmission ts. He expects to visit the recent development on the issippi River at Keokuk, Ia., and then go to Denver, Lake City, Los Angeles, San Francisco, Portland and tle. It is his intention to attend the Pacific convention he American Institute of Electrical Engineers in Van- er, B. C., Sept. 9-13, and to return East by way of the adian Pacific Railroad. He will be back in Ithaca t Sept. 20, in time for the beginning of the school .

**r. Frank N. Boyer**, for several years assistant district ager of the Chicago office of the General Electric Com- , has been appointed district manager in St. Louis for ame company, succeeding the late George D. Rosenthal. The new manager of the St. Louis office has been active in electric business affairs of the Middle West for a number of years. In earlier life he was for some time superintendent of the Edison Light & Power Company, of Reading, Pa. In 1889 he became connected with the Chicago office of the old Edison General Electric Company. When the Edison and Thomson-Houston companies were consolidated to form the General Electric Company in 1892 Mr. Boyer was made assistant manager of the supply department in the Chicago office. Three years he was made Chicago manager of the department, a ion which he held for more than thirteen years. In 1908, Mr. Boyer was promoted to be assistant mana- f the Chicago office, succeeding in that position the ames W. Johnson, who had just been made manager e office. Mr. Boyer has an exceptionally wide ac- tance among electrical men.



FRANK N. BOYER

**Dr. Harold Pender**, who has been appointed director of the research division of the department of electrical engineering at the Massachusetts Institute of Technology, was born at Tarboro, N. C., Jan. 13, 1879. He received his early education in Baltimore and prepared for college at the McDonough School. He was graduated at Johns Hopkins with the degree of A.B. in 1898 and received the degree of Ph. D. from the same institution in 1901, being at the time assistant in the physical laboratory of the university. The next year he spent at the McDonough School as instructor, and during the following year he was instructor in physics at Syracuse University. In January, 1903, Dr. Pender went to the Sorbonne, Paris, on special invitation of the late M. Poincaré, under a grant from the Carnegie Institution, to repeat there certain experiments on the magnetic effect of a moving electrostatic charge. His previous series of experiments, extending over two years, which confirmed Maxwell's theory and an earlier experiment made by Prof. Henry A. Rowland, had been questioned by a French scientist, V. Cremieu, who had been unable to detect such an effect. The Paris investigation which was undertaken by Pender and Cremieu together proved beyond reasonable doubt that a moving charge does produce a magnetic field. In May, 1903, Dr. Pender entered the apprenticeship course of the Westinghouse Electric & Manufacturing Company and was appointed to a regular position on the engineering staff in the fall, being given charge of the testing of silicon steel for electrical purposes. In 1904-05 he was in the electrical engineering department of the New York Central, his work being largely the planning of the distribution system of the New York Terminal. He next became associated with Dr. Cary T. Hutchinson, and was at the time secretary and assistant to the chief engineer of the McCall Ferry Power Company. The work upon which he was engaged from 1905 to 1909 included a report to the International Railway Company of Buffalo on the use of water-power to charge batteries in connection with its steam plant; a report to the city of New York on the cost of complete lighting from a municipal plant; the electrification of the Cascade tunnel of the Great Northern Railway, together with various economic and hydraulic problems for the McCall Ferry Power Company, and investigations of the effect of methods of heat treatment on the magnetic and electric properties of silicon steel. Since 1909 Dr. Pender has been connected with the Massachusetts Institute of Technology, until 1912 as professor of electrical engineering and now as director of the research division of the department of electrical engineering. The technical articles from the pen of Dr. Pender include a score or more of important contributions in French and in English to the leading technical journals. He is the author of "Principles of Electrical Engineering" and editor of "The American Electrical Engineer's Handbook."

# Obituary

**A. S. Michener**, controller of the Puget Sound Traction, Light & Power Company, of Seattle, Wash., was drowned Sunday while on a fishing trip up the Homahoma River near Seattle. Together with Messrs. J. P. Dabney, A. L. Kempster, A. W. Leonard, C. C. James and Mr. Best, of the Puget Sound Traction, Light & Power Company, Mr. Michener left Saturday on the launch of Mr. J. Sodenberg, a prominent business man of Seattle, whose guests they were. Arriving at their destination, the party started up stream on foot, and the supposition is that Mr. Michener while fishing alone slipped. His dead body was discovered half an hour later. Algernon Stanton Michener was born in Washington, D. C., in 1869 and was a son of the late Captain John E. Michener. After graduating in law from Georgetown University he entered the American Ordinance Company, leaving there later to join the staff of the Stone & Webster organization. At the time of his death he was vice-president and controller of the Puget Sound Traction, Light & Power Company, having left Boston for Seattle in 1912. He is survived by a widow, sister and brother. Interment will be made at Washington on Aug. 9.

# Construction

## New England

authorize an increase in the capital stock of the company by $500,000, to

addition to the central generating station of 12,000 hp and the construc-

## Middle Atlantic

for the construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Cortland, N. Y. Drawings and specifications may be obtained at the above office or from the custodian at Cortland. O. Wenderoth is supervising architect.

JAMAICA, N. Y.—The New York & Queens El. Lt. & Pwr. Co. has purchased a site on Van Wyck Avenue, just north of the new Long Island Railroad terminal, on which it proposes to erect a new substation, executive offices and headquarfters for the construction force of the company in the Jamaica district. Energy for the substation will be supplied from the Long Island City and Astoria generating stations.

MECHANICSVILLE, N. Y.—The Mechanicsville El. Lt. & Gas Co. expects to purchase within the next 30 days one 150-hp boiler, one feed-water heater (150 hp), motor to drive pump and No 6 and No. 8 weather-proof pipe. Edward Farrow is president and manager.

NEW YORK, N. Y.—The Public Service Commission, First District, has executed a contract with the E. E. Smith Contracting Co., 101 Park Avenue, New York, for the construction of the section of the Broadway (Manhattan) subway lying between Union Square and Twenty-sixth Street for $2,056,702. The plans call for a four-track underground railroad with one-half of the express station at Union Square and a local station at Twenty-third Street and Madison Square.

PLATTSBURG, N. Y.—The Plattsburg Gas & El. Co., it is reported, has completed arrangements for extensive alterations and improvements to its system, work on which has already begun. The company is rebuilding the lines from its power house at Indian Rapids to Plattsburg, and when completed the transmission lines will be extended to Morrisonville to furnish electrical service in that village.

SYRACUSE, N. Y.—The Oswego River Pwr. Trans. Co., of Syracuse, has applied to the Public Service Commission for permission to construct a distributing system in the town of Schroeppel and erect a transmission line across that town to a connection with the lines of the Mexico El. Co. in the town of Palmero; also to begin construction of distributing system in the villages of Cato and Meridian to furnish energy for lamps and motors in those places. This construction involves the extension of the company's lines from the hamlet of Fairdale, through the towns of Hannibal, Ira and Cato, through the settlement of Hannibal Center and Ira Hill, to the villages of Cato and Meridian.

TROY, N. Y.—The contract for the construction of the new telephone building of the New York Telephone Co., to be erected at Fourth and State Streets, Troy, at a cost of $500,000, has been awarded to the Charles P. Boland Co., of Troy.

DAUPHIN, PA.—The residents of Dauphin are preparing a petition asking the county court for authority to raise the money necessary to install an electric-lighting system. The service will be furnished by the Harrisburg Lt. & Pwr. Co., which was recently granted a franchise by the Borough Council. The streets are now lighted by oil lamps.

WILLIAMSBURG, PA.—The Penn Central Lt. & Pwr. Co., of Altoona, is building a new plant at Williamsburg. The initial equipment will include a 4000-kw Westinghouse turbine and Edgemoor boilers. The ultimate generating capacity of the plant will be 15,000 kw. Contracts for equipment have been placed. Day & Zimmerman, of Philadelphia, are engineers.

CAMDEN, N. J.—The City Council has rejected an ordinance appropriating $540,000 for a municipal electric-light plant. A resolution was adopted by the Council providing that the question should be brought before the voters at the next election.

EGG HARBOR, N. J.—The dam at Park Lake gave away on Aug. 1, undermining the concrete foundations to the electric-light plant and saw mill. The electric-light plant, it is said, was badly damaged.

SOUTH RIVER, N. J.—Bids will be received by the Borough Council

tion of gas-producer engine, generator, switchboard, coal and coal conveyor. C. S. Partridge is superintendent of public work

WASHINGTON, D. C.—Bids will be received at the Engineer Depot, United States Army, Washington Barracks, D. C., until Aug. 2, for furnishing five direct-current switchboards, etc. Further information may be obtained upon application to Major W. J. Barden.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 28, for furnishing and installing lighting fixtures in the new building for the

and specifications, copies of which may be obtained at the above office. O. Wenderoth is supervising architect.

D. C.—Bids will be received at the Government Printing Office, Washington, D. C., until Aug. 25 for furnishing and installing in that office certain boilers, stokers, feed-water heers, piping and flues, foundations, coal and ash-handling machinery, smokestack, turbine and generator switchboard and tunnel between the Government Printing Office and the new post office building. Detailed specifications and proposal giving complete information, etc., may be obtned by addressing Cornelius Ford, public printer.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 19, for furnishing at the various navy yards and naval stations supplies as follows: Norfolk, Va., Schedule 5711—one motor-driven metal disk grinder, complete; Boston, Mass., Schedule 5701—restranded and insulating cables; Philadelphia, Pa., Schedule 5709—miscellaneous truck and storage battery, complete, etc.; Brooklyn, N. Y., Schedule 5701—500 ft. paper-insulated, lead-sheathed telephone cable, 3500 ft. rubber-insulated, lead-sheathed duplex cable, 700 ft. paper-insulated lead-sheathed three-conductor cable; East and West, Schedule 5659—miscellaneous electric fixtures, miscellaneous globes for electric fixtures at prismatic reflectors: Mare Island, Cal., Schedule 5664—two 50-kw turbo-generator sets complete, two 100-kw turbo-generator sets complete with spare parts. Schedule 5665—three portable current transformers, three dole-voltage, single-phase indicating wattmeters, one high-sensitivity galvanometer, etc. Bids will also be received at the same place until Aug. 26, as follows: Mare Island, Cal., Schedule 5712—9600 ft. miscellaneous paper-insulated and lead-sheathed electrical cable, Naval Engineering Experiment Station, Annapolis, Md., Schedule 5679—furnishing and installing one Diesel engine, one direct-current oil-engine-driven exciter unit and one alternating-current generator. Bids will also be received at the same place until Sept. 2, as follows: Brooklyn, N. Y., Schedule 5698—for miscellaneous transmitting and receiving radio sets; Mare Island, Cal., Schedule 5700—one motor-driven emery grinder, one motor-driven surface plan grinder one motor-driven grindstone, with trough complete, one motor-driven boring and mortising machine, one motor-driven core-box machine, one 24-in. motor-driven vertical swivel-turret boring and turning mill, one vertical 30-in. motor-driven boring and turning mill, one motor-driven hydraulic test pump, one 34-in. motor-driven band saw, one motor-driven universal bench saw and one motor-driven scroll saw. T. Cowie is paymaster general, U. S. N.

## North Central

BAY CITY, MICH.—The lighting committee is contemplating the installation of a new street-lighting system, to cost approximately $27,000. The present plans provide for 152 standards, carrying inverted 6.6-amp magnetite lamps. Park cable will be used. F. H. Mohr is chairman of lighting committee, and William H. Fitzhugh superintendent of the municipal electric-light department.

CASS CITY, MICH.—At a special election held recently a proposition to issue $11,000 for improvements to the municipal eetric-light plant and water-works system was carried. It is proposed to erect a new power house on another site, the present plant to be moved to the new power house, additonal machinery put in and a new street-lighting system (tungsten lamps) installed.

HOUGHTON, MICH.—The Houghton County Trac. Co. is planning to remodel its substation at Laurium.

MASON, MICH.—Within the next 30 days the management of the municipal electric light plant expect to purchase a generator and engine, exciter, switchboard and instruments, transformers, lightning arresters, meters, etc., and within the next three months two boilers. George N. Cummings is superintendent.

CLEVELAND, OHIO.—Bids will be received at the office of W. H. Kirby, secretary to the director of public service, No. 204 City Hall, Cleveland, until Aug. 14, for electric-light poles for the Municipal Electric Light Department, in accordance with plans and specifications which may be obtained in the office of the engineer of construction, 419 City Hall. W. J. Springborn is director of public service.

CLEVELAND, OHIO.—Bids will be received at the office of W. H. Kirby, secretary to the director of public service, No. 204 City Hall, Cleveland, Ohio, until Aug. 12, for transformers for the Broadway substations of the municipal electric light department, in accordance with plans and specifications which may be obtained in the office of the engineer of construction, Room 419, City Hall. W. J. Springborn is director of public service.

MARTINS FERY, OHIO.—Improvements are being made to the distribution lines of the municipal electric-light plant and Westinghouse meters are being stalled for the flat-rate consumers. J. W. Tush is superintendent.

OAK HARBOR, OHIO.—The Town Council has decided to submit the proposition of ading the town for the installation of a municipal electric-light plant t a special election to be held soon. The Council has rejected the proposition of the Ohio Northwestern Ry. & Pwr. Co. for street lighting.

PIQUA, OHIO.—The Dayton Lt. & Pwr. Co. (which owns the Piqua electric plant), it is reported, has closed a contract with the Western Ohio Ry. Co., of Ina, for energy to operate the local system. A transmission line will e erected from Lockingham to Piqua, a distance of 6 miles. The Weern Ohio Ry. Co. will also furnish energy to operate the cars of thDayton & Troy El. Ry. Co. and the Dayton, Covington & Piqua Trac o. Under the terms of the contract power is to be delivered at the Lkingham substation by Oct. 1. O. H. Hutchings, of Dayton, is generalsuperintendent of the Dayton Lt. & Pwr. Co.

SANDUSKY, OIO.—At an election held July 30 the proposition to issue $200,000 forhe installation of a municipal electric-light plant was defeated.

TOLEDO, OHI—Bids will be received by the Board of County Commissioners of Luc County, Court House, Toledo, until Aug. 28, for furnishing materia required and construction of underground steam and water connections nd electric service wires at the power plant of the Lucas County Infirmary, in accordance with plans and specifications prepared by David L Stine, architect, Toledo, which are on file in the office of the county uditor and at the office of the architect. Charles J. Sanzenbacher is aitor.

TROY, OHIO.—The city of Troy expects to rebuild its power house next year, combing the electric power plant and water-works system, and go into new fids for water-works, using wells. L. A. Pool is superintendent.

CLAY, KY.—Te Clay Lt. & Ice Co. expects to purchase new equipment and machine as follows: One about 30-kw, single-phase, 60-cycle, 2300-volt, revolvir field, belt-driven generator, one automatic steam engine (about 50 p), switchboard for above generator and leather drive belt. The compar would consider second-hand machinery, but it must be in first-class ondition. C. R. Clark is secretary and manager.

HARDINGSBUG, KY.—Within the next 60 days the Hardinsburg El. Lt. & Pwr. Cexpects to erect an electric light and power plant and to purchase withi the next 30 days one 30-kw or 40-kw, 220-250-volt direct-current genator and 9-in. belt, switchboard and material for wiring for inside ar outdoors, and will also need one power pump for boiler-feed. Engi and boiler have been purchased. Within the next six months the copany will also purchase from 800 to 1000 incandescent lamps.

HENDERSON, KY.—Bids will be received at the office of L. P. Hite, superintendent ofthe municipal electric-light plant, until Aug. 16 for one 400-hp water-be boiler with chain-grate stoker; also for one 225-ft. (by 11 ft. inside ameter) self-supporting unlined steel smokestack. An alternative propos will be accepted on radial brick smokestack of same dimensions. Speccations may be obtained on application to the above office.

HOPKINSVILE, KY.—The Kentucky Pub. Ser. Co., of Hopkinsville, has closed contract with Captain S. G. Ragsdale, who owns the lighting franchisein Pembroke and Trenton, to furnish energy from the Hopkinsville planto operate the systems in the two towns. It is also proposed to furna electricity to residents along the line, which will be 20 miles long. Te Kentucky Pub. Ser. Co., it is said, contemplates the construction of a ew power house in Hopkinsville in the near future.

LEBANON, K.—The Lebanon Lt., Ice & Pwr. Co. expects to purchase within the ext 12 months a coal and ash-handling system. J. A. Kelly is treasure

LIVERMORE, KY.—The Smith-Cooperage Co., of Livermore, is negotiating with the rdents of the town of Island, 3 miles distant, to extend its electrical serve to that place. If an agreement is reached equipment will be required r the entire line.

LOUISVILLE, KY.—The Board of Park Commissioners is contemplating the installion of a new lighting system along the borders of the Southern and Eaern Parkways. The Louisville Gas & El. Co. has been asked to submit timates for furnishing the service.

BOURBON, ID.—A new tungsten street-lighting system has recently been installed he by the Union Wtr., Lt. & Pwr. Co. E. Kessler, superintendent.

FRANKFORT, ND.—The Board of Electric Light Commissioners expects to purchase within the next 12 months one 500-hp boiler, a 1000-kw turbine and 120 eters. H. B. Wickham is secretary.

LEBANON, ID.—The Interstate Pub. Ser. Co., successor to the Citizens' El. Lt. Pwr. Co. of Lebanon, expects to rebuild its transmission lines witin the next 12 months. The company has just installed one 300-k General Electric turbine and one switchboard panel. F. H. Miller is al manager.

SHERIDAN, ID.—The Sheridan Wtr., Lt. & Ht. Co. has nearly completed the installion of a complete new electric-light plant and water-works. The equment consists of one 100-kw and one 75-kw generating unit and 300-hp oiler and new General Electric switchboard. A day service was established July 1, 1913. C. E. Layton is secretary and treasurer.

HILLSBORO, ILL.—Arrangements are being made by the Peabody Coal Co. to install electrical equipment in the Kortkamp mine, near Hillsboro, for operating hauling and lifting apparatus.

LINCOLN, ILL.—A movement has been started by the business men to install ornamental street lamps on Broadway between Kickapoo and Chicago Streets.

OTTAWA, ILL. — The Northern Illinois Lt. & Trac. Co., of Ottawa, has increased its capital stock from $250,000 to $750,000.

PANA, ILL.—The Central Illinois Pub. Ser. Co., of Mattoon, has submitted a proposition to the City Council offering to furnish energy for lamps and motors to the city and for street-lighting. The company agrees to furnish arc lamps at $60 each per year, electricity for domestic purposes at 8 cents per kw-hr., for industrial purposes at 4 cents per kw-hr. and for the ornamental street lamps at 4 cents per kw-hr.

STERLING, ILL.—The installation of a new electric elevator in the new city hospital (to cost $2,000) is under consideration.

WATSEKA, ILL.—The Central Utilities Co., of Watseka, is reported to have purchased a site in Watseka upon which it will erect a new power plant.

ANTIGO, WIS.—The Antigo El. Co. has been granted authority by the Wisconsin Railroad Commission to issue $10,000 in capital stock to provide funds for extensions and additional equipment.

JANESVILLE, WIS.—The Janesville El. Co. expects to purchase a 300-kw to 400-kw, three-phase, 60-cycle, 2300-volt, 600 r.p.m. generator with switchboard panel. The company would prefer a good second-hand generator. P. H. Korst is manager.

KIEL, WIS.—Bids will be received by Fred Duecke, village clerk, until Aug. 20 for the construction of an electric-light system for the village of Kiel. Plans and specifications are on file in the office of the village clerk.

MADISON, WIS.—The Peninsula Pwr. Co., of Madison, has received authority from the Wisconsin Railroad Commission to issue capital stock to the amount of $400,000, the proceeds to be used for the purchase of additional equipment for its hydroelectric plant and transmission line in the counties of Florence, Wis., and Dickinson, Mich., and for the retirement of outstanding bonds, etc.

MEDFORD, WIS.—The Medford Lt. & Htg. Co. contemplates improving its distribution system by putting in larger wire. William Ungrodt is superintendent.

MENOMONIE, WIS.—Bids will be received by the trustees of the State Board of Industrial Education for the State of Wisconsin, at the Stout Institute, Menomonie, Wis., until Aug. 18, for general construction, heating, ventilating, plumbing and electric wiring for the new trades building and additions to present boiler house and fuel rooms and present heating plant, etc., to be erected at Menomonie, in connection with the Stout Institute. Copies of plans and specifications may be obtained from John D. Chubb, architect, 822 Chicago Opera House, Chicago, Ill., for which a deposit of $25 will be required to be refunded upon return of same. Complete sets of drawings are on file at the Stout Institute, Menomonie, also at the office of the architect, Chicago, Ill.; the Builders' Exchange, Milwaukee, and the Builders' Exchange, Minneapolis, Minn.

EAST GRAND FORKS, MINN.—The managers of the municipal electric-light plant are building a new substation and rebuilding the distribution system of the municipal electric-light plant. Material and supplies have already been purchased. Charles E. Fiers is superintendent.

ROCHESTER, MINN.—Contracts have been awarded by the city of Rochester for material for an incandescent cluster-lamp street-lighting system, at a cost of about $3,700. The plans provide for 59 lamp standards, carrying one 60-watt and four 40-watt lamps, maintained by underground cable. The city will install the system. H. E. Swanson is superintendent of the municipal electric-light plant.

CHARLES CITY, IA.—The capital stock of the Charles City Lt. & Ht. Co. has been increased from $75,000 to $250,000.

CLINTON, IA.—Bids will be received by the county auditor of Clinton County, Clinton, until Aug. 13, for the construction of a power house and steam-heating plant in the County Home. The cost is estimated at about $7,000.

FONDA, IA.—The city of Fonda has voted to issue $15,000 in bonds for the installation of a municipal electric-light system. The Northern Iowa Pwr. Co., of Humboldt, will furnish energy for same. Arrangements have been made whereby the company will erect the transmission line from Humboldt to Pomeroy and thence to Fonda, furnishing poles, lines, transformers and everything complete to furnish a 24-hour service.

MASON CITY, IA.—The People's Gas & El. Co., of Mason City, expects to erect within the next three months an addition to its power house and to install one 2000-kw turbine and two 500-hp boilers and to install within the next six months one 1000-gal. deep-well pump. M. Anderson is manager.

POMEROY, IA.—At an election held July 12 bonds to the amount of $15,000 were voted for the erection of a transmission line (14 miles long) to connect with the lines of the Northern Iowa Pwr. Co., of Humboldt, which will furnish energy to operate same. The company will also build the lines and distributing system in Pomeroy under contract

with the town. No engineer has yet been engaged. S. H. McClure is city clerk.

SPENCER, IA.—Bids will be received until Aug. 15 by M. [illegible] M. Smith, city clerk, Spencer, for the installation of a 12-in. by 16-in. Corliss engine in the municipal power house, in accordance with plans and specifications, copies of which may be obtained from the city clerk or from K. C. Gaynor, of Sioux City, consulting engineer.

SPIRIT LAKE, IA.—The electric plant of the Spirit Lake El. Co. was recently destroyed by fire, causing a loss of about $15,000. At present the town of Spirit Lake and the resorts at Orleans, Arnold's Park and Templar Park are without electrical service. The plant, it is understood, will be rebuilt at once.

TIPTON, IA.—The Tipton Lt. & Htg. Co. has changed its plant from direct current to alternating current. A new substation has been erected which will be equipped with three 50-kva transformers, lightning arrester, oil switches, switchboard, etc. All material has been purchased.

DEXTER, MO.—The proposition to issue $58,000 in bonds for the installation of an electric-lighting plant and sewers will soon be submitted to the voters.

JOPLIN, MO.—At an election held recently the proposition to issue $75,000 in bonds for extensions and improvements to the municipal electric-light plant was defeated. This is the third time since April 22 that a proposition to enlarge the plant has been defeated.

LAMAR, MO.—Within the next six months the city of Lamar expects to purchase heating appliances, vacuum cleaners, washing machines and motors. Charles B. Hall is superintendent of the municipal electric-light plant.

OZARK, MO.—The Ozark Pwr. & Wtr. Co. has applied to the State Utility Commission for authority to issue $6,000,000 in bonds, the proceeds of $2,000,000 to be used for the construction of the White River dam and the remainder to be utilized in enlarging the dam and general improvements.

FORT PIERRE, S. D.—The Fort Pierre Power Co. expects to purchase within the next two months material for erection of electric transmission line across the Missouri River. Copper-clad steel wire and towers will be used. The company would like to receive catalogs and prices from manufacturers of towers.

GARRETSON, S. D.—The town of Garretson expects to purchase within the next three months one 20-hp oil engine, one 18-kw, three-wire, 250-volt direct-current generator, one blue Vermont marble switchboard panel and necessary instruments to match switchboard now installed.

GRAND ISLAND, NEB.—Extensive improvements are being made to the municipal electric-light plant, including construction of new power house and the installation of a 500-kva Allis-Chalmers turbo-generator with all condensing equipment, at a cost of about $20,000. An electrolier lighting system for the business section, consisting of five-lamp clusters and using steel-taped cable instead of conduits, costing about $13,000, is being installed. J. H. Miller is water and light commissioner.

PLATTSMOUTH, NEB.—The Nebraska Ltg. Co., of Plattsmouth, is reported to have decided to rebuild its entire plant. Energy for operating the local system while improvements are being made will be supplied from Red Oak, Ia., for which transmission lines are now being erected. Arthur Huntington, of Chicago, is engineer in charge of the work.

SALEM, NEB.—An election has been called for Aug. 25 to vote on the proposition to issue $4,953 in bonds for the installation of a municipal electric-light plant. A preliminary estimate has been submitted by the Alamo Engine & Supply Co., of Omaha, placing the cost of the plant at $6,000.

ABILENE, KAN.—The Riverside Lt. & Pwr. Co., of Abilene, is reported to be negotiating with the city of Herington to secure a lease of the municipal electric-light and power plant. If the deal is carried through, energy will be transmitted from the power plant at the River to Herington, a distance of 20 miles.

COTTONWOOD FALLS, KAN.—The Home Lt. & Pwr. Co. is installing a 50-hp internal-combustion engine for auxiliary power for ice plant now being installed. W. W. Austin is manager.

MANHATTAN, KAN.—The Manhattan City & Interurban Ry. Co. contemplates the construction of a new power house soon in Manhattan.

MULVANE, KAN.—The Mulvane Ice & Cold Storage Co. expects to erect within the next three months a new building, 45 ft. by 30 ft., for engine room for power plant, and to purchase within the next two months one 15-kva, three-phase, 60-cycle, 2300-volt generator, one 80-hp and one 20-hp oil engine. O. A. Climerts is manager.

SABETHA, KAN.—Within the next 30 days the managers of the municipal electric-light plant expect to purchase one 200-kva Westinghouse-Parsons three-phase, 60-cycle, 2300-volt turbine, one boiler-feed pump and one switchboard panel complete with instruments for above generator. F. W. Hunter is general superintendent.

## Southern States

BENSON, N. C.—At an election held recently the proposition to issue $25,000 in bonds for the installation of a municipal electric-light plant was carried.

BLACK MOUNTAIN, N. C.—The Black Mountain Tel. Corpn. will install an electric-light plant in connection with the Dickey-Campbell Co. The proposed plant will be located about 1¼ miles from the [illegible] equipment will include one 75-kva General Electric generator, switchboard, etc.; 120 poles and 4500 lb. No. 18 and 6-wire will be used for the distribution system. Work has already begun on the plant. P. B. Braid has charge of the work.

TARBORO, N. C.—The City Council has authorized improvements to be made to the municipal electric-light plant, to cost about $5,500. Contracts for machinery have already been placed. E. P. Meredith is superintendent.

WILSON, N. C.—The city of Wilson, it is reported, has engaged Gilbert White, of Charlotte, to prepare plans and superintend the construction of the proposed new lighting system. The cost is estimated at $100,000.

ROCK HILL, S. C.—Within the next 30 days the water and light commissioners expect to purchase three 100-kva, 11,000-2200-volt transformers for the municipal electric-light plant. J. G. Barnwell is superintendent.

YAZOO CITY, MISS.—The Public Service Commission expects to purchase within the next three months one motor-generator set for the municipal electric-light plant. J. S. Butler is superintendent.

ALEXANDRIA, LA.—The managers of the municipal [illegible] plant and water-works system expect to install a 1000-kw Allis-Chalmers high-pressure, three-phase, 60-cycle, 2300-volt turbine and to [illegible] within the next few months a surface condenser with vacuum pumps and vertical submerged-type centrifugal cold-water injection and pump with vertical motor.

ARCADIA, LA.—The North Louisiana Lt. & Pwr. Co., of Arcadia, expects to erect within the next six months a 6600-volt transmission line to Gibslands, a distance of 8 miles, and to purchase within the next five months one 90-kw, three-phase, 60-cycle, 2300-volt generator, one 125-hp engine and one 54-in. by 16-ft. horizontal tube boiler, switchboard and protective devices, and within the next six months transformers and poles; also within the next 12 months to purchase fans and heating apparatus. The company purchased the electric plant in Arcadia about 90 days ago and is incorporated with a capital stock of $10,000. T. B. Herring is president; B. Davis, vice-president, and J. T. Reeves, secretary and treasurer.

HAMMOND, LA.—The Hammond Ice, Lt. & Bottling Co. expects to purchase within the next six months a 150-kw or 200-kw, 2300-volt generator directly connected to turbine or oil engine and switchboard panel for same. James Jumonville is manager.

OPELOUSAS, LA.—The managers of the municipal electric-light plant expect to purchase within the next three months one 150-hp oil engine, one 100-kva alternator and generator switchboard panel. A. C. Jones is superintendent.

RAYNE, LA.—The managers of the municipal electric-light plant expects to purchase within the next six months an internal-combustion engine of about 150 hp, with three-phase, 2300-volt alternating-current generator. Plans have not yet been prepared for the new plant and it is not yet known exactly what will be required. E. J. Bertrand is superintendent.

MUSKOGEE, OKLA.—The War Department has given its approval of the project to construct a dam and hydroelectric plant in the Grand River between Muskogee and Fort Gibson. The proposed plant will be built by the Muskogee Wtr. Pwr. Co., which has contracted with Chicago capitalists to build the plant at a cost of about $1,000,000. The plans call for the development of 10,000 hp.

RALSTON, OKLA.—The managers of the municipal electric-light plant expect to erect an addition to the municipal power house and install a 80-hp engine and a 100-hp boiler to replace the gas engine now in use and also to purchase within the next two weeks the equipment mentioned above; also to purchase within the next three months a duplex pump with capacity of 500 gal. per minute, and within the next two months material for distribution system, including meters, wires, etc. F. E. Bryant is commissioner.

DENISON, TEX.—The City Council is considering the question of installing an electrically operated pump in the water works [illegible] station.

GRAPEVINE, TEX.—The property of the Grapevine Lt. & Ice Co. has been purchased by J. W. Day, of Fort Worth.

MADISONVILLE, TEX.—The Madisonville Lt. & Pwr. Co., recently organized, proposes to construct an electric light and power plant. A. Allen, A. E. Page and F. E. White are incorporators.

ORANGE, TEX.—The Orange Ice, Lt. & Wtr. Co. has just completed the installation of a 15-ton Vogt exhaust ice-making machine in connection with its electric plant, using the exhaust for the ice plant.

SAN ANTONIO, TEX.—The Mountain Townsite Co., 225 Bedell Building, San Antonio, is reported to be contemplating the development of 1500 acres at Mount Alamo, in Kendall County. The plans provide for installation of water works, electric-light plant and sewer system. Bids for construction of same will be opened Sept. 15. E. T. Hall is engineer in charge. I. M. Putnam is president of the company.

TEXAS CITY, TEX.—The Texas City Electric Lt. & Wtr. Co. is now installing a 200-kw, 2200-volt synchronous motor directly connected to one 50-kw, 250-volt direct-current generator and on opposite end of motor one 150-kw, 250-volt direct-current generator, all manufactured by the Westinghouse Company. This installation includes new panel equipment, operating on three-wire, 250-500 direct current, for industrial uses at 250 volts and for street-car service at 500 volts; also a 25-kw alternating-current and direct-current exciter set.

## Pacific States

BREMERTON, WASH.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Aug. 16, for furnishing air compressors, condensers, filters, pipings, meters, etc., at the navy yard, Puget Sound, Wash. The cost is estimated at $40,000. Plans and specifications may be obtained on application to the bureau or to the commandant of the navy yard named. H. R. Stanford is chief of bureau.

DAVENPORT, WASH.—The County Commissioners of Lincoln County have granted the Washington Wtr. Pwr. Co. of Spokane, a franchise to erect and maintain transmission lines in this county. The company will erect a line from Davenport to Crescent, Wilbur and Almira at once.

EVERETT, WASH.—The City Council has granted the Northern Pacific Trac. Co. a franchise to construct and operate an electric railway in Everett.

TACOMA, WASH.—Within the next four weeks the Tacoma Ry. & Pwr. Co. expects to erect a 13,000-volt, three-phase transmission line to the powder works at Du Pont, a distance of 14 miles, with 300-kva transformer installation at DuPont. K. C. Schluss is superintendent of power and equipment.

VANCOUVER, WASH.—The Independent El. Co., of Portland, Ore., has petitioned the County Commissioners for a franchise to furnish lighting and motor service and also for permission to erect transmission lines from the Woodland Bridge to La Center and thence to the north line of the city limits of Vancouver.

CONDON, ORE.—The Condon El. Co. expects to purchase a few incandescent lamps within the next six months.

ARCATA, CAL.—The Humboldt Cooperage Co., of Arcata, it is reported, is planning to install a new power plant, including the erection of a new concrete power house, 70 ft. by 40 ft., and a new fuel bin. At present there are 20 motors in use in the factory and 30 more will be installed. The old steam engine will be taken out and two more boilers added.

MARTINEZ, CAL.—The Pacific Gas & El. Co. has awarded a contract to H. R. Ingram, of Martinez, for the construction of a reinforced concrete and steel electric substation at the Associated Oil Plant in Avon. The station will be equipped with five transformers. Energy for the refinery will be supplied from this section.

MONROVIA, CAL.—The City Council is considering the question of extending the ornamental street-lighting system to White Oak Avenue and Myrtle Avenue, thus adding several more blocks to the system.

ST. MARIE'S, IDAHO.—Application has been made to the Public Service Commission by H. S. Simmonds, of St. Marie's, for permission to install a power plant to be operated in conjunction with the plant of the St. Marie's Lumber Co. If granted a franchise, electricity will be supplied in this city and vicinity.

RED MOUNTAIN, COL.—The Western Colorado Pwr. Co. is erecting an outdoor 17,000-volt switching station to accommodate 22 sets of disconnecting air-brake switches controlling circuits to mines and small towns within a radius of 7 miles and at altitude varying from 6000 ft. to 13,000 ft.

ST. ELMO, COL.—The Tin Cup Gold Mining Co., of Denver, has been granted a permit by the Secretary of Agriculture to construct a hydroelectric power plant on Chalk Creek in the Leadville national forest near St. Elmo. Energy will be transmitted across the Continental Divide and will be used to operate a gold dredge at Tin Cup. The initial installation will develop about 300 hp.

## Canada

WINNIPEG, MAN.—The city of Winnipeg expects to erect 77 miles of three-phase, 110,000-volt, two-circuit steel-tower transmission line and to purchase three 4000-kw, three-phase, 60-cycle, 6600-volt generators, various switch gears for 110,000, 6600 and 2200-volt circuit, within the next 12 months; also to purchase various quantities of material for distribution and lighting systems (most of which is now let on tender) and 500 flatirons. E. V. Caton is engineer.

GRAND FALLS, N. B.—The corporation of Grand Falls will soon call for tenders for substation equipment and pole-line supplies for a distribution system to furnish electricity for lamps and motors in Grand Falls. Energy to operate the system will be obtained from the Maine New Brunswick Pwr. Co. An electric motor-driven pumping plant is at present being installed here by the Canadian Allis-Chalmers Co., Ltd.

HALIFAX, N. S.—The foundry department of the Nova Scotia Car Co. was recently destroyed by fire. This department will be rebuilt at once and equipped throughout with electrically operated machinery.

BRIGHT, ONT.—The question of securing electricity from the Hydro-Electric Power Commission of Ontario is being considered.

FORT WILLIAM, ONT.—The Kaministiquia Pwr. Co., of Fort William, it is reported, is contemplating making further improvements to its plant at Kakabeka Falls, 19 miles north of Fort William. The proposed work contemplates a development of 15,000,000 hp, at a cost of about 1,000,000. W. A. Black is managing director and R. S. Kelsch consulting engineer, both of Montreal.

KINGSTON, ONT.—The city of Kingston is contemplating placing overhead wires underground. Tenders will soon be called in connection with placing certain sections underground.

MOUNT FOREST, ONT.—The Water and Light Commissioners expect to purchase a water pump of about 40 hp and also within the next three months to purchase wire and wiring supplies. John Morris is superintendent.

NEW TORONTO, ONT.—At an election held recently the by-law to secure electrical service from the Hydro-Electric Power Commission was approved by the ratepayers. The by-law involves an expenditure of about $7,000, which will cover the cost of distribution lines from the substation and for street-lighting purposes.

ORILLIA, ONT.—Within the next two years the Orillia Water, Light & Power Commission expects to erect a new reinforced-concrete hydroelectric power house complete (operated under a 47-ft. head), equipped with three units of 5000-kw rating, and to purchase two 1500-kva, three-phase, 60-cycle, 2200-volt generators, two exciters, complete switchboard for 5000 kva, 2200-22,000-volts, three sets electrolytic arresters, oil switches, etc., four 750-kva transformers for 2200-22,000 volts, single-phase, 60 cycles. W. K. Greenwood is engineer.

TORONTO, ONT.—The villages of Drumbo, Princeton, Plattsville and Ayr have recently voted in favor of by-laws authorizing the municipalities to enter into contracts with the Hydro-Electric Power Commission of Ontario for hydroelectric power.

TORONTO, ONT.—The Hydro-Electric Power Commission of Ontario has decided to enlarge the power station at Niagara Falls, Ont., and to double the transmission lines between London and Dundas. The towers are already erected and work will begin at once on stringing the wire to supply the western portion of Ontario with Niagara power. The cost of the work is estimated at $300,000.

WESTON, ONT.—The Weston Water Power and Light Commission is contemplating extensions to the hydroelectric system throughout the town of Etobicoke in response to a petition of the ratepayers in that section of the county, who are anxious to secure electrical service from the Hydro-Electric Power Commission of Ontario. It is proposed to erect transmission lines to connect Weston with Richview, Burgess' Corners and Thistletown. The cost of the proposed extension is estimated at about $13,000.

HULL, QUE.—The ratepayers recently approved a by-law authorizing the expenditure of $21,000 for a new generator to take care of 100 supplementary arc lamps for street illumination.

MONTREAL, QUE.—The Montreal Board of Commissioners has decided to accept the tender of the Canadian Allis-Chalmers Co., Ltd., Montreal, for furnishing an electrically driven pump of 6,000,000-gal. capacity for the high-level reservoir. The pump will be directly connected to a 455-hp single motor unit, the type not yet decided upon.

QUEBEC, QUE.—The Canadian government, it is reported, is contemplating the construction of a large dry-dock (1150 ft. long, 137 ft. wide and 40 ft. deep), to be located at St. Joseph de Levis, opposite Quebec. The present plans provide for the installation of a large electric generating plant, to be equipped with three direct-current units (550 volts), one 1500-kw, one 750-kw and the third 300-kw, driven by steam turbine or by triple expansion reciprocating engines.

WESTMOUNT, QUE.—The Council has awarded a contract to R. T. Smith & Co., Montreal, for the construction of a conduit on Western Avenue. The cost of the work is estimated at $25,000. The city is now installing 50 inverted magnetite-arc lamps on Western Avenue, which will replace the present bracket arc lamps.

REGINA, SASK.—The city of Regina expects to erect a building for a 12,000-kw steam station, and complete switchboard equipment, consisting of approximately six generator panels, two exciter panels and 16 feeder panels. E. W. Bull is manager.

## New Incorporations

DOVER, DEL.—The Ingison Hydro Electric Pwr. Co. has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $1,000,000. The incorporators are: J. W. Ingison, M. H. Powers and C. Bicker, of Bowbells, N. D.

ATLANTA, GA.—The Middle Georgia Tel. Co. has been incorporated with a capital stock of $25,000 by J. A. Faucett, H. M. Fleetwood, of Macon; J. P. Peacock, of Cochran, and others. The company proposes to construct a telephone system through five counties and ten cities.

NIAGARA FALLS, N. Y.—The Canadian-American Pwr. Corpn. has been incorporated with a capital stock of $4,000,000 to develop and distribute electricity in Erie, Niagara, Orleans, Monroe, Chautauqua and Cattaraugus Counties. The directors are: E. G. Connette, of Buffalo; S. Reading Betron, Marshall J. Dodge and Francis T. Homer, of New York, and Rodman E. Griscom, of Haverford, Pa.

BLACKLICK, PA.—The Blacklick Lt., Ht. & Pwr. Co. has been granted a charter with a capital stock of $5,000 to operate in Blacklick Township. The incorporators are: C. V. Bergh, A. G. Lanners, M. B. Courtright and W. L. Scott, of Philadelphia. The main office of the company will be located in Philadelphia.

DOLAND, S. D.—The Doland El. Co. has been incorporated with a capital stock of $10,000 by D. P. Fargo, William Eells and others.

# Weekly Record of Electrical Patents

[illegible] PATENTS ISSUED JULY 29, '11

[illegible] 16 Exchange Place, New York.

[illegible] ALTERNATING CURRENT MOTOR. E. E. W[illegible] ... N. Y. Apl. filed Feb. 4, 1910. Operates motor as commutator motor for running and as an induction generator with [illegible] for varying the [illegible] of poles of the inducing winding to control the braking speed.

1,068,410. PROCESS OF AND APPARATUS FOR COATING ELECTRIC CONDUCTORS; L. W. Chubb, Wilkinsburg, Pa. App. filed June 25, 1907. Produces insulating film on wire by moving wire progressively through a bath and causing simultaneous flow of current through the wire and through the bath.

1,068,411. METHOD OF AND APPARATUS FOR COATING WIRES; L. W. Chubb, Wilkinsburg, Pa. App. filed Jan. 26, 1910. Passes aluminum wire progressively through electrolyte contained in a series of tanks connected by tubes through which the wire passes.

1,068,412. APPARATUS FOR TREATING WIRES AND CABLES; L. W. Chubb, Wilkinsburg, and H. R. Edgecomb, Edgewood Park, Pa. App. filed Jan. 26, 1910. Wire is passed through slots in end walls of a series of tanks, and the liquid escaping through the slots is caught in pans, pumped back and used again.

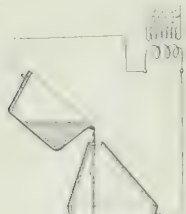
1,068,413. METHOD OF AND APPARATUS FOR COATING WIRES AND CABLES; L. W. Chubb, Wilkinsburg, Pa. App. filed June 25, 1907. An alternating current is induced in the conductor as it passes through the bath.

1,068,439. MANUFACTURE OF ELECTRICAL ACCUMULATORS; P. Marino, London, England. App. filed Aug. 3, 1912. Coats aluminum grid with an acid-resisting and electrically conductive composition.

1,068,440. FIRE-ALARM SYSTEM; J. J. McCarthy, Newton, Mass. App. filed Oct. 28, 1912. Current in an ordinary working circuit, such as bell, lighting, or even a telephone circuit, is made use of to sound an alarm in case of fire.

1,068,453. MAGNETIC SEPARATOR; L. G. Rowand, East Orange, N. J. App. filed Jan. 27, 1903. Uses armature rotating freely in a magnetic field as a separating element.

1,068,469. FIRE ALARM; J. H. Walsh, South Framingham, Mass. App. filed June 4, 1912. Fusible block held in place between two spring-contact arms by a pin extending into the block from one of [illegible]



1,068,643—Method of Heating Material by Electricity.

1,068,473. ELECTRIC WELDING MACHINE; W. C. Winfield and A. C. Taylor, Warren, Ohio. App. filed Oct. 16, 1911. For making accurate butt welds; has slidable work holding clamps operated by toggle.

1,068,494. GENERATOR, CONVERTER AND ALTERNATING-CURRENT MOTOR; V. A. Flynn, Blackheath, England. App. filed May 8, 1907. Stator has an exciting winding, with two windings displaced from each other and means for short-circuiting the two last-named windings, and the rotor has slip-rings, a commuted winding and an additional winding connected to the commuted winding and to a slip-ring.

1,068,521. AUTOMATIC SWITCH FOR TELEPHONE SYSTEMS; G. E. Mueller, La Grange, Ill. App. filed July 27, 1910. Movable wiper is moved in a primary direction to select a group of contacts and thereafter in a secondary direction to select a contact in the group.

1,068,531. ELECTRIC MOTOR; H. A. Rhodes, Denver, Col. App. filed Sept. 13, 1909. Field structure in the form of a plurality of ironclad solenoids and armature has segments of same length as the solenoids.

1,068,558. ELECTRIC FURNACES; J. Bally, Grenoble, France. App. filed July 5, 1912. Central inductor having polar pieces so arranged that the axes thereof extend radially from the axis of the furnace.

1,068,568. APPARATUS FOR CLEANING ARTICLES; E. L. Couch, Hartford, Conn. App. filed Jan. 31, 1913. A movable belt of electrolytically active material carries the articles into and out from chambers containing chemicals or gases which will react with the electrolytically active material.

1,068,588. OIL SWITCH; E. H. Jacobs, Schenectady, N. Y. App. filed July 19, 1910. Metallic reinforcing lining embedded in the insulating walls and bottom of the containing vessel; fluid put under pressure by the arc is confined in the metallic part of the vessel and is directed against the arc to extinguish it.

1,068,614. AUTOMATIC BLOCK SYSTEM; W. H. Watson, Los Angeles, Cal. App. filed March 24, 1908. Semaphores are set so near the track as to be engaged by a control member projecting from the train.

1,068,615. ELECTRIC FURNACE AND PROCESS OF OPERATING THE SAME; E. Weintraub, Lynn, Mass. App. filed Oct. 5, 1912. The vaporizable electrode is a flowing stream within arcing range of the material to be melted.

1,068,640. SECONDARY OR STORAGE BATTERY; B. Ford, Philadelphia, Pa. App. filed Dec. 29, 1911. An insulating shelf receives and insulates the falling sediment.

1,068,641. SECONDARY OR STORAGE BATTERY; B. Ford, Philadelphia, Pa. App. filed Dec. 29, 1911. Inactive grid with buttons of rolled, ribbed lead tape inserted in openings in the grid.

1,068,643. METHOD OF HEATING MATERIAL BY ELECTRICITY, [illegible] Pa. Apl. filed March 2, 1909. Heated material is poured from one receptacle into another, the refractory linings of the receptacles being in circuit.

1,068,658. ELECTRICAL HEATING DEVICE; G. A. Hughes, Chicago, Ill. App. filed July 11, 1912. Resistance conductor set in grooves in refractory plate and looped through holes connecting alternate pairs of grooves.

1,068,681. IGNITION APPARATUS; H. Lyon, Gloucester City, N. J. App. filed June 5, 1911. Hot-wire igniter located in closed ignition chamber receiving gas direct from burner outlet.

1,068,702. SYSTEM OF ELECTRICAL CONTROL; W. Robbins and A. H. Zimmerman, St. Louis, Mo. App. filed Dec. 11, 1911. For vehicles; to prevent overspeeding, sudden reversal of motor, to disconnect energy before applying brakes, to throw controller to "off" position when brakes are applied, and to return controller to its original position if brakes were not applied long enough for controller to have reached its "off" position.

1,068,706. ELECTRIC COOKING APPARATUS; L. D. Smith, Detroit, Mich. App. filed Feb. 12, 1912. Has removable top and bottom and an intermediate permanently secured radiator.

1,068,707. METHOD OF HEATING CARBON AND APPARATUS THEREFOR; W. A. Smith, Niagara Falls, N. Y. App. filed May 23, 1912. Subjects carbon to heat developed by induced electric currents.

1,068,716. APPARATUS FOR PRODUCING HOLLOW QUARTZ BODIES; A. Voelker, Beuel, and N. Meurer, Cologne, Germany. App. filed Sept. 14, 1911. Quartz body fused around vertical heating core and is supported by the core, the inflating medium being introduced through the hollow perforated core.

1,068,740. ELECTRIC-HEATING APPARATUS; O. A. Colby, Wilkinsburg, Pa. App. filed Dec. 5, 1910. Handle to the heater unit contains the terminals and serves to secure the heater detachably in the vessel.

1,068,757. SECONDARY MEMBER FOR INDUCTION MOTORS. G. H. Garcelon, Wilkinsburg, Pa. App. filed Oct. 31, 1910. Squirrel-cage type core slots inclined without twisting the straps.

1,068,759. ELECTRIC MOTOR FOR TRANSMITTING ANGULAR MOVEMENTS; R. Giradelli, Rome, Italy. App. filed March 7, 1912. Transmitting and receiving apparatus, the latter having an auxiliary motor.

1,068,763. ELECTRIC-HEATING DEVICE; W. S. Hadaway, Jr., East Orange, N. J. App. filed July 24, 1908. Metal cylinder with ribbon of resistance material insulated therefrom and bound in place by a wire wrapping.

1,068,774. ELECTROGRAPHIC DISPLAY APPARATUS AND METHOD; M. R. Hutchison, Bronxville, N. Y. App. filed Oct. 30, 1905. Hand-controlled contact device is moved over body containing an electrolyte to produce writings, etc.

1,068,812. SMOOTHING OR LAUNDRY IRON; A. Niola, Newark, N. J. App. filed Sept. 1, 1911. Special form of heating coil and a switch which cuts out current when iron is tilted on its heel.

1,068,869. SELECTIVE TELEGRAPH SYSTEM; C. M. Edwards, Galveston, Texas. App. filed Sept. 6, 1912. Selecting means is cut out of path of current to minimize resistance.

1,068,871. COOLING DEVICE FOR TELEPHONE TRANSMITTERS FOR STRONG CURRENT; C. E. Egner, Stockholm, and J. G. Holmstrom, Saltsjostorangen, Sweden. App. filed March 26, 1910. Uses cooling medium such as paraffin.

1,068,907. RESISTOR; P. Kraeuter, Wilkinsburg, and S. M. Kintner, Pittsburgh, Pa. App. filed Dec. 10, 1910. Strap with continuous edges and zigzag arranged apertures.

1,068,928. WARNING APPARATUS FOR THE PROTECTION OF VALUABLE OBJECTS; A. L. Pucel, Sceaux, France. App. filed Feb. 12, 1913. Gives warning in case of attempt to remove or damage an object such as a picture, strong-box, etc.

1,068,929. BATTERY PLATE; G. H. Rabenalt, Buffalo, N. Y. App. filed March 26, 1912. Increases capacity of pasted storage-battery plate by forcing a fabric die into the paste while soft and removing the die after the paste has sufficiently set to cause the grooves to remain.

1,068,949. TELEPHONE DISINFECTANT ATTACHMENT; J. Tichy, Chicago, Ill. App. filed Dec. 9, 1912. Web of disinfectant paper is fed across mouth of transmitter.

1,068,[illegible] REGISTER FOR TELEPHONE CALLS. H. S. [illegible] ton, Baltimore, Md. App. filed Dec. 19, 1911. Attached to telephone instrument, and can be operated from central station only when subscriber has adjusted the mechanism to permit such registration.

1,069,014. TROLLEY POLE AND WHEEL; J. F. Ireland, Pennville, Ind. App. filed Dec. 10, 1909. Endless chain, supported on two wheels, carries clamps which engage the trolley wire.

1,069,027. TRACK RELAY FOR ELECTRIC SIGNAL SYSTEMS; J. J. Rudick, Newton, Mass. App. filed Aug. 17, 1912. Relay is in normally closed circuit and is maintained inoperative until a car passes onto the insulated-rail section.

1,069,051. STRAIN INSULATOR; F. G. Woodlock, St. Louis, Mo. App. filed Sept. 23, 1912. Insulating body with outwardly tapering threaded sleeves embedded therein and a transverse tool-receiving sleeve also embedded in said body between the sleeves.

1,069,060. MOTOR CONTROL; E. L. Gale, Sr., Yonkers, N. Y. App. filed Nov. 8, 1910. Combination of reversing switches and stop magnet for elevators.

1,069,061. MOTOR-CONTROLLING SYSTEM; E. L. Gale, Sr., Yonkers, N. Y. App. filed Nov. 18, 1911. For elevators; alternating current motor with generator as a dynamic brake therefor.

1,069,089. HOUSED TRACK CONTACT FOR RAILWAY SIGNALING SYSTEMS; B. F. Wooding, Denver, Col. App. filed May 23, [illegible] ... openings for the track contacts yield to the train hanger.

# Electrical World

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**he Federal Vater-Power Policy**

As noted at length elsewhere in this issue, the federal authorities have granted a permit for water-power development to the International Power & Manufacturing ompany, which marks the second and perhaps most notable ıstance of the adoption of a progressive conservation olicy by the government. The permit is unique in sevral important particulars, chief among which is the slidıg scale of rates of compensation to be paid by the comany. The provision that this rate shall vary directly s the square of the average price for electric energy nd inversely as the square of the proportional developıent of the power site is clearly intended to promote ıe lowest reasonable rates for energy and the developıent of the broadest possible market. This is conservation f natural resources in the best sense, aiming at both use of ıe resources for the public benefit and profit to the prooters. The rates of compensation per horse-power deloped, for low development and high energy rates, are gh. That the company may be relieved of an obvious ırden during the stages of construction and early operion, the payment of compensation is waived for the rst ten years. This wise provision, coupled with the ct that the grant is an indeterminable permit, revocable ly for cause or in case the public authorities take over e property at its fair and reasonable value, should assist aterially in securing the necessary capital for the enterise on favorable terms. It is also worth noting that the tal yearly compensation will decrease as the rates for ergy are reduced and as the proportion of full developent of the site increases. The terms of the permit issued the government undoubtedly measure closer to the ading features of recent public utility laws than any levious grant of such character. No value for the rposes of transfer to municipal, state or federal authores, or for earning a return, may be put upon the perit, which ruling is in line with accepted views as to the lue to be placed upon franchises under regulation. The determinate feature conforms with the Wisconsin pub utility law and others more lately adopted. The same n be said in general of the provision for municipal, ate or federal purchase of the property.

**otecting the es of the Public**

Work from which much good will result has been undertaken and partly completed by the (British) Illuminatig Engineering Society in the study of school and library hting with a view to formulating recommendations suitle for general adoption. Committees of this society, in -operation with committees of the Association of Teachs in Technical Institutions and the Library Association, have issued preliminary reports on the artificial lighting of schools and libraries which call attention to several important features that should not be, but frequently are, overlooked. Prominent among these is the subject of glare. That glare is annoying to the reader and injurious to eyesight has long been appreciated, but only recently have attempts been made systematically to avoid glare in artificial lighting. Perhaps the half-formed belief that reduced lighting efficiency is inseparably associated with the avoidance of glare has played an important part in retarding the application of proper lighting methods in this connection. Investigations have confirmed the theory that less density of illumation is required for seeing when glare is absent than when it is present, so that even though the illuminometer shows less luminous-flux density, yet the eye is able to see more clearly when the lamps are hidden from view. A good motto for the designer of the lighting equipment of schools and libraries is "Safety first for the eyes." The fact that glare can be eliminated without extra cost points to the rapid introduction of proper illuminating methods in all places where even a small amount of attention is paid to the subject.

**Co-operation with Real-Estate Dealers**

The co-operation which has proved so wholesome between electric railways and real-estate men may well be extended to the central station. In some cities advantage is already being taken of the opportunities for mutually beneficial work in the development of new neighborhoods and the improvement of existing residential streets, but in other places the possibilities of close relations between the realty man and the distributor of electrical energy have received little recognition. There are two principal directions in which the real-estate business appeals to the commercial side of central-station work—first, as a long-hour user of energy for office and sign lighting, and second, as an influence on behalf of the most advanced practice in domestic applications, with special reference to a sufficient number of outlets, the maximum convenience of switch location and, in a word, the complete electrification of the home. Electric wiring is placed in almost every new building within the reach of central-station circuits, but too often the installation is stereotyped with too great a regard for first cost. Real-estate interests and architects are coming into closer relations, and it is desirable that more attention be given to the location of floor and baseboard outlets, wall switches and the provision of circuits capable of carrying large currents for electric heating and cooking service. Where a large group of houses is built under the general supervision of a real-estate firm the central-station man can give far

better advice than the average architect as to the proper wiring installation for the discriminating purchaser or lessee. The returns from such co-operation are worth while to all parties concerned, insuring a larger ultimate use of electricity, raising the standards of the property from the real-estate viewpoint and helping to satisfy the resident of the house or apartment with his selection. A liberal policy toward the real-estate man is worth cultivating.

## A Profitable Small Central Station

An income of over $6 per capita from a central station serving a rural community having 3500 inhabitants is rather exceptional, so much so that curiosity is aroused as to how the territory is developed to bring such results. Ordinarily a central station in such a town would have a precarious existence unless it were combined with some other industry or connected with an electric transmission system, and even at best it is seriously handicapped by high overhead charges and limited income. The problems of small central stations otherwise do not differ except in degree from those confronting large systems; but there is divided responsibility in the latter, together with an inherent striving for departmental efficiency at the expense of co-operation, while in the former close co-operation abounds and efficiency is lacking. If, therefore, the human efficiency as well as the plant efficiency is increased in small systems and the overhead charges are not too high, success, if it can be at all attained in the community, is sure to follow. This is in brief the secret of the showing made by the central station located at Walton, N. Y., and described elsewhere in this issue.

The manager of a small station must combine engineering discrimination with business ability, and he must be certain beforehand that any plan which he evolves will work and be successful, for he has no money to waste on experiments. In the rehabilitation of the Walton plant many engineering problems were involved. A change-over from 133 cycles to 60 cycles in a village which has primarily a lighting load and small prospects for a motor load is not ordinarily made so long as satisfactory single-phase motors for 133-cycle service are obtainable. However, the number of 133-cycle systems is constantly becoming smaller, which means that in a short while 133-cycle apparatus will be special and subject to higher prices and longer delivery dates. Moreover, within a reasonable time 60-cycle transmission systems will extend throughout the country and small generating stations will become substations for local distribution, so that the scrapping of 133-cycle equipment, even where many motors are in operation, is sound engineering and justifiable from an economic standpoint. The size of generating units is also a question well worth consideration in small stations. Because of a desire to have ample reserve equipment, two units of approximately the same size are ordinarily installed, with the result that in most cases a unit is operating at about one-tenth load two-thirds of the time. In the Walton plant a smaller unit is employed to carry the load during sixteen or twenty hours of the day with marked saving in steam.

That central stations in many small towns are not living up to their opportunities is shown by the small number of customers supplied by them. There is a prevailing impression that small-residence customers are unprofitable and while in large cities with underground conduit systems the cost of running the service wires, including the meter ranges from $50 to $80 and the income in many cases does not exceed $15 per annum, still in rural communities the cost of connecting a customer, including the meter, does not exceed $25 and oftentimes is not more than $15. Intensive development must obtain in a small community if the station is to be profitable, and this means that every house should be connected. To accomplish this requires a high-grade man, and unfortunately in most cases the income is not sufficient to permit the employment of such a man. It is curious to note what effect the tungsten lamp has had on the load curve of the Walton station and also what effect it would have had on the income curve if the company had not pushed the sale of appliances to offset the loss in energy consumption due to the use of a more efficient lamp.

## The Heyland Commutator Machine

In many respects the alternating-current commutator motor is a more desirable machine than is its direct-current competitor. Its speed can be controlled by means of highly efficient stationary transformers instead of inefficient rheostats, while it can utilize energy obtained from a transmission system with the minimum of loss in conversion. In spite of these facts the machine has not been widely adopted for industrial service, largely by reason of its relatively high first cost, low efficiency and poor commutation. In the *Digest* in this issue appears an abstract of an article dealing with an alternating-current commutator machine said to be as economical in construction material and as efficient in operation as a direct-current motor designed for the same service. This motor has been developed and is described by Mr. A. Heyland, to whom credit is due for much pioneer work relating to the application of commutators to alternating-current machinery. In many respects the machine described by Mr. Heyland resembles simultaneously the Alexanderson repulsion-series motor outlined in our issue dated Jan. 18, 1908, and the Fynn unity-power-factor machine described in our issue of July 19, 1913. Use is made of the operating connections employed by Alexanderson, and the commutator remains short-circuited at all times along one axis in accordance with the method utilized by Fynn. In the latter respect the Heyland machine takes advantage of the operating features characteristic of the so-called Latour-Winter-Eichberg motor.

In view of the fact that the voltage across coils in electrical space quadrature to the short-circuited axis on the commutator must at all times have zero value, it will be appreciated that brushes placed on the commutator to cover these coils are always in neutral zones. It is evident, therefore, that these brushes can be dimensioned as though they were intended for use on a direct-current machine. To this fact are attributed certain of the desirable features of the new motor. In this connection sight must not be lost of the additional fact that when the conditions are as just described the machine is devoid of starting torque. In order to obtain torque at standstill resort must be had to other

connections which introduce all of the bad commutating conditions inherent in the single-phase motor of either the series or the repulsion type. One must make a choice between good commutation with zero starting torque and adequate starting torque with unsatisfactory commutation. In respect to the prominent outstanding starting difficulty with the alternating-current commutator motor the new machine seems to possess no advantage over standard types, and with reference to operating characteristics it seems to be merely on a par with the several improved types of motors recently developed in this country and abroad. To just what facts can be attributed its higher efficiency and smaller dimensions one is unable to determine from the data presented by the author. It is sincerely to be hoped that his claims can be substantiated in service performance and that he will continue his work of development, which promises well for the industry.

## Indirect Car Lighting

The ordinary parlor or sleeping car has been a wonderful example of most of the things undesirable in artificial lighting. It has been most liberally provided with light obtained from small intense points located along the upper part of the car, striking the eye of the unoffending passenger in whatsoever direction he may turn. The result is a very noticeable amount of eye strain, and in spite of the brilliant illumination reading is by no means so easy as it should be. Not only does intense light contract the pupil abnormally and shut out light which would otherwise be useful, but owing to the motion of the car there is a constant effect of flickering as the images of the bright lamps shift upon the retina. Probably this effect is particularly responsible for the tired feeling that often comes over the eyes after a long train ride. The same trouble, lessened to a considerable extent, is too often noted in interurban and other electric cars. There are in this case a much smaller number of lamps, and these are in a less extended vista than in the case of the long cars of an express train, so that while the nature of the lighting may be just as troublesome, it is somewhat more easily dodged.

The indirect car-lighting fixtures recently introduced on express trains running out of New York are certainly admirable in effect, and reading under them is a pleasure. They consume a good deal more energy for equal illumination than do lamps used in direct lighting. On the other hand, we are very strongly inclined to the opinion that the indirect lighting will afford equal ease of seeing in the car without any increased expenditure of energy over that used in the glaring system which it replaces. We know of no place where from the general situation indirect lighting is more beautifully applicable than in cars where good direct lighting from the shape and dimensions of the space is particularly difficult to obtain. The scheme is certainly well worth trying on some of the more important interurban lines which operate practically under steam road conditions. Indirect fixtures are not subject to the breakage which checks the use of ordinary glassware and are quite simple to install and maintain. The chief requirement for their use is a suitable diffusing surface on the ceiling of the car, and the space between reflector and ceiling being relatively small, particular pains must be taken to get smooth and uniform diffusion. The texture as well as the color of the surface is all-important, a fact which is very noticeable in some of the cars in which indirect lighting is used. Here one notes at a glance the difference in the result produced by the tinting and texture of the car ceiling. These, however, are trivial matters, for a very little experience will show the best way of carrying out what is a most pleasing and commendable innovation in car lighting.

## The Capacity of Single-Phase Lines

In all high-tension transmission systems the electrostatic capacity of the lines plays a prominent part, since the charging current of the system, containing a large reactive component, is proportional to this capacity. Rules and formulas are available for predetermining the capacity of uniform conducting lines in certain simple cases; but, in general, it is not possible to compute the capacity of a given geometrical distribution of conductors in two-dimensional space and the computation of the capacity of a given set of conductors in three-dimensional space is still further removed from our present mathematical abilities. Nevertheless, it is always possible to measure the capacity of any well-insulated set of conductors so that the present impossibility of computing such capacities need give no unhappiness to engineers. Moreover, estimates based on the judicious smoothing of contours can be made with a fair degree of precision to meet practical requirements. We merely have to admit that the general computation of electrostatic capacities, like the general computation of various other questions in the unsolved-problem locker of science, far transcends the powers of existing mathematics.

In the article by Messrs. C. A. Pierce and F. J. Adams appearing in this number are discussed two specific problems in the electrostatic capacity of two-dimensional uniform conductors, namely, that of two straight parallel cylindrical conductors in free space and that of two such conductors inclosed in a grounded metallic sheath. The solution of the former, or unsheathed, case is already well known, and has been published in a somewhat similar form in German textbooks for some years. A much simpler and more compact solution, using hyperbolic functions, has been worked out in this country by Dr. A. E. Kennelly and has appeared in our own columns, as in the number of Oct. 27, 1910. It has been shown, moreover, in our columns on Sept. 22, 1910, by Messrs. H. Pender and H. S. Osborne, that the surface density of the charge on each of such a pair of conductors may be represented by an ellipse, with one of its foci at the axis of the conductor.

The second, or sheathed, case is practically important because it represents the conditions encountered in many two-wire lead-covered cables, except that, in practice, the conductors are stranded instead of being strictly cylindrical. The article of Messrs. Pierce and Adams gives a useful reminder of the Maxwellian method of dealing with such a case. This method has been applied advantageously in three-conductor cables by changing the cross-sections of the conductors from the circular to the clover-leaf type.

# The News of the Week

**Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.**

## Interstate Commerce Commission Requests Records of Telephone Operation

By the terms of an order issued on Aug. 8 by the Interstate Commission at Washington, all the common carrier telephone companies must furnish by Oct. 1 a detailed statement of their organization, equipment and physical and financial operations. This is the first order of the commission since the formal beginning of the telephone investigation. Already the inquiry has been very extensive, special agents of the commission having gathered an immense amount of data bearing upon the operation of telephone companies. As soon as practicable the commission will hold in various parts of the country public hearings, at which testimony will be taken as to the rates and operating methods of such companies as come within its jurisdiction

## Representative Men to Discuss Problems of the Industry

An invitation has been extended to about 200 men, consisting chiefly of the presidents of national, state and city electrical associations, societies and leagues, together with officials and representatives of the large electrical manufacturing companies, to attend a meeting at Association Island, Henderson Harbor, N. Y., Sept. 3 to 6. The meeting will be held under the auspices of the Association Island Corporation, and Mr. J. B. McCall, president of the National Electric Light Association, has been requested to preside. A tentative program has been arranged along broad lines, and it is expected that eminent men in various walks of life who have been invited to participate will attend. A meeting of high inspirational and educational value to the electrical fraternity is aimed at, with the hope that its character will be such as to justify a similar gathering each year, and that it will lead to an organization through which important work can be done for the industry.

## Meeting of Executive Committee of N. E. L. A. Commercial Section

The executive committee of the Commercial Section of the National Electric Light Association met on Aug. 7 at Association Island, Henderson Harbor, N. Y. Mr. T. I. Jones, of Brooklyn, chairman of the section, presided, Mr. Douglass Burnett, of Baltimore, vice-chairman, and Mr. Joseph F. Becker, of New York, secretary, together with eleven other members of the committee being present. A number of standing committees were appointed, the personnel of which will be announced at the October meeting, to be held in New York City. Mr. E. L. Callahan of Chicago, was appointed chairman of the finance committee, and Mr. Douglass Burnett, of Baltimore, vice-chairman. Mr. Burnett was also appointed chairman of the publication committee, and Mr. E. H. Edkins, of Chicago, vice-chairman and sales manager. The membership committee is headed by Mr. J. F. Becker, of New York, and Mr. D. L. Gaskill, of Greenville, Ohio, is vice-chairman.

It was decided to revise the "Solicitor's Handbook," which has been turned over to the Commercial Section by the association, and to publish it free in connection with data on electric light and motor installations heretofore included in the "Digest." It was also decided to keep down the number of papers to be read at the next convention so as to permit more time for discussion. The papers themselves will be devoted to topics of national importance, interesting alike to small and large companies. A new constitution was presented for consideration, and the term of each member of the executive committee was fixed at three years, six members completing their term of service each year. The next meeting of the committee will be held in New York City during the Electrical Show.

## Public Service Company of New Jersey Appeals Utility Commission Decision

The Public Service Gas Company, of Newark, N. J., carried to the Court of Errors and Appeals at Trenton on July 31 an appeal from the decision of the Supreme Court of New Jersey sustaining the order under which the Public Utility Commission forced the company to furnish 90-cent gas in fifteen municipalities constituting the Passaic zone The company contends that the order is unjust and unreasonable and unconstitutional, because its effect is to take property without just compensation. Other grounds advanced for reversal are that the valuation of $4,750,000 placed upon the property by the board was below the fair value of the property; that in estimating the reproduction cost the board disregarded reliable and uncontradicted proof of value and accepted unreliable and inaccurate evidence that the board excluded important elements of value, including special franchises, bonds and stocks representing the cost and the market value of securities, and that the findings were inadequate because the board included only fifteen of the 150 municipalities in which the company operates in the State.

## A. I. E. E. Affairs

At the first meeting of the directors of the American Institute of Electrical Engineers for the new administrative year, held in New York on Aug. 8, President C. O Mailloux announced the appointment of most of the Institute committees for the year. The chairmen of the standing committees thus far appointed are as follows:

Finance, Mr. J. Franklin Stevens, Philadelphia, Pa. library, Dr. Samuel Sheldon, Brooklyn, N. Y.; meetings and papers, Mr. W. S. Rugg, New York; editing, Mr Lewis T. Robinson, Schenectady, N. Y.; board of examiners, Mr. Maurice Coster, New York; sections, Mr. Paul M Lincoln, Pittsburgh, Pa.; standards, Dr. A. E. Kennelly Harvard University; code, Mr. Farley Osgood, Newark N. J.; law, Mr. Charles A. Terry, New York; patent, Mr Ralph D. Mershon, New York; educational, Prof. Henry H. Norris, Ithaca, N. Y.; electric power, Mr. David B Rushmore, Schenectady, N. Y.; telegraphy and telephony Mr. F. F. Fowle, New York; electrochemical, Prof. Albert F. Ganz, Hoboken, N. J.; electrophysics, Dr. J. B. Whitehead, Baltimore, Md.; use of electricity in mines, Mr. Wilfred Sykes, Pittsburgh, Pa.; use of electricity in marine work, Lieut. C. S. McDowell, U. S. N., Brooklyn, N. Y

blic policy, Mr. Calvert Townley, New York; historical iseum, Mr. T. C. Martin, New York; United States na- nal committee of International Electrotechnical Commis- n, Prof. Francis B. Crocker, New York; code of prin- les of professional conduct, Prof. George F. Sever, New rk; relations of consulting engineers, Mr. Lewis B. illwell, New York; membership, Mr. A. M. Schoen, lanta, Ga.; constitutional revision, Mr. Bancroft Gher- di, New York.

The board elected from its own membership the follow- g three members to serve upon the Edison medal com- ttee for two years in place of members on the commit- e whose terms had expired: Messrs. H. H. Barnes, Jr., illiam McClellan and S. D. Sprong. Mr. Ralph D. Mer- on was also elected a member of the committee for the rm of one year to fill a vacancy. The board also con- med the appointment by the president of Mr. J. Franklin evens and Mr. H. W. Buck as members of the Edison edal committee for the term of five years.

The following local honorary secretaries, whose terms pired on July 31, 1913, were reappointed for the two ars ending July 31, 1915: Mr. Clare F. Beames, for India; r. Richard O. Heinrich, for Germany. Mr. Guido Sem- za was appointed local honorary secretary for Italy for e same period.

## Electrical Men in Automobile Accident

As the result of an automobile accident near Wyandotte, ich., on the evening of Aug. 10, Messrs. Louis E. Beil- in, until recently general manager of the Toledo (Ohio) ilways & Light Company; James T. Ross, consulting en- neer of the Northern Ohio Traction & Light Company of ron, Ohio, and the Lake Shore Electric Railway of eveland, Ohio, and the chauffeur lost their lives, and Mr. F. Collins, vice-president and general manager of the ichigan Traction Company of Jackson, Mich., and Mr. lward T. Wickwire, sales manager of the Ohio Brass mpany, Mansfield, Ohio, were seriously injured. A ditch s encountered on the outskirts of Wyandotte, and in an empt to turn the machine out the right front wheel col- sed and the automobile turned over. The plans for the p from Toledo to Jackson, Mich., were made in the office the Lake Shore Electric Railway at Cleveland and Mr. arles Currie, general manager of the Northern Ohio action & Light Company, accompanied the party to To- o by train, but returned home when they started on the o trip. On Aug. 13 hopes were entertained for the re- very of both the injured men.

## New Hampshire Hydroelectric Situation

The controversy between the federal government and State of New Hampshire, which was precipitated by action of Attorney General Tuttle of New Hampshire blocking the purchase of forest reserve lands under the eeks act, has taken a new turn at Washington in view of spective hydroelectric developments in Grafton County the Central New Hampshire Power Company. A por- n of the reserve is situated in this section of New Hamp- re, and under the terms proposed by Mr. Tuttle the leral government is required to surrender to the State only the title of all public waters but in addition the ht of access thereto, together with the right to grant public franchise upon the reserve. The Central New mpshire Power Company, incorporated under the laws the State of Maine, has recently made plans for develop- 80,000 hp to be utilized at various points in Grafton, livan and Merrimac Counties. The first development l be at Croydon Brook, and the company estimates that gross yearly income from this project alone will be ,000, while the revenue from all the developments in which the company is interested, aside from possible developments in the federal reserve, is $3,000,000. According to data on file with the Bureau of Corporations, the State of New Hampshire imposes no tax upon water-power development, and the federal authorities are reported to be up in arms lest the resources now running to waste on the proposed Appalachian reserve be developed by the Central New Hampshire Power Company acting under the authority of the New Hampshire State officials, who have manifested every desire to encourage hydroelectric development within the borders of the commonwealth.

## Mr. Ernest Freeman on Contractors and the Society for Electrical Development

In the following paragraphs are given arguments by President Freeman of the National Electrical Contractors' Association relating to the benefits to be derived from co-operation under the auspices of the Society for Electrical Development.

Electrical contractors believe that the work of the society will be of direct benefit to the industry and to contractors individually, and that the direct individual profit will be very much in excess of the relatively small proportionate share subscribed to the movement. This result will follow, not only from the national advertising, but also from the publicity work in newspapers, magazines, moving pictures, electric-sign exchanges and numerous other means.

One of the announced purposes of the society is to bring about co-operation for promoting harmonious local relationship. Harmony is a distinctly practical business proposition, not only to contractors but to the central station, the jobber and the manufacturer, who make up the industry in which all are doing a distinctly related business.

"Related," we say, but there are cases where the relations are strained—strained to a point where it is the belief of all that the sale of sockets, wire, conduit, lamps, motors, fans, irons and all classes of supplies and appliances and of electric energy is being actually hindered. The friction between the various interests engaged results in immense loss to us all, and this friction is chiefly caused by lack of understanding of each other, and perhaps lack of sagacity in merchandising.

It seems logical to believe that the more live people or concerns there are pushing electrical goods, the more electrical business will be done. It is well known that in the cities where there is harmony the constructive development of the industry is at its greatest, to the mutual profit of all concerned.

Considerable time will be required to harmonize local conditions, and much money will be required. The time required can well be devoted to it and the money needed can well be spent in this way. The carefully graded subscriptions by which the funds are created for the various kinds of work are a very small proportion of what it will mean to accomplish the purposes of what is probably the greatest and most far-sighted mutual co-operative movement that has ever been started in any known industry.

## Display Lighting at Fall River, Mass.

What was probably the greatest civic celebration in the history of the city marked the opening of the new "White Way" in Fall River, Mass., on Aug. 6. The new lighting system, consisting of an original installation of ninety-six 6.6-amp inverted magnetite arc lamps, with more to follow, was installed by the Fall River Electric Light Company as the result of a vigorous campaign conducted by the merchants' association. The ceremonies included a banquet attended by 300 guests, speeches by the Mayor and other leading citizens, a parade and other features such as go to

make up a carnival night. The banquet hall was illuminated by about 1,200 incandescent lamps, modeling the type used on the streets. The service will be furnished by the Fall River Electric Light Company at a price of 30 cents per night for lamps burning from dusk to dawn and at 24 cents each per night for lamps burning from dusk to midnight. The local merchants' association secured subscriptions totaling $12,000 toward the expense of installation, and the association and the city share the operating cost, the former paying one-third and the latter two-thirds of the expense. It was pointed out at the banquet that the cost of ornamental display lighting will not increase taxation over 5 cents per $1,000. During the present month the company will supply electricity free to the display installation. The New Bedford (Mass.) City Council lighting committee attended the opening of the Fall River service and was sufficiently impressed to decide upon an early increase in the street-lighting installation of the former city.

## Leonard Patent for Electric Control

There has been issued to Mr. H. Ward Leonard an unusually broad and comprehensive patent for an electric-current controller, which is of more than passing interest. The application had been pending in the Patent Office for nearly nine years, having been filed on Dec. 12, 1904. Generally speaking, the invention, described in Patent No. 1,064,749, June 17, 1913, consists of a system of electromagnetic contactors for automatically cutting out starting

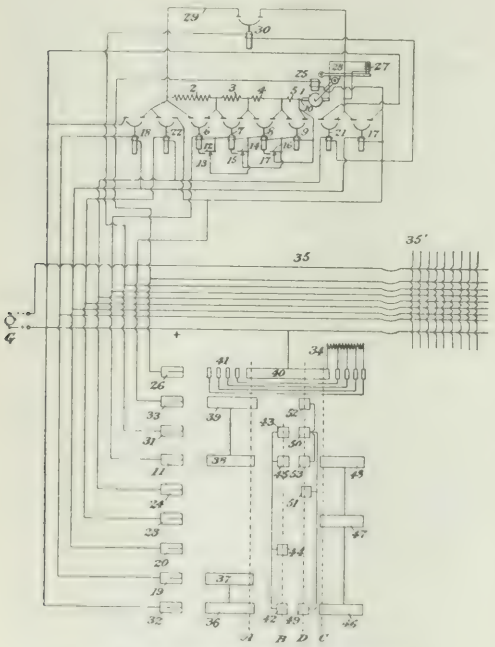


FIG. 1—CONTROL OF SHUNT-WOUND MOTOR

resistances in a motor circuit and means for utilizing the same contactors and resistances in automatic electrodynamic braking, one of the interesting features being the application to multiple-unit control of electric trains.

The preamble of the specification states that the invention relates to the control of the current through a device by means of the electromotive force upon the terminals of the device, or upon the terminals of a device functionally related thereto. An instance of its application is the control of the current through a motor armature by means of the electromotive force upon the armature terminals. The principal object is to control the current through the device so that the current will be automatically maintained within such limits as are required for the desired operation.

Among the useful applications of the fundamental principles named are electric motors, storage batteries, electromagnets, electric furnaces and other forms of electroheating devices, rheostats, electric lamps and electric signaling devices.

Fig. 1 illustrates the invention as applied to the control of a constant-potential shunt-wound motor. The motor armature is shown at 1, the field circuit at 25, the starting resistors at 2, 3, 4 and 5, and the corresponding contactors 6, 7, 8 and 9 just below the latter. A mechanical brake on the motor shaft is shown at 28, which is released when armature current flows through the solenoid 27. The controller is shown at the lower part of the figure, the energy source being *G*, and the group of conductors 35 extending away to the right representing connections to multiple units similar to the one shown. The several positions of the controller are as follows: *A* is the forward-running position; *B* is the electrodynamic-braking position for stopping in the forward direction; *C* is the reverse-running position, and *D* is the corresponding braking position.

Upon passing from the "off" postion to *A*, the field circuit is closed through contact 40 and finger 26; contacts 36 and 37 and fingers 32 and 19 operate contactors 17 and 18 and close the line circuit through the armature and the entire starting resistor, while contacts 38 and 39 and fingers 11 and 33 connect the contactors 6, 7, 8 and 9 in series across the motor brushes, but contactor 6 has a switch short-circuiting 7, and 7 in the same way short-circuits 8, etc., so that 6 only is in circuit at the start.

As the armature speed increases so does the counter emf and the current in 6, and presently there is sufficient current in the latter to close it and cut out resistor 2. This also throws contactor 7 in series with 6 and again presently the operation is repeated, as the counter emf keeps rising with the speed, and resistor 3 is cut out. And so on, 8 and 9 operate in succession, and finally all resistance is cut out and the motor is at full speed. Further speed increase can be obtained by hand control by cutting the resistors 34 in series with the motor field, upon slight movement of the controller handle.

Passing to position *B*, to apply braking, all contactors are opened and released; then 17 is reclosed by means of contact 44 and finger 20, while 6, 7, 8 and 9 are connected in series with the motor armature across the supply mains by means of contact 45 and finger 11, and the braking contactor 30 is closed by 43 and 31 at the controller, thus closing the motor armature circuit through the starting resistors 2, 3, 4 and 5. The difference between the counter emf of the motor armature and the emf of the supply circuit, which oppose each other, increases as the motor speed decreases; thus the contactors act as before and successively cut out resistance until, at rest, the armature is short-circuited.

In postion *C* the whole operation is quite similar, except that contactors 21 and 22 are closed instead of 17 and 18, thus reversing the armature current. Among the advantages claimed are acceleration and retardation with nearly constant torque, contributing greatly to the comfort of passengers and materially reducing the strain and wear on the mechanism. An arrangement of contactors generally similar, but securing reverse of rotation by reversing the field connections, was also shown and as a whole appears less complicated. Many applications of the invention were discussed in the specification, and one in particular, a motor-driven planer with slow-cutting stroke and fast bed return, was illustrated.

Fig. 2 illustrates an arrangement in which a single

lenoid can be used to control automatically the resistance the armature circuit during starting. Successive lifts of e plunger, each against an increased weight or washer, ke place as the counter emf rises and increases the suc- on of the solenoid, cutting out successive resistance steps. The patent contains in all sixty-four claims. Some of ose which seem especially significant are given herewith:

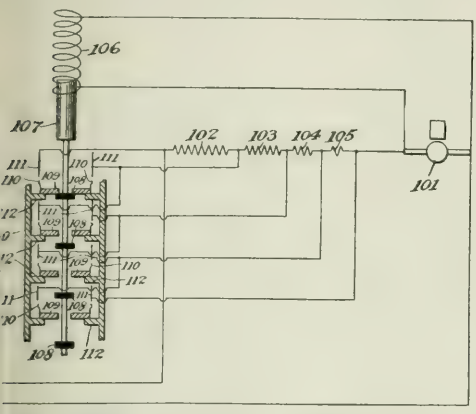



FIG. 2—RESISTANCE CONTROL OF ARMATURE CURRENT

2. The combination of an electric motor and means for omatically accelerating and retarding the motor, said ans comprising one or more automatic switches closed the counter emf of the motor, the same switch contacts ng employed and closed for controlling both accelera- and retardation of the motor.

5. The combination of an electric motor, means con- led by the counter emf of the motor for automatically elerating the motor and for automatically retarding the tor controlled by the difference between the source of f and the counter emf of the motor.

24. The combination of an electric motor, a rheostat ircuit therewith, means responsive to the electrical con- on of the motor armature for automatically reducing the stance of said rheostat to accelerate said motor, and ns for causing the motor armature to generate a brak- current through said resistance and for cutting out at t a part of said resistance.

26. The combination of a plurality of electric motors, a ting rheostat for each of said motors, means for ultaneously connecting the motors with the supply cir- , and independent automatic means corresponding to motor for automatically accelerating and retarding motors, said means for retarding comprising an element netically moved to increase the retardation.

45. The combination of a dynamo electric machine hav- a field winding energized independently of its arma- current, an energy absorbing means in series with the ature of said machine, and automatic controlling means causing said absorbing means automatically to control armature while the armature is absorbing energy and causing said absorbing means automatically to control energy and retard the armature while the armature is rating energy, said automatically controlling means prising a plurality of windings selectively responsive to nges in the electrical condition in the motor armature uit.

54. A multiple-unit control system, comprising a plural- of units, means for automatically electrically accelerat- and automatically electrically retarding said units, and rality of means under the control of the operator and esponding to different units for controlling said first- ed means."

## Canada's Largest Generating Station

Work is at present under way on a hydroelectric station on the St. Lawrence River which when completed will be the largest in the Dominion of Canada. Its initial rating will be 100,000 hp, and later on this will be increased to 160,000 hp. The site is at Cedar Rapids, about 30 miles above Montreal, and the work is being pursued by the Cedar Rapids Manufacturing & Power Company. The property was taken over January, 1912, by the financial interests with which the Shawinigan Water & Power Company and the Montreal Light, Heat & Power Company are allied. Up to that time it was controlled by Mr. D. Lorne McGibbon, who remains as one of the directors of the company at present, and the engineering work had been under the charge of Mr. Henry Holgate, the well-known consulting engineer of Montreal. With the transfer of the property the personnel of the company changed as follows: President, Mr. J. E. Aldred; vice-president, Mr. Howard Murray; secretary-treasurer, Mr. J. S. Norris; electrical engineer, Mr. R. M. Wilson, and hydraulic engineer, Mr. Julian C. Smith.

Shortly afterward the question of the design and construction was actively taken up and an effort made to let the work by contract. At that time comparatively little was known regarding the conditions of the ground, and particularly as to what would be encountered after the unwatering work was completed. Because of these uncertainties it was decided that the company itself should undertake the preliminary work, and accordingly a construction force was organized and the cofferdams were built. There is about 15,000 ft. of cofferdam in connection with the work, and the cofferdams were practically completed in June, 1912. As soon as the site was unwatered Messrs. Fraser, Brace & Company received the contract for the steam-shovel excavation and concrete work in connection with the powerhouse substructure. A contract was made with the Unity Construction Company for the superstructure, and it is believed that this is the first time that a large power station is to be built by the unit method. The building will be a special reinforced-concrete structure with steel sashes and metal doors. The general design is in many ways similar to that of the hydroelectric station at Keokuk, with the exception of the canal, which extends above the power house for a distance of about 10,000 ft.

There are three rapids in the St. Lawrence River between Lake St. Francis and Lake St. Louis. Beginning at the upper end, these are the Coteau Rapids, Cedar Rapids and Cascade Rapids. On both sides of the St. Lawrence River are also canals built by the Dominion government. On the south side is the Beauharnois Canal, which is to a large extent abandoned for navigation purposes, but which is now in use by the Canadian Light & Power Company in connection with its development at St. Timothée. On the north side of the river is the Soulanges Canal, through which all shipping passes from the Great Lakes to Montreal. The three rapids mentioned are rather long slopes in the river, and the steamers of the Richelieu & Ontario Navigation Company run the rapids as part of their trip from the Thousand Islands to Montreal.

The Cedar Rapids development utilizes the fall of the Cedar Rapids by the construction of a canal along the north shore of the St. Lawrence River and by the erection of a power house which will form the dam at the lower end of this canal. The canal is built immediately on the old shore line of the river and utilizes this shore line as part of one bank. The south bank is formed by an artificial earth dike about 10,000 ft. long. The head on the waterwheels will be approximately31 ft., and owing to the very stable water levels of the St. Lawrence River this head will be almost constant, as the level of the water above and below the development only varies about 3 ft. as an extreme. The Cedar Rapids Manufacturing & Power Company has a lease from the

Dominion and provincial governments for the utilization of sufficient water to develop 160,000 hp continuously for this head. Contracts have been made with the I. P. Morris Company, of Philadelphia, for nine 10,800-hp vertical waterwheels and with the Wellman-Seaver-Morgan Company of Cleveland for three units of the same kind. An interesting feature in connection with the design of the turbines is the arrangement for carrying the weight of the generator rotor and the moving parts of the turbine on a thrust-bearing above the generator instead of below it as is often done. The weight of the generator will be taken by cast-iron supporting barrels through the turbine to the foundation below. The main units will be of the single-runner, vertical-shaft type and will be installed in the concrete foundations of the power house. The intakes will be of the scroll or involute type, and the waterwheels will probably be the largest in bulk ever made.

All of the governors, governor pumps and exciter wheels and the various appurtenances for the waterwheels have been purchased from the I. P. Morris Company. A contract has also been made with the Canadian General Electric Company for twelve 10,000-kva, 6600-volt, 60-cycle, three-phase alternators operating at 55 r.p.m. The exciters, exciter motor-generator sets and various other apparatus used in connection with the generators and exciters have also been purchased from the Canadian General Electric Company. The work in the field was well advanced, and it is expected that water will be let into the completed canal in the fall of 1914 and that shortly thereafter delivery of electrical energy will commence. Contracts have been made with the Aluminum Company of America and with the Montreal Light, Heat & Power Company for large amounts of energy, so that the income of the company is assured. The company is very strongly financed, being controlled jointly by the Shawinigan Water & Power Company and the Montreal Light, Heat & Power Company and having interested in its development various other financial interests allied with the two corporations. The initial bond issue was taken up by shareholders of both the Shawinigan Water & Power Company and the Montreal Light, Heat & Power Company.

## Electric Vehicles for Meat Delivery

At the annual convention of the United Master Butchers of America, held this week in Boston, a paper on "The Economical Delivery of Meats and Provisions" was presented at the request of the organization by Mr. Day Baker, New England manager of the General Vehicle Company and president of the Electric Motor Car Club of Boston. The author emphasized the rising cost of horse transportation and its inadequacy in the face of modern demands for rapid and extended deliveries, and pointed out the economic waste resulting from the non-productive acreage required in raising feed for animals. Analyzing the space requirements of a given capacity in horse-drawn and electric truck equipment, Mr. Baker stated that for carrying 5 tons of meat over 30-mile routes two horse-drawn trucks would require 240 sq. ft. of storage area; stalls for four to six horses, 160 sq. ft.; harness room, 60 sq. ft.; hay, grain, bedding storage, 120 sq. ft.; manure storage, 30 sq. ft., or a total of 610 sq. ft., compared with only 160 sq. ft. for a 5-ton electric truck to do the same amount of work. The saving in area at $1 per sq. ft. per year, the New York price, would be $450 in favor of electric service.

Comparing operating expenses, the per diem cost of service on a 5-ton, 30-mile basis would be as follows: Horse service, space value, $2 per day; feed, $5; drivers' wages, $6; total, $13. With the 5-ton electric truck, the space value would be 50 cents per day; cost of electrical energy, $1; drivers, $3; total, $4.50. Taking all costs into account, including fixed charges, the speaker said that two 5-ton horse-drawn trucks cannot be operated for less than $15 per day, while a 5-ton electric truck can be run for an over-all expense of from $8 to $11 per day. With horse traction all expenses tend to increase as time goes on, while with the electric truck the price of all large items such as electricity, batteries and tires is decreasing. Electricity has fallen in price from 10 cents to from 4 cents to 1.5 cents per kw-hr. in the larger cities. Tires can now be guaranteed for 10,000 miles' service, or eighteen months' life.

In conclusion, the speaker exhibited a large number of lantern slides showing applications of the electric truck in packing and provision-house service, pointing out that the first motor truck used in carrying meats was operated seven years ago by Schwarzschild & Sulzberger at Norfolk, Va., during the Jamestown Exposition. This machine is in service in New York to-day, its long life being due to its being an electric truck without fast vibratory engine, change of gears or running at excessive speeds. The growing popularity of the electric truck in this field is shown by the fact that twenty-seven of the prominent packers and dealers of the country are using ninety-five machines of a single make, aggregating 260 tons in carrying capacity and ranging in size from the 1000-lb. wagon to the 5-ton truck. The United Dressed Beef Company of New York operates twenty-three trucks, of which nineteen are rated at 3½ tons each. Sulzberger & Sons Company, New York, operates eleven trucks of 3½ tons rating and the smaller dealers are taking up the question of electric transportation in many parts of the country and are obtaining striking economies from their first equipment.

## Long Acre Electric Light & Power Company Wins Decision

Justice Greenbaum announced on Aug. 11 in the Supreme Court that he would dismiss the foreclosure suit brought by the Edison Electric Illuminating Company of New York City against the Long Acre Electric Light & Power Company through the Metropolitan Trust Company, as trustee, on condition that the $90,000 interest which has been accumulating since 1906 was tendered to the bondholders at once. The interest money was offered to the bondholders on the trial of the foreclosure suit, and as the Long Acre company still has the backing of the banking firms of A. B. Leach & Company and Harvey Fisk & Sons the interest doubtless will be paid.

The foreclosure suit followed a previous action brought to prove the Long Acre company's charter invalid. The courts denied this contention and the Public Service Commission of the First District granted the company permission to issue $4,000,000 in bonds and $2,000,000 new capital stock to build up its plant.

The Long Acre company issued $500,000 in bonds in 1900 when its claims to a valid electric lighting franchise in Manhattan were not taken seriously. A block of $185,000 of these bonds fell into the hands of the late William H. Kelly, at one time judge of the City Court, who named Mr. Charles F. Murphy as one of the executors of his estate. Mr Murphy, it is claimed, sold the bonds to the president of the New York Edison Company.

In his opinion Justice Greenbaum said the nominal buyer of the bonds was the Central Trust Company, but the money was furnished by the Edison company. The trust company bought up over $400,000 of the bonds and then called on the Metropolitan Trust Company as trustee to foreclose on the mortgage, asserting the right to demand payment of the principal at once because of default of interest since 1907.

The Long Acre company contended that the bonds were invalid because it had failed to get the permission of the Public Service Commission before it issued them. Justice Greenbaum overruled this defence and said that more serious and interesting issues were whether the Central Trust

Company, which bought the bonds with money furnished by the Edison company, was an "owner and holder" with power to declare the principal payable before the date fixed in the mortgage, and whether there had been a default in the payment of the interest.

Justice Greenbaum said that even if he was wrong in his ruling that the trust company was not the real owner of the bonds, the plaintiff failed to show by evidence of a satisfactory character that a demand for the payment of the interest was ever made. The court ruled that the Long Acre company might renew its offer made on the trial to pay the $90,000 interest due up to the date of the trial, and if the plaintiff refused to accept the interest the money might be paid into court.

## Increase in Electric-Truck Registrations in Massachusetts

In a recent interview at Boston, Vice-president E. S. Mansfield of the Electric Motor Car Club of that city stated that the registration of electric trucks in Massachusetts for the seven months ended July 26 shows a gain of 92 per cent over the number of machines of this type in the State a year ago. Mr. Mansfield pointed out that the electric-truck industry has reached a development competent on a small scale to duplicate practically every other form of land transportation service.

Recent sales of electric vehicles at Boston include a 5-ton General Vehicle ice wagon for the Central Manufacturing Company to operate on a schedule of about 35 miles per day between the Dorchester section and the wholesale market district. The savings in leaks resulting from the increased schedule speed of the motor-driven ice cart as compared with the time-honored horse-drawn wagon was an important factor in securing the adoption of electricity. The Edison Electric Illuminating Company of Boston has added six General Vehicle 2-ton electric trucks with winch equipment to its fleet, and these units are provided with extra large batteries in order to facilitate rapid and heavy work in line construction and maintenance on hilly roads and streets in the suburban districts. The company now operates a total of forty-two electric vehicles. Electric trucks are becoming more popular in the Boston coal trade and suburban dealers are beginning to purchase this equipment.

In the central-station field, the New Bedford (Mass.) Gas & Edison Light Company now operates some eight machines. General Manager W. H. Snow, with the assistance of Mr. Daniel W. Beaman, of this company, will present a paper on "The Value of the Electric Vehicle to the Central Station" at the Burlington (Vt.) convention of the New England Section of the National Electric Light Association on Sept. 17-19. President Day Baker of the Electric Motor Car Club of Boston accepted an invitation of the Master Butchers of America to deliver an illustrated lecture on "The Transportation of Meat and Provisions" at the twenty-eighth annual convention of that organization in Boston on Aug. 12. On July 16 the Electric Motor Car Club held an outing at the New England Kennel Club, Braintree, Mass., as the guests of President Edgar of the Boston Edison company, so that on neither the social nor the business side was there any midsummer dullness.

## Public Service Commission News

### Maryland Commission

The Maryland Public Service Commission has received complaint from Mr. George A. Whiting, who said that the Consolidated Gas, Electric Light & Power Company drew up plans for wiring his company's plant and furnished two experts to supervise and approve the work last fall. For six or eight months the bill for energy averaged about $500. Then it was discovered that the wires were grounded and that a large quantity of energy was being wasted. The central station remedied the trouble and the monthly bill for energy dropped to $256. Mr. Whiting now asks the commission to compel the company to revise its previous bills on the basis of tonnage turned out at the plant. Mr. Whiting's complaint will be referred to William Cabell Bruce, general counsel for the commission.

### New York Commissions

The Public Service Commission of the First District has ordered the United Electric Light & Power Company to cancel by Oct. 1 three "riders" now in force in its standard contracts. Action of the commission was taken upon the recommendation of Commissioner Maltbie, who held hearings on the complaint of Alonzo B. Knight, who owns two buildings, each containing residents' apartments as well as stores. The company's rate to small consumers is 10 cents per kw-hr. One "rider" covered "tenants' consumption-wholesale rate," and the complainant wanted to take advantage of this rate whereby he might get the entire energy of the two buildings charged to him at 5 cents per kw-hr. or less, he collecting from the tenants at the full rate of 10 cents. Commissioner Maltbie held that the riders objected to are discriminatory.

The New York Edison Company and the Astoria Light, Heat & Power Company have made application to the Public Service Commission for the First District for permission to issue additional securities. The New York Edison Company asks for permission to issue $15,800,000 in capital stock in addition to $50,153,400 already issued. The proceeds of the new stock are to be used to pay off notes given to the Consolidated Gas Company for money used on the plant and property of the Edison company. The Astoria Light, Heat & Power Company asks for permission to issue $5,000,000 in first mortgage 5½ per cent bonds and also $9,500,000 capital stock in addition to $500,000 capital stock already outstanding. The proceeds of the proposed stock and bonds are to be applied to the refunding of $14,125,000 in notes of the company held by the Consolidated Gas Company and for the retirement of $375,000 outstanding as mortgage bonds.

# Current News Notes

Employees' Saving Fund in Chicago.—A statement issued on July 1, 1913, showed that of the 2756 employees of the Commonwealth Edison Company eligible for the employees' saving fund, 2126, or 77 per cent, have availed themselves of the opportunity presented.

* * *

Wireless in Canal Zone.—Construction work has begun on the large radio station at Caimito, Canal Zone. This will be one of the most powerful wireless stations in the world and will be similar to the great station at Arlington. It will embrace three towers, each of which will be 600 ft. high, which will be arranged in the form of a triangle with sides 900 ft. long. Nominal radius for the sending and receiving machinery will be 3000 miles, which will enable it to keep in communication with Washington.

* * *

University of Illinois.—The building program of the University of Illinois for 1913-14 calls for an expenditure of $1,400,000, including $250,000 for a chemical laboratory, $100,000 for an engineering hall and $45,000 for a boiler house. Mr. John I. Parcel, of the University of Minnesota, has been appointed professor of structural engineering, and Mr. George B. Rice, of the Treasury Department at Washington, has been named as lecturer on the installation and operation of mechanical equipment.

Telephone Controversy in Louisville.—The Cumberland Telephone & Telegraph Company (Bell) has submitted terms for a compromise in the litigation in which the city and the company have been involved since 1909. It offers to refund $137,000 collected since 1909 in excess of ordinance rates; to give the "metropolitan" zone service rather than the restricted city service; to dismiss all suits against the city now pending, and to erect a million-dollar office building in the business district. In return it asks that the Grinstead rate ordinance be amended to permit the charging of these rates: Business, direct line, $72; business, two-party line, $51; residence, direct line, $36; residence, two-party line, $27. These rates are somewhat higher than those fixed in the Grinstead ordinance, which apply, however, to the city only.

* * *

Annual Report of Department of Electricity of Chicago.—For the calendar year 1912 the expenses of the department of electricity of the city of Chicago amounted to $1,400,239, as shown in the annual report of Mr. Ray Palmer, the city electrician. The revenue earned by the department for the year was $251,671, the largest item being fees for electrical inspection, which amounted to $163,340. It is of interest to note the cost of electrical inspection was $74,812, so that this bureau of the city government is one that returns a satisfactory profit. The city electrician recommends that the revenue from the electrical inspection shall be expended only for the purpose of electrical inspection work; otherwise the balance of the inspection fees becomes a tax on the users of electrical energy. The number of officers and employees in the whole department was 442.

* * *

A Faulty Detail of Hat Construction.—Very frequently persons who are following dangerous vocations are careful that their apparel shall in no wise increase the risk they are taking. Yet many men engaged in handling high-tension wires wear what is commonly known as a black stiff hat, not having observed that there is an electrical conductor embedded in the rim of the hat. A fatal accident resulting from this type of hat has rather forcibly called attention to the fact that each hat of this kind is made with a steel wire as the reinforcing element of the rim. A substation foreman on an electric line in northern Indiana was explaining details of some work to his men in a recently completed substation. In pointing out a joint in the high-tension wiring, hat in hand, the rim of the hat came into contact with the wiring. The circuit was completed from the high-tension line through the small steel wire and the man's body to the ground thereby causing a shock which proved fatal. In view of the above accident it might be well for men in the electrical industry to specify hats with non-conducting reinforcement in their future purchases.

* * *

Standardization Work of the Electric Vehicle Association of America.—The standardization committee of the Electric Vehicle Association has under consideration at the present time a proposed charging plug of larger size which will take care of the heavier commercial vehicles. An attempt is also being made to adopt a standard list of lamp bulbs, in order to reduce the number now in use because of small variations in voltage ratings and deviations in bulb shapes. The committee is going to take up the question of a standard method of testing the rating of solid tires for efficiency. Because of the wide variation in compounds used and of the effect this has on both speed and mileage of electric vehicles, this is a very important question. The standards which have been adopted and which are proposed should result in improving the electric vehicle as a whole and should bring more uniform practice in regard to the various attachments and equipment. These can just as well be standard as any others, without at all limiting the several manufacturers in carrying out their individual ideas. It is thought that the work already done along the line of standardization, as well as that planned for the future, will result to the decided advantage of all concerned, including the vehicle manufacturer, the owner, the garage and the central station.

* * *

## SOCIETY MEETINGS

Vermont Electrical Association.—The Vermont Electrical Association will hold its annual convention at Burlington on Sept. 18. Mr. A. B. Marsden, Manchester, Vt., is secretary and treasurer of the association.

* * *

Cedarmen's Association.—The Northwestern Cedarmen's Association will hold its next annual convention on Jan. 6, 1914. Mr. H. E. Boucher, 743 Lumber Exchange, Minneapolis, Minn., is secretary of the association.

* * *

Empire State Association.—The annual meeting of the Empire State Gas and Electric Association will be held in New York City during the early part of October. Mr. C H. B. Chapin, 29 West Thirty-ninth Street, New York, is secretary of the organization.

* * *

Convention of the American Water Works Association.—The thirty-fourth annual convention of the American Water Works Association will be held at Philadelphia some time during May, 1914. Mr. J. M. Diven, 47 State Street, Troy, N. Y., is secretary and treasurer of the society.

* * *

Ohio Society of Mechanical, Electrical and Steam Engineers.—The Ohio Society of Mechanical, Electrical and Steam Engineers will hold its annual meeting at Columbus, Ohio, Nov. 20 to 22. Prof. Frank E. Sanborn, Ohio State University, Columbus, Ohio, is secretary and treasurer.

* * *

Annual Meeting of the Railway Telegraph Superintendents.—The annual meeting of the Association of Railway Telegraph Superintendents will be held in New Orleans, La., from May 19 to 22, 1914. Mr. P. W. Drew, 112 West Adams Street, Chicago, is secretary and treasurer of the association.

* * *

Kansas Convention at Hutchinson in October.—The annual convention of the Kansas Gas, Water, Electric Light and Street Railway Association will be held at Hutchinson, Kan., Oct. 9 and 10. Succeeding Mr. W. H. Fellows, of Leavenworth, Mr. Ivor Thomas, Wichita, Kan., has been appointed secretary-treasurer.

* * *

Chicago Electrical Credit Association Meeting.—The Electrical Credit Association of Chicago, which is affiliated with the National Electrical Credit Association, will hold its annual convention in Chicago some time in November. Mr. Frederic P. Vose, 1343 Marquette Building, Chicago, is secretary of the Chicago association.

* * *

Chicago Electric Club Picnic.—A real old-fashioned basket picnic has been arranged for Aug. 21 by the Electric Club of Chicago, to be held at Northfield Grove, Ill., about 20 miles northwest of the city. Special cars have been chartered on trains leaving Chicago in the morning and at noon over the Chicago, Milwaukee & St. Paul Railroad, and similar accommodations have been provided for the return trip. Electrical manufacturers, jobbers and dealers have generously furnished prizes for the events, such as vacuum cleaners, percolators, fan motors, toasters, etc. A large attendance is expected, as the president of the club, Mr. George C. Keech, has sent letters to all of the firms whose employees who are members of the Electric Club requesting them to declare a half holiday on that date.

# Profitable Station in a Town of 3500 Inhabitants

**Rehabilitation of Southern New York Power Company's system at Walton, N. Y.—Methods adopted to increase earnings and improve the efficiency of generation**

WHEN, in 1910, the Southern New York Power Company purchased the Walton Electric Light Company and the Walton Public Service Company, both of which were operating in a town which possessed less than 3000 inhabitants, the problem confronting the management was to make a property seventeen years old and giving only night service pay. At that time the yearly gross revenue was less than $3 per capita and the net earnings were not sufficient to meet the interest on nine one-thousand-dollar bonds. The equipment in the generating station was obsolete, consisting of 133-cycle, 100-volt, single-phase generators and a wooden switchboard. Moreover, owing to a certain weakness in human nature which is very general, the management had during the previous year exchanged the engines and generators for equipment of double the size for no other reason than that the new second-hand equipment could be purchased at a bargain. This resulted in a consumption of 16 lb. of coal per kw-hr. generated, because the units were too large for the work.

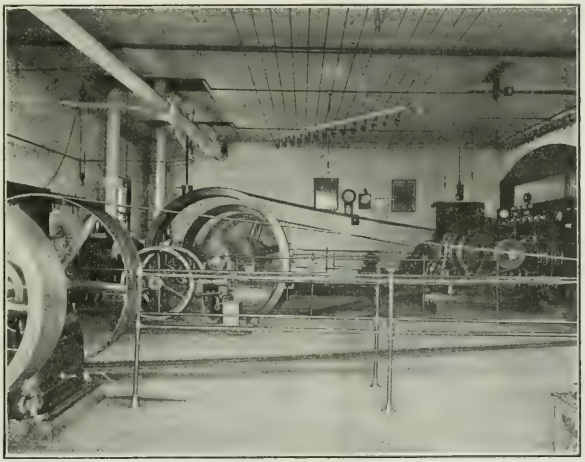


FIG. 1—STATION OF SOUTHERN NEW YORK POWER COMPANY

After a study of the situation, the present management determined to install three-phase, 2400-volt, 60-cycle apparatus and a new switchboard, and to do this it was necessary to build an addition to the power house. In the addition were installed a small engine and generator of such size as to carry the load during the period when the demand was smallest. Moreover it was felt that the quickest way to acquire a day load was to give all-day service rather than to canvass first and then make the change. In the process of rehabilitation all the small transformers were scrapped and all of the Schallenberger meters. A new constant-current transformer, street-lighting system displaced the old shunt-mix system and tungsten lamps were installed. The changes were not made simply to modernize the system, but because investigations showed that a sufficient saving in operating expenses warranted such action. From the data and curves published herewith, these facts are brought out more fully. There was no day service given in 1909, and the operating expense per kw-hr. was 6.46 cents, while in 1912, with all-day service, the operating expense was reduced to 3.93 cents. It should not be inferred, however, that the changes were all made at once. Much of the credit for these results is due to the loyalty and enthusiasm of the superintendent and his staff.

In selecting the resident manager, it was decided to take a townsman because the good will of the community was an asset. Of course it would have been an easy matter to select a man with the requisite experience from elsewhere; but he would be a stranger in the community and it would take time for him to establish friendly relations and obtain the confidence of the customers. A resident of the town, even with limited business and engineering experience, would not be thus handicapped; because experience can be acquired by a practical lineman who is not afraid to ask questions. In this connection also it was thought best to pay good wages since an organization employing first-class men is well thought of in a small community, and with sufficient remuneration it is possible to get the best service that a man can give. It is believed that the Southern New York Power Company pays higher salaries than any similar organization in the State, and the employees merit the confidence placed in them. In addition to a stated salary the company gives a bonus of 20 per cent of the increased net revenue.

A change in office management took place with the change in administration. An office having a good show window was opened on the main business street, and a bookkeeper, something which the company had never before possessed, was hired. The bookkeeper is a young woman who also acts as cashier and indoor-appliance saleslady, the latter duty taking up a good part of her time. In handling the accounts of over 500 customers a loose-leaf system of bookkeeping is employed, and in order to expedite the monthly reports an adding machine has been installed. Prior to the installation of the adding machine, it was necessary to employ an assistant to the bookkeeper several days a month, but now the bookkeeper is able to handle all the work unaided.

Before attempting any change in the street-lighting system the village trustees were called together, and the management submitted to them a proposition to increase the number of street lamps by about 40 per cent. Inasmuch as this greater number of lamps could be obtained at an increase of only 15 per cent in cost, the proposition was accepted by the village trustees. To be sure, there was not an enormous profit in the street-lighting contract, but the management believes that municipal street lighting should be taken at a small margin of profit, because it disarms the exponents of municipal ownership of one of their chief arguments and also because it benefits the whole community in that the streets are better lighted. Any general improvement along this line is certain to



fier discounts for prompt payment or else to employ a collector. After mature consideration it was felt that the giving of discounts would not interest the class of people who were backward in meeting their obligations, so in place of the boy who was employed three or four days a month to read meters, and also in place of a lineman's helper, a first-class all-round man was engaged to perform the duties of these two and also act as collector. In this way the personal friendship excuses for not paying bills which the superintendent had to consider were eliminated. The company now employs three men for the power house, a combination lineman, meter reader, meter tester and collector, a bookkeeper and superintendent. An additional man is hired to act as a groundman on line work when necessary.

To what extent it is possible to effect economies in the operation of a small station is well illustrated in the table which is given on this page showing the generating costs. It will be noted that although in 1909 there was no day-light service the cost of labor, fuel, water and supplies was greater than in the following years when all-day service prevailed. A saving in this direction was effected by a change in the generating equipment, as noted in the beginning of this article, and also by the better load-factor. However, expert supervision also played an important part in the result, and to this may be traced the items on repairs to boilers, engines and generators, which, while not large in the aggregate, have a marked bearing on the amount of coal and water consumed per unit generated. Fortunately, the engineer in charge of the Walton plant is also the best mechanic in the village and his time is not so taken up that he cannot look after the repairs around the station while on duty. For that purpose a small machine shop has been fitted up for his benefit, where most of the machine work required for the station is done.

In Fig. 5 is given a view of the rear of the switchboard, which replaced one of wood. The instruments and apparatus on this board were of course purchased, but all of the other work on the board was done by the company itself at a great saving. The usual array of instruments is provided in addition to a frequency indicator. The latter is not always included in the switchboard equipment of a small station, but has proved its worth many times. An important use is made of it to detect when the spring of the engine governor becomes weak. At such times the speed of the engine decreases, and of course the frequency drops and the motors on the line do not run up to speed. In a manufacturing plant slow speed means decreased output and dissatisfaction with electric service, and a refinement such as a frequency indicator at small expense was deemed worth while in Walton for the reason stated.

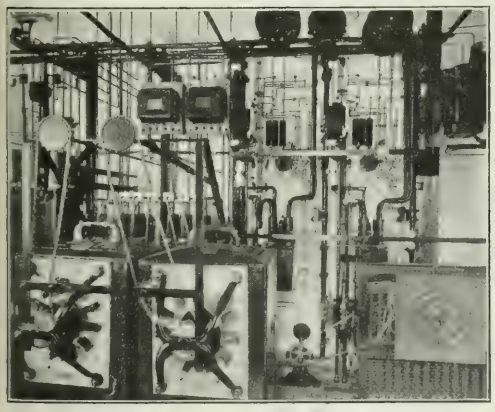


FIG. 5—REAR VIEW OF SWITCHBOARD

The company gives twenty-three and one-quarter hours' service daily except on Sundays. On that day unless it is cloudy or raining the plant is shut down during the day to allow repairs in the power house and changes on the line to be made. In addition, the station is shut down during the noon hour daily, during which time minor repairs can be made and new customers cut in on the circuits. Should any of the mills require service during the noon hour, however, a telephonic request to the superintendent is all that is required to keep the station in operation during that period. By operating the units in the station to advantage according to the load and by weighing the coal and improving the piping layout in the station, the company has doubled its gross earnings and is now getting over $6 per capita per year with a profit of several thousand dollars, whereas previously there was no profit at all, but a loss. Fig. 6 shows the relation existing between the coal consumption per kilowatt-hour with increased load-factor and supervision. The curve is made up from monthly reports of kilowatt-hours generated and coal consumption with reference to the maximum demand of the year and shows that as the load-factor increases the coal consumption decreases. The officers of the company are as follows: President, Mr. C. A. Graves; treasurer, Mr. R. C. McGargel, and manager, Mr. F. Haverly.

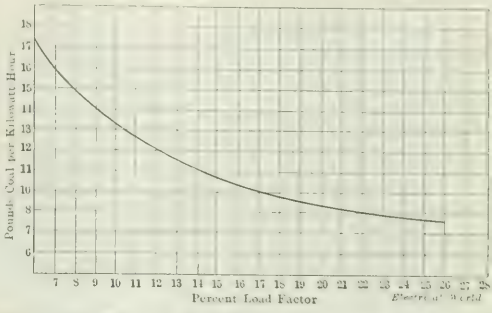



FIG. 6—RELATION OF COAL CONSUMPTION AND LOAD-FACTOR

COST IN CENTS PER KW-HR. GENERATED

| | 1909 | 1910 | 1911 | 1912 |
|---|---|---|---|---|
| Station labor | 0.87 | 0.88 | 0.80 | 0.73 |
| Fuel | 2.16 | 1.78 | 1.43 | 1.23 |
| Water | 0.05 | 0.05 | 0.03 | 0.02 |
| Supplies | 0.19 | 0.17 | 0 18 | 0.15 |
| Repairs, building | 0.01 | 0.02 | | 0.03 |
| Repairs, boilers | | 0.09 | 0 11 | 0.05 |
| Repairs, engines | 0.18 | 0.06 | 0.05 | 0.0 |
| Repairs, generators | | 0 08 | 0.01 | |
| Repairs, accessories | | | | |
| Repairs, miscellaneous | | | | |
| Total production | 3 48 | 3.10 | 2 58 | 2.24 |
| Distribution superintendence | 0 24 | 0.20 | 0 26 | 0.25 |
| Moving meters and transformers | | | 0.01 | |
| Repairs, distribution mains | | 0 06 | 0.14 | 0.09 |
| Repairs, services | | | 0 00 | 0.01 |
| Repairs, transformers | 0 09 | | 0.01 | |
| Repairs and operation of meters | | 0 34 | 0.01 | 0.04 |
| Total distribution | 0.33 | 0.60 | 0.43 | 0.39 |
| Commercial incandescent operation | 0.23 | 0 19 | 0.21 | 0.14 |
| Street-lighting operation | 0.09 | 0.15 | 0.02 | |
| Street-lighting, repair | | 0.03 | | |
| Total utilization | 0.32 | 0.37 | 0.23 | 0.14 |
| Total commercial | | | 0.05 | 0 03 |
| Total general | 2 58 | 1 58 | 1 18 | 1 00 |
| Total operating | 6.46 | 5.45 | 4.47 | 3 93 |
| Kw hr generated | 149,200 | 163,000 | 250,427 | 289,310 |

## Present Status of the Locomobile

By Warren H. Miller

More than two years have elapsed since the writer reported in the *Electrical World* his observations of the so-called locomobile then in use in Germany but unknown here. This type of machine is now being built in America

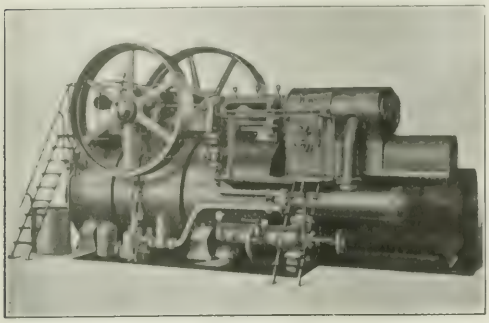


Fig. 1—Wolf 130-hp tandem compound locomobile with single superheater

and the subject therefore becomes of increasing interest to *Electrical World* readers. In view of this interest it seems well to give a brief outline of the machine, even the name of which is somewhat confusing by reason of its use in connection with a well-known automobile.

The name "Lokomobile" was given by the Germans to a combination of boiler, engine and superheater, compactly assembled for the purpose of eliminating radiation and piping losses. Cylinder condensation has been to a large extent done away with by carrying the superheating up to nearly 600 deg. The engine is mounted on top of the boiler, even in units as large as 1000 hp, and with it is mounted the generator if the installation is designed for producing electrical energy. The saving in floor area is remarkable, the 1000-hp Lanz unit, which supplied nearly all the electric lighting and motor service for the Brussels Exposition in 1910, taking only 24 ft. by 32 ft. of floor area.

Loss of heat is minimized by jacketing the high-pressure

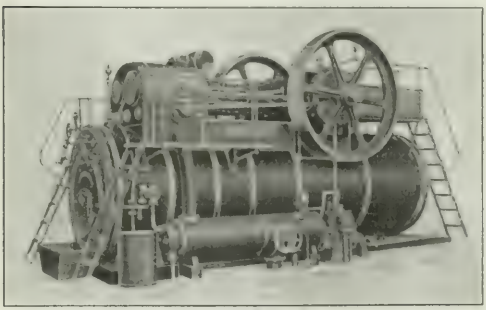


Fig. 2—Lanz 210-hp cross-compound, single-superheat locomobile

and low-pressure cylinders, either by mounting them in the steam dome of the boiler or by putting them in the chimney uptake, where the waste heat gases serve not only to prevent radiation losses but even, in the case of the low-pressure cylinder, to return a certain amount of heat through the cylinder walls. To insure that the economy will not fall off through boiler scale and superheater soot-ing, the furnace and tubes are removable. The boiler is fired internally, being provided with a corrugated furnace and the front and rear plates are bolted to the flange of the boiler shell and made tight with a special packing. The entire equipment is very handsomely got up, and, as the engine and the boiler are in one unit, both must be kept clean. The fuel consumption being very low, one man usually runs both the engine and the boiler, in all sizes up to about 250 hp. Automatic stokers and low heat-value fuels are much in favor for use with the locomobile for the same reason.

The rate of introduction of these machines in Europe and all her trade dependencies during the last twelve years has been phenomenal. In Germany, France, Russia, Italy, Holland and Belgium there are over 50,000 installations at present, ranging in size from 40 hp up to 1000 hp. They are used for every conceivable service such as with mill shafting, pottery machinery, mine crushers, woodworking shops, machine and tool works, electric generation and industrial plants where use is made of three-phase induction motors.

The every-day working fuel consumption of these plants averages from 1.1 lb. to 1.4 lb. (of 13,000 b.t.u.) coal per brake hp-hr. and the specific consumption does not vary either with the size of the plant or the load. It does not rise appreciably at three-quarters and one and one-quarter load, and at half-load is about 0.2 lb. of coal more. The

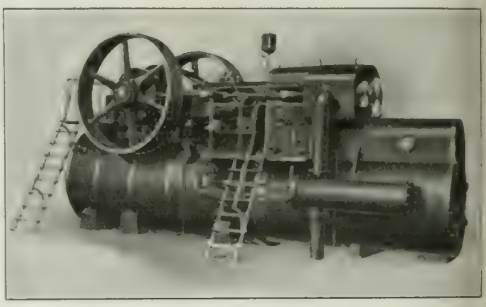


Fig. 3—150-hp double-superheat American locomobile

world's record for economy is held by a 130-hp Wolf locomobile, one of which supplies the electric lighting for the Czar's palace at Peterhof, where the steam consumption is 7.06 lb. and the coal 0.74 lb. per brake hp-hr. The 1000-hp Lanz locomobile at the Brussels Exposition consumed 9.2 lb. steam and 1.1 lb. coal per hp-hr. in the day's run tests, the difference between it and the Wolf engine undoubtedly being due to double superheat of the latter and the jacketing of the cylinders with the chimney gases instead of with the boiler saturated steam, as is the case with all the Lanz engines.

In an article in the *Electrical World* on April 6, 1911, the writer reported the results of some personal investigations of the every-day efficiency of the locomobile throughout Germany, in which the fuel consumption was found to average about 1.3 lb. for good soft coal and 2.4 lb. per hp-hr. for the brown coal (of about 7000 b.t.u. per lb.) which is extensively used there in factory service. The Lanz and Wolf locomobiles at Brussels in 1910 were found to run very smoothly, and tachometer measurements showed them amply able to drive alternating-current generators in parallel, as indeed has been done in dozens of installations since that date, notably in South America where advanced engineering practice by young German and French engineers is the rule rather than the exception.

Herewith are illustrated two standard types of German locomobiles, Fig. 1 showing a 200-hp Lanz unit, single superheater, with cylinders jacketed in the steam dome, and

Fig. 2 a Wolf unit with double superheater and cylinders jacketed in the chimney uptake. Each of these 130-hp units possesses the feature of removable corrugated furnace and tubes, the engine and boiler being arranged as one unit. The principal difference being in the form of the superheater and the type of valve gear employed. As will be noted with the Lanz machine, the cylinders are jacketed by casting them and the dome in one piece of tough gray iron, with space for the circulation of the saturated boiler steam. The Wolf company makes a large number of machines of this type, ranging from 250 to 1200 hp, but of late has been concentrating more upon the double superheater type shown in Fig. 2. The latter is made in ratings from 80 hp up to 300 hp and has a number of notable features. After passing over the usual coil superheater the chimney gases enter a second superheater of the multiple type, inside of which is exhausted the steam from the high-pressure cylinder. The temperature of the exhaust is about 260 deg. Fahr.; the chimney gases raise the temperature to about 370 Fahr. before the steam enters the low-pressure cylinder. In this way the steam is superheated in each cylinder sufficiently to eliminate cylinder condensation loss without imposing an excessively high initial temperature.

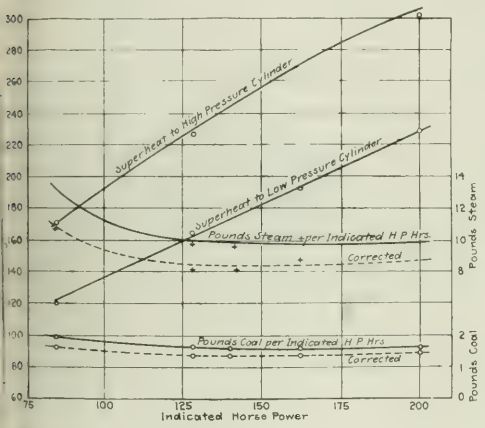



FIG. 4—RESULTS OF TESTS ON 150-HP BUCKEYE-MOBILE SHOWN GRAPHICALLY

In the Lanz type of machine use is made of a single combone superheater, and the initial temperature is carried up to 610 deg. Fahr. as compared with 570 deg. for the Wolf unit. Whether the greater simplicity of the Lanz type does not more than repay for the more or less theoretical disadvantage of a high initial super-temperature is subject under dispute in German technical circles.

The Lanz valve gear is of the pop-valve type, while that of the Wolf is of the well-known piston type. The former undoubtedly gives better steam distribution and has no frictional troubles, but the highly superheated steam surrounds the pop-valve stem so that a labyrinthine packing and round metal bushing must be used, whereas with the Wolf unit the stem of the valve is on the exhaust steam side so that ordinary packing can be used. There are at least four other companies in Germany manufacturing the locomobile, and many of its features are common property.

In this country the Buckeye Engine Company of Salem, Ohio, has placed on the market its own line of locomobiles, having secured certain indispensable patent rights. In the American locomobile use is made of the double superheat and smoke gas cylinder-jacket principle. An illustration of the first American-built locomobile is shown in Fig. 3. This is of 150 hp normal rating. The author ran three tests with it on three-quarters load, one and one-quarter load and with full load, of from three to eight hours' duration, and got a consumption of 11.2 lb. of steam and 1.6 lb. of coal per hp-hr.—a good result for a first design. The principal measurements made during the test are indicated in Fig. 4. Tests were conducted in accordance with standard A. S. M. E. regulations; coal and water were weighed as fed and readings were taken every fifteen minutes. The American built locomobile is much like the Wolf type of unit with double superheat and smokestack cylinder jacketing, but it contains a number of notable mechanical improvements.

In operation the American machine falls short of the performances of the Lanz and Wolf machines in Germany even on the indicated-horse-power basis, whereas all the foreign figures mentioned relate to the brake-horse-power. However, this is a first machine, and, at that, its performance is nothing to be ashamed of. How many saturated-steam engines of 150 hp in this country can touch or even approximate 1.6 lb. of coal per indicated-horse-power-hour?

As might be expected, the Germans have not been asleep during the two years that we have been developing the American locomobile. Their latest contribution comes in the shape of a uniflow cylinder applied to a series of large locomobiles made by the Wolf company. These units range from 300 hp to 800 hp and are of the cross-compound type, with uniflow cylinders for both high and low pressure. Single superheat only is used in this type and the results so far obtained show 8.05 lb. of steam per indicated-horse-power-hour, as tested at the University of Prague. While the application of the uniflow-cylinder principle to a machine already eliminating cylinder condensation by high superheat may seem to be wasted pains, the logic back of this new unit is very simple.

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## Formulas for Capacity of Single-Phase Transmission Lines and Cables

By C. A. Pierce and F. J. Adams

Practically all formulas for computing the capacity of transmission lines or cables are based on the assumption that the surfaces of the conducting wires, and the inside surface of the armor sheath in the case of cables, are equipotential surfaces and that the charges are distributed uniformly over the surfaces of the conductors. This assumption has sometimes been plainly stated, though in most cases it is not mentioned, and one finds it to be implicitly included in the hypothesis only when one analyzes the formulas, giving especial attention to the assumptions and approximations involved. The following article will include the deduction of some formulas for computing the capacities of single-phase transmission lines and cables, and particular attention will be given to the assumptions underlying the formulas and to the accuracy which may be expected when they are used.

### The Potential of a Long, Straight Cylindrical Conductor

The potential of a long, straight cylindrical conductor, when charged with a quantity of electricity and supposed to occupy the whole field of force alone, is defined as the work done upon a unit positive electric charge when this unit charge is carried from the wire to a region where the field of force is zero. Since the potential is independent of the path along which the unit charge is carried, it is usual to suppose that the charge is carried along a path described by a radius of the conductor extended to the limit of the field. The work is then equal to

$$W = \int F\, dr$$

where $F$ is the force exerted upon the unit charge at any point in the path and $dr$ is an infinitesimal length of the path. The force $F$ is equal to the number of lines of elec-

[illegible] area normal to $r$ at the point where $r$ is considered. Since $\frac{4\pi}{k}$ lines of force originate upon unit charge, where $k$ is the specific capacity of the dielectric surrounding the charge, $\frac{4\pi Q}{k}$ lines of force will originate upon unit length of the conductor, if $Q$ is the charge upon unit length thereof. Owing to symmetry, these lines will radiate as equally spaced straight lines from the surface of the conductor, except near the ends. Hence the density of lines at any point, $P$, outside of the conductor and not near the ends, is equal to

$$F = \frac{4\pi Q}{2\pi r \times 1 \cdot k} = \frac{2Q}{kr}.$$

The expression for the work now becomes

$$W = \int \frac{2Q}{kr}\, dr.$$

Exactly this same expression will be obtained if one considers the charge $Q$ to be concentrated along unit length of the axis of the conductor. It will be noticed that the assumption of equally spaced lines radiating from the surface of the conductor tacitly assumes that the surface of the conductor is an equipotential surface and that the charge is uniformly distributed over its surface.

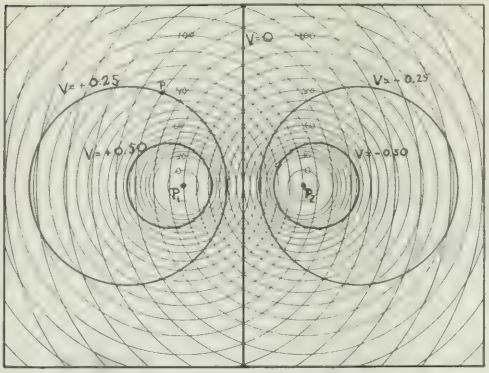



FIG. 1—EQUIPOTENTIAL SURFACES CAUSED BY TWO EQUAL BUT OPPOSITE PARALLEL LINEAR CHARGES

The absolute value of the potential of the charged conductor is equal to

$$V = W = \int_{r_1}^{r} \frac{2Q}{kr}\, dr = \frac{2Q}{k}\left[\log r\right]_{r_1}^{r}$$

The upper limit is at an infinite distance from the conductor and the expression for $V$ is of no value in this problem. In the following work the absolute value of the potential of the conductor is not required; rather, it is the potential difference of two points in space due to the charged conductor which is useful. The potential difference of any two points, $P_2$ and $P_3$, situated distances $r_2$ and $r_3$ normally from the axis of the conductor is equal to the work done upon a unit positive charge when it is carried from one point to the other, and is

$$V = V_2 - V_3 = \int_{r_2}^{r_3} \frac{2Q}{kr}\, dr = \frac{2Q}{k}\log\frac{r_3}{r_2} \qquad (1)$$

It is to be noted that this expression holds whether the charge $Q$ is distributed uniformly upon the surface of any cylindrical conductor or is concentrated at the axis of the conductor. The only limitation is that the radius of the conductor must be less than either $r_2$ or $r_3$.

## The Potential Difference of Two Long, Straight Parallel Cylindrical Conductors Equally but Oppositely Charged

If the surfaces of two straight, parallel cylindrical conductors are assumed to be equipotential surfaces when one is charged with $+Q_1$ units of electricity per unit length and the other with $-Q_2$ units ($Q_1 = Q_2$ numerically), the potential difference between them, assuming that they also occupy the field of force, will be equal to

$$V = W = \int_{r_1}^{D-r_2} \left(\frac{2Q_1}{kr} - \frac{2Q_2}{k(D-r)}\right) dr$$

provided that it is assumed that the charges are evenly distributed over the surfaces of the conductors.

As will be seen in Fig. 1, the potential changes sign at the neutral midway between the conductors, consequently the equation above can be handled more easily if we write

$$V = W = 2\int_{r_1}^{D/2} \left(\frac{2Q_1}{kr} - \frac{2Q_2}{k(D-r)}\right) dr$$

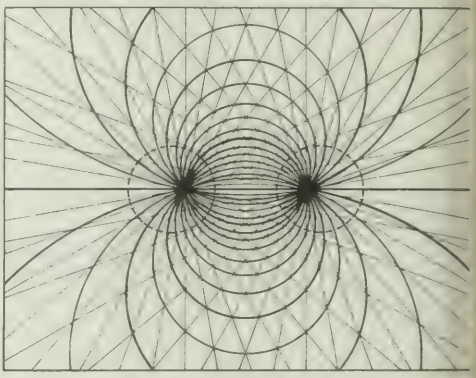


FIG. 2—LINES OF FORCE BETWEEN TWO EQUAL AND OPPOSITE PARALLEL LINEAR CHARGES

$$\frac{4Q_1}{k}\log\frac{D-r_1}{r_1} \text{ electrostatic units} \qquad (2)$$

where $D$ is the distance between the axes of the conductors and $r_1$ is equal to the radius of either conductor. But two charged conductors do not give rise to equipotential surfaces which coincide with the surfaces of the conductors except when the charges are not uniformly distributed over the surfaces of the conductors, as will be shown later. Hence equation (2) can be only approximately true and becomes of interest to ascertain the degree of approximation and, if possible, to deduce an equation which is exactly correct.

In order to solve this problem, it is convenient to find the equipotential surfaces for the two charges when they are concentrated along the axes of the two parallel conductors. This can be done in a manner similar to that already developed by Clerk Maxwell for the case of two point charges.* Fig. 1 represents a cross-section normal to the two axes, $P_1$ and $P_2$, along which the charges, $+Q_1$ and $-Q_2$ ($Q_1 = Q_2$ numerically) per unit length, are concentrated. The equipotential surfaces for $P_1$ alone are represented by the circles concentric with $P_1$. As it is not convenient to use absolute potentials, the circles are drawn to represent potential differences. That is, the potential d

* See Chapter VII, Vol. I, "Electricity and Magnetism," by Cl Maxwell

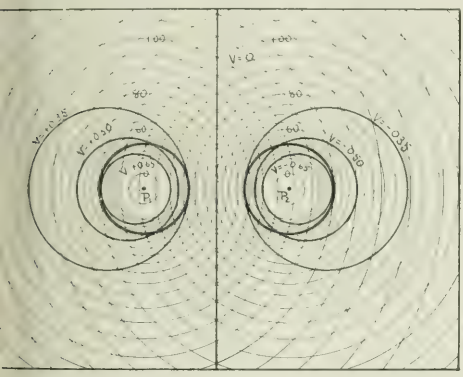
ence of circles marked 0.80 and 0 is, by equation (1), al to

$$V = \frac{2Q_1}{k}\int\frac{dr}{r} = 4.6\ \frac{Q_1}{k}\ \log_{10}\frac{r_{80}}{r_0}.$$

the figure is drawn for the case where air is the dielec-, $k$ is equal to unity. For convenience in drawing the ure, 4.6 $Q_1$ was taken equal to unity, making $Q_1 = 0.217$. a similar manner the equipotential surfaces for $P_2$ are wn. Now, consider some point, as $P$, in the field. The ential at $P$ is equal to the algebraic sum of the two entials at $P$ due to the two charges $Q_1$ and $Q_2$ separately. As the absolute values of the potentials are not known, ne means must be found for using the differences of ential which are available in the figure. Assume that equipotential circle drawn around $P_1$ and marked zero at some absolute potential, which we may call $V$. Then construction the potential at $P$ due to the charge at $P_1$ equal to $V - 0.80$ unit. Likewise the potential at $P$ due the charge at $P_2$ is equal to $-(V - 1.05)$ units. Hence potential at $P$ due to both charges is equal to

$$V - 0.80 - (V - 1.05) = +0.25 \text{ electrostatic unit.}$$

a similar manner, the potential at any point in the field be found, and, furthermore, by connecting all points the same potential, an equipotential surface can be lo-




3—ANOMALOUS POTENTIAL DISTRIBUTION WHEN CHARGE ON EACH CONDUCTOR IS ASSUMED TO BE UNIFORMLY DISTRIBUTED ABOUT PERIPHERY

d. Several equipotential surfaces are indicated in the re by the heavy lines. They are seen to be of circular ss-section, but are not concentric about $P_1$ and $P_2$. Now, ve suppose that any two equipotential surfaces, such as = + 0.50 and $V = -0.50$ in Fig. 1, are replaced by con-tors, and if we suppose that these conductors are rged with $+Q_1$ and $-Q_2$ units of electricity per unit rth (in other words, with the same charges that $P_1$ and had), the equipotential surfaces outside the conductors remain the same as they were for the concentrated ges at $P_1$ and $P_2$ (see previous reference). The poten- difference between these new conductors is then al to

$$+0.50 - (-0.50) = 1.00 \text{ electrostatic unit.}$$

just be kept in mind that this is the true potential dif-nce between the two conductors which replace the potential surfaces $V = +0.50$ and $V = -0.50$ in 1, and takes account of the fact that the charges are uniformly distributed over the conductors.

he distribution of electricity over two conductors which coincide with any two equipotential surfaces, such as $V = +0.50$ and $V = -0.50$ in Fig. 1, will not be uniform n can be found by drawing the lines of force in a ner similar to that used by Clerk Maxwell in the case of charged spheres (see reference above). Fig. 2 shows the lines of force corresponding to the two concentrated linear charges shown in Fig. 1. The lighter continuous lines in Fig. 2 are the construction lines for the lines of force which are shown by heavy continuous lines. Two equipotential surfaces, $V = +0.50$ and $V = -0.50$, are shown in Fig. 2 by the dotted circles. The lines of force

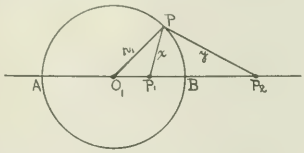



FIG. 4—METHOD OF CONSTRUCTING EQUIPOTENTIAL SURFACES FOR TWO PARALLEL CONDUCTORS EQUALLY BUT OPPOSITELY CHARGED

between two conductors which coincide with any two equipotential surfaces and are charged with $+Q_1$ and $-Q_2$ units of electricity respectively are coincident with those portions of the lines of force for the concentrated charges which lie between the two conductors. The density of the charge over the surfaces of the conductors is shown by the density of the lines of force over the surfaces of the conductors. As can be seen in Fig. 2, the charges are drawn toward the adjacent sides of the conductors represented by the dotted lines, which is the result one would expect on account of the mutual attractions of the charges.

By a proper choice of constants the number of lines of force in Fig. 2 could have been made equal to $4\pi Q_1$, but this did not seem worth while, so the lines of force are drawn proportional to $4\pi Q_1$.

By referring to Fig. 1, it will be seen that if one considers two conductors having radii equal to the radii of two equipotential surfaces $V = +0.50$ and $V = -0.50$, and coincident in space with these two surfaces, the potential difference between them will be 1 electrostatic unit if one conductor is charged with $+Q_1 = +0.217$ units of electricity and the other with $-Q_2 = -0.217$ units. The error made by applying formula (1) is found by substituting the geometric constants of Fig. 1. As originally drawn to scale, the distance between the centers of the two conductors was scaled off as 8 units. The radii of the two conductors were scaled off as 2.87 units. Hence the difference of potential between them according to formula (1) is

$$V = 4Q\log\frac{5.13}{2.87} - 9.2 \times 0.217\log_{10}\frac{5.13}{2.87}$$

$$= 0.506 \text{ electrostatic unit.}$$

The difference between the true value 1 and the value 0.506 is accounted for by the fact that the electric centers and the geometric centers of the conductors do not coincide, on account of the non-uniform distribution of the charges over the surfaces of the conductors.




FIG. 5—METHOD OF CONSTRUCTING EQUIPOTENTIAL SURFACES FOR TWO PARALLEL CONDUCTORS INCLOSED BY A CYLINDRICAL METALLIC ENVELOPE AND SCREEN

The error made by considering the electric centers of the conductors to be coincident with the geometric centers is further brought out in Fig. 3. The two heavy circles concentric with $P_1$ and $P_2$ represent the conductors discussed above. The electric centers are supposed to be at $P_1$ and $P_2$. The equipotential surfaces are constructed as in Fig.

1. As will be seen in the figure, the surfaces of the conductors will not be equipotential surfaces if the electric centers are supposed to coincide with the geometric centers. In fact, the potential difference of the adjacent surfaces of the conductors is seen to be about 0.70 unit, while that of the further surfaces is seen to be about 1.30 units. This figure therefore shows that the supposition of uniform distribution over the surfaces of the conductors does not lead to a conclusion that the surfaces of the conductors are equipotential surfaces.

### Capacity per Unit Length of Two Straight Parallel Cylindrical Conductors

The two conductors may be considered to form a condenser. The capacity per unit length of conductor is, then, equal to

$$C = \frac{Q}{V}$$

where $Q$ is the charge per unit length of one conductor and $V$ is the potential difference of the two conductors. This expression is usually considered to hold only when the charge is uniformly distributed over the surface of the conductor and the surface of each conductor is an equipotential surface. The expression is true, however, if only the second condition is fulfilled. Consider the surfaces of the conductors to be made up of infinitesimal sections. Then

$$C = \frac{\int dQ}{\int V} = \frac{Q}{V}$$

Since formula (2) has been found not to give exactly the true potential difference of the two conductors, it cannot be used to derive the true formula for capacity, which is ordinarily given as

$$C = \frac{Q}{V} = \frac{Qk}{2Q\log\frac{D-r}{r}} = \frac{k}{4\log\frac{D-r}{r}}$$

$$= \frac{k}{0.2\log_{10}\frac{D-r}{r}} \text{ electrostatic units.}$$

### Construction of the Equipotential Surfaces for Two Straight Parallel Cylindrical Conductors

The equipotential surfaces found in Fig. 1 may be drawn much more readily than by the method used to construct Fig. 1. In Fig. 4 let $P_1$ and $P_2$ be the electric centers with concentrated charges $+Q_1$ and $-Q_2$ ($Q_1 = Q_2 = Q$ numerically) per unit length. The potential at any point, $P$, in the field is the algebraic sum of the separate potentials due to each charge alone. It is expressed by

$$V = V_1 - 2Q\log\frac{x}{r} - \left(V_0 - 2Q\log\frac{y}{r}\right)$$

$$= -2Q\log\frac{x}{y},$$

where $r$ is the radius and $2V_0$ is the potential difference of a pair of equipotential reference surfaces around $P_1$ and $P_2$. The locus of all points for which $V$ equals a given constant represents a desired equipotential surface through $P$. If we suppose the potential at $P$ to be found, then the equation of the equipotential surface through $P$ is

$$\frac{x}{y} = \log^{-1}\frac{V}{2Q} = \text{a constant.}$$

This condition is satisfied when $P_1$ and $P_2$ are two inverse points of the circle which represents the equipotential surface.† And, conversely, the locus of $x \div y =$ a constant is a circle of inversion for the inverse points $P_1$ and $P_2$. Reference to Fig. 1 will recall the fact that the equipotential surfaces have already been shown by construction to be circular in cross-section. The circles for the different surfaces may now be drawn according to the relations derived from the theory of inverse points, but it seems easier to get at the positions of the centers of the circles together with their corresponding radii in the following manner:

Let $A$ and $B$, Fig. 4, be the points where the equipotential surface through $P$ cuts the line through $P_1P_2$. Let the distance $P_1P_2 = C$, $BP_1 = z_1$ and $AP_1 = z_2$. The potential at $B$ is equal to

$$V_1 = -2Q\log\frac{C-z_1}{r} + 2Q\log\frac{z_2}{r},$$

while that at $A$ is equal to

$$V_2 = -2Q\log\frac{C+z_2}{r} + 2Q\log\frac{z_1}{r}.$$

But $B$ and $A$ lie on the same equipotential surface. Therefore

$$\log\frac{C-z_1}{r} - \log\frac{z_2}{r} = \log\frac{C+z_2}{r} - \log\frac{z_1}{r}$$

$$\log\frac{C-z_1}{z_2} = \log\frac{C+z_2}{z_1}$$

$$\frac{C-z_1}{z_2} \cdot \frac{z_1}{C+z_2} = 1$$

$$Cz_1 = C^2 - z_2^2. \qquad (3)$$

$z_1$ is determined by equation (3) if $z_2$ is known. But $z_2$ can be determined from the relation

$$V = V_1 \text{ or } V_2 = 2Q\log\frac{C+z_2}{r} - 2Q\log\frac{z_2}{r}$$

$$= 2Q\log\frac{C+z_2}{z_2}. \qquad (4)$$

$$z_2 = \frac{C}{1-\log^{-1}\frac{V}{2Q}} = \frac{C}{1-2.3\log_{10}\frac{V}{2Q}}. \qquad (5)$$

If $V$ is given various values, $z_2$ and $z_1$ can be determined. Now, the radius of an equipotential surface is equal to $\frac{1}{2}(z_1+z_2)$ and the distance $O_1P_1$ in Fig. 4 is equal to $\frac{1}{2}(z_2-z_1)$. Hence the positions of the centers, as well as the radii, of the equipotential surfaces are determined.

While formulas (3) and (4) are adapted to the drawing of equipotential surfaces for two concentrated charges, $P_1$ and $P_2$ (Fig. 4), they are not in a convenient form for the determination of the potential difference between two straight parallel cylindrical conductors. Suppose that one desires to determine the potential difference of two conductors which coincide with the equipotential surfaces $V = +0.25$ and $V = -0.25$ (Fig. 1). Let $D$ equal the distance apart of the axes of the conductors and $r_1$ equal the common length of their radii. Turning to Fig. 4, let the equipotential surface $PAB$ represent one of the conductors; a similar circle (not drawn) around $P_2$ will represent the other conductor. Since the surfaces of the conductors are equipotential surfaces, the points $P_1$ and $P_2$ (position of both as yet undetermined) are inverse points with the cross-section of either conductor corresponding to a circle of inversion. Hence

$$P_1O_1 \cdot P_1O_2 = (O_1P_1)^2,$$

but

$$P_2O_2 = D - P_1O_1,$$

hence

$$P_1O_1(D - P_1O_1) = r_1^2,$$

and

$$P_1O_1 = \frac{D}{2} - \sqrt{\frac{D^2}{4} - r_1^2};$$

but

$$z_1 = r_1 + P_1O_1,$$

also

$$C = D - 2P_1O_1.$$

ence, by substitution in equation (4),

$$V = -2Q \log \frac{r_1 + \frac{D}{2} + \sqrt{\frac{D^2}{4} - r_1^2}}{r_1 + \frac{D}{2} - \sqrt{\frac{D^2}{4} - r_1^2}},$$

the potential difference of the two wires is equal to

$$2V = -4Q \log \frac{r_1 + \frac{D}{2} + \sqrt{\frac{D^2}{4} - r_1^2}}{r_1 + \frac{D}{2} - \sqrt{\frac{D^2}{4} - r_1^2}}. \qquad (6)$$

he minus sign for the potential occurs because equation (4) is based on an equation which contains both $-Q_1$ and $-Q_2$ and proper care was not observed in the e of these signs. The matter is unimportant because if ne wire is at a higher potential than the other, the difference of potential is positive or negative according to the point of view.

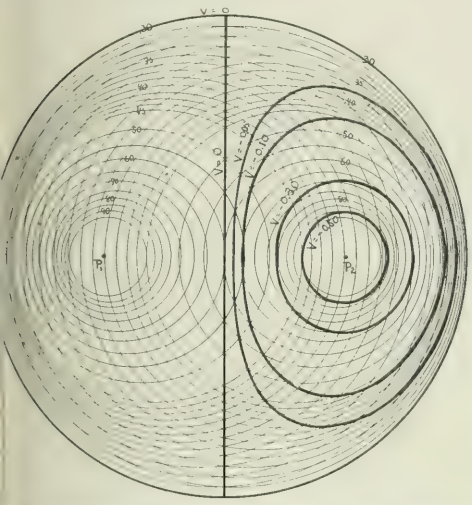


FIG. 6—EQUIPOTENTIAL SURFACES WITHIN A CABLE SHEATH SET UP BY PARALLEL LINEAR CHARGES OF EQUAL MAGNITUDE BUT OPPOSITE SIGN

Formula (6) may be checked by Fig. 1. The constants f the equipotential surfaces, $V = +0.50$ and $V = -0.50$, a originally drawn to scale, are $D = 2.46$, $r_1 = 0.70$ and = 0.217, so that

$$2 \times 0.217 \times 2.3 = 1.00$$

E formula (6), using the lower sign of the radical,

$$2V = 2 \log_{10} \frac{0.70 + 1.23 + 1.01}{0.70 + 1.23 - 1.01} = 1.004.$$

According to Fig. 1, $2V = 1.00$.

f $D$ is large compared with $r_1$, formula (6) becomes

$$2V = -4Q \log \frac{D + r_1}{r_1}. \qquad (7)$$

The use of the other sign of the radical in formula (6) merely changes the algebraic value of the potential but ne its arithmetical value.

### Capacity of Two Straight Parallel Cylindrical Conductors

The capacity of two straight parallel cylindrical conductors in any medium of specific capacity $k$ is

$$C = \frac{kQ}{2V},$$

where $2V$ is the potential difference between the conductors. Substituting formula (6)

$$C = \frac{k}{4 \log \frac{r_1 + \frac{D}{2} + \sqrt{\frac{D^2}{4} - r_1^2}}{r_1 + \frac{D}{2} - \sqrt{\frac{D^2}{4} - r_1^2}}} \text{ electrostatic units.}$$

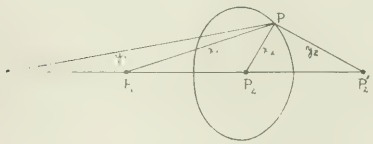



FIG. 7—METHOD OF CONSTRUCTING EQUIPOTENTIAL SURFACES WITHIN A TWO-CONDUCTOR CABLE

### Capacity of a Two-Conductor Cable with Grounded Sheath

As is well known, a problem of this kind is generally solved by the method of "electrical images," which was devised by Lord Kelvin.‡ Because Lord Kelvin and others applied the method to charged spheres and similar problems only, it is necessary to adapt the method to the case of linear charges.

Let $P_1$ and $P_2$ (Fig. 5) represent two parallel conductors of infinitesimal cross-sectional area. Let $+Q_1$ and $-Q_2$ ($Q_1 = Q_2$ numerically) be the charges per unit length of $P_1$ and $P_2$ respectively. At $P_1'$ let us suppose there is another infinitesimal conductor, charged with $-Q_1$ units of electricity per unit length. With $O$, the point midway between $P_1$ and $P_2$, as a center, describe a circle $LMN$ with radius $a$. The distances $P_1'O$ and $a$ are defined by the inverse point relation, i. e., $P_1'O \times P_1O = a^2$. The equipotential surfaces for $P_1$ and $P_1'$ can now be drawn according to the method illustrated by Fig. 1 or by means of equations (3) and (4). It is evident that one of the surfaces, $V = 0.30$ in Fig. 6, will coincide with $LMN$. In the same manner one can find the equipotential surfaces for $P_2$ and $P_2'$, where $P_2'$ bears the same relation to $P_2$ that $P_1'$ bears to $P_1$. One of these surfaces, $V = 0.30$ in Fig. 6, will coincide with $LMN$. The two surfaces which coincide with $LMN$ and consequently coincide with each other are of opposite sign because the charges at $P_1$ and $P_2$ are of opposite sign; hence $LMN$ represents an equipotential surface at zero potential. A thin conductor may be made to coincide with $LMN$ and the equipotential surfaces will remain unchanged. If this conductor is grounded, the wires $P_1'$ and $P_2'$ together with their charges may be removed and the equipotential surfaces within $LMN$ will remain unchanged. If $LMN$ be supposed to represent the inside surface of a cable sheath, then the equipotential surfaces due to the grounded cable sheath and the two conductors $P_1$ and $P_2$ may be obtained by combining the sur-

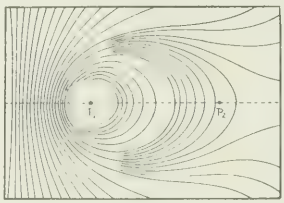


FIG. 8—EQUIPOTENTIAL SURFACES WHEN THE IMAGE CHARGE IS DISTORTED IN MAGNITUDE AND POSITION

‡See Chapter XI, Vol. 1, "Electricity and Magnetism," by Clerk Maxwell.

faces due to $P_1$ and $P_1'$ with those due to $P_2$ and $P_2'$. This is done in Fig. 6, where a number of surfaces around $P_2$ are drawn with heavy lines. The surfaces around $P_1$ are not drawn, but would be similar to those around $P_2$. Now, any surface such as $V = -0.30$ around $P_2$ and the corresponding surface $V = +0.30$ around $P_1$ can be replaced with conductors charged with $-Q_2$ and $+Q_2$ units of electricity respectively, the charges at $P_2$ and $P_1$ being withdrawn, and the equipotential surfaces between the conductors and the sheath will remain unchanged. Hence, if the inside surface of a cable sheath coincided with the circular equipotential surface $V = 0$, and the two conductors coincided with the surfaces $V = -0.30$ and $V = +0.30$, the difference of potential between the conductors could be obtained by the method of constructing Fig. 6. As constructed, $k = 1$, $Q_2 = 0.217$ electrostatic units, and the potential difference between conductors is 0.60 electrostatic units. If $k$ were taken greater than unity, the potential difference of the conductors would have been equal to $0.60 \div k$.

The capacity of this cable per unit length is equal to

$$C = \frac{kQ}{V} = \frac{k \times 0.217}{0.60} = k \times 0.362 \text{ electrostatic unit.}$$

By reference to Fig. 6, it will be seen that some of the resultant equipotential surfaces are nearly circular in cross-section while others depart very much from the circular form. Furthermore, the equipotential surfaces which are nearly of circular cross-section are not concentric with $P_1$ or $P_2$.

An equation for the resultant equipotential surfaces in Fig. 6 can be easily derived, but the equation is not in a form which is easy to use. The potential at any point in Fig. 6 is equal to the algebraic sum of the potentials due to $P_1$ and $P_1'$ considered as one system and $P_2$ and $P_2'$ considered as a second system. If these two potentials are $V_1$ and $V_2$ respectively, then the potential at any point is equal to (see Fig. 7)

$$V = V_1 + V_2 = 2Q \log \frac{x_1}{y_1} - 2Q \log \frac{x_2}{y_2}$$

$$= 2Q \log \frac{x_1}{y_1} \div \frac{x_2}{y_2},$$

where the charge per unit length of $P_1$ is $+Q_1$ units and that on $P_2$ is $-Q_2$ units ($Q_1 = Q_2 = Q$ numerically). Or

$$\frac{x_1 y_2}{y_1 x_2} = \log^{-1} \frac{V}{2Q} = R = \text{a constant.}$$

$$\frac{x_1}{y_1} = R \frac{x_2}{y_2} \qquad (7)$$

For $V = 0$, i. e., for $R = 1$

$$\frac{x_1}{y_1} = \frac{x_2}{y_2} \qquad (8)$$

But it has already been shown that the equipotential surface for

$$\frac{x_1}{y_1} = \text{a constant} = \frac{x_2}{y_2}$$

is a circle. Hence equation (8) represents an equipotential surface, $V = 0$, which is circular in cross-section. Although the general equation (7) will give any of the equipotential surfaces, it is not in a form that renders computation easy.

While the foregoing theory will enable one to design a two-conductor cable of circular cross-section having a homogeneous dielectric, it does not lend itself to the computation of the potential difference of the conductors, and hence to the computation of the capacity of a cable which is already made. Clerk Maxwell has well said: "It appears, therefore, that what we should naturally call the inverse problem of determining the forms of the conductors when the . . . potential is given is more manageable than the direct problem of determining the potential when the form of the conductors is given."

The capacity of a cable constructed after Fig. 5 is, of course, equal to

$$C = \frac{kQ}{V}$$

where $k$ is the specific capacity of the dielectric, $Q$ is equal numerically to the charge per unit length of $P_1$ or $P_2$ and $V$ is the difference of potential of two equipotential surfaces in Fig. 6 (those around $P_1$ are not drawn), which is constructed with $k =$ unity for convenience.

In Fig. 5, $P_2'$ and $P_2'$, with their charges $-Q_1$ and $+Q_2$, may be called the "electrical images" of $P_1$ and $P_2$ in the sheath, the inside surface of which coincides with *LMN*. In this case the "image" charge was taken equal to the "object" charge and the distances $P_2'O$ and $P_1O$ were related to $a$ by the inverse point relation. Obviously neither of these conditions need be fulfilled, and figures not at all like Fig. 6 might result. In Fig. 8 are shown several equipotential surfaces which result from charges spaced as in Fig. 5 but with the "image" charge taken as numerically equal to the "object charge" multiplied by $a \div P_1O$. This value was chosen at random, being suggested by the fact that it is the proper value to assume with point charges in order to fulfil the "image" relation in a spherical conductor. The equipotential surfaces for $P_1$ and $P_1'$ are shown in Fig. 9, $P_1'$ being situated to the left of $P_1$ and not shown in the figure. Obviously the equipotential surfaces for $P_2$ and $P_2'$ are correctly pictured by inverting Fig. 9 and assuming $P_1$ to represent $P_2$. These two sets of equipotential surfaces can be combined to produce those shown in Fig. 8. The cross-section of the inside surface of the resulting cable sheath, corresponding to $V = 0$ in the figure, is seen to be approximately elliptical in form. The other equipotential surfaces approach the circular form but are not concentric about $P_1$ and $P_2$. Fig. 8 is obviously not suited to cable design because if the conductors are supposed to coincide with the equipotential surfaces, $V = +20$ and $V = -20$ say, the dielectric between the two conductors is far thicker than twice that between conductor and cable sheath.

## Conclusions

The theoretically exact formula for the capacity of a two-wire transmission line, as deduced above, is

$$C = \frac{1}{4 \log \dfrac{\frac{D}{2} + \sqrt{\frac{D^2}{4} - r_1^2}}{r_1 \div \frac{D}{2} - \sqrt{\frac{D^2}{4} - r_1^2}}}$$

where $C$ is the capacity in electrostatic units of one centimeter length of conductor, $D$ is the distance between centers of conductors and $r_1$ is the radius of either conductor. The usual formula is

$$C = \frac{1}{4 \log_e \dfrac{D - r_1}{r_1}}.$$

Reducing both formulas to microfarads per 1000 ft. of conductor and changing to logarithims having the base 10, the formulas become

$$C = \frac{0.003677}{\log_{10} \dfrac{\frac{D}{2} + \sqrt{\frac{D^2}{4} - r_1^2}}{r_1 \div \frac{D}{2} - \sqrt{\frac{D^2}{4} - r_1^2}}} \qquad (9)$$

and

$$C = \frac{0.003677}{\log_{10} \dfrac{D - r_1}{r_1}}$$

The error introduced by using the second formula when

he conductors are large and near together has already been illustrated. When the conductors are small and relatively far apart, the second formula is not much in error, though a better form for it is

$$C = \frac{0.003677}{\log_{10} \frac{D}{r_1}} \qquad (10)$$

For example, consider No. 0000 B. & S. round wire spaced 6 ft. apart. According to formula (9), the capacity is equal to 0.00147 microfarads per 1000 ft., and according to formula (10) it is equal to 0.00147 microfarads. The error is too small to be calculated on the slide rule. However, the second formula must not be assumed to hold when $D$ is not large with respect to $r_1$. It could not be expected to hold in the case of wires close together as in a cable.

Since the formula for the capacity of a three-phase, three-wire transmission line, with wires situated at the vertices of an equilateral triangle, is based directly upon the formula for a single-phase line, the necessary correction for the three-phase formula can be obtained directly from equation (9).

The capacity of a two-conductor cable with grounded sheath can be arrived at by means of the method used in connection with Fig. 6. Referring to this figure, it will be seen that the equipotential surface $V = -0.50$ around $P_2$ is nearly circular in cross-section and is nearly concentric about $P_2$. The constants of Fig. 6 may be used to calculate

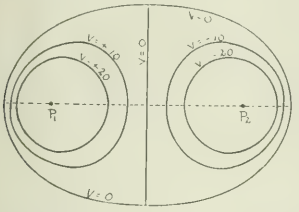



FIG. 9—EQUIPOTENTIAL SURFACES WITHIN A TWO-CONDUCTOR CABLE HAVING AN ELLIPTICAL SHEATH

the capacity of a two-conductor cable in which the inside of the sheath coincides with the circular equipotential surface $V = 0$, and the two conductors of which coincide with the equipotential surface $V = -0.50$ around $P_2$ and the corresponding surface around $P_1$. The difference in potential of the conductors is then $V = 1$ electrostatic unit when the conductors are charged one with $+0.217$ and the other with $-0.217$ electrostatic units of electricity. The capacity is then

$$C = \frac{Q}{V} = \frac{0.217}{1.000} = 0.217$$

electrostatic units per centimeter length of cable. This result is based upon the supposition that the specific capacity of the dielectric is unity. If the specific capacity were equal to $k$, the capacity would be $k$ times the value above. According to the usual formula, the capacity is

$$C = \frac{0.003677k}{\log_{10}\left[\frac{D}{r_1}\left(\frac{a^2 - \frac{D^2}{4}}{a^2 + \frac{D^2}{4}}\right)\right]}$$

microfarads per 1000 ft. of cable. As drawn to scale, the constants of Fig. 6 are: $k = 1$, $D = 4$, $a = 4$ and $r_1 = 0.25$. Substituting these constants, $C = 0.00721$ microfarads per 1000 ft. of cable. To compare with the value 0.217 electrostatic units of capacity per centimeter of cable it is necessary to change this value to microfarads per 1000 ft.; the result is 0.00735 microfarads per 1000 ft. The difference between the two values is not of importance, and shows that the unequal distribution of the charge about the surface of the conductor is not so great in a two-conductor cable as it would be in a two-conductor transmission line of the same size of wire and spacing. But, from Fig. 6, it is evident that if larger circular conductors are placed in the same sheath, the usual formula could not be expected to hold because the surfaces of the conductors would not correspond to the equipotential surfaces. To compute the capacity from the constants of Fig. 6, the conductors would have to be of cross-section far from circular. To compute the capacity of a cable in which the conductors are of circular cross-section and large—that is, occupy most of the space within the cable sheath—is probably impossible at the present time.

## Federal Permit for Power Development on the Pend d'Oreille

On July 29 the Secretaries of the Interior and of Agriculture jointly in behalf of the government issued a permit to the International Power & Manufacturing Company, of Spokane, Wash., granting the right to construct and operate a large hydroelectric undertaking on the Pend d'Oreille River, otherwise known as Clark's Fork, in the State of Washington, and situated on the public domain. The permit itself is an elaborate document, an abstract of the leading features of which is presented in what follows. Literally the permit covers the use and occupancy of certain lands of the Department of the Interior and in the national forests, said use and occupancy, however, being necessary for the construction of the works, part of which—the dam—had already been authorized by Congressional act. Certain provisions as to state regulation and the use of the lands in connection with any unlawful trust, and an agreement that the lands and permit shall be considered as of no value in respect to sale of the property or to regulation, follow closely those contained in the transmission line permit to the Great Falls Power Company, abstracted in the *Electrical World* of Feb. 8. The permit is indefinite as to period, but revocable, after due notice and hearing, for violation of the terms thereof. The most novel features of all relate to the fixing of maximum rates for energy and the compensation to be paid to the government. The Secretary of the Interior states that at lowest stages the stream flow is sufficient for the development of about 120,000 continuous hp and by use of storage facilities upon the stream above 350,000 hp can eventually be developed during years of low precipitation.

Among the definitions set forth in Section 1 of the permit, the following are of special interest:

"Nominal stream flow" means the sum of (a) the average of the values estimated for the mean natural flow for the two-month (calendar) minimum-flow period in each successive five-year cycle or major fraction thereof, and (b) the increase in such average due to artificial means other than the project works.

"Project storage flow" means the estimated increase in nominal stream flow made practicable by the project works.

"Available stream flow" means the sum of nominal stream flow and project storage flow.

"Total capacity of the power site" means the power estimated to be available for transmission, and is determined as the continued product of (1) the factor 0.08; (2) the average effective head, in feet; (3) the available stream flow at the intake (in cubic feet per second and in amount not to exceed the maximum hydraulic capacity of the project works), and (4) a factor, not less than the average load-factor of the power system, representing the degree of practicable utilization of the available stream flow, and based on the extent of practicable forebay storage and the load-factor of the system.

Respecting the compensation to be paid for the privilege, the power company will be required to pay nothing prior to the year 1923, but on or before the first day of February in each year, beginning with 1924, the permittee shall pay an amount calculated from the total capacity of the power site at rates per horse-power per year varying directly as the square of the average price for electric energy charged to customers and consumers of the permittee and varying inversely as the square of the proportional development of the power site, as shown by the accompanying table:

[illegible] development of power site [illegible]

| [illegible] mittee is as shown by this column. | Then the rates of compensation to the United States per horse-power per year will be as shown below | | | | | | |
|---|---|---|---|---|---|---|---|
| [illegible] | [illegible] | $0.06 | [illegible] | $0.10 | $0.14 | $0.20 | [illegible] |
| 0.3 and over 0.2 | [illegible] | 0.14 | 0.18 | 0.23 | 0.31 | 0.45 | [illegible] |
| 0.4 and over 0.3 | 0.20 | 0.25 | 0.31 | 0.41 | 0.56 | 0.80 | [illegible] |
| 0.5 and over 0.4 | 0.31 | 0.39 | 0.49 | 0.64 | 0.87 | 1.25 | [illegible] |
| 0.6 and over 0.5 | 0.45 | 0.56 | 0.70 | 0.92 | 1.25 | 1.80 | [illegible] |
| 0.7 and over 0.6 | 0.61 | 0.76 | 0.96 | 1.25 | 1.70 | 2.45 | [illegible] |
| 0.8 and over 0.7 | 0.80 | 0.99 | 1.25 | 1.63 | 2.22 | [illegible] | [illegible] |
| 0.9 and over 0.8 | 1.01 | 1.25 | 1.58 | 2.06 | 2.81 | 4.05 | 6.33 |
| 1.0 and over 0.9 | 1.25 | 1.54 | 1.95 | 2.55 | 3.47 | 5.00 | 7.81 |
| [illegible] | 1.80 | 2.22 | 2.81 | 3.67 | 5.00 | 7.20 | 11.25 |
| 1.5 and over 1.2 | 2.81 | 3.47 | 4.40 | 5.74 | 7.82 | 11.25 | 17.60 |
| 2 and over [illegible] | [illegible] | 6.17 | 7.82 | 10.00 | 13.80 | 20.00 | 31.25 |
| 3 and over 2 | 11.25 | 13.87 | 17.58 | 22.95 | 31.25 | 45.00 | 70.40 |
| 4 and over 3 | 20.00 | 24.70 | 31.25 | 40.80 | 55.60 | 80.00 | [illegible] |
| 5 and over 4 | 31.25 | [illegible] | [illegible] | 63.80 | 86.80 | 125.00 | [illegible] |
| [illegible] | 45.00 | 55.60 | 70.40 | 91.80 | 125.00 | 180.00 | [illegible] |

At any time not less than ten years after the date for the first payment or after the last revision of the rates of compensation the Secretaries of the Interior and Agriculture may review such rates after application by or notice to the permittee and impose such new rates of compensation as they may decide to be reasonable and proper, provided that such rates shall not be so increased as to result in reducing the margin of income (including appreciation in land values) from the project over proper actual and estimated expenses (including reasonable allowance for renewals and sinking-fund charges) to an amount which, in view of all the circumstances (including fair development expenses and working capital) and risks of the enterprise (including obsolescence, inadequacy and supersession), is unreasonably small; but the burden of proving such unreasonableness shall rest upon the permittee.

Complete development of the power site shall mean the construction of such permanent project works and the installation of such generating equipment as will provide for the full utilization of the total capacity of the power site.

The project works as a whole, excepting installation of hydraulic and electric machinery, shall be begun within one year and completed within three years. Machinery of 50,000-hp rating shall be installed within three years, and additional machinery shall be installed as the conditions of the market will warrant or as the Secretaries or any duly authorized State agency may direct.

The average price for electric energy charged to customers and consumers of the permittee shall be determined by dividing the total actual and estimated annual receipts from the sale and disposition of electric energy by the total number of kilowatt-hours generated, provided that in determining said total annual receipts there shall be included estimated receipts for any electric energy used by the permittee at a price which shall not be less than 2 cents per kw-hr. nor less than the cost per kilowatt-hour of generating, transmitting and delivering such energy to the point of use, taking into account proper operating and maintenance expenses, fixed charges and reasonable allowances for renewals and sinking fund.

Unless otherwise authorized by the Secretaries of the Interior and Agriculture, the maximum price at which electric energy developed by or transmitted from the power project may be disposed of to customers or consumers shall not exceed 6 cents per kw-hr., and the maximum price at which such electric energy in excess of 2000 kw-hr per annum with an average annual delivery of more than 25 per cent of the connected installation within the year may be disposed of to customers or consumers shall not exceed 2 cents per kw-hr., said maximum price being determined by dividing the total annual charge to the purchaser by the corresponding total annual delivery to him of electric energy. In contracts with its customers the permittee shall specify the maximum price of final sale or resale and shall reserve the right to cancel any contract or agreement for sale or resale of electric energy that provides for a price in excess of such maximum. No more than 50 per cent of the total deliverable capacity of the power site shall be delivered to any one consumer. The total capacity of the site shall be deemed and taken to be 112,000 hp, but is subject to adjustment by the Secretaries annually to provide for increase or decrease, by storage or otherwise, of available stream flow to an amount of 10 per cent or more, or for increase or decrease of 10 per cent or more in average effective head, or in degree of practicable utilization.

The permittee is, upon demand in writing by the Secretaries, to surrender the permit to the United States or to transfer the same to such state or municipal corporation as the Secretaries may designate, and to sell or transfer with the permit all property then owned or held by the permittee on lands of the United States and then valuable or serviceable in the generation, transmission and distribution of energy, provided (a) that such transfer shall not be demanded in the case of a municipal corporation unless by condemnation such corporation shall have acquired, or unless by proceedings in a court of competent jurisdiction it shall have been determined that such a municipal corporation has the right to acquire, the property of the permittee situated elsewhere than on public land, or unless such municipal corporation has the power to acquire the property and rights of the permittee in accordance with the following conditions: (b) that such surrender or transfer shall be on condition precedent that the United States shall pay or the transferee shall first pay to the permittee the reasonable value of all such works and property to be surrendered or transferred; (c) that such reasonable value shall not include any sum for any permit, right, franchise or property granted by any public authority in excess of the sum paid to such public authority as a purchase price therefor, and (d) that such reasonable value shall be determined by mutual agreement of the parties in interest, and in case they cannot agree, by the Secretaries under a rule which, except as modified by the requirements of this section, shall be the then existing rule of valuation for power properties in condemnation proceedings in the State in which the properties to be surrendered or transferred are located. But nothing herein shall prevent the United States or any state or municipal corporation from acquiring by any other lawful means the permit or the works or property then owned or held by the permittee on lands of the United States occupied or used under the permit.

No value whatsoever shall at any time be assigned to or claimed for the permit or for the occupancy or use of Interior Department lands or national forest lands thereunder, nor shall the permit or such occupancy or use ever be estimated or considered as property upon which the permittee shall be entitled to earn or receive any return. The power company is also enjoined from entering into any unlawful restraint of trade or competition. It is further agreed that at intervals of not less than twenty years, on application of the permittee or on demand of the Secretaries, this agreement and the permit shall be modified to conform to the then subsisting regulations fixed by the Secretaries under the act of 1901 or amendments thereto.

# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## "Iron by Wire"

Advertising electric flatirons, the Union Electric Light Power Company, of St. Louis, adopts the rather striking logan "Iron by wire." It is declared that an electric iron an mean more to the health, comfort and happiness of the ome than any other one thing. On request an electric iron ill be loaned for thirty days' free trial. One point is at "nothing gets hot but the iron." The price made is 3.50, and the irons (except cords) are unconditionally uaranteed to customers, with no time limit.

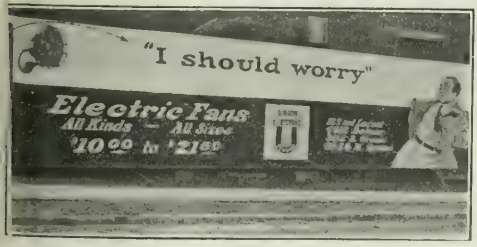
## Electric Pumping for West Springfield, Mass.

Hydroelectric energy supplied from the transmission lines f the Amherst Power Company will supersede steam and asoline engine service on Sept. 1 at the Bear Hole pump- ig station of the West Springfield (Mass.) water-works. wo General Electric motors of 275 hp combined rating ill be installed. The contract for the work, which has een awarded to Mr. P. C. Fitzpatrick, of Springfield, lass., includes a rearrangement of pumps and other sta- on equipment to provide a more efficient service.

## Fan Sales in St. Louis

Electrically lighted billboards bearing the display matter own in the accompanying illustration, coupled with a ecial appliance campaign and the necessary hot weather make it effective, resulted in the largest electric fan sale hich the Union Electric Light & Power Company, St. ouis, has had in years. Fig. 1 shows one of the electrically ghted billboards. There were 715 linear feet of these ards used to advertise the comforts of an electric fan dur- g the otherwise unbearably hot days which have pre- iled over this country during the greater part of the sum- er. The boards range from 30 ft. to 40 ft. in length.

Mr. Charles E. Michel, manager of the new-business de-




F. 1—ADVERTISEMENT ON ELECTRICALLY LIGHTED BILLBOARD

partment of the company, reports that during the last week in June and the first week in July 50 per cent more electric fans were sold than during the entire previous year. The fan campaign was really started on June 25, when the new-appliance room was opened to the public. On that day a 10 per cent discount was offered on everything. During the two weeks mentioned 842 fans were sold, having an aggregate consumption of 55,796 watts. The money paid for the energy consumed by these fans represents a considerable increase over the regular revenue. The fans ranged in diameter from 8 in. to 16 in., most of them having oscillating attachments.

Fig. 2 is a view of the new-appliance room, in which fans and other conveniences made possible by electricity



FIG. 2—NEW-APPLIANCE DISPLAY ROOM

are displayed. The room is lighted by six "brascolite" fixtures, each containing a 250-watt tungsten lamp. This type of lighting has cut down the energy consumption by one-half from what it was when the room was illuminated by direct lighting and has increased the illumination at 3 ft. above the floor from 3.9 to 8.5 ft.-candles. The wall cases and show cases are made of selected quarter-sawed oak lined with black broadcloth. The interior of these cases is lighted by lamps inclosed in semi-cylindrical reflectors arranged horizontally. The compartments below the wall cases are used to store appliances wrapped in cartons.

## Central-Station Improvements at Greenfield, Mass.

The Greenfield (Mass.) Electric Light & Power Company has lately effected a number of improvements in its generating and distributing system which go far toward strengthening the company's position in the north-central portions of the State. A 2000-kw Curtis steam turbine costing about $30,000 has been installed in the main steam plant at Greenfield, with two Porcupine boilers, rated at 500 hp each, at a cost of $11,500. The condensing-water supply formerly pumped into the station has been rearranged to permit its introduction by gravity, and an addition of two 1170-kva waterwheel-driven generators with S. Morgan Smith turbines is being made to the equipment of the company's hydroelectric station at Gardners Falls, on the Deerfield River. The company has erected a transformer station in Barnardston and is distributing energy at 2300 volts there and in the town of Northfield. The river channel below Gardners Falls station has been deepened to supply additional head. A new dam is shortly to be built on the Green River, in Greenfield, to maintain an ample supply of condensing water, and a small water-power is to be developed at this point for supplementary service. The Gardners Falls plant originally contained two

400-kw generators, but, following the developments of the New England Power Company on the Deerfield River described in the Dec. 28, 1912, issue of the *Electrical World*, the opportunity to develop additional power was recognized.

The new equipment at the Gardners Falls station includes two 1450-hp turbines designed to operate at 150 r.p.m. under 37 ft. working head and an exciter turbine of S. Morgan Smith make, rated at 135 hp, the cost of these erected being $11,500, or $3.85 per hp. The electrical apparatus consists of two generators of 1170 kva rating, a 60-kw exciter and three 1200-kva, three-phase transformers for delivering energy at 13,200 volts to the Greenfield company's transmission feeders, the price of this equipment f.o.b. factory being $29,500. The estimated cost of switchboard additions for this installation is about $15,000, including incidentals, and the contract for excavation, extending the station and installing foundations is figured at $4,250.

In a recent statement, Mr. Philip Cabot, vice-president of the company, pointed out its strategic position with reference to neighboring developments and discussed its operating features from the standpoint of economical production. The company purchases surplus energy from the hydroelectric plant of the Turners Falls Power Company at a price of about 0.5 per kw-hr., or less than the cost of coal landed at the Greenfield station. As a result of the use of this exclusive energy and that from Gardners Falls throughout about two-thirds of the year the cost of energy to the Greenfield company is lower than in many other plants in the State doing a larger business. For the calendar year 1912 the company's water-power plant output was 4,080,800 kw-hr.; its steam-plant production was 624,020 kw-hr. and it purchased 3,062,900 kw-hr. The total costs of operation per kw-hr. were: Manufacturing, 6.6 mills; distribution, 4.8 mills; general expense, 2.6 mills; overhead charges, 8.2 mills, the total expense being 2.22 cents per kw-hr. The average revenue per kw-hr. from sales for motor service was 1.76 cents; from commercial lighting, 12.3 cents; public lighting, 5.6 cents; sales to other companies, 2.4 cents. Mr. Cabot further pointed out that the operation of the hydroelectric plants at Turners Falls and Gardners Falls in connection with the steam turbine plants at Greenfield and Easthampton, including in the latter service supplied by the Amherst Power Company, permitted advantageous load-factors to be enjoyed under centralized direction.

## Free Flatiron with Wiring Contract

It is the practice of the Public Service Company of Northern Illinois to give an electric flatiron free to every householder adjacent to its lines who signs a contract for the wiring of his house. Mr. John G. Learned, of that company, reports for the first half of this year 800 contracts for the wiring of old houses, compared with 350 for the corresponding period of last year. Before 1913 the company had never wired more than 1200 houses in one year, but it has set its mark for 2000 for this year. Each of these new customers will have a flatiron as part of his load.

## Free Fan Service for the Sick

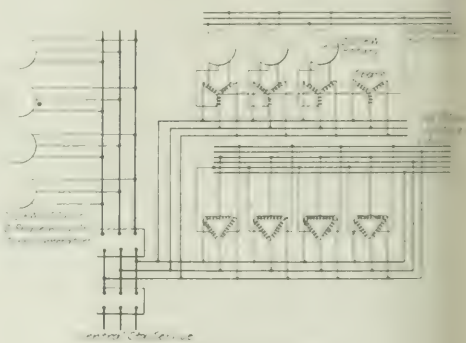
The policy of giving free fan service to the needy sick, which originated with the Rochester (N. Y.) Railway & Light Company some years ago, has been very extensively adopted throughout the country. One of the latest companies to place it in effect is the Kentucky Utilities Company, a subsidiary of the Middle West Utilities Company, which has offered free electric fan service for the remainder of the summer to every sick person who is unable to pay for the service and whose residence can be reached from its existing distributing lines. In order to protect itself against imposition, the company requires its local managers to obtain a physician's statement certifying the necessity of such fan service and also the patient's inability to pay for it. The physician is also instructed to notify the local manager when the necessity for the service ceases.

If the house is not wired, the company will run service wires and install sufficient wiring to operate the fans, loaning the latter to the patient as long as, in the judgment of the physician, may be necessary. Energy for operating the fans is also supplied gratis. The offer applies only in the towns in which the company is supplying twenty-four-hour service and where the service lines can be installed without extending the distributing lines.

As the use of an electric fan greatly improves the condition of a patient whose vitality is reduced by the extreme heat of the summer months, and sometimes represents the narrow margin between life and death, this generous offer has been very effective in securing the good will of the community in which the electric service is available.

## Electric Service for Large Office Building Controlled from Another Building a Block Away

Because space in the new Railway Exchange Building in St. Louis is so very valuable, all feeder switching apparatus is installed in the basement of another building in an adjoining block. Electrical energy will be secured from an isolated plant and also from the Laclede Gas Company of St. Louis. The isolated plant is in the same basement as the feeder switchboard and will be operated by the Light



CONTROL CONNECTIONS

& Development Company, of St. Louis. In a basement adjoining the isolated plant the Laclede company is erecting a substation. During the winter the isolated plant will furnish energy for a load of about 1800 kw, as well as the heat for the building, while from May 1 to Oct. 1 the energy will be purchased from the central-station company.

The isolated-plant generating equipment will consist of four 750-kw, 250-volt, three-phase, 60-cycle General Electric turbo-generators, which will receive steam from four 500-hp Heine boilers. A 600-ton concrete coal bunker into which coal can be unloaded through manholes in the sidewalk is provided, and an endless belt conveyor receives coal from chutes opening out of the bottom of the bunker and conveys its charge to 10-ton overhead hoppers. Ashes may be disposed of by means of small cars dumped onto telescoping sidewalk lifts, or by a vacuum ash-handling system, and loaded onto wagons.

The steam-turbine units supply energy at 250 volts to eight 300-kw, three-phase auto-transformers, four of which are delta-connected and supply energy for lighting circuits. Taps are provided in the middle of each leg of the delta for three-wire service, the middle taps being unfused, sin-

an unbalanced load on the three-wire system would cause lamps to burn out in case a fuse was ruptured. Busbars connect all of the 250-volt taps on these auto-transformers so that a tie switch may be used to connect with the central-station source of supply. The remaining transformers are star-connected and supply energy to three 300-kw rotary converters. The rotaries supply direct current at 250 volts for elevator service, and a tap from the neutral of the sets provides for 125-volt direct-current service.

Four 300-kw, 4150-250-volt, three-phase transformers are also installed in the basement and receive energy from the Laclede Gas Light Company's adjoining basement substation. The secondary terminals of these transformers may be connected onto the 250-volt alternating-current bus by a tie-switch when it is desired to change over from one source to the other.

## Merit System for Central-Station Salesmen and Solicitors

A plan of remuneration of the sales force of the Union Electric Light & Power Company, of St. Louis, according to the merit system, has now been in force for about a year and the results obtained therefrom have proved very satisfactory. Operated in conjunction with the merit system there is a sales school, sessions of which are held every Saturday afternoon in the company's office building under the instruction of a faculty composed of three industrial graduate engineers, the assistant sales manager and Mr. F. D. Beardslee, sales manager. The purpose of the course is to familiarize the employees of the sales department with rate schedules and general terms and conditions of contracts, and also to ascertain what each man knows so that the proper one can be picked for certain duties.

Every employee of this department is assigned to one of the three classes, the attendance at which is compulsory. Class No. 1 is composed of new men and others whose understanding of the business is questioned. Class No. 2 is composed of men better posted in matters of salesmanship and rates pertaining to commercial lighting and small motor-service business. No. 3, the advanced class, is composed of industrial engineers and men who are familiar with all phases of the sales business of the company.

In class No. 1 the men are taught the fundamentals of rate-making, reasons for certain rates, and the application of rates to residential and ordinary commercial lighting and small-motor business. They are also drilled with reference to taking and handling business according to the company's handbook. In class No. 2 the student is taught the application of rates in the more complicated commercial lighting and medium-sized motor installations, receiving in addition some instruction in illuminating engineering. In class No. 3 discussions on various applications of electric drive to industrial purposes are taken part in, and rate schedules are applied to mixed lighting and motor installations. Lectures by engineers are given from time to time before this class.

Promotions are made from the different classes as soon as the student is able to pass the corresponding examination, which consists of twenty written questions and oral demonstrations on ability to sell electric service to one of the faculty.

The accompanying chart shows the scheme of paying the salesmen on an equitable basis. The plan is that the monthly salaries shall increase with each year's service with the company, thereby giving the older employees a higher salary, on the general theory that the longer a man stays with the company the more valuable his services become. On the other hand, a new man on a smaller salary, if more capable, may earn more by obtaining high merit points as indicated in the chart. To equalize the merit points which are received from different districts, sections of the city in which business is comparatively easy to obtain are labeled with handicaps. Each district has a specified minimum business determined from past records.

The sequence of promotion is in the order of residential, commercial and industrial service salesmen, but after ten years' employment it is considered that the men will be in a position to justify advancement to salaries which are not covered by this schedule. Errors are provided for by deducting merit points. As occasions demand the merit chart is revised. As the men progress from class No. 1 to class No. 2 they are considered as having advanced one year in the service of the company. A commercial chart is located in the salesmen's meeting room, on which the business which each salesman has done during the day is recorded, with the corresponding merit points. This bulletin is watched like a "baseball-return" board, and it inspires each man to surpass the others.

CHART OF MERIT SYSTEM OF PAYMENT FOR CENTRAL-STATION SALESMEN

PAYMENTS FOR MERIT

| Commercial Salesmen | | Residential Salesmen | |
|---|---|---|---|
| First | $40.00 | First | $15.00 |
| Second | 30.00 | Second | 10.00 |
| Third | 20.00 | Third | 7.50 |
| Fourth | 10.00 | Fourth | 5.00 |
| Fifth | 5.00 | | |

COMMERCIAL SERVICE SALESMEN—MERIT POINTS

| | |
|---|---|
| For each new-business contract on office call (not additional) | 3 |
| For each new-business contract on personal call (not additional) | 6 |
| For each successor's contract | 2 |
| For each kw capacity, new business and additional | 1 |
| For each $100 estimated yearly revenue | 3 |
| For each $10 appliance sales | 3 |
| For each suggestion for good of the service which is adopted | 10 |

RESIDENTIAL SERVICE SALESMEN—MERIT POINTS

| | |
|---|---|
| For each new-business contract on office call (not additional) | 3 |
| For each new-business contract on personal call (not additional) | 6 |
| For each successor's contract | 2 |
| For each contract to wire old houses | 10 |
| For each kw capacity, new business and additional | 1 |
| For each $100 estimated yearly revenue | 3 |
| For each $10 appliance sales | 3 |
| For each suggestion for good of the service which is adopted | 10 |

HANDICAPS AND MINIMUMS

| Districts | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Commercial: | | | | | | | | | | |
| Handicaps | 100 | 90 | 90 | 80 | 70 | 100 | . | | 30 | 40 |
| Minimums | 200 | 190 | 190 | 180 | 170 | 150 | 100 | 100 | 130 | 140 |
| Residential. | | | | | | | | | | |
| Handicaps | 80 | 100 | 50 | 80 | 80 | | 60 | 30 | | |
| Minimums | 180 | 200 | 150 | 180 | 180 | 100 | 160 | 130 | | |

INDUSTRIAL SERVICE SALESMEN

Salaries based on efficiency and each salesman handicapped one point for each dollar of monthly salary. Merit points same as commercial-service salesmen.

Monthly payments for merit: First, $15; second, $10; third, $5.

APPLICATION AND LAMP ENGINEERS, MAIN OFFICE AND BRANCHES

Salaries based on efficiency.

Merit points: For each $10 appliance sale, $3.

Monthly payments for merit: First, $5; second, $3; third, $2.

Note.—No merit payment will be made to any individual, unless he or she has obtained nine or more points during the month

# Illumination and Wiring

## Special Sidewalk Lighting for Theater Approach

An effective method of calling attention to the shortest route to the playhouses is shown in the accompanying illustration of a special sidewalk lighting installation at Worcester, Mass., used by the Worcester Theater. The establishment is located on a side street and slightly below the main thoroughfare of traffic. To provide better illumination for patrons and to establish an avenue of light leading directly to the main entrance seven pipe-frame brackets were attached to the side walls of a hotel building bordering the passageway, each bracket being equipped with six 25-watt tungsten lamps with clear bulbs. The brackets are about 7 ft. long and are about 25 ft. apart, being from 15 ft. to 20 ft. above the sidewalk. The wiring is carried in conduit along the outer wall of the hotel, with fuse



ILLUMINATION FOR THEATER APPROACH

boxes at the individual brackets. The sidewalk is 7 ft. wide, and at the end of the row of brackets a large electric sign projects from the theater into the street, forming a climax in the perspective. Energy is supplied by the local central station.

## Distribution Line Records—II

By H. A. Holmes

In last week's issue it was suggested that data on manholes, poles, etc., might be kept on cards instead of on drawings. Fig. 6 represents a series of 5-in. by 8-in. cards showing each manhole, the ducts occupied and the apparatus in the manhole. Manholes should be numbered on the decimal system. By doing so intermediate manholes or handholes can be inserted without disarranging the numbering scheme. For example, if Nos. 5 and 6 have been assigned to two manholes about 400 ft. apart and a handhole is placed about 100 ft. from No. 5, the number assigned to this would be 5.2. If two manholes were afterward installed between Nos. 5 and 5.2, they could be numbered 5.05 and 5.1. This subdivision may be carried as far as necessary. The four ruled squares grouped around the central square represent the side of the manhole laid down flat. They are ruled in squares so that the ducts can be easily outlined by following these lines. Their approximate point of entrance to the manhole can also be shown, and if transformers are installed in the manhole the location may be indicated by a circle drawn with water-color. The number of the transformer should be marked near it with water-color. The size and other data should be placed on the back of the card (Fig. 6a). Data on switches and branch or main fuses should also be recorded on the back of the card. If the dimensions given are entered on this card, it will often save reference to the drawings in Series No. 5. These dimensions should not be considered essential, however. In the system for which this card was designed the number of ducts in a row might increase to

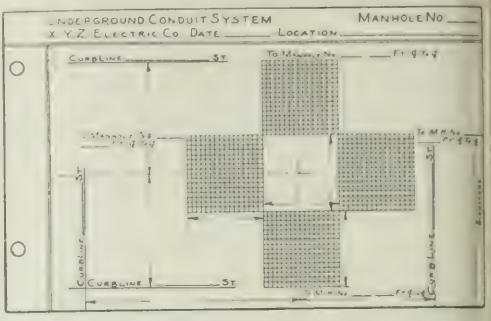



FIG. 6—MANHOLE RECORD CARD

sixteen. This made the size of the ruled squares so small that the number of the circuit could not be placed in the square corresponding to the proper duct. The occupied ducts are merely indicated by a dot. If it is known that the number of ducts will not exceed that many, the squares may be enlarged and this card may then render the use of the one shown in Fig. 7 unnecessary. The card should be filled in by the construction foreman and punched for his note book. In this connection it may be suggested that all work orders, etc., be made on 5-in. by 8-in. cards and punched similarly for use in these notebooks. When properly filled in, the card is turned over to the engineering department for use as a guide for the inspector in obtaining data for the remaining series. It is possible that the construction foreman's order can be arranged so that the purpose served by Fig. 6 can be performed by it. If so, it would be unwise to duplicate his work by using the front of this card.

Fig. 7 represents a series of 5-in. by 8-in. cards showing a section between each two manholes. This card involves a system of numbering ducts. The following is suggested

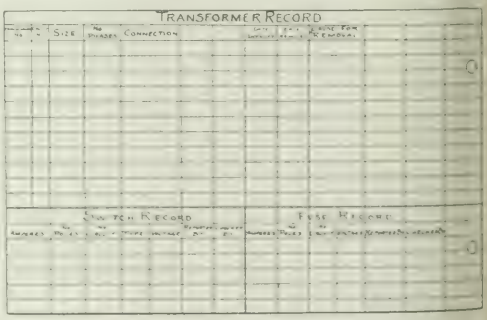



FIG. 6A—REVERSE SIDE OF CARD SHOWN IN FIG. 6

Stand so that you can look along the line of ducts and face either northeast, north, northwest or west and number the ducts from left to right beginning at the top. The only object of numbering the ducts is to enable an order to be sent to the construction department to pull cable in a certain duct or replace cable in a certain duct. As the method of showing the duct cross-section may not be clearly under

stood, an instance has been shown in Fig. 7 where a system of ducts has been outlined and numbered. The other columns are self-explanatory. A line is used for each cable. The information "date removed" and "cause of removal" may not seem necessary to some, but if the column "date removed" were not supplied it would be necessary to cross out a line when a cable is removed. This confuses the record, and it is much neater and easier to insert a date which will supersede the record than to cross out a line of writing. The cause of removal may be interesting in noting the behavior of different classes of cable and the growth of business. It will also indicate whether sufficient allowance for increase in load is being made. It may be omitted without detracting from the efficiency of the record, however. The object in considering a section between manholes instead of each face of the manhole is that in the latter system there would be duplication of records. In the present system a section between two manholes will always be filed under the manhole with the lowest number of the two. For a pole line this card would be modified as shown in Fig. 7a. These cards and the following series, No. 8, are punched for insertion in the notebook of the inspector.

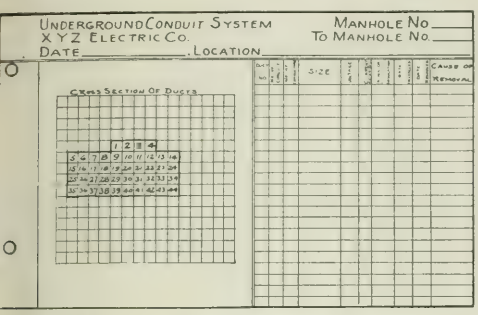



FIG. 7—CARD FOR SECTIONS BETWEEN MANHOLES

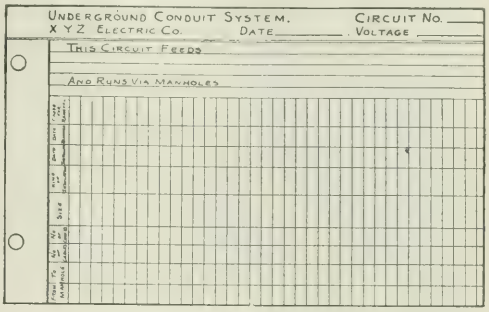



FIG. 8A—CABLE RECORD

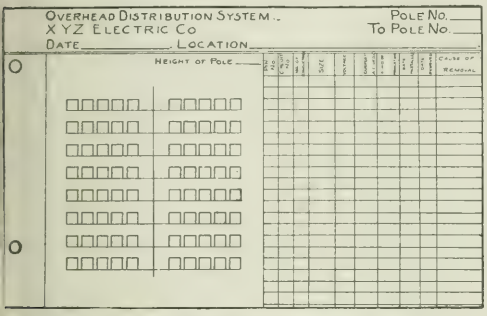



FIG. 7A—CARD FOR OVERHEAD POLE LINE

Where the distribution system passes through several manholes or over several poles without change or taps, one card may represent the entire section until such time as a change is made.

Fig. 8 represents a series of cards somewhat similar to those of Fig. 7 with the cross-section omitted. If the lines on Fig. 7 become filled, the data are continued on these cards. The corresponding card for the pole line would be similar to the right-hand side of Fig. 7a.

While somewhat separate from the distributing system proper the transformer is nevertheless one unit of it. A

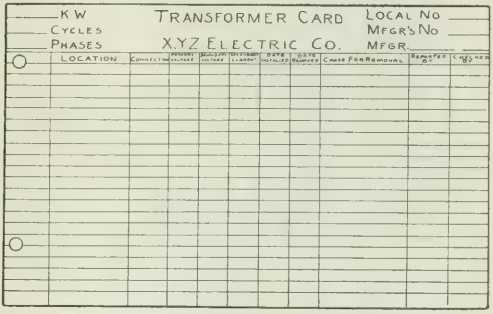



FIG. 9—TRANSFORMER RECORD CARD

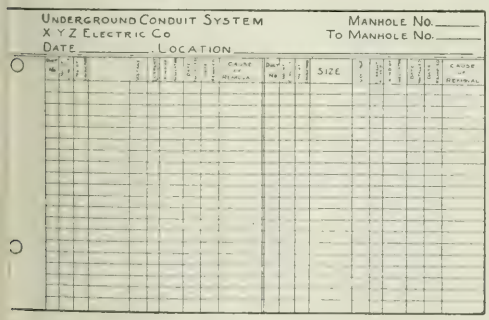



FIG. 8—CARD FOR UNDERGROUND CONDUIT SYSTEM

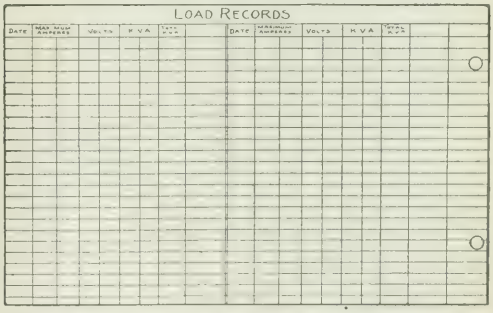



FIG. 9A—REVERSE SIDE OF CARD SHOWN IN FIG. 9

card (Fig. 9) is therefore given for recording the data on transformers. This card gives the complete history of the transformer from the time of its receipt by the company. The column "cause for removal" on this card will show up any recurring trouble in the transformer. The column so headed in Fig. 6a will indicate trouble recurring on a particular circuit or in a particular manhole. The back of this card (Fig. 9a) should be used to record the tests made at peak and light load periods to determine when a larger transformer is needed or when transformers may be disconnected. It will be noted that columns for only two circuits or phases are given. If three-phase transformers are used, there should be space for readings on the third phase.

In installing this system the data would be obtained by inspectors assigned to the duty. They would necessarily have to obtain much of the information from the foreman of construction. If no data of this nature have previously been kept, it will be a long and tedious task to get information, but the accessibility of the information will more than justify its tabulation.

All new construction or changes in the underground system should be made by the construction department in accordance with drawings furnished by the engineering department under Series 5. If only a service duct and handhole are being installed, a small 8-in. by 10.5-in. drawing placed on an 8.5-in. by 11-in. sheet is sufficient. The blue print should be returned to the engineering department with notes showing any changes which were necessary because of underground structures not known to exist. The tracing should then be corrected.

If the change involves any change in the circuits, Series No. 1, 2, 3 or 4 should be corrected accordingly. This work of keeping the maps up to date should not be allowed to accumulate, as constant attention reduces the work to a minimum.

If a new manhole has been added or if the circuit or wire sizes have been changed, the construction foreman should return to the engineering department a card of Series 6 or his order giving the data called for thereon. If new wires only have been installed or the sizes changed, a dot in the proper duct with a note regarding the work is all that is necessary. The inspector should then verify the information turned in and correct or fill out the cards of Series 7 and 8.

## Recent Telephone Patents

### New Transmitters and Receiver

Early experiments showed carbon to have such excellent microphonic properties that for a long time it has been used extensively in transmitter manufacture. Mr. S. G. Brown, of London, England, has found what he considers an advantageous substitute in osmium iridium alloy as it occurs in nature. Its use is suggested either for a single contact or as granules. A United States patent has been granted to Mr. Brown for transmitting devices using this alloy.

Mr. Francis Kayser, of Philadelphia, has patented a unique type of transmitter for use in conjunction with desk-set telephones. The upright of the stand carries a carbon rod the upper end of which is secured to the diaphragm. The diaphragm must be integral with or have a fixed relation to the upright. The carbon rod is swung upon a horizontal pin near the diaphragm. The lower or long arm dips into a receptacle containing a stationary contact and a mass of carbon granules. The lever acts as a movable electrode and its motions control the resistance.

It is the object of Mr. A. Marr, of Manchester, England, to cut down the peripheral contact of the diaphragm of the telephone receiver. To accomplish this the diaphragm is clamped between two rings whose opposing faces have been oppositely beveled. The diaphragm is held between the rings which make line contact with it.

# Letter to the Editors

## Solution of the Telephone Trust Difficulty

*To the Editors of the Electrical World:*

Sirs:—The writer has noticed from time to time that your editorial department is perhaps inclined to complain of the attempts of the United States Department of Justice to regulate telephone traffic, and, in fact, has covered with a very thin veneer of courtesy its opinion of suits against other so-called trusts. The following facts are called to your attention:

Two telephones or more in a town are a needless annoyance and expense, but wherever you find both trust and independent telephones you find better service and cheaper rates. The problem, then, is to get the cheap service and cheaper rates without the needless expense, which is, perhaps, one cause of the high cost of living. This can be done by forcing telephone companies to interconnect. There is absolutely no reason, either legal, financial or technical, why there should not be a system of trunk lines connecting the offices of the different telephone companies so that the user of one telephone would be able to talk just as satisfactorily and freely with a subscriber on another line as with a subscriber on his own line.

Such a method would give competition pure and simple, would do away with the necessity of having two telephones, and would enable the company which gave the better service to have the greater number of subscribers.

Now, in regard to the suit against the American Telephone & Telegraph Company. You are probably aware that this company is perhaps one of the greatest companies restraining trade that there are in existence. You probably know that any one of the licensee Bell telephone companies could not purchase one cent's worth of material without buying from the Western Electric Company (company store). This, of course, is a legal method of doing business, but it is a dishonest one for the reason that the owners of the company store charge high prices for the material, supplies and apparatus which they sell, thereby robbing the minority stockholders of the licensee telephone companies just as surely as if they met them on some dark street some night and rifled their pockets. This is proved by the fact that the identical apparatus which the licensee companies are forced to purchase through the company store is sold for export at less prices than to the American companies.

I sincerely believe that the Department of Justice and the Interstate Commerce Commission are doing nothing whatever to injure business in any way; that they are not causing a nerve-racking ferment; that there is no hysteria caused by the spirit of the Sherman act; that people who say that Congress should be forgotten for ten years could be put in jail on general principles and the country would never miss them.

*Minneapolis, Minn.* R. L. Lunt.

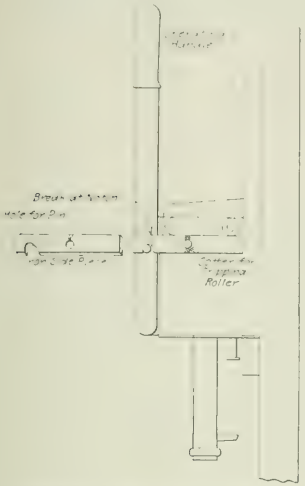
[The tone of our correspondent's letter is a very good example of the hysteria to which we referred in the article of Aug. 2 on the telephone suit. Legally it is not an easy matter to effect such an interchange of telephone traffic as he proposes. The public gets a large measure of relief through consolidation of plants under commission control. Regulation of rates and service by public authorities is the answer of society to the tendency in this country toward monopoly. It does not help in working out this solution for critics like Mr. Lunt to speak of the objects of their attacks as riflers of people's pockets. If Mr. Lunt will re-read our comments on the telephone suit, he will notice that we did not criticise the Department of Justice or the Interstate Commerce Commission in the least. On the contrary, we pointed out that they were merely doing their duty. We did criticise the American people for an anomalous condition created by conflicting statutes.—Eds.]

# Field of the Operating Engineer

**A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers**

## Temporary Repair to Oil Switch

The accompanying sketch shows the temporary repair made on a circuit-breaker operating handle which had broken down at the catch notches designed to hold the handle in the closed position. Side blocks were accordingly made the same shape as the notch parts, using flat pieces of




TEMPORARY REPAIR TO OIL SWITCH

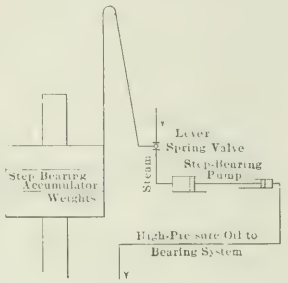
iron. These side pieces were then fixed in place by the cotter pins which hold the tripping roller inside. The job cost little to carry out, and will keep the oil switch in operation until a new casting can be secured.

## Accidents and Their Prevention

One feature of the useful safety bulletin issued monthly by the department of safety, sanitation and relief of the Inland Steel Company of Chicago is a department entitled "Accidents and Their Prevention." Here are mentioned briefly some accidents that have happened in the works at Indiana Harbor with a few words of warning. Thus, a laborer was screwing an electric lamp in a socket when it exploded and he was burned by the flash. The moral is thus expressed: "Turn off power before screwing lamp globes in sockets. Laborers and all persons not authorized should not meddle with electrical apparatus. Call an electrician." Again, an electrician who was splicing wires was burned by a flash. This gives occasion for the following admonition: "Don't work on live wires unless absolutely necessary, and then take necessary precautions for safety." The little pamphlet contains condensed and attractively presented information about various methods of safety in industrial works, as the guarding of gears, the operation of machinery, instructions as to first aid to the injured and the like. Prizes are offered for safety suggestions. Mr. J. C. Smith is the safety inspector of the company.

## Automatic Control of Step-Bearing Pumps

An automatic control is provided for the step-bearing pumps serving one of the vertical turbines in the Blue Island plant of the Public Service Company of Northern Illinois, so that if the accumulator weights fall below a fixed level steam is admitted to the bearing oil pumps, re-




AUTOMATIC CONTROL OF STEP-BEARING OIL PUMP

storing the high-pressure supply. A cord fastened to the accumulator weights passes over a pulley and is attached to a lever of a spring valve in the steam line of the pump. If the weight gets low, it pulls upon the valve, turning steam into the pump until the high-pressure oil supply again reaches its normal quantity.

## Energy Losses in a Large Electric-Service System

In an appendix to the recent report of Mr. Ray Palmer, city electrician of Chicago, on the maximum-rate investigation of the Commonwealth Edison Company appears the diagram reproduced herewith. It shows roughly the principal elements of a large electric-service system, with the energy losses in various parts. The figures given indicate approximately the percentage of the potential energy in the coal utilized by various parts of the system. The figures applying to customers' premises show the percentage of the energy in the coal burned which is actually utilized in the

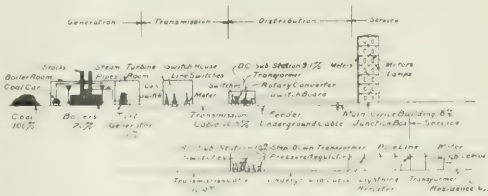



DIAGRAM OF ENERGY LOSSES

translating appliances of the consumer. The lower diagram shows the alternating-current distribution system, the direct-current system being indicated on the upper level.

In Chicago electricity is generated in turbo-alternators at 9000 volts to 12,000 volts and transmitted through underground cables to substations, where it is reduced in voltage for distribution. In the central part of the city—that is,

the territory south of North Avenue, east of Ashland Avenue and north of Thirty-ninth Street—direct-current transmission is used. Outside of this central district alternating-current is employed.

## Burners for Oil Fuel—I

By R. T. Strohm

The purpose of the burner is to spray the oil fuel into the furnace; consequently the first requisite of a good burner is that it shall atomize the fuel satisfactorily. As oils are of different densities and viscosities, and as different rates of feed must be used to accommodate the rate of combustion to the load on the boiler, it follows that the burner must be fitted with suitable valves in order that its action may be regulated closely. This regulation applies not only to the oil but to the atomizing medium as well.

A second important feature of a good burner is accessibility for cleaning and repair. It is almost impossible, even after taking the precaution of cleaning and straining, to prevent dirt from being carried along with the oil. As a result, clogging of the oil orifices may occur, and it then becomes necessary to clean the burner. To do this easily and quickly, the burner must be designed so that it may be taken apart readily and without undue labor. In some types of burners the oil and steam currents cause erosion,

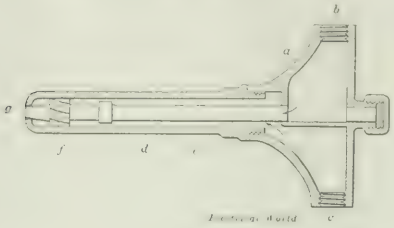


FIG. 1—REGULAR GEM OIL BURNER

and in such forms it is necessary to make provision for removing and renewing the worn parts without loss of time.

A form of Gem burner designed particularly for use in small furnaces is shown in Fig. 1. Its body *a* is of cast iron and contains two inlets *b* and *c*, the former for the oil and the latter for the steam that is used as the spraying agent. The oil flows along the central pipe *d* and escapes at the tip of the burner. The steam passes along the pipe *e* surrounding the oil pipe and is given a whirling motion by the vanes of the whorl *f* near the tip. It then escapes past the conical end of the oil pipe, through an annular opening *g*, sweeping the oil into the furnace.

As the oil pipe *a* is surrounded by live steam throughout its entire length, the oil becomes well heated in flowing through the burner, and the effect of this heating is to make it more fluid and easy to atomize. The regulation of the flow of oil and steam is accomplished by valves in the pipes attached at *b* and *c* respectively, since there are no moving parts in the burner itself. Should the oil pipe become clogged with dirt, the cap at the back may be unscrewed and a rod may be inserted to remove the obstruction.

An improved form of this burner is shown in Fig. 2. It differs from the form shown in Fig. 1 mainly in that it has a needle valve included in the burner to enable the oil flow to be regulated more closely. The stem *a*, Fig. 2, of the needle valve is threaded near its inner end and passes through a stuffing-box *b* at its outer end; thus any expansion of the stem due to increase of temperature does not alter the adjustment of the valve, as it would do if the stem were threaded at the stuffing-box end. The oil surrounds the stem inside the pipe *c* and flows to the nozzle through grooves cut in the side of the stem. The atomization is effected in the same way as in the simpler type. Each of these burners may easily be unscrewed and taken apart for cleaning.

The Parson burner illustrated in Fig. 3 is similar in principle to that shown in Fig. 2. The tip of *a* of the Parson burner has a passage *b* for the steam, which is admitted through the connection *c*. The oil enters at *d* and flows

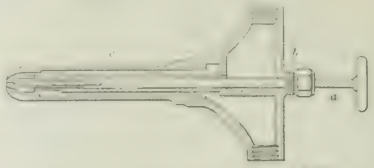


FIG. 2—IMPROVED GEM OIL BURNER

into the chamber *e*, from which it is allowed to pass into the nozzle *f* past the regulating valve *g*. This valve has a very slight taper, and consequently the flow of oil can be adjusted with great precision. The nozzle projects through the center of the steam passage in the tip, and the oil is thus heated on its way to the furnace. The valve stem *h* is furnished with a stuffing-box *i* to prevent the leakage of oil.

The Booth burner, shown in Fig. 4, is one that has been used extensively in stationary-boiler practice. The body of the burner consists of a box-shaped casting *a* that is set horizontally. It contains two passages *b* and *c*, oil being admitted to the former through the pipe *d* and steam to the latter through the pipe *e*. The oil flows outward through the wide, shallow slot *f* at the tip of the burner and drools downward across the end. An adjustable steel plate *g* is bolted across the steam orifice. This plate has a long notch cut in the top edge, forming the outlet *h* for the steam, and on the inside it is beveled or chamfered so as to direct the steam upward toward the orifice. The escaping steam sweeps along the under side of the burner tip and in expanding sprays the oil that runs down from the upper slot. The bolts that hold the plate *g* in place pass through long vertical slots in the plate, and this construction allows the plate to be moved up or down to give the desired depth of slot *h*. This adjustment, of course, is made when the burner is disconnected and not in use.

The arrangement of the piping to the Booth burner is simple. The supply of steam is brought to the burner through the pipe *e*, the flow being regulated by the valve *i*. In the same way a valve *j* in the oil line *d* is used to control the rate of flow of the oil. Between the oil pipe and the steam pipe is inserted a short connection fitted with a valve *k*. This serves as a by-pass to admit steam to the oil passage when it becomes necessary to clean out the passage. The oil valve *j* and the steam valve *i* are first closed and then the by-pass valve *k* is opened. The steam rushes through the oil passage, and its heat and its cutting

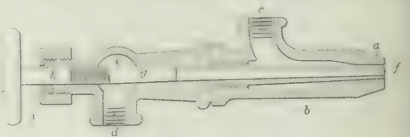


FIG. 3—PARSON OIL INSPIRATOR

action together scour the passage clean. The steam passage may be cleaned by removing the plate *g* completely and allowing steam to blow through at full pressure. The passages in the burner are straight and fairly large, and there is little danger of their becoming clogged frequently.

A form of externally atomizing burner known as the Bes burner is shown in Fig. 5. The tip by which the atomizing

s accomplished is supported by two pipes *a* and *b* that convey the steam and the oil, and these pipes are made of such length that they will extend through the boiler front and bring the burner just within the front of the furnace. The tip is of cast iron and contains a steam passage *c* and an oil passage *d* connecting with the oil pipe *b*. The oil passage is curved upward, so that the escaping steam sweeps

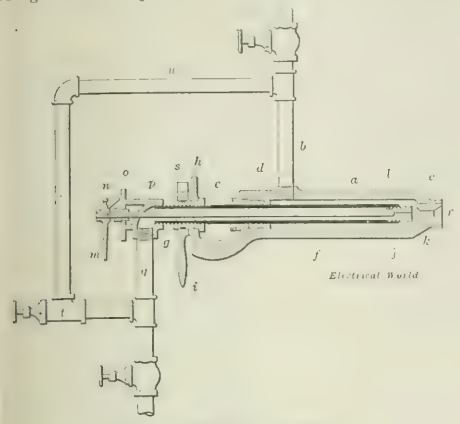



FIG. 4—BOOTH OIL BURNER

across the face of the orifice *e* at right angles to the direction of flow of the oil, thus insuring excellent atomization. Moreover, it is stated that this arrangement of the two orifices causes the steam to have a sort of ejector action on the oil, with the result that the oil is drawn toward the orifice *e* and only a low pressure is necessary in the oil system.

The steam orifice *f* is a long, shallow slot in the under face of a hinged lip *g* that during the normal working of the burner is held down firmly against the body of the tip. A fork *h* is pinned to the lip and has fastened to it a rod *i* that is threaded at its outer end and fitted with two adjusting nuts *j* and *k* on opposite sides of the bracket *l*. When the steam passage becomes clogged or choked, these nuts are turned so as to force the rod *i* inward and swing the lip upward. Full steam pressure is then turned on to blow out the obstruction, after which the lip is drawn down on its seat. This may be done from the front of the boiler without disturbing the setting of the burner. The flow of oil is regulated by a cock *m* and the steam supply by a

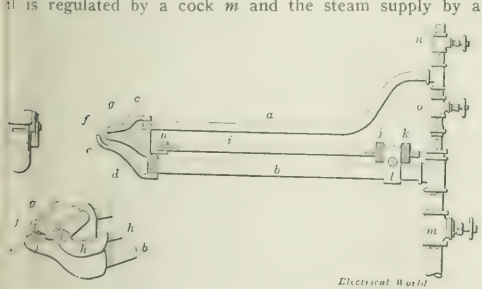



FIG. 5—EXTERNALLY AUTOMIZING BEST BURNER

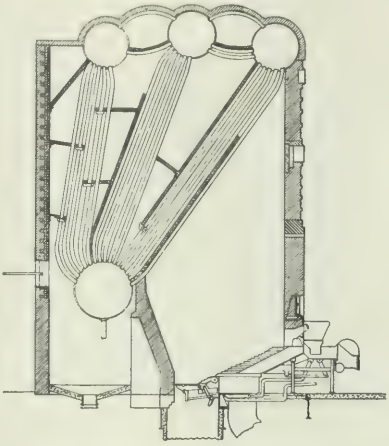
valve *n* in the steam pipe. A by-pass valve *o* is inserted between the steam and oil pipes, to enable the oil side of the burner to be cleaned out readily, as explained before.

The construction of the Best burner is such that there is little or no wear, and the absence of needle adjusting valves and constricted passages reduces the likelihood of clogging. If desired, this burner may be operated with tar as fuel, and it is equally serviceable with heavy oils. The flame produced is fan-shaped and spreads to about the width of the boiler furnace.

## Improved Baffling Arrangement with Large Combustion Chamber

At its recently completed Park Place heating plant the Central Heating Company, of Detroit, Mich., has adopted a modification of the baffling arrangement without the arch, as employed with such success and increased efficiency in the 500-hp boilers of the Detroit Edison Company's Delray station. At the latter plant boiler efficiencies as high as 80 per cent have been obtained in the region of rated loadings, while the units are capable of heavy overloads.

In the case of the new Park Place boilers, however, the mud drums have been raised 10 ft. above the boiler-room floor in order to secure increased combustion-chamber space. The number of passes is limited to three, the damper being placed at the mud drum. This reduction from the four passes obtained with the highly efficient Del-



MODIFIED BAFFLING ARRANGEMENT

ray boilers was made for the purpose of reducing the drop in draft through the setting. The Park Place boilers have a nominal rating of 727 hp, but will be operated over a range from 75 to 250 per cent of normal horse-power capcity.

## Load on Double-Turbine Unit

When a high-pressure steam turbine exhausts into a low-pressure turbine and the two turbines drive alternators independently connected to a common supply system, what governs the division of load between the alternators? C. O.

Between any two alternators connected in parallel the division of load is determined by the load characteristic and operating conditions of the prime movers. In the case outlined each alternator would deliver to the system such power as it received from its turbine, less the losses in the alternator itself. With two "series-connected" turbines the relative amount of power developed by each depends upon the admission and exhaust pressures and the mechanical efficiencies in each case. When driving alternators the relative speeds are set by the number of generator poles, and no governor need be provided for the low-pressure turbine since it utilizes such steam as is exhausted from the high-pressure turbine, to which steam is admitted in accordance with the total load to be carried by the double-turbine unit.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*Single-Phase Motor.*—A. Heyland.—An illustrated description of a new single-phase motor, which the author claims can be built with the same dimensions at the commutator and the same commutator voltage as a direct-current motor. The result is that the dimensions of the motor, its losses, heat and efficiency may be held within the same limits as in direct-current motors. The principle is the superposition of two motors in the same armature. One is a series motor which is fully loaded and the other is a repulsion motor which is slightly loaded, that is, loaded only temporarily and during the starting operation. The short-circuit axis of the repulsion motor is neutral to the main axis of the motor. Potential differences between commutator segments below the brushes occur only in the repulsion motor, and as the latter may be designed for a low number of ampere-turns the short-circuit currents below the brushes may be maintained as low as desired. At the same time, "the repulsion axis is automatically always loaded in such a way that all disturbances are kept away from the main brushes, so that the main brushes are continually, even during starting, in an absolutely neutral zone, just as is the case with direct-current motors." The motor is of the two-brush-axis type (Fig. 1a), the short-circuited axis being perpendicular to the main axis. The short-circuit axis impresses an elliptic field upon the armature in such a way that below the brushes the emf of rest is always compensated by the emf of motion. At speeds above synchronism the larger axis of the elliptic field is in the direction of the short-circuit axis; at speeds below synchronism it is in the direction of the main brushes. In the new type of motor of the author this is avoided in such a way that by a displacement of the field (Fig. 2) the load currents are first temporarily impressed on the short-circuit brushes; when the speed increases and the main field is strengthened, the load currents are taken over by the main brushes. The main brushes, therefore, behave continually as in a direct-current motor and may, therefore, be dimensioned as normal broad brushes. The reactance voltage may be overcome by the same means as in direct-current motors. The author gives six different diagrams showing possible con-



FIG. 1.—DIAGRAM OF CONNECTIONS

nections of the motor when loaded. In Fig. 1, a, b, c, three of these diagrams are reproduced. Fig. 1a shows a simple "Atkinson motor" with a double-axis short-circuit. The connections shown in Fig. 1b are obtained by opening the circuit of the main brushes and connecting them to the mains as shown in diagram b. This motor has a shunt [illegible] speed can be adjusted to a [illegible] value by means of the transformer *f* and is independent of the load. The stator and the rotor windings may be connected in parallel or in series. The former arrangement is shown in Fig. 1b, the latter in Fig. 1c. With parallel connection the field and the overload range of the motor increase with increasing speed. With series connection they decrease. For traction purposes the connections of Fig. 1b

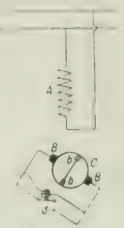


FIG. 2.—DIAGRAM OF STARTING ARRANGEMENT

are considered the most suitable ones. The starting operation is accomplished in such a way that by a displacement of the field the short-circuit axis is temporarily made the load axis, the motor starting as a repulsion machine. A change of the connections is preferably made near synchronism since then the voltage between the main brushes is zero. The displacement of the field during the starting operation may be obtained either by displacement of the brushes or by a change of the connections at the stator. The author gives six different starting arrangements, of which only one, Fig. 2, is reproduced herewith. It is the simplest method, the motors starting with open circuit of the main brushes. When the motor has reached synchronism the circuit of the main brushes *BB* is closed to obtain position of Fig. 1a, whereupon further speed regulation may be obtained by a gradual increase of the voltage at the brushes *BB* according to Fig. 1b. That is, the auxiliary brushes *bb* are continually closed and all changes of connection are made in a circuit without voltage. The change of connections may be made entirely automatic by keeping the switch *a* in Fig. 2 first open by means of a voltage-operated coil connected to the brushes *BB*. At synchronism, where the voltage between *BB* becomes zero, the switch will then automatically close. The author concludes that the change from the connections of Fig. 2 to those of Fig. 1a and 1b is the simplest and most economical method of operation. Motors of this type may be built for single-phase railroads in which parts of the line are operated by direct current, so that the motor can be operated as a direct-current machine without the necessity of connecting several motors in series as is necessary with other single-phase motors. For traction purposes the dimensions of the machine are those of a low-voltage direct-current motor. It has series characteristics during starting and shunt characteristics during normal operation. It is possible to recuperate energy usefully. In the simplest form of the motor the field increases as a linear function of the speed and adjusts itself to the conditions of traction in such a way as always to operate most economically at all loads. The same principle may also be used in the design of polyphase motors.—*Elek. Zeit.*, Jul 24, 1913.

### Lamps and Lighting

*The Lighting of Schools.*—An account of the recent report of a joint British committee which is chiefly representative of the (British) Illuminating Engineering Society, but also includes representatives of the Association of Technical Institutions, the Association of Teachers in Technical Institutions, the London Teachers' Association and the Medical Officers of Schools Association. It is recommended that for clerical work the minimum artificial illumination on any desk where light is required should not fall below 2 ft.-candles, though apparently four members of the committee are of the opinion that the minimum should not be less than 2.5 ft.-candles. For special work, such as stitching with dark materials, a minimum of 4 ft.-candles is suggested, while for general illumination it is recommended that a minimum of 1 ft.-candle should be adopted. All measurements are made upon a horizontal plane 3 ft. 3 in. above the ground, which appears to be a satisfactory height for measurements in this class of work. The recommendation is made that no lamps should come within the solid angle subtended at the eye by the blackboard and a space 2 ft. above it, unless they are completely screened from the eye by shades impervious to light. The subject of daylight illumination is to be taken up in a further report.—London *Electrician,* July 25, 1913.

*Lighting of Libraries.*—An account of a recent report of a joint committee of the (British) Illuminating Engineering Society and associate delegates. For table, desk or newspaper stand lighting the illumination should in no case be less than 2 ft.-candles. This value is understood to apply to reading ordinary type printed on white paper. When books printed in small type or manuscripts or surfaces having a low reflecting power are to be studied a higher illumination is necessary and a tentative value of not less than 5-ft. candles is suggested. For bookcase and shelf lighting the minimum vertical illumination on the case or shelf should be 0.5 ft.-candle. For general illumination a minimum of 0.5 ft.-candle is specified. Local illumination should be measured on the desk, slope or table where reading is carried on. Measurements of general illumination should be made on a horizontal surface 3 ft. 3 in. above the ground. In all cases the illumination is to be expressed in foot-candles. Special emphasis is laid on the avoidance of glare, the avoidance of reflection from the surface of paper or tables and the avoidance of shadows.—London *Electrician,* July 25, 1913.

### Traction

*Paris.*—A note on the Paris Metropolitan Railway, stating that the number of passengers carried by this undertaking has increased from 100,000,000 during 1903 to nearly 1,000,000 during 1913. This is partly due to the new sections which have been constructed, bringing the total length of the line up to 46 miles. The ratio of working expenses to receipts for last year was 42.52 to 100.—London *Electrician,* July 25, 1913.

*The Mechanics of Electric Train Movement.*—An account of the extended discussion which followed the presentation of Mr. F. W. Carter's paper on the above subject.—London *Electrician,* July 18 and 25, 1913.

### Generation, Transmission and Distribution

*Pressure Regulation.*—E. Wyatt.—An abstract of a paper read before the Newcastle Students' Section of the (British) Institution of Electrical Engineers. The author discusses the requirements of the continuity of supply, design and maintenance of cables, methods of regulation and independent regulation of feeders. Among the automatic regulators which he mentions is the Taylor-Scotson automatic regulator, which consists of a small booster, in series with the exciter field coils when used in conjunction with alternators or with the shunt field coils when applied to direct-current machinery. The field current of this auxiliary booster is obtained from any available continuous-current supply, the field coils being split into two halves connected differentially. An assisting or opposing boost is given to the exciting field magnetism, according to which half of the coils is in operation. The whole of the assisting or opposing boost is given at one step by short-circuiting one or other of the differential windings. This is effected by a solenoid or pressure-operated coil.—London *Electrician,* July 25, 1913.

*Gas Engine Plant in Japan.*—A description of the new gas engine plant of the Kawaski Dockyard Company, which has scrapped its old steam plant. A 500-kw generator has been installed directly coupled to a four-cylinder scavenger-type producer-gas engine, together with the necessary gas plant.—London *Elec. Review,* July 25, 1913.

### Installations, Systems and Appliances

*British Central Station.*—An abstract of last year's financial report of the St. Marylebone (London) municipal electric station. As the price of coal advanced by 30 per cent, and the low candle-power, high-voltage metallic-filament lamp made further inroads into energy consumption for lighting, the results were not as satisfactory as expected. However, motor connections have increased and energy consumption for heating and cooking has increased at even a greater rate. The output during the year was 15,000,000 kw-hr., the total number of consumers 9234 and the total connections 25,556 kw. The generating expenses per kw-hr. sold were 1.04 cents, the distribution expenses 0.24 cent, the management expenses 0.28 cent, rents, taxes, etc., 0.56 cent; hence the total cost per kilowatt-hour sold, exclusive of capital charges, was 2.12 cents, and including capital charges 5.76 cents. The total revenue was 6.16 cents.—London *Electrician,* July 25, 1913.

### Electrophysics and Magnetism

*Ferrocobalt Magnets.*—Pierre Weiss.—The compound $Fe_2Co$ of iron and cobalt has a magnetic saturation value 10 per cent higher than iron at ordinary temperature. The results of measurements are given showing the possibilities of producing stronger magnetic fields with an electromagnet with ferrocobalt pole pieces than is possible with iron.—*Comptes Rendus,* Vol. 156, p. 1970, 1913; abstracted in *La Lumière Elec.,* July 19, 1913.

*Spark-Gap.*—J. P. Minton.—This article presents the results of an experimental investigation of the effect of dielectric spark-lag upon both needle and sphere gaps, which go to show that the sphere-gap is the more reliable, on account of the lesser dielectric spark-lag which it is found to possess. The correctness of this conclusion is still further confirmed by a theoretical argument based on Maxwell's theory of stresses. This type of gap should, therefore, be used wherever possible, especially for the measurement of voltages of short duration.—*Gen. Elec. Rev.,* July, 1913.

*Nature of Dielectric Fatigue.*—W. Holttum.—An account of an investigation the object of which was to determine the relation between the duration of application of the pressure and the instantaneous strength when identical samples were tested at constant pressure and frequency. Alternating pressures were used. Instantaneous strength is defined as the pressure of a certain wave shape which would just cause breakdown if applied for one-tenth of a second at a frequency of 50 cycles per second. The arrangement of the experiments is described in detail and the results obtained with ebonite and presspahn are discussed. The general conclusions to be drawn from these tests are that fatigue due to electric stress alone is almost negligible for ebonite and presspahn until the point of breakdown is approached, the greatest amount measured for ebonite being 2 per cent of the initial instantaneous strength (as defined above), and that the least pressure which will cause breakdown if applied continuously is about 80 per cent of the lowest measured value to which the in-

stantaneous strength can be reduced by fatigue. The conclusion of greatest practical importance that can be drawn from these tests is that the dielectric strength of ebonite for sudden stresses lasting for a fraction of a second is only some 28 per cent greater than it is for long-continued stress, and that any ebonite used for insulation purposes should be designed for the greatest pressure which may occur as though that pressure were continuous.—London *Electrician*, July 25, 1913.

### Units, Measurements and Instruments

*Meter.*—An official announcement of the German Reichsanstalt by which a new oscillating motor meter for direct current of the Allgemeine Elektricitäts Gesellschaft is admitted for calibration. Its construction is described in detail and illustrated by diagrams.—*Elek. Zeit.*, July 24, 1913.

*Electric Measuring Machine.*—P. E. Shaw.—An abstract of a paper read before the British Institution of Mechanical Engineers on a new electric machine for the accurate measurement of end-gages of length. The machine (Fig. 3) consists of a heavy cast-iron bed, on which travel two headstocks and a gage-holder. The latter provides for the accurate adjustment of the gage in position with regard to the bed, and for its movement between the measuring ends, so that every part of the ends of the gage can be measured without risk of introducing error by the displacement. Each headstock is provided with a "measuring end," a micrometer screw and a reading microscope. The accompanying illustration shows one of the measuring ends. In the older machine direct electrical contact

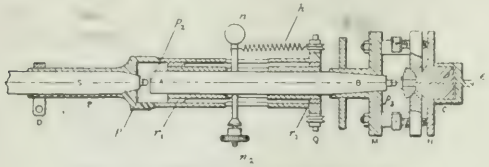


FIG. 3—SECTION OF A MEASURING END

was made between the point $p_1$ and the gage; in the present machine, if point contact is to be made, one either uses the extreme point $e$ or the point $p_2$; in the latter case the end piece $M\ N$ is pulled off the bar $A\ B$. For most purposes $p_2$ is better than $e$ for point contact. If, on the other hand, we wish to measure with flat ends, the end cap $c$ is pulled off, leaving the lapped flat surface $b$ at the extreme end. The brass tube $P\ Q$ is coned to fit the screw spindle $S$, so that when pushed on the latter and the clamp $D$ adjusted the whole forms a rigid system. The invar bar $A\ B$ is made a true fit in the ebonite bush rings $r_1$ and $r_2$, and is prevented from rotating on its axis by the cross pin $n\ n_2$, which slides in the slotted brass tube. The end of $A\ B$ is coned, and the coned end of the fitting $M\ N$ is pushed tight on $a\ b$, the two parts being ground to fit. By means of adjusting screws the end surface $b$ can be brought into a plane perpendicular to the line of the bed. A spring $h$ controls the system and keeps the contact points $p_1$ and $p_2$ about ½ mm apart normally; $S$ is the invar shaft of a micrometer screw. Suppose this screw is advanced to cause the end of the system to meet a gage surface on the extreme right beyond $e$. First $e$ meets the gage, then, as the screw is farther advanced, contacts $p_1$ and $p_2$ are brought together. The meeting of $p_1$ and $p_2$ completes an electric circuit consisting of a high resistance (say, 5000 ohms), a cell, switches and telephone. As soon as the telephone sounds, the observer reads the divided head of the micrometer screw. On reversing the micrometer screw the spring $h$ comes into action, breaking contact $p_1$ $p_2$ and the telephone again sounds.—London *Elec. Review*, July 25, 1913.

*Roentgen-Ray Tubes.*—Fr. Klingelfuss.—An illustrated abstract of a paper on tests of X-ray tubes by means of instruments at present available.—*Elek. Zeit.*, July 24, 1913.

### Telegraphy, Telephony and Signals

*Wireless Telegraphy.*—G. W. O. Howe.—A system in use by the Société Française Radio-Électrique involving an intermediate transforming circuit, in which it is claimed that a single wave is emitted with the closest coupling. The author shows mathematically that this is impossible and describes experiments which fully confirm his calculations. He concludes that the claims of the French company are apparently based on a fallacy, and the method described in the patent specification and used by the company does not enable the coupling to be made any tighter than the ordinary system, without introducing the same defects.—London *Electrician*, July 25, 1913.

### Miscellaneous

*German Association of Electrical Engineers.*—Zehme.—The twenty-first annual meeting of the German Association of Electrical Engineers was held from June 17 to 21 at Breslau. The president, Christiani, reported on the development of electrical engineering during the past year. Usbeck lectured on the commercial importance of electric traction on trunk railroads. The secretary, Dettmar, reported that the number of members is 5300. There are twenty-two local sections and the society owns $52,000. Seventeen committees have been working during the past year. For the first time scholarships—forty-four in number—have been granted to students of electrical engineering from the Max Günther Stiftung. S. Ruppel presented a paper on protection of buildings against lightning, Weid and Jensch one on corona losses on transmission lines, and Monasch one on new electric sources of light. In the discussion of the latter paper the Allgemeine Elektricität Gesellschaft stated that it had succeeded in making high candle-power incandescent lamps with a specific consumption of 0.5 watt per hefner-candle. G. Klingenberg presented a paper on the distribution of electric energy over extended districts. The banquet was attended by 600 members and ladies. Various excursions were made, among them one to the Riesengebirge, where the electrification of the mountain railroads was inspected.—*Elek. Zeit.*, July 10, 1913.

*Students' Tour.*—An account of the recent tour made by the Student Section of the (British) Institution of Electrical Engineers. This covered the Newcastle district. An account is given of the various visits made.—London *Electrician*, July 25, 1913.

# Book Review

Electric Wiring and Lighting. Part I. Electric Wiring. By Charles E. Knox. Part II. Electric Lighting. By George E. Shaad. Chicago: American School of Correspondence. 94 pages, 81 illus. Price, $1.

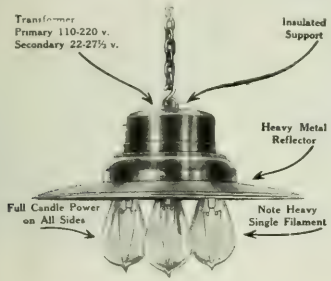
This book accomplishes to an unusual degree its purpose in presenting in an instructive way for home study the progress in electric wiring and illumination. The treatment is concise, the mathematics simple, and in 100 pages most of the ordinary methods of wiring with simple calculations and most lighting methods are covered with surprising thoroughness. Illustrations and diagrams are numerous and clearly explanatory of the points brought out in the subject matter. The features of safety and convenience are particularly emphasized, and the data and suggestions are such as to make the book not only well adapted for the non-technical beginner but of considerable use as a reference for the interior wiring contractor and the inspector.

# New Apparatus and Appliances

**An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers**

## Transformer-Reflector Fixture

On account of the smaller diameter of the filament, low-andle-power lamps are more fragile than high-candle-ower units for the same voltage, and high-voltage lamps re more fragile than low-voltage units for the same candle-ower. The most fragile units are therefore the low-andle-power, high-voltage lamps. To overcome this disad-antage, the Campbell Electric Company, Lynn, Mass., has




TRANSFORMER-REFLECTOR FIXTURE

aced on the market a transformer fixture by means of hich low-voltage lamps may be used in the fixture even nen the distributing circuits are operated at high voltage. ne miniature transformer mounted immediately above the flector receives energy at the regular distribution volt-e and delivers it at a convenient low voltage for the mps. It is said that this fixture is used in large quan-ies by some of the extensive mills.

## Non-Metal Electric Toaster

The electric toaster illustrated herewith is said to be ry efficient in that all the heat is radiated in a useful rection. The utilization of practically all of the heat nerated is accounted for by the material of which the ister is constructed. In place of having a metal body nich will conduct away considerable heat, the toaster is



NON-METALLIC ELECTRIC TOASTER

nstructed entirely of an asbestos compound with the heat-in coils laid in grooves in the top of the device. Asbestos ing a poor conductor of heat allows the heat generated radiate upward in a useful direction. In addition to the ed efficiency of operation, there is no metal from which ou can get burned. Although designed as a toaster, the ap liance can be used as a general-utility stove with ordi-nary cooking utensils. The device consumes 400 watts, is neat in appearance, will not tarnish or rust and, it is as-serted, will withstand considerable abuse. The toaster is manufactured by the National Electric Company, Chicago.

## Tubular Electric Signs for Display Purposes

An electric sign for interior display purposes, the lamps in which serve to illuminate the sign as well as the show case or display window beneath it, was on exhibition for the first time at the window trimmers' convention held re-




FIG. 1—TUBULAR ELECTRIC SIGN

cently in Chicago. The sign consists of a rectangular frame made of copper-plated brass, in which opal glass tubes 2 in. in diameter and 4 in. long, each bearing a letter, are placed vertically so as to spell the display word. As the tubes are made of translucent glass, the space occupied by the letters is left bare and the remainder of the tube is copper-plated for contrast. Inside of the tubes and fastened to the upper horizontal member of the frame are miniature receptacles for holding 8-cp candelabra lamps. These receptacles are connected in parallel to a flexible cord and plug which may be inserted in an electric lamp outlet.

The frames are made in lengths to accommodate different numbers of tubes, which can be replaced by others by tak-ing off the top horizontal member of the frame. In the lower horizontal member, below each tube, is a hole having the same diameter as the inside of the glass tubes. The light from the small candelabra lamps can shine through

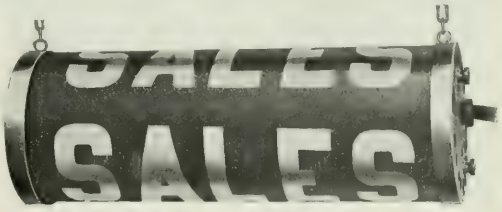



FIG. 2—TUBULAR ELECTRIC SIGN

this opening and illuminate anything placed below the frame without reducing the effectiveness of the sign. As the lamps are entirely concealed, the sign is as attractive in the daytime as it is at night.

Another type of tubular sign displayed by the same com-pany consists of a hollow, cylindrical translucent glass tube with a perforated metal cap on each end. Fastened to each

of these caps instead of the tube are receptacles for holding 10-watt tungsten lamps. The lamps are connected in parallel to a flexible cord which can be attached to an electric lamp outlet. The tube is copper-plated except for the space occupied by the display feature. As only about one-third of a cylindrical surface can be seen at close range, the tubes can be installed in three sections, each of which bears different advertising material. The tubes are replaceable so that the sign fills a utilitarian place in any store display window or case. Either one of the signs mentioned can be suspended from above by chains, the heat radiated from the lamps being carried away through perforated caps. These signs are made by the Sterling Deposit Manufacturing Company, Chicago.

## Motor-Driven Air Washer

In order that the air supply furnished to the banking rooms, engine rooms, pump rooms, café, barber shop, lavatories and other departments in the lower portion of the Woolworth Building, New York City, may be uncontaminated air washers have been installed to cleanse and purify it. From an opening over the street the air is drawn in through sprays of water in an atomized condition. The atomizer equipment and its supporting framework are shown in Fig. 1. The air passes through this spray and is led through a series of baffles, where the greater portion

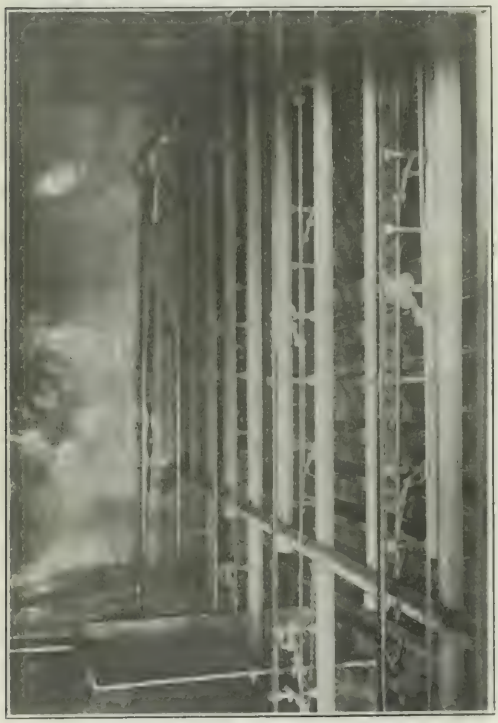


FIG. 1—AIR-WASHING EQUIPMENT

of the entrained moisture is removed. After passing the baffles the air is delivered to the rooms themselves, being then free from foreign matter and cooled to within 3 deg. Fahr. of the temperature of the purifying water.

The equipment for pumping the water to the atomizing nozzles consists of a small motor-driven centrifugal pump which is mounted on the basement floor near the door opening into the spray compartment. In order that the nozzles may not become clogged by continuous use of the water, which will in time accumulate some dirt, an arrangement is provided for periodically changing the direction of the spray. The pan seen in Fig. 1 catches the falling spray, and when the weight of the water contained in it becomes sufficient it is automatically emptied. This motion

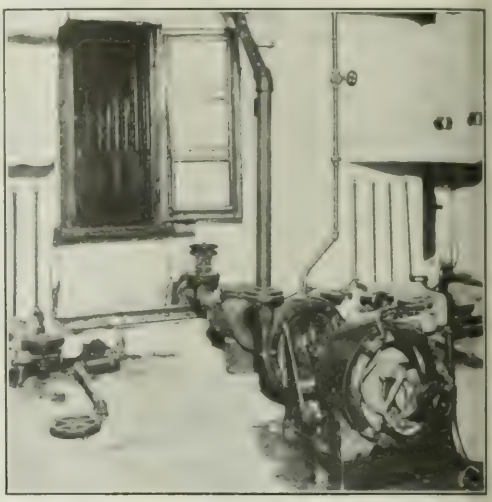


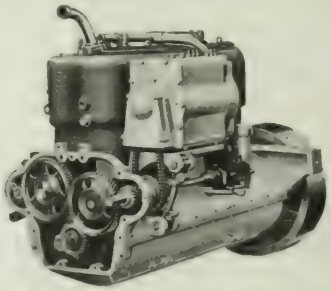
FIG. 2—MOTOR-DRIVEN PUMPS

of the pan is transmitted through a set of levers to appliances on the atomizing nozzles which change the direction of the spray and blow any foreign matter out of the nozzles.

The air-washing equipment in this installation was furnished by the Kauffman Heating & Engineering Company, St. Louis, Mo.

## Automobile Starting and Lighting System

In the system of electric starting and lighting of automobiles illustrated herewith both of the functions indicated are performed by one unit which operates as a generator to produce energy for charging the storage battery or as a motor, driven by energy from the storage battery, for start-



DYNAMO FOR AUTOMOBILE STARTING AND LIGHTING SERVICE

ing the automobile. The unit changes from motor to generator, or the reverse, without automatic switches, controllers or auxiliary devices, and without any change in gear reduction. The generator-motor unit is geared permanently to the gasoline engine by means of a silent chain.

The equipment is built in two sizes for application to four-cylinder or six-cylinder cars. The battery with the

former is rated at 35 amp-hr. and that with the latter at 50 amp-hr., the electromotive force in each case being 18 volts. The generator-motor is an 18-volt four-pole machine provided with two series-wound poles, use being made of an auxiliary shunt-wound "bucking coil" for regulating the output.

With the automobile stationary, closing the control lever

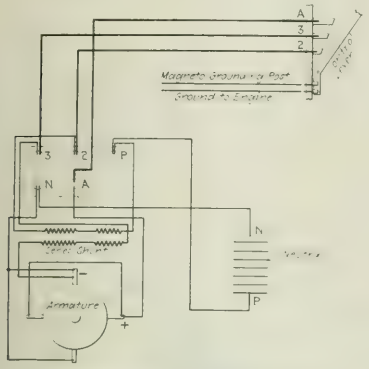



FIG. 2—DIGRAM OF CONNECTIONS

switch causes energy from the battery to pass through both the series and shunt windings in the same direction, the "bucking coil" augmenting the series coils. When the engine speed becomes sufficiently high for the generator voltage to exceed that of the battery, namely, at about 800 r.p.m., the function changes from motor to generator. The voltage rises with the increase in speed until a maximum charging current of 15 amp is reached at about 3600 r.p.m.; a further increase in speed reduces the current delivered to the battery. The regulation of the current is accomplished automatically through the agency of the bucking coils. Current in these coils neutralizes the effect of the series coils. The regulation is thus a feature of the design rather than of automatic switching devices. The rate of charging is so proportioned to the service required of the battery that the tendency is for the battery to be overcharged rather than undercharged. In order to prevent heating and gasing of the battery by reason of too much overcharge provision is made for disconnecting the generator in case of long-continued running at high speed.

The above-described equipment, known as the A-B Entz system, is built by the Adams-Bagnall Electric Company, Cleveland, Ohio

## Transformers for Manholes

Manholes and underground chambers are usually damp and quite frequently are flooded, so that it often becomes necessary for the transformers to continue in service while partly or wholly submerged in water. A transformer for such service must therefore be water-tight and air-tight. The joints between the case and cover, as well as those where the leads issue from the case, must be of such a construction as to prevent any possibility of moisture entering the case.

On account of the poor ventilation in manholes and the resultant fairly high temperature, transformers for this service must have low temperature rise. Owing to the limited space available for installation and handling, they must be compact but at the same time rugged in design.

In the transformer herewith illustrated the joint between the cover and case is made waterproof and air-tight by means of a wire gasket fitting in a V-shaped groove in the case. This wire is an alloy of tin and lead which is said to give excellent results for this purpose. The cover is secured to the case by a number of bolts placed around the periphery of the case; as these are tightened, the wire gasket is compressed and its shape is slightly changed so as to conform exactly to that of the groove. Sherardized bolts and nuts are used so as to prevent rusting of the nut and bolt together and resulting difficulty of removing the cover from the tank.

Since these transformers are made air-tight, internal pressures are developed due to the expansion of the air and oil, caused by an increase in the temperature. An air space between the oil level and the cover, however, forms an effective cushion for taking care of the expansion of air and oil.

The bushings furnished with these transformers not only prevent moisture entering the case but are so designed that

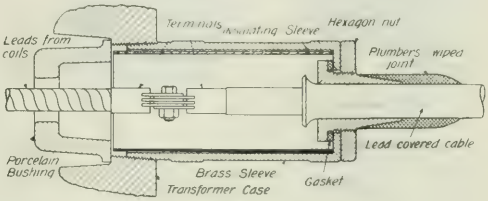



FIG. 1—TRANSFORMER BUSHING

it is possible to connect and disconnect the transformer very readily. As the space in the manhole is usually quite limited, this feature is of advantage. The method of bringing out the leads from the transformer through the outlet bushings is shown in detail in Fig. 2. The leads are brought from the coils through a heavy porcelain bushing and terminate in leaf connectors. Connection is made to the line by inserting the leaves of a similar connector to the lead-covered cable and tightening a bolt which is inserted in a hole passing through all the leaves. A brass sleeve with an insulating lining is slipped over the connection and

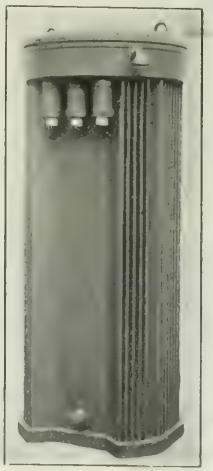


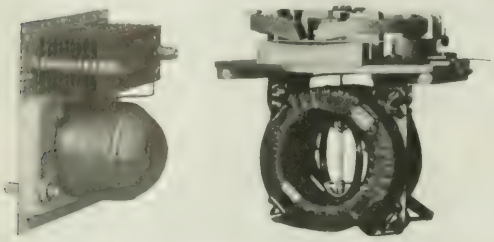
FIG. 2—MANHOLE TRANSFORMER

screwed into the transformer case. The lead casing of the cable is connected to a flanged sleeve by a plumber's wiped joint. A nut is used to force this sleeve to a seat on the gasket in the outlet bushing, by this means making a water-tight joint.

This line of transformers has been placed on the market by the Westinghouse Electric & Manufacturing Company.

## Portable Meters for Alternating-Current or Direct-Current Circuits

The fundamental advantages obtained by the use of moving coil meters are higher accuracy and the convenience of using one meter for either direct-current or alternating-current circuits. In the instruments shown herewith the movement is mounted as a unit and can be taken from



FIGS. 1 AND 2—DETAILS OF PORTABLE METER

the dustproof case after removing the face-plate. A laminated iron shield is riveted to the aluminum mounting plate, thereby protecting the movement both from dust and from stray magnetic fields. The weight of the moving element is slight and the torque is relatively high. The pointer is of U section.

The meters attain their highest accuracy on alternating current, and are free from temperature, frequency and wave-shape errors. On direct current, the meter may be subject to slight errors due to residual magnetism of the laminated iron shield, but this can be eliminated by taking the average of reversed readings.

A contact switch operated by a button on the front of the instrument is provided on each voltmeter. The voltmeters and wattmeters are self-contained, all necessary resistors being mounted in the case. The wattmeters that have double-current or double-voltage ranges are provided with a switch operated by a knob on the face-plate, which makes the proper series or series-parallel connection of coils.

The meters are mounted in hardwood carrying cases 7.75 in. by 7.75 in. by 6.3125 in. They have hinged covers that are easily removable, and are made with flexible sole-leather handles.

A special damping sector moving in the concentrated field of a permanent magnet eliminates unnecessary wear on

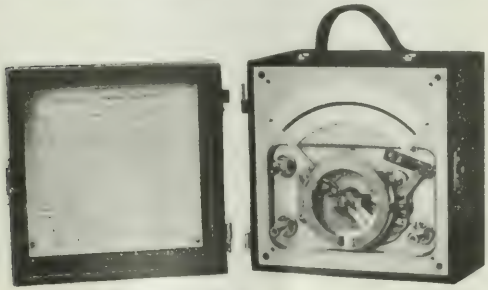


FIG. 3—PORTABLE VOLTMETER

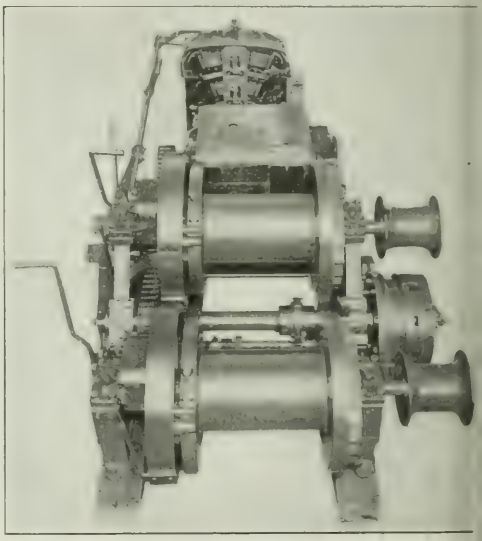
bearings. The scale covers an arc of 90 deg. and for the wattmeters the divisions are wider at the lower end, while for the voltmeters they are wider at the middle where readings are most frequently made.

These meters are being brought out by the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa.

## Improved Double-Drum, Two-Speed Electric Hoist

Changing the speed of electric hoists without stopping the motor is now accomplished in an improved double-drum two-speed type of apparatus recently brought out in Chicago. In the ordinary two-speed hoists square-jaw clutches and sliding gears are used, making it necessary practically to stop the rotation of the motor and drum to shift the gears, thereby losing valuable time in restarting. To be able to proceed from low to high speed without varying the pull on the hoist line is of particular advantage in such service as drag-line excavation and operation of clam shell and orange-peel buckets, where heavy work under slow speed is done at the start and the emptying part of the load is light. It is also of use in steel erection where low speed is necessary at the end of the run in setting members.

Instead of the jaw clutch and gears a planetary transmission and friction clutch, similar to that used in automobile design, is used to obtain the two speeds. The chain driven pinion on the jack-shaft is keyed to a live axle which runs to the opposite end of the shaft on which the transmission is carried. Torque is transmitted through the planetary



DOUBLE-DRUM, TWO-SPEED ELECTRIC HOIST

gears to a hollow shaft or quill, which in turn has keyed to it a driving pinion meshing with the gears on the two hoisting drums. Assuming the hoist in the low-speed position, a short movement of a speed-change lever, within easy reach of the operator, effects a special reduction of three to one. The transmission acts as a unit on high speed, giving a flywheel effect to the hoist. Inasmuch as the gears are packed in grease within a tight case the friction loss on low speed is reduced to a minimum.

Both drums are fitted with band friction brakes, thereby eliminating all side thrust, and the drums and motors are equipped with V-groove irreversible braces acting automatically.

The first hoist built went to the Indiana Sand & Gravel Company, Indianapolis, to replace a double-drum single speed hoist operating a slack line Shearer & Mayer 1½-yd. drag-line excavator. The new hoist, which was constructed at the suggestion of Mr. R. R. Sauerman, agent for the excavator, to meet the arduous variable-load requirements of drag-line service, is now regularly built by the Thomson Elevator Company, Chicago.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Business in Small Motors and Generators Brisk.**—The ort Wayne Works of the General Electric Company, at ort Wayne, Ind., while enjoying a very good business in l lines, are at present swamped with orders for fractional rse-power sizes of motor and generator equipment.

**New Handbook on Construction Costs Imminent.**—The nstruction Service Company of 15 William Street, New ork, in which R. T. Dana has a controlling interest, is anning to issue shortly a handbook of construction cost ta along mechanical and electrical lines. It is proposed publish this book in Chicago.

**Exports of American Electrical Goods.**—The exports of nerican-made electrical machinery and appliances in May this year totaled in value $874,867. Of this amount 80,043 represents the value of the generator, motor and wer apparatus shipped out, $87,630 that of lamp exports, d $207,194 the value of the telephone and telegraph equipnt sold abroad.

**Large Minneapolis Power Contract.**—The Minneapolis linn.) General Electric Company has closed a contract th the Twin City Trading Company covering 2000 hp in tors. At present only 500 hp will be installed, but new vators, which will be constructed within a year, will reire an additional 1200 hp or 1500 hp. This contract enles the grain concern to shut down its isolated steam nt.

**Condenser and Pump Sales.**—A large manufacturer of mps, condensers and other power-plant auxiliaries, interwed recently by a representative of the *Electrical World*, ted that a good volume of business in these lines, pers a litt'e larger than normal, is being handled and that s business consists almost entirely of moderate-sized lers for apparatus of standard size and design, a condin which was stated to be very satisfactory.

**Electric Trucking in Manila.**—The Manila Railway & ght Company, of Manila, P.I., recently placed an order for 2-ton electric trucks with the General Motors Company ough J. G. White & Company, of New York. This was second order for this type of car, the first shipment of similar trucks having been made about six weeks ago. ne of these cars are to be used by the above-mentioned ity, and several of them are for use by progressive mernts in Manila.

**Convention of the Federal Sign System (Electric).**—The rth annual convention of the Federal Sign System lectric) was held recently in Highland Park, Ill., a suburb Chicago. Branch office managers, department heads and neral executives were in attendance, and three sessions a were held, devoted to the reading and discussion of nical and business matters of interest to company repreatives. The convention ended with a banquet, after ch the whole party visited the Chicago factory.

**American Brass Company Plans Generating System.**—The Ansonia Brass & Copper Branch of the American Brass Company has recently completed the installation of two 5[illegible]kw gas-driven generating units (operating on producer g[illegible]) at its brass rolling mills at Ansonia, Conn., and it has started work and obtained part of the necessary equipment for a 900-kw water-turbine-generator installation at its copper mill in the same town. The electrical apparatus is to be supplied by the Westinghouse Electric & Manufacturing Company. A permit has been granted by the local Board of Aldermen for laying conduits to connect these new generating plants and the various mills of the American Brass Company. Arrangements will be made so that both two power plants can work either in conjunction or independently in carrying this mill load.

**Linoleum Factory Gets Electric Drive.**—The George W. Blabon Company, of Philadelphia, Pa., has arranged to operate its linoleum factory at Nicetown by electric drive and has ordered one 100-kva and two 500 kw alternating-current generators with 22-kw exciters and switchboard panels. Twenty-two motors ranging from 5 hp to 50 hp will be employed for operating the various machines. All the apparatus will be furnished and installed by the General Electric Company.

**Peerless Company Takes Rauch & Lang Boston Agency.**—The Peerless Motor Car Company of New England has secured the Boston agency for the Rauch & Lang Company, of Cleveland, Ohio, and will feature the electric vehicles under the direction of J. L. Snow at its headquarters, 660 Beaver Street, Boston, Mass. D. C. Tiffany, formerly agent for the Rauch & Lang electric car in Boston, has taken the agency for the Ohio car and will continue service for his electric garage at 136 Chestnut Street, Boston.

**July Increase in Connected Load on Byllesby Properties.**—During the four weeks ended Aug. 1, according to reports from all of the Byllesby properties, there was shown a net gain in electric connected load of 881 customers, representing 1163 kw in lighting, 1818 kw in motors and 1350 kw in appliances, such as flatirons, fans, toasters, percolators, vacuum cleaners and washing machines. In this period the total output of all the properties was more than 27,000,000 kw-hr., an increase of 29.7 per cent over the figures for the corresponding period in 1912.

**Working on Telephone Train-Dispatching System.**—The Denver & Rio Grande Railroad Company is now installing telephone train-dispatching between Ogden, Utah, and Grand Junction, Col., a distance of about 330 miles. Two No. 9 hard-drawn bare copper wires form the circuit, and selectors and telephone apparatus of the Western Electric Company's manufacture are to be used. It is expected that the first section of 114 miles, between Salt Lake City and Helper, will be put in service about Sept. 1, and the rest of the line some time in October or November.

**Utilities Buy Stokers.**—The American Engineering Company, of Philadelphia, Pa., has recently received orders for Taylor stoker equipment from the New York, New Haven & Hartford Railroad Company, New York; United Illuminating Company, Bridgeport, Conn.; Detroit (Mich.) Central Heating Plant; Cleveland (Ohio) Municipal Light Plant; Detroit City Gas Company, Detroit, Mich.; Interborough Rapid Transit Company, New York; Elmira (N.Y.) Water, Light & Railroad Company; Edison Illuminating Company, Lancaster, Pa., and the Detroit Edison Company.

**General Electric Industrial Power Installations.**—A large number of industrial power installations have been secured recently by the General Electric Company, and among these the following are important and representative: The Morse Chain Company, of Ithaca, N. Y., will add to its power plant equipment a 300-kw Curtis turbo-generator, with switchboard. The Altoona Portland Cement Company, of Altoona, Kan., will install electric drive equipment, consisting of sixteen motors ranging from 15 hp to 150 hp. A 625-kva Curtis steam turbo-generator, thirty motors of from 5-hp to 50-hp rating, a switchboard and auxiliaries are to be installed in the plant of the Humboldt Cooperage Company, at Arcata, Cal. The J. G. Brill Company, of Philadelphia, Pa., big car builder, proposes to add to its power station equipment two 300-kw rotary converters, six 110-kva transformers and necessary switchboard panels. Thirty-seven new motors, ranging in size from 5 hp to 20 hp, will be placed in operation shortly by the Marion Steam Shovel Company, of Marion, Ohio.

**Sunbeam Sales Conference.**—The Sunbeam sales conference of the Western Electric Company was held at Nela Park, Cleveland office, during the week of July 28 and a number of prominent lamp men addressed the assembled delegates. Two sessions a day were held and the program included talks on the lamp situation from sales, publicity, commercial and technical standpoints. Particular attention was paid to the questions of tungsten sales stimulation, co-operation between the sales and engineering departments and the introduction of Sunbeam lamps into industrial plants.

**New Electrical Equipment for a California Utility.**—The San Joaquin Light & Power Corporation, of Fresno, Cal., will add to the equipment of its power station 3000-kva and 3750-kva alternating-current generators with two 80-kw turbo-exciters and a 50-kw motor-generator exciter, four 666-kva and four 1000-kva water-cooled transformers, a 100-kw motor-generator set and necessary switchboard panels. The order also includes four 1250-kva water-cooled transformers and switchboards for the stations at Bakersfield and Friant, Cal. All the apparatus will be built by the General Electric Company.

**Electrical Hand Lantern Selling Well.**—The Jenks Lantern Company, of 3 North Clark Street, Chicago, Ill., states that it is receiving large orders for its recently perfected electric hand lantern. The lantern consists of a 3½-volt, 1½-cp incandescent lamp, supplied from three dry cells carried in the base. The battery is guaranteed to give fourteen hours' continuous service or its equivalent in intermittent use. The lamp resembles in design the old oil lantern and is bail-operated; that is, with the bail vertical, as when in use, or with it hanging on one side, the lamp is lighted; when hanging on the other side the light is extinguished. This lamp is adapted to the same service as the old oil lantern.

**Solderless Connectors Used in Wiring Large Hospital.**—A large order for solderless connectors was recently placed with Dossert & Company, of New York City, for the wiring of the new General Hospital in Cincinnati, Ohio, the work being done by the William A. Corrao Company, of St. Louis. Not only were Dossert connectors specified for the switchboard wiring and for making the tap-offs from feeders, but special Dossert type B lugs were attached to the ends of the large feeder cables ranging up to 1,500,000 circ. mils, for the purpose of pulling in the cables. This method of pulling cables through conduit was first used by the Thompson-Starrett Company in wiring the Gimbel Building, Broadway and Thirty-third Street, New York.

**Electrics in High Favor on the Pacific Coast.**—A tire manufacturer who returned from a visit to the Pacific Coast recently expressed himself on the outlook for electric vehicle business in the West as follows: "At present both the electric pleasure car and commercial car hold an eminent position. The excellent roads throughout the Pacific Coast, especially in California, afford bright prospects for this type of machine. The Western States along the Pacific Coast raise an enormous quantity of fruit. The rapidity with which fruit products can be delivered to shipping points by trucks is appreciated by the fruit growers, as they fully realize that their product is one of perishable nature. The continuance of the good roads policy is bound to establish this section of the United States as the largest user and possibly producer of electric vehicles."

**Kansas Utility Increases Its Generating Capacity.**—The Kansas City (Mo.) Terminal Railway Company is increasing its generating capacity by the construction of a new power house, measuring 184 ft. by 94 ft., with a brick stack 14 ft. in diameter at the top and 250 ft. high. The boiler room is laid out to accommodate eight 500-hp Babcock & Wilcox horizontal water-tube boilers, and six of these will be installed at once. These are to be equipped with superheaters and chain-grate stokers of the same make and will have high reverse settings, giving large combustion chamber and smokeless operation. Worthington feed-water pumps are to be put in, driven by Kerr turbines. The present installation of electrical equipment will consist of two 1250-kva General Electric horizontal turbo-generators, three-phase, 60-cycle, 3600-r.p.m., and one 35-kw, 120-volt exciter. Two absorption-type refrigerating machines are also to be installed, with a combined capacity of 75 ton. The power plant will be equipped with coal and ash-handli machinery, reserve fire and elevator pump, house-serv pumps and crane. The service wires and piping to t station building and other points will be carried throug an underground tunnel.

**New Type of Drawing Tables to Be Marketed.**—T Economy Drawing Table Company, of Toledo, Ohio, a decided to manufacture and carry in stock an iron ba adjustable-type drawing table, in addition to its regul line of drawing tables and filing cases which has been known as the "Economy" furniture. Some entirely n devices on this adjustable table will enable the drafts to make the adjustment easily and quickly from the fron the table, and also to fix the top firmly at any height angle desired.

**Indirect Lighting in Newark, N. J.**—Speaking of the que tion of indirect lighting and its special availability for c tain classes of illumination work, H. R. Jackson, of Newar N. J., recently stated to an *Electrical World* representativ "There is no question in my mind but that in the near futu this system will be used for lighting all banking and co mercial offices, and to a considerable extent in private re dences." At the office of the Federal Trust Company Newark there have been installed recently ten indirec lighting units. Each consists of a bowl 24 in. in diamete containing a 500-watt lamp and suspended 3 ft. 6 in. below 20-ft. ceiling. The fixtures were supplied by the Alexali Company, of 432 East Twenty-third Street, New York. Th space lighted by these units measures 25 ft. by 100 ft., an the installation has given such satisfaction that three oth Newark concerns, the Washington Trust Company, Fideli Trust Company, and Liberty Trust Company, have place orders for similar equipment. On these last-named jobs th units will contain 250-watt lamps and the fixtures are to b supplied by Cassidy & Son, of 133 West Twenty-thir Street, New York. The installation at the Federal Tru Company's office replaced about a hundred individual de lights, and it is estimated that the cost for energy will b about the same as with the old system, but the illuminatio is said to be so much superior to that formerly obtain as to be beyond comparison. These four installations we all awarded to the above-mentioned contractor.

**Chicago Jobber on Trade Conditions.**—According to th Central Electric Company of Chicago, Ill., the most rad cal change that has been made for a long time in the sa of electrical goods is that put in force recently by th National Tube Company. That company has applie (*Electrical World*, Aug. 2) to electrical conduit of its man facture list prices and discounts that have governed th sale of wrought iron or merchant pipe for a number years. By this plan the weight per 100 ft. determines th list price, and instead of a basic discount of 50 per ce and a number of tens and fives additional, a discount usually only two figures is employed. The National Tub Company's active entrance into the conduit field was une pected, as was also the change in the method of pricin and it is hoped that the new arrangement will be a va improvement over the past uncertain and unstable practic Of great moment also at the present time in electrical lin is the general reduction in profits and the increase in ope ating expenses, the former due to the indifference on th part of many manufacturers and jobbers to the necessi of an average percentage of profit that will be in acco with the expense of doing business, and the latter to th fact that keen competition has reduced the size of orde and increased their number, necessitating the handling ten transactions or orders instead of one. Necessary i creases in salaries, hotel and other expenses have also p the selling cost far beyond old figures. The compar maintains that many buyers of electrical material fail realize that this extra service must be paid for and a therefore surprised when they discover that prices whi do not include an average profit to the seller always car a penalty to the buyer in the shape of slow delivery poor quality goods or both. The company is of the opinio that the time is not far away when the buyer will b keenly interested in the seller making a profit; when, fact, the buyer will not do business with a concern th disregards profit.

**Electrical Industry from a Western Viewpoint.**—The Automatic Electric Washer Company, of Newton, Ia., has implicit faith in the future of the electrical industry in this country, as witness the following abstract of a letter recently received from that company: "While no doubt many of our Eastern customers wonder why we are located 'way out here in the West on the prairie,' it is nevertheless true that we are supplying some of the largest holding and operating companies in the country. They no doubt find that our machine pleases their customers or they would not recognize it as they do. We regard it as merely a question of time when this entire country will be electrified and every farmhouse will be an electric 'prospect.' The wonderful engineering achievement at Keokuk will make cheap power possible within a large radius."

**Relief Promised to Stockholders.**—Immediate payment of interest on deferred payments of stock of the St. Joseph (Mo.) Railway, Light, Heat & Power Company has been offered to holders who deposited stock with the Fidelity Trust Company, in accordance with an offer of purchase made by Henry L. Doherty & Company upon condition of a new plan of extending payments.

**Controversy Over Utility Taxation in Colorado.**—The taxation valuation of the Denver Gas & Electric Light Company, which is operated by the Cities Service Company, was placed at $2,777,730 by the Colorado tax commission and later reduced to $1,784,020 by the commissioners of the city of Denver. Suit has been brought by the former commission against the latter to enjoin it from taking this action. Court proceedings came about through a conflict as to jurisdiction of the two commissions and will probably result in a long-drawn-out controversy. In the meanwhile it is learned that the company, which is controlled by the Henry L. Doherty interests in New York, has paid its taxes on the valuation of the city commission.

**Lansden Company Failure.**—The Lansden Company ,of Newark, N. J., and Allentown, Pa., manufacturer of electrical vehicles, filed a schedule in the Bankruptcy Court in Newark on Aug. 8, showing claims amounting to about $193,000, held by 300 or more creditors, and assets of $304,046. Of the latter item a very large proportion is represented by manufactured product at the two above-named plants, totaling in value $118,178. The assets include also $32,516 in bills receivable. The largest creditors are the Merchants' National Bank of Jersey City, which has a claim of $30,428, partly secured; the Edison Storage Battery Company and the General Electric Company, whose combined claims total about $30,000, and the North Ward National Bank, whose claim of $12,500 is unsecured. The company was organized in 1904 by Thomas A. Edison, and in January, 1912, control of it passed into the hands of W. L. Case and interests represented by him, as recorded in the *Electrical World* of Feb. 3, 1912. At this time the capital was increased from $100,000 to ten times that amount and a new factory was leased in Newark. In June of the present year the company acquired the plants of the Webb and the Mack Brothers companies at Allentown, Pa., and established a branch at that place, moving to it part of the equipment of the Newark plant. Notice of this change appeared in the May 31 issue of the *Electrical World*. The company consented to an immediate adjudication of the above claims upon the filing of a bankruptcy petition by the Crescent Auto Company, of New York. George Paddock, of the Paddock-Zuzi Motor Company, is the receiver.

**The Copper Situation.**—During the last half year there have been several unusual factors affecting the copper situation in this country, the presence of which has been reflected in the figures on production and consumption. A period of great activity in business at the start of the year, followed by a decided slump (arising apparently from a combination of tariff and currency legislation agitation and from the Mexican and Japanese complications), caused tightness in the money market, which was very generally felt throughout the country. Following closely on the heels of this interval of financial gloom came labor trouble at the large Nichols refinery, and later a strike at the Lake mines, which is still in effect, and when the Nichols plant did finally get into operation one of the big furnaces broke down, holding up the delivery of probably 10,000,000 lb. of copper during July. As a result of these and other unfavorable local conditions, and following an increase in the volume of imports and a falling off of exports, copper prices were forced down to a fairly low figure, reaching during one week in July as low as 13.25 cents for spot. A number of big buyers held up their purchases at this time, because of money tightness and also in accord with the general belief that prices would go still lower. As it turned out, however, 13.25 cents proved to be about the low-water mark, and the period of depression was followed by a gradual increase in prices for all grades, an effect possibly attributable, in some measure at least, to the fact that the big electrical manufacturers, which are large consumers of copper, have lately enjoyed unparalleled activity. The present market is quiet and is expected to remain so through August. Statistically the copper situation is strong, the prospects are good for a steady, large consumption, and money is getting easier. There is a fear expressed in some quarters that the recent labor troubles have resulted in too great depletion of the reserve stocks, but no immediate trouble from this source is to be expected. September should, according to present indications, bring a period of renewed activity.

## Statement of the Copper Producers' Association for July

The big slump in domestic copper deliveries during July is summed up in the totals for that month, as follows:

| | July, pounds | | June, pounds | |
|---|---|---|---|---|
| Stocks on hand in the United States on first of month | | 52,904,606 | | 67,474,225 |
| Production | | 138,074,602 | | 121,860,853 |
| | | 190,979,208 | | 189,335,078 |
| Domestic deliveries | 58,904,192 | | 68,362,571 | |
| Foreign deliveries | 78,480,071 | | 68,067,901 | |
| | | 137,384,263 | | 136,430,472 |
| Stocks on hand at end of month | | 53,594,945 | | 52,904,606 |

## Industrial Securities

| Security | Capital Stock Listed | DIVIDEND Per Cent | Period | QUOTATION Aug. 6 | Aug. 13 |
|---|---|---|---|---|---|
| Allis-Chalmers, t.r., 5th pd | $19,800,000 | | | 9 | 8¾* |
| Allis-Chal., pf.,t.r.,5th pd. | 16,050,000 | | | 16½ | 16¾* |
| Amalgamated Copper | 153,887,900 | 1½ | Q | 70¾ | 74 |
| American Tel. & Tel. | 344,471,400 | 2 | Q | 128⅝ | 129½ |
| Electric Storage Battery,c. | 16,074,425 | 1 | Q | 48 | 48 |
| General Electric | 101,363,600 | 2 | Q | 141 | 142½ |
| Mackay Cos., c. | 41,380,400 | 1½ | Q | 89 | 89* |
| Mackay Cos., pf. | 50,000,000 | 1 | Q | 66 | 67* |
| Western Union Tel. | 99,747,600 | ¾ | Q | 67 | 68 |
| Westinghouse, E. & M., c. | 34,496,400 | 1 | Q | 63½ | 68 |
| Westinghouse, E. & M., pf. | 3,998,700 | 1¾ | Q | 114 | 114* |

*Last price quoted.

### NEW YORK METAL MARKET PRICES

| | Aug. 5 Bid. | Asked. | Aug. 12 Bid. | Asked. |
|---|---|---|---|---|
| Copper: | | | | |
| Standard, spot* | 14.37½ | | 14.72½ to 15.85 | |
| | Selling Prices | | Selling Prices | |
| | £ s d | | £ s d | |
| London, standard, spot* | 67 17 6 | | 69 0 0 | |
| Prime Lake | 15.25 to 15.37½ | | 15.75 to 15.87½ | |
| Electrolytic | 15.12½ to 15.25 | | | 15.75 |
| Casting | 14.87½ to 15.00 | | | 15.50 |
| Copper wire base | 16.25 to 16.37½ | | 16.75 to 17.00 | |
| Lead | 4.50 | | 4.50 | |
| Nickel | 40.00 to 45.00 | | 40.00 to 45.00 | |
| Sheet zinc, f. o. b. smelter | 7.50 | | 7.50 | |
| Spelter, spot | 5.60 to 5.65 | | | 5.75 |
| Tin, spot* | 40.80 to 40.87½ | | 41.75 to 42.00 | |
| Aluminum: | | | | |
| Prompt delivery | 22.75 to 23.25 | | 22.75 to 23.25 | |
| Future | 21.00 to 22.00 | | 21.00 to 22.00 | |

### *OLD METALS

| | | |
|---|---|---|
| Heavy copper and wire | 13.75 | 14.50 |
| Brass, heavy | 8.75 | 9.25 |
| Brass, light | 7.75 | 8.25 |
| Lead, heavy | 4.40 | 4.40 |
| Zinc, scrap | 4.25 | 4.62½ |

### *COPPER EXPORTS

| | |
|---|---|
| Total tons to Aug. 17 | 12,929 |

*From daily transactions on the New York Metal Exchange.

## Business Notes

**Imperial Electric Company.**—Mr. H. A. Truitt has purchased the interest of Mr. Thomas G. Truitt in the Imperial Electric Company and will continue the business of this company at 1022 Arch Street, Philadelphia, Pa. The company will act as distributing agent for the Franklin Electric Manufacturing Company, Hartford, Conn., and the Empire Lamp Works, of New York.

**Manning, Maxwell & Moore, Inc.,** together with their subsidiary companies, will move their general offices about Oct. 1, from 85-89 Liberty Street to the new Lewisohn Building, 113-119 West Fortieth Street, New York. This change is being made to meet the demand for a more convenient and central location, as well as for larger space to handle material increases in the company's various lines, which include electric traveling cranes, machine tools, engineering specialties, and railway, machinists', engineers', factory and contractors' supplies. A large portion of this product is manufactured by their constituent companies, the Shaw Electric Crane Company, the Ashcroft Manufacturing Company, the Consolidated Safety Valve Company, the Hayden & Derby Manufacturing Company, and the Hancock Inspirator Company. Manning, Maxwell & Moore, Inc., will occupy the twentieth and twenty-first floors of the new building, which will give them 28,000 sq. ft. of office space, almost double that at present occupied for offices on Liberty Street.

## New Industrial Companies

**The Karkas Lamp & Wire Company,** of Hoboken, N. J., has been incorporated by Maurice J. Breen, William H. McTigue and David Lubach. The company is capitalized at $125,000 and proposes to manufacture incandescent lamps.

**The Thermo Electric Instrument Company,** of Newark, N. J., has filed articles of incorporation with a capital stock of $100,000. The company proposes to manufacture and deal in electric ovens and other electrical devices. S. Lawrence Miller is one of the incorporators.

**The Monmouth Electric Company,** of New York, N. Y., has been incorporated by C. H. Hopper, M. H. Hopper and C. Meyer, all of 92 Murray Street, New York, N. Y. The company is capitalized at $10,000 and proposes to manufacture and deal in electrical goods.

**The Electric Device Company,** of Logan, Utah, has been incorporated with a capital stock of $10,000 for the purpose of dealing in electrical devices. The officers of the company are: Thomas G. Lowe, president; D. S. Betts, vice-president, and F. L. Jensen, secretary and treasurer.

**The National Rotary Power Company** has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $2,000,000. The incorporators are: G. G. Steigler, C. L. Ward and M. Z. Grubb, of Wilmington, Del.

## Trade Publications

**Generators for Electrolytic Work.**—Bulletin A-4093, recently issued by the General Electric Company, illustrates and describes its generators for electrolytic work.

**Lightning Arresters for Electric Railways.**—Bulletin No. A-4135 of the General Electric Company refers to lightning arresters for electric railways and supersedes a previous bulletin on the same subject.

**Prism Fixtures.**—A twelve-page booklet, issued by the F. W. Wakefield Brass Company, Vermilion, Ohio, shows a number of distinctive designs of Colonial prism fixtures. Renewed interest in prism glassware has caused the new line to be placed on the market.

**Storage Batteries.**—In Handbook FL, which is a supplement to its Handbook HL, the Electric Storage Battery Company, Philadelphia, Pa., gives many valuable data relating to batteries for low-voltage isolated electric plants. The batteries operate at from 32 volts to 28 volts.

**Heating Devices.**—In a well-illustrated mailing folder now being sent to dealers in electric-heating devices the Hotpoint Electric Heating Company, Ontario, Cal., lists and describes stoves, irons, toasters and various other electric-heating devices. A thirty-day free display of an electric stove is made to dealers who will agree merely to act as agents in introducing the stove to the local public.

**Automatic Starters.**—A bulletin of the General Electric Company, No. A-4124, is devoted to a detailed description of its automatic starters for alternating-current motors. Descriptions are given of automatic control panels for squirrel-cage induction motors and slip-ring induction motors, float switches for remote control of automatic starting panels or rheostats, and pressure governor panels.

**Auto Fuse Material.**—The Chicago Fuse Manufacturing Company, 1014 West Congress Street, Chicago, is sending out an illustrated leaflet referring to its auto fuse material. In the circular attention is called to the fuse box which centralizes the fuse cut-outs in an accessible position. The circular will interest electrical jobbers and wholesale and retail automobile supply manufacturers and dealers.

**Good Light.**—The Macbeth-Evans Company, Pittsburgh, Pa., has issued a booklet of twenty-four pages, with the title "Good Light," giving in a succinct and interesting manner the essentials that form the basis of a satisfactory lighting system. The photographs of typical installations showing an application of these essentials are admirable and convey a good idea of the possibilities of efficient decorative illumination.

**Diesel Engines.**—Usines Carels Frères, the big Diesel engine makers of Ghent, Belgium, have put out a handsome new catalog—the first printed in English—describing their product. A brief history of this engine is given, followed by an exposition of its working principles. In the frontispiece is given an impression of the Carels shops in color, and the rest of the pamphlet is copiously illustrated. The whole thing is a work of art and of information.

**Rail Bonds.**—The Electric Service Supplies Company, Philadelphia, has issued an attractive seventy-two-page catalog referring to its protected rail bonds and appliances. The catalog gives comprehensive information on the value of proper installation of rail bonds, the importance of accurate testing apparatus aand the use of bond compressors. Because of the practical information contained in this publication it will be found of interest and value to operating men.

**Direct-Current Motors.**—The General Electric Company has issued Bulletin No. A-4130 describing its adjustable speed direct-current motors. These are designed to meet the requirements of individual drive of machine tools. The bulletin illustrates these motors and their application in detail, and contains various curves showing the horse-power outputs at speeds of 300 to 900, 400 to 1200, 500 to 1500 and 600 to 1800 r.p.m. and the horse-power each motor will develop at intermediate speeds.

**Receiver Separators.**—Catalog B of the Harrison Safety Boiler Works, Philadelphia, contains an illustrated description of high-pressure separators equipped with wells or receivers of large capacity not only for the purpose of storing exceptional amounts of water, but also to serve as a reservoir for the storage of steam between the intervals of opening of the engine admission valve. A chart is given showing the most economical diameter of piping, assuming coal at $3 per ton and uniform flow, as where receiver separators of large capacity are installed.

**Economy and Efficiency in the Operation of Utilities.**—Under the heading of "The Efficiency Movement" the department of examinations and reports of H. M. Byllesby & Company, Chicago, has issued its department bulletin No. 6. The purpose of the circular is to point out that under modern conditions, and the increasingly close supervision by state commissions and municipal bodies, utility companies find it of the greatest importance to operate economically and efficiently. Scientific means must be employed to prevent unfair rate reduction and to secure equitable rate schedules. The department of examinations and reports offers its services to develop efficiency, to make appraisals, or to deal with sales methods or problems of a financial nature arising in utility management.

# Personal Mention

**Mr. George Brockman** has resigned as superintendent of e Herington (Kan.) municipal water and light plant.

**Mr. C. R. Vincent** has succeeded Mr. M. D. Leslie as perintendent of the Osceola (Mo.) Electric Light Com- ny.

**Mr. J. C. Anderson** has succeeded Mr. T. T. Kruger as perintendent of the municipal electric-lighting plant of ru, Ind.

**Mr. L. A. Baldwin** has succeeded Mr. Edwin Fisher as sident of the municipal electric-light and water plant at ldwater, Kan.

**Mr. D. J. Fleming** has been appointed manager of the Red ing (Minn.) Gas Light & Power Company, succeeding . Adolph Wagner.

**Mr. George F. Cooper** has been appointed successor to . J. E. Pappan as auditor of the Knoxville (Tenn.) Rail- y & Light Company.

**Mr. F. H. Smith** has taken the place of Mr. E. W. Smyth vice-president of the Franklin Springs Electric Light mpany, of Clinton, N. Y.

**Mr. Roy W. Wright** has been appointed superintendent the municipal electric-light plant at Lydon, Kan., as cessor to Mr. J. R. Bortle.

**Mr. G. A. Rodenbeck** has succeeded Mr. E. B. Stanley secretary and treasurer of the Franklin Springs Electric ht Company, Clinton, N. Y.

**Mr. A. C. Herren** has been appointed superintendent of municipal electric lighting and water plant of Tipton, ., succeeding Mr. N. Hiatt, resigned.

**Mr. J. W. Carruthers** has been elected president of the ntague (Prince Edward Island, Canada) Electric Com- y as successor to Mr. W. L. Poole, resigned.

**Mr. A. Strohm** has been appointed superintendent of er and equipment of the Warren (Pa.) & Jamestown eet Railway as successor to Mr. R. Endinger.

**Mr. A. E. Berdon,** formerly chief engineer of the Easter- Company, Indianapolis, Ind., and designer of graphic ters, has severed his connection with that company.

**Mr. Samuel C. Shaffner** has resigned as operating engineer the American Public Utilities Company, Grand Rapids, h., to accept a position with an operating and engineering pany.

**Mr. Elmer G. Stahl** has been appointed superintendent of municipal electric-light plant at Topeka, Kan., succeeding G. G. O'Neill. Mr. Stahl is a graduate of the Kansas te Agricultural College.

**Mr. Montague Ferry,** of the Department of Electricity of city of Chicago, has been appointed municipal telephone ervisor. He will have charge of the recently created eau of telephone complaints.

**Mr. Justin W. Lester,** of the Old Colony Trust Company, ton, Mass., has been appointed chief accountant of the ssachusetts Public Service Commission, with head- rters at 20 Beacon Street, Boston.

**Mr. Guy E. Tripp,** chairman of the board of directors of Westinghouse Electric & Manufacturing Company, d from New York on Aug. 9 for a five weeks' tour of ope. While there he will visit the foreign subsidiaries he company.

**Mr. Arthur J. Cantin** has been appointed superintendent the electric light and power department of the town of ville, Sask., Canada. Mr. Cantin was formerly connected the Gorman, Clancey & Grindley sales engineering staff dmonton, Alberta.

**Mr. W. L. Abbott,** chief operating engineer for the Com- lwealth Edison Company, was one of the experts called o give testimony before the legislative committee in- igating the purchase of voting machines by the election missioners of Chicago.

**Mr. B. T. Gifford,** formerly connected with the American rict Steam Company of North Tonawanda, N. Y., has en appointed operating engineer for the American Public Utilities Company, of Grand Rapids, Mich., as successor to Mr. S. C. Shaffner, resigned.

**Mr. Frank H. Evans** has been appointed commercial agent of the La Crosse (Wis.) Gas & Electric Company. Mr. Evans has been connected with the Public Service Gas & Electric Company, of Plainfield, N. J., in various capacities for the past six years, being new-business manager at the time of his resignation. The La Crosse Gas & Electric Company has handled only gas appliances until recently. It now intends to put in fully equipped display rooms, etc.

**Mr. S. W. Cheney** has been appointed assistant engineer of Kelsey, Brewer & Company, with headquarters at Grand Rapids, Mich. Mr. Cheney leaves the position of engineer and general superintendent of the La Crosse (Wis.) Gas & Electric Company, which he has filled for the past four months. He has been identified with public utility industries since his graduation from the University of Wisconsin in 1904, and has filled responsible positions at Denver, Col.; Lincoln, Neb.; Montgomery, Ala.. and with the Railroad Commission of Wisconsin.

**Mr. A. W. Higgins** has been appointed engineer and general superintendent of the La Crosse (Wis.) Gas & Electric Company. Mr. Higgins has been doing engineering work of various kinds since graduating from the Massachusetts Institute of Technology in 1901. He has been associated with the E. H. Abadie Company, St. Louis, Mo., engineer and contractor, and more recently was in charge of the installation of the new power plant for the Big Muddy Coal & Iron Company, of Herrin, Ill. Mr. Higgins succeeds Mr. S. W. Cheney, who goes to the home office of Kelsey, Brewer & Company, at Grand Rapids, Mich., who operate the La Crosse property.

**Mr. Stephen L. Coles** has been appointed acting secretary-treasurer of the Society for Electrical Development, vice Mr. Philip S. Dodd, resigned. As announced in these columns several months ago, Mr. Coles' services were retained by the society as director of publicity. For the past four months the society has loaned Mr. Coles to the Toronto Electric Light Company, Ltd., of Toronto, Ontario, where he has been engaged in constructive service and advertising problems. Mr. Coles has had twenty-five years' experience in daily newspaper, magazine, weekly and advertising agency work, and was for several years managing editor of the *Electrical Review*. His electrical education was obtained at the Massachusetts Institute of Technology and in the field during the formative period of the electrical industry.

**Mr. C. A. Graves** has resigned his position as manager of the power bureau of the sales department of the Edison Electric Illuminating Company of Brooklyn to engage in consulting engineering work. Mr. Graves has organized the Graves Engineering Company, Inc., with offices at 35 Pine Street, New York City, and will specialize in central-station management and sales campaigns in small communities. In addition to his connection with the Brooklyn Edison company Mr. Graves has been president and active executive of a central station in central New York for the past three years, in which venture he has met with marked success. His connection with the Brooklyn Edison company runs back nine years, during which time he secured many of the large industrial contracts. In addition, he has acted as rate expert. Mr. Graves has been active in the affairs of the National Electric Light Association, having served on the gas-engine committee and on the power committee. He has also taken a prominent part in Brooklyn civic and engineering associations. He is a member of the Brooklyn Engineers' Club, the Electrochemical Society and the Beta Theta Pi Club and an associate in the American Institute of Electrical Engineers and the American Society of Mechanical Engineers.



C. A. GRAVES

# Construction

## New England

KEZAR FALLS, MAINE.—The Cornish & Kezar Falls El. & Pwr. Co. of Kezar Falls expects to erect a new power station near the mill there next month. The equipment will be taken from the present power house, replacing such new parts as are necessary. Allen Garner is president and manager.

SPRINGFIELD, VT.—The Colonial Pwr. & Lt. Co., of Springfield, expects to erect within the next two months a 44,000-volt transmission line from Springfield to Rutland, Vt., connecting with Claremont, N. H., line at Cavendish, Vt. The company has just completed a line from Springfield to Chatham, N. H., connecting with the Bellows Falls, El. Co. J. G. Menut is manager.

EVERETT, MASS.—Plans are being considered by Aldermen Dorgan for the installation of an ornamental street-lighting system on Broadway from the Revere Boulevard through Central Square to Glendale Square. The committee on municipal lighting of the Board of Trade is also interested in the project.

PEABODY, MASS.—The municipal electric-light power station was destroyed by fire on Aug. 8, causing a loss of about $50,000. Arrangements are being made to secure electrical service from the Salem El. Lt. Co. of Salem.

SOUTHBRIDGE, MASS.—The Selectmen have signed a contract with the Webster & Southbridge Gas & El. Co. for the installation of a new street-lighting system on Main Street for a period of 10 years at $1,380 per year.

WALTHAM, MASS.—The special aldermanic committee appointed some time ago to make investigations in connection with the street-lighting problem will also consider the question of establishing a municipal lighting plant as well as the plan suggested by the Edison El. Illg. Co. for replacing the arc lamps now in use with new lamps throughout the city.

WESTERLY, R. I.—The Westerly Lt. & Pwr. Co. expects to erect within the next six months a substation at Westerly to distribute energy in Bradford and Watch Hill, R. I., and Stonington and Mystic, Conn. In the near future the company expects to replace the arc lamps now in use with cluster lamps, except in the main part of the town, where the flaming-arc lamp will be installed. The company has installed at White Rock, in the substation of the Norwich & Westerly Trac. Co., a 400-kw frequency changer and is now purchasing part of its energy from the traction company. M. H. Spellman is general manager of the Westerly company.

CHESTER, CONN.—At a special town meeting held recently the Selectmen were authorized to make a new contract for street-lighting for a period of five years. The new contract calls for 50 lamps at $1,025. At present the town is paying $750 per year for 30 gas lamps.

SOUTH NORWALK, CONN.—The city of South Norwalk Electric Works expects to purchase in the near future about 12,000 ft. of weather proof No. 0000 copper line wire and some other sizes. The city may take up ornamental street lighting to some extent next year. A. E. Winchester is general superintendent.

## Middle Atlantic

BROOKLYN, N. Y.—Bids will be received by the Department of Public Charities, foot of East Twenty-sixth Street, New York, until Aug. 19, for furnishing labor and material necessary to reset 12 horizontal tubular boilers in the power house at the Kings County Hospital, borough of Brooklyn. Blank forms and further information may be obtained at the office of the chief engineer of the department, foot of East Twenty-sixth Street, New York, where plans and specifications may be seen. Michael J. Drummond is commissioner.

EAST HAMPTON, N. Y.—The East Hampton El. Lt. Co. has received authority from the Public Service Commission to issue $2,500 in bonds, the proceeds to be used for improvements to its property.

ELMIRA, N. Y.—Plans are being prepared by the Lackawanna R. R. Co. for the construction of an electric power plant in its yards here. The proposed plant will furnish electricity for lighting the station, yards and office buildings in addition to charging electric batteries in passenger coaches.

NEW YORK, N. Y.—Bids will be received by Enoch Throop, fire commissioner, at the headquarters of the Fire Department of the city of New York, 157 and 159 East Sixty-seventh Street, borough of Manhattan, until Aug. 19 for furnishing all labor and materials required for the extension to the fire-alarm telegraph system in the borough of the Bronx. Blank forms and further information may be obtained and plans and drawings may be seen at the office of the Bureau of Fire Alarm Telegraph of the Fire Department, 157 and 159 East Sixty-seventh Street, Borough of Manhattan.

NEW YORK, N. Y.—Bids will be received by the Board of Water Supply, seventh floor, 165 Broadway, New York, until Sept. 2 (contract 56) for installing a hydroelectric power equipment, of approximately 250 kw rating, at the lower gate and screen chambers of the Ashokan reservoir on the basin of Olive. Pamphlets containing information [illegible] forms of proposal, contract specifications, contract drawings, etc., be obtained upon application to the above office. A deposit of $10 be required for each pamphlet, to be refunded upon return [illegible] Joseph P. Morrissey is secretary.

NEW YORK, N. Y.—Bids will be received at the office of the Board of Water Supply, seventh floor, 165 Broadway, New York, until Sept. (contract 153) for furnishing and delivering a complete portable power plant, consisting of a gasoline or oil-driven motor-generator set, a switchboard and one motor-driven air compressor, at a designated locality along the line of the Catskill Aqueduct. Pamphlets containing information for bidders, forms of proposals and contract, specifications, etc., can be obtained at the above address. A deposit of $5 will be required for each pamphlet, to be refunded upon return of same. Joseph P. Morrissey, secretary.

NEW YORK, N. Y.—Ordinances have been approved by the Board of Aldermen and the Mayor authorizing an appropriation of $50,000 to provide funds for the installation of electric wiring and fixtures in the City Hospital, Blackwell's Island; $35,000 for electric wiring and fixtures at the City Home, Blackwell's Island; $10,000 for additional electric-lighting facilities at the Kings County Hospital; also $20,000 for the construction of a tunnel, duets, etc., to connect New York Farm Colony with Sea View Hospital power plant, borough of Richmond, and $20,000 for the installation of water mains, hydrants and electric wiring at New York City Farm Colony, borough of Richmond, all under the jurisdiction of the Department of Charities, foot of East Twenty-sixth Street.

PATCHOGUE, N. Y.—The Village Trustees have awarded the contract for street lighting to the Patchogue El. Lt. Co. for a period of 5 years. Under the terms of the contract the company agrees to furnish 100 tungsten lamps of 40 cp at $20 each per year and 50 lamps of 60 cp at $23 per lamp per annum; also 12 arches (consisting of 22 lamps of 4 cp) across Main Street and Ocean Avenue for $47.50 each per year, making a total of $3,600 per year. Under the old contract the village paid $20 each for lamps of 20 cp.

GROVE CITY, PA.—Within the next six months the managers of the municipal electric-light plant expect to purchase one 250-hp gas engine and one 175-kw, three-phase, 60-cycle, 2300-volt generator with complete switchboard equipment for same. Paul J. Hays is superintendent of the plant.

HONESDALE, PA.—The Honesdale Consol. Lt., Ht. & Pwr. Co. expects to erect within the next two months one series incandescent circuit, consisting of 26 40-watt lamps.

PHILADELPHIA, PA.—Bids will be received at the Department of Supplies, Room 312, City Hall, until Aug. 19 for furnishing the following supplies during the year 1913: Electric lamps and cable for the Electrical Bureau and rubber valves for the Bureau of Water in accordance with schedules which may be seen at place designated on proposal. S. Herman Loeb is director.

PHILADELPHIA, PA.—Plans are being prepared by the Philadelphia El. Co. to increase the output of its generating plant; also to erect a new substation at Sixty-fifth Street and Paschall Avenue, to distribute energy to plants in West Philadelphia, Chester and Delaware Counties. A substation at Marcus Hook is to provide power for the silk factory of the American Vicose Company at that place, and another substation at Chester will furnish electricity for the Chester Solid Steel Casting Co., rolling mill and other industrial plants. The company is also planning to enlarge its Christian Street power plant, in which two new turbine generators (one of 47,000 hp and the other of 41,000 hp) will be installed next year.

ASBURY PARK, N. J.—The Atlantic Coast El. Lt. Co., of Asbury Park, has submitted a proposition to the City Council offering to install [illegible] 15 arc lamps on Oak Bluff Avenue for a period of [illegible] years at $95 each per year.

BALTIMORE, MD.—Bids will be received by the Board of Awards of Baltimore City at the office of the city register, City Hall, Baltimore, until Sept. 10 for furnishing and erecting electrical equipment for [illegible] tion plant (contract No. 20, Water Department) as follows: four 400-kw transformers, one 50-kva transformer, circuit-breakers and high-tension switchboard, one nine-panel, low-tension switchboard, all wiring and starters for connecting up various motors; also for furnishing the following motors: one 400-hp motor, two 350-hp motors, one 250-hp motor, one 75-hp motor and three 50-hp motors. Plans and specifications may be obtained at the office of the water engineer, City Hall, Baltimore. A charge of $5 will be made for each set of plans and specifications which will be refunded upon return of same before Sept. 6. Ezra Whitman is water engineer, and James H. Preston is president of board of awards.

EMMITSBURG, MD.—The Public Service Commission has granted the Emmitsburg El. Co. permission to issue $7,500 in capital stock to begin construction of its plant. The company will furnish electricity in Emmitsburg.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until Aug. 26 for furnishing to the Signal Corps 200 telephones, field-artillery type, model 1912, with 5-ft. cords and plugs connected at each end, in accordance with specifications 535-C. Major W. L. Clarke is disbursing of-

WASHINGTON, D. C.—Bids will be received at the office of the ommissioners of the District of Columbia, Room 509, District Build- g, Washington, D. C., until Aug. 21 for furnishing 29,000 ft. under- ound signal and telephone cable for use by the Electrical Depart- ent of the city. Specifications and form of proposal may be obtained om the purchasing office of the district of Columbia, Room 320, Dis- ict Building, Washington, D. C.

WASHINGTON, D. C.—Bids will be received by the Department of e Interior, Washington, D. C., until Sept. 2 for installing or placing position in the patent office, old post office and pension buildings at ashington, D. C., stationary chemical fire-extinguishing apparatus, in- uding complete electrical operating alarm and annunciator systems and ping, etc., for said apparatus. Blank forms of proposal and specifi- tions may be obtained on application to Lewis C. Laylin, assistant cretary.

WASHINGTON, D. C.—Bids will be received at the office of the ief signal officer, War Department, Washington, D. C., until Aug. 23 r furnishing to the Signal Corps the following supplies: (1) 10,000 ik brackets, as per drawing 207 b-1; (2) 350 cells, type V, complete, per specification 341-D; (3) 7000 double-petticoat glass insulators; ) 500 porcelain knobs No. 14; (5) 270 miles C. I. 144-mil wire (com- ercial standard); (6) 2000 ft. pothead 33-mil wire (commercial standard, . T. & T. specification). Bids will also be received until Aug. 27 for 0 miles of 11-strand field wire, in accordance with specification No. A and drawing No. 106. Major W. L. Clarke is disbursing officer.

## North Central

BELDING, MICH.—A complete power plant, it is understood, will installed in the Belding Brothers Building, now in course of con- uction.

BENTON HARBOR, MICH.—The Benton Harbor Club is promoting project to install ornamental street lamps on 12 blocks. For further formation address the secretary of the club.

DETROIT, MICH.—The Detroit Oak Belting Co. is reported to have arded contracts for a generator and motors to be installed in its boiler nt.

DOWAGIAC, MICH.—The Beckwith Estate, electric light department, Dowagiac, expects to purchase within the next six months feed-water aters; also within the next twelve months fifty 1-kva to 5-kva trans- rmers, 100 5-amp meters, 10,000 ft. No. 1014 rubber-covered wire, 00 lamps, 100 irons and other heating devices, 750 switches and other pplies. G. M. White is manager.

DURAND, MICH.—The city of Durand expects to purchase within next eight months lamp-posts and underground cable for an orna- ntal street-lighting system for the business section of the city. H. F. senecrans is superintendent of the municipal electric-light plant and ter-works system.

HOLLAND, MICH.—Bids will be received by the Board of Public rks until Sept. 1 for furnishing and installing a vertical centrifugal mp (1100 gal. per minute) directly connected to a vertical motor. ecifications may be secured from R. B. Champion, superintendent of blic works.

LANSING, MICH.—The State Railroad Commission has approved of following bond issues, the proceeds to be used for improvements: Grand Rapids-Muskegon Pwr. Co., of Grand Rapids, $154,000; onomy Pwr. Co. of Michigan, $115,000; Au Sable El. Co., $62,000; mmonwealth Pwr. Co., of Jackson, $130,000; Bay City Pwr. Co., of y City, $8,000; Saginaw Pwr. Co., of Saginaw, $34,000; Pontiac Pwr. ., of Pontiac, $6,000; Flint El. Co., of Flint, $14,000, and Consumers' r. Co., of Jackson, Mich., $12,000. The Economy Pwr. Co. of chigan has filed application with the commission for another bond ue of $531,000. As yet no action has been taken.

COLUMBUS, OHIO.—The Board of Control has awarded contracts for installation of cluster lamps on High Street from Warren Street to th Avenue, at $13,068, to H. M. Saxbe, of Urbana and the Simonton nstruction Co. Mr. Saxbe will furnish the standards and cables for cluster lamps in State Street from Fourth to Grant Avenue, and Avery-Loeb Electrical Co. the transformers. The cost of this work ll be $3,384. Mr. Saxbe was also awarded the contract for cluster mps on Fourth Street from Mound Street to Livingston Avenue, at 116.

GLOUSTER, OHIO.—Bids will be received by the Board of Public fairs of Glouster, addressed to J. L. Davis, clerk, until Aug. 23 for ipping power plant with piping, including pump suction and discharge ll machinery foundations.

HUDSON, OHIO.—The Board of Public Affairs expects to extend the tribution lines of the municipal electric-light plant and to purchase in near future for three-wire system No. 6 and No. 8 paper-insulated, d-covered cable, No. 8 weather-proof wire, transformers, poles, cross- ms, etc.; also cast-iron water mains, valves, sewer pipe, etc., for water- rks system. For further information address J. R. Wilson, superin- ndent of power station.

McCOMB, OHIO.—Within the next six months the managers of the nicipal electric-light plant expect to purchase a 150-hp boiler and 200 ters. A. Keel is clerk.

MINGO JUNCTION, OHIO.—The power house of the plant of the United States Steel Co. here was destroyed by fire recently, causing a loss of about $15,000.

ARLINGTON, KY.—The Arlington Lumber Co. is considering the installation of an electric-light plant for the purpose of furnishing electricity to operate its sawmill. A motor-driven pump for operating water service for the mill buildings may also be installed.

CARLISLE, KY.—The Carlisle El. Lt. & Pwr. Co. is contemplating the purchase of a producer plant and gas engine of about 200 hp and would like to secure information pertaining to an electric plant operated by a producer gas engine using a directly connected generator or a belt-connected system. Boon Ingels is secretary and manager of the company.

GRAYSON, KY.—The Home Lt. Co., of Grayson, has recently installed one 50-kw direct-current Bullock generator directly connected to a 12-in. by 14-in. Ideal engine and one 100-hp Murray boiler and new switchboard.

LOUISVILLE, KY.—The National Pwr. Co., of Birmingham, Ala., is planning a hydroelectric development on the Ohio River at Louisville by the use of a new type of motor. B. M. Inman, of Birmingham, Ala., is interested in the project.

LOUISVILLE, KY.—The Board of Park Commissioners has awarded the contract for the erection and maintenance of ornamental lamp standards, each carrying one lamp, in the parks and boulevards to the Louisville Gas & El. Co.

LOUISVILLE, KY.—The Foundation Co., of Louisville, has had a bill introduced in Congress authorizing it to establish a power station of the falls of the Ohio River at Louisville, to utilize the power to generate electricity. D. Long Miller, of Louisville, is president of the company.

LOUISVILLE, KY.—The J. Schwarzwalder & Son Co., of Louisville (a cooperage concern), has announced plans for equipping its proposed new plant with electrically operated machinery. The company has a steam plant and generating equipment; it is understood that motors will be purchased in the near future. Arthur B. Herb is general manager of the company.

SEBREE, KY.—The property of the Sebree Lt. & Milling Co., consisting of flour mill, grain elevator, granary and electric-light plant, has been purchased by G. H. Warren & Sons.

CLOVERDALE, IND.—The Putnam El. Co., of Greencastle, has submitted a proposition to the Town Board offering to furnish electrical service in Cloverdale from its plant in Greencastle. The company has secured permission from the County Commissioners to erect a transmission line along the Cloverdale Pike. John G. Bryson, of Brazil, is secretary and manager of the Putnam El. Co.

HUNTINGTON, IND.—The City Council has passed an ordinance authorizing the construction of a municipal electric-light plant, to cost $75,000. The proposition to issue bonds for same will be submitted to the voters in November. H. I. Young is city clerk.

JEFFERSONVILLE, IND.—Plans and specifications have been prepared for an ornamental street-lighting system, consisting of 100 arc lamps mounted on ornamental iron posts. It has not yet been definitely decided to install the system, but bids on it will be asked in the near future, in connection with a renewal of the contract for lighting the city, which is now held by the United Gas & El. Co., of New Albany.

RICHMOND, IND.—The Richmond Lt., Ht. & Pwr. Co. contemplates making improvements to its system involving an expenditure of about $100,000.

WAYNETOWN, IND.—Arrangements are now being made for the installation of a municipal electric-light plant in Waynetown. J. W. Esterline is consulting engineer. J. J. Birdsell is president of Board of Town Trustees.

BLANDINSVILLE, ILL.—C. R. Houston, owner of the local electric-light plant, is contemplating the purchase of incandescent lamps.

CHICAGO, ILL.—Bids will be received by the city of Chicago, at Room 406 City Hall, until Aug. 20 for furnishing one 75-kw motor-generator at the water-works shops, 2304 South Ashland Avenue, Chicago, according to plans and specifications on file in the office of the Department of Public Works, Room 406. L. E. McGann is commissioner of public works.

EAU CLAIRE, WIS.—Bids will be received by the city of Eau Claire until Sept. 2 for lighting the streets with electricity; also for gas lamps. John C. Fennessey is city clerk.

WITTENBERG, WIS.—The electric plant of the Wittenberg El. Co. is reported to have been purchased by E. L. Debe, of Wausau, Wis.

CHOKIO, MINN.—The installation of an electric-lighting system in Chokio is under consideration. It is understood that energy will be secured from the Fergus Falls plant.

EDEN VALLEY, MINN.—The property and franchises, etc., of the Lethert Lt. & Pwr. Co., of Eden Valley, have been purchased by the Central Minnesota Lt. & Pwr. Co., of Glencoe, which will operate same. The Central Minnesota company has also obtained franchises in Watkins and Kimball.

HOWARD LAKE, MINN.—The Central Minnesota Lt. & Pwr. Co., of Glencoe, it is reported, contemplates the construction of a power plant in Howard Lake to furnish energy for different points on the Great Northern. W. R. Rutledge, of Howard Lake, is general manager.

JACKSON, MINN.—Bids will be received by the Village Council until Aug. 25 for the erection of the old dam across the Des Moines River and the construction of a new concrete dam and a concrete and brick power house, together with the furnishing and installation of the hydraulic and electrical equipment for a power plant with an output of 125 kw, in accordance with plans and specifications prepared by L. P. Wolff, consulting engineer, Germania Life Building, St. Paul. Plans and specifications may be seen and blank proposal form secured at the office of the consulting engineer and at the office of I. W. Mahoney, village clerk.

MANKATO, MINN.—The City Council has rejected the proposition of the Consumers' Pwr. Co., of Mankato, for municipal lighting and has decided to take immediate steps to have plans and specifications prepared for the installation of a municipal electric-light plant.

NEW ULM, MINN.—Bids will be received by the city of New Ulm at the office of the city clerk until Aug. 25 for additions to municipal electric-light plant as follows: (1) Addition and changes to brick power station; (2) radial brick or concrete stack; (3) 150-hp return tubular boiler and accessories; (4) steam engine with a rating of approximately 400 hp for direct connection to a 312-kva generator and accessories; (5) one 312-kva generator with switchboard extensions, wiring and accessories; (6) purchase by contractors of old 75-kw unit; (7) installation of shaking grate under the old boiler. Plans and specifications may be seen at the office of the city clerk at New Ulm, or at the office of the Oscar Claussen Engineering Co., Commercial Building, St. Paul. Additional copies may be secured of the engineers upon payment of $4 to cover cost of reproduction of same. Albert J. Meyer is city clerk.

WOODLAKE, MINN.—At an election held July 29 the proposition of issuing $9,900 in bonds for the installation of a municipal electric-light plant was carried. As yet no engineer has been engaged. Harry F. Payne is recorder.

ALBIA, IA.—The question of installing an electric-light plant in Albia is under consideration by the City Council.

MAXWELL, IA.—At an election held recently the proposition to grant a franchise to the Maxwell Lt. & Pwr. Co. to construct and operate an electric plant in Maxwell was carried. For further information address C. E. Lookingbill.

OTTUMWA, IA.—Plans are being considered by the public utilities committee, the Water Works Commission and the City Commissioners for the installation of a municipal electric-light plant in connection with the water-works system. The cost of installing the system is estimated at $125,000, of which $60,000 would be required for new concrete dams.

SWEA CITY, IA.—The installation of a municipal electric-light plant in Swea City is under consideration.

COLUMBIA, MO.—Plans are being prepared for the installation of an electric power plant at the University of Missouri.

GRANBY, MO.—The Ozark Pwr. & Water Co., of Ozark, has applied for a franchise to erect an electric distribution system in Granby.

ABERDEEN, S. D.—Bids will be received by George F. Fossum, architect, Aberdeen, until Aug. 20 for the construction of a three-story and basement municipal building for the city of Aberdeen. Bids on plumbing, heating, electric wiring, painting, etc., will be let separately at another date.

BRISTOL, S. D.—The Town Board has granted S. P. Waage a franchise to install an electric-light plant in Bristol.

LINDSAY, NEB.—The El. Lt. & Tel. Co., of Lindsay, expects to install storage batteries within the next 12 months and is also contemplating the installation of an alternating-current generator with motor for suburban line. Within the next six months the company expects to purchase lightning arresters, insulators and meters. The company could make use of second-hand fans and motors (must be in good condition). F. W. Edwards is manager.

POLK, NEB.—The Village Council has engaged Grant & Fulton, of Lincoln, to prepare plans and supervise the construction of an electric-light system and extensions to water-works system, for which bonds to the amount of $16,000 have been voted.

VERDON, NEB.—Charles G. Humphrey, city clerk, writes that the city does not contemplate the installation of a municipal electric-light plant as reported in the issue of Aug. 2.

WAVERLY, NEB.—Arrangements, it is reported, have been completed whereby electricity will be secured from the electric plant at Havelock to operate the proposed electric system in Waverly.

ARMA, KAN.—Albert C. Moore, of Joplin, Mo., has been engaged by the Mayor and City Council of Arma to prepare plans and specifications and to supervise the construction of the new electric-lighting plant and water-works system. The cost of the work is estimated at $40,000.

HOWARD, KAN.—Bids, it is reported, will be received by the city of Howard until Aug. 27 for an electric-light system. W. K. Palmer & Co., 919 Baltimore Avenue, Kansas City, Mo., are consulting engineers.

JUNCTION CITY, KAN.—The installation of an ornamental street-lighting system in Junction City, it is reported, is under consideration. It is proposed to contract with the Union Lt. & Pwr. Co., of Junction City, for installation of same.

KANOPOLIS, KAN.—Plans are being prepared by Henrici, Kent & [illegible], engineers, 1525 Grand Avenue, Kansas City, Mo., for the installation of an electric-light plant and water-works system at Kanopolis to cost about $30,000.

LYNDON, KAN.—Within the next three months the managers of the municipal electric-light plant expect to purchase a one-panel switchboard (24 in. by 54 in.), one oil switch, one circuit-breaker, one transformer (2200-6600 volts) one voltmeter and one ammeter.

WILSON, KAN.—The Wilson El. Lt. Co. expects to erect within the next two months a substation for transmission line and to purchase within the next 30 days switchboard, instruments, protective devices, poles, underground conduit, meters, etc.; also an alternating-current generator (of about 50 kw) and engine, directly connected, within the next four months, and a coal conveyor and lamp-posts within the next six months.

## Southern States

ALBEMARLE, N. C.—The Piedmont Pwr. Co., it is reported, contemplates the construction of a hydroelectric power plant on the Yadkin River, near Albemarle. It is proposed to develop about 18,000 hp. W. J. Lawrence, 18 Tremont Street, Boston, Mass., is engineer in charge.

GASTONIA, N. C.—It is reported that a contract has been awarded for the installation of an electric-light plant at Linwood College. W. T. Lindsay is president.

SILER CITY, N. C.—The Siler City Lt. & Tel. Co. is planning to install an oil engine and would like to receive catalogs and prices from manufacturers and dealers on 50-hp, 75-hp and 100-hp engines.

WELDON, N. C.—Bids will be received by the Town Council until Aug. 20 for construction of water-works and sewer systems, including two electrically driven centrifugal pumps and motors, capacity [illegible], to be about 750 gal. per minute against 60-lb. pressure. Specifications, etc., may be seen at the office of the Mayor and at office of W. C. Riddick, consulting engineer, West Raleigh, N. C.

WILKESBORO, N. C.—The town commissioners have granted J. T. Humphries, of Moravian Falls, a 30-year franchise to furnish electricity to light the town.

LAKE CITY, S. C.—We are informed that the election to vote on the proposition to issue bonds for the installation of an electric-lighting system will not be held until Aug. 20. It was stated in the issue of Aug. 2 that bonds had been voted for the system.

MADISON, GA.—Within the next four months it is expected to erect 100 new poles in connection with extension to the municipal arc-lamp lighting circuit. G. W. Hubbard is superintendent.

THOMSON, GA.—The managers of the municipal electric-light plant expect to purchase within the next 60 days from 75 to 100 35-ft. to 40-ft poles, and to purchase a 50-hp engine and a 35-kw generator within the next six months. L. J. Porter is superintendent.

TOCCOA, GA.—The Toccoa Falls Lt. & Pwr. Co. expects to install within the next 30 days an emergency steam plant at Capps Cotton Mill, using a 150-hp Corliss engine, and also to purchase one 100-kw 2300-volt, alternating-current generator and switchboard equipment for same. E. P. Simpson is manager.

JASPER, FLA.—The local electric-light plant is reported to have been purchased by L. T. Forlaw, of Fort Pierce. It is understood that the new owner will make improvements to the system.

MELBOURNE, FLA.—E. H. Hale has been granted a franchise to install an electric-light system in Melbourne.

BRINKLEY, ARK.—The Brinkley Wtr. & Lt. Co. will change its system from direct to alternating current (2300 volts) and has purchased machinery and equipment for generating unit, excepting exciter and will have to purchase one 25-hp, 110-volt, 60-cycle, three-phase motor for centrifugal pump. The company also expects to purchase within the next few months one switchboard complete (about three panels) for alternating current generator, 12 or 15 transformers, for primary circuit 3 or 4 miles, cross-arms and glass insulators for same and one two transformer for a series tungsten lamp street-lighting system. J. W. Neff is superintendent.

DANVILLE, ARK.—The Danville El. Co. expects to purchase within the next 30 days a boiler (from 90 hp to 100 hp) and to install same within the next two months. C. T. Meadows is superintendent.

MORRILLTOWN, ARK.—S. R. and M. D. Morgan, owners of the Eldorado electric-light plant, are reported to have taken charge of the local electric-light system and will make extensions and improvements to same.

MARIETTA, OKLA.—The City Council has engaged the Bonham Engineering Co., 435 American National Bank Building, Oklahoma City to prepare plans and specifications for extensions to the electric-light plant, water-works system and sewers. The proposition to issue bonds for the proposed work will be submitted to the voters.

CORPUS CHRISTI, TEX.—A 200-kw direct-current General Electric generator directly connected to a right-hand tandem compound Harrisburg engine is being installed in the Earl C. Heinly power and light plant. Within the next three months it is expected to purchase 50 arc lamps for use on 550-575-volt direct-current circuit. V. S. Heinly is secretary.

DALLAS, TEX.—The Board of Municipal Commissioners will receive bids until Aug. 20 for the mechanical equipment and installation of same in the new municipal building. The apparatus includes the heating and ventilating equipment, with fans and pumps, plumbing and gas fitting, with hot and cold water and necessary pumps, cleaning system with four sweeper attachments, electrical wiring and appliances and elevators for passenger service and for sidewalk lift.

PORT ARTHUR, TEX.—Plans are being considered by the business men for the installation of ornamental lamps on Austin Avenue from Proctor Street to Sixth Street.

RUNGE, TEX.—At an election to be held Aug. 27 the proposition to issue $20,000 in bonds for the installation of an electric-light plant and water-works system will be submitted to the voters.

VAN HORN, TEX.—The commissioners of Culberson County have purchased the electric light and power plant and water-works system of the Van Horn Lt. & Wtr. Co. for $10,000. It is understood that the plants will be enlarged and other improvements made to the service.

VENUS, TEX.—The Venus Lt. & Wtr. Co. has recently installed a new engine for day load. A. D. Frost is manager.

## Pacific States

CASHMERE, WASH.—The power site owned by O. M. Carter and associates on the Wenatchee River was recently purchased by O. B. Hollis and M. M. Dickson, both of Spokane, who, it is said, propose to build a hydroelectric power plant to develop 1600 hp.

METALINE FALLS, WASH.—The Department of the Interior has granted the International Pwr. & Development Co. a permit to erect a large hydroelectric power project on the Pend Oreille River near Metaline Falls. The proposed plant will have an ultimate output of 350,000 hp and will cost when completed about $5,000,000. Wilbur S. Yearsley, of Spokane, is president of the company.

PALOUSE, WASH.—Several important transmission line extensions will be erected out of this city by the Washington Wtr. Pwr. Co., of Spokane.

SPOKANE, WASH.—The property owners on the Main and Trent Avenues districts have petitioned the city commissioners for a street-lighting system, the same to be installed between Lincoln and Division Streets.

CLATSKANIE, ORE.—The local electric-light plant has recently changed hands. The new owners, it is understood, will enlarge and improve the plant. An addition will be built to the power house and concrete foundations put in for new machinery, which, it is said, will double the output of the plant. Contract has already been placed for the waterwheel. W. W. Seymour, Mayor-elect of Tacoma, Wash., is president of the company.

HEPPNER, ORE.—Plans are being considered by the Heppner Lt. & Pwr. Co. for enlarging its power plant and establishing a day service. The present plans provide for doubling the output of the plant, rebuilding the distribution system and replacing the present arc-lamp street-lighting system with incandescent lamps. The cost of the improvements is estimated at $20,000.

MARSHFIELD, ORE.—The Oregon Pwr. Co., which recently took over the electric franchises in Coquille and Myrtle Point, is planning to erect a large central power plant in Marshfield to furnish energy for North Bend, Marshfield, Eastside, Coquille, Myrtle Point and other towns in the county. A high-tension transmission line, now under construction, will be used jointly by the Oregon Pwr. Co. and the C. A. Smith Co., the latter transmitting energy to its logging camps. At present the Oregon Pwr. Co. is purchasing the surplus energy from the plant of the Smith Lumber Co. and distributing same among local consumers.

PORTLAND, ORE.—The proposition to purchase the lighting system which serves the Laurelhurst district and improve same is under consideration by Mayor Albree and the city commissioners. The city commissioners also contemplate the installation of cluster lamps in the Laurelhurst district.

LOS ANGELES, CAL.—The State Railroad Commission has authorized the Pacific Lt. & Pwr. Co. to issue $2,500,000 in capital stock to be sold at not less than $80 per share, the proceeds to be used for the completion of its hydroelectric development at Big Creek in Fresno County.

SACRAMENTO, CAL.—The North Sacramento Land Co. has made arrangements with the Great Western Pwr. Co. whereby the latter will extend its distribution lines 2 miles or more to furnish energy for lamps and motors in the suburb of North Sacramento.

SAN DIEGO, CAL.—The Los Angeles & San Diego Beach Ry. Co. is contemplating the construction of a power plant near Pacific Beach.

SUTTER CREEK, CAL.—The Board of Trustees has accepted the bid of the Amador El. Lt. & Pwr. Co., of Sutter Creek, for lighting the streets of the city, and it is expected that work will soon begin on installation of the system. The plans provide for lighting not only the principal thoroughfares but the alleys and streets throughout the town.

TWIN FALLS, IDAHO.—All bids submitted Aug. 4 for installing a cluster street-lighting system in lighting district No. 17 were rejected. New bids will probably be received later. Stuart H. Taylor is city clerk.

BINGHAM, UTAH.—The transformer station and the compressor plant of the Utah Copper Co. was recently destroyed by fire, causing a loss of about $100,000.

GREAT FALLS, MONT.—The City Council recently formed a lighting district which provides for the installation of cluster lamps on Second Avenue immediately.

HOLLY, COL.—The Water and Light Commission will install within the next 30 days one 50-kw, 60-cycle, 2300-volt alternator and a new power panel to switchboard in the municipal electric light and water plant.

## Canada

NEEPAWA, MAN.—The town of Neepawa will call for tenders in the near future for equipment for an electric plant, consisting of two 150-hp boilers and generating unit, consisting of a 125-kw generator directly connected to suitable engine. Plans and specifications are now being prepared by W. E. Skinner, Ltd., 204 Sterling Bank Building, Winnipeg, Man.

AURORA, ONT.—At an election held Aug. 4 the ratepayers voted in favor of the by-law appropriating $16,000 for the purchase of electrical machinery for the municipal electric-light system, also a by-law providing $5,000 for the purchase of electrically operated pumps. Steps will be taken at once to install the machinery and increase the number of street lamps from 60 to about 300.

FORT WILLIAM, ONT.—The proposed development of the Kaministiquia Pwr. Co., of Fort William, at Kakabeka Falls, is to be 15,000 hp instead of 15,000,000 hp as stated (owing to a typographical error) in the issue of Aug. 9.

WELLAND, ONT.—The Electric Sheet & Metals Co., Ltd., is reported to have secured property in Welland on which it will erect an iron and steel plant (melting iron and steel by electricity). It is also stated that the company has contracted for electrical energy to the amount of several thousand horse-power to operate its plant.

CHARLOTTETOWN, P. E. I.—The Charlottetown Lt. & Pwr. Co. is making improvements to its plant, including the installation of a second gas producer and engine and other apparatus, also changing its system from 133 cycles to 60 cycles. Upon completion of the plant a day service will be established.

MONTAGUE, P. E. I.—The Montague El. Co. expects to build within the next three months a dam with concrete flume. N. J. McDonald is secretary.

COOKSHIRE, QUE.—The Westbury El. Lt. & Pwr. Co., of Cookshire, expects to erect within the next few months about 8 miles of transmission lines and to purchase a 200-kw alternating-current generator, waterwheel governor and 100 watt-hour meters. H. A. Worby is manager.

# New Incorporations

TAMPA, FLA.—The American Utilities Co. has been incorporated with a capital stock of $100,000 to construct and operate water-works, electric-light systems, etc. The officers are: James F. Taylor, president; J. J. Logan, vice-president, and Charles H. Davis, secretary and treasurer.

COLUMBUS, GA.—The Muscogee Lt. & Pwr. Co. has been incorporated by Edward W. Swift, J. P. Illges, J. P. Kyle, Clifford J. Swift, John T. Davis, Jr., T. E. Golden and others. The company is capitalized at $50,000 and proposes to generate and distribute electricity for lamps and motors.

BRIDGEWATER, PA.—The Bridgewater El. Co. has been granted a charter with a capital stock of $5,000.

HARRISBURG, PA.—Articles of consolidation have been filed at the State Department by 22 electric light and power companies organized to do business throughout Beaver and Lawrence Counties under the name of the United Pwr. & Lt. Co. The new company is capitalized at $110,000. The officers are: George R. Barnett, president; E. E. Barnitz, secretary, and George Heard, treasurer, all of Harrisburg.

RED LION, PA.—The Laurel El. Lt. & Pwr. Co. has been organized with a capital stock of $10,000 for the purpose of furnishing electrical service in the township of East Hopewell. The directors are: Benjamin F. Roseman, of Red Lion, treasurer; Samuel Roseman, of Red Lion, and Charles A. Shaull, of Laurel. The office of the company will be located in Red Lion.

MADISONVILLE, TEX.—The Madisonville Lt. & Pwr. Co. has been incorporated with a capital stock of $6,500 by A. A. Allen, A. E. Page and F. E. White.

BARNET, VT.—The McIndoe Falls Lt. & Pwr. Co. has been incorporated with a capital stock of $4,000 by J. M. Gibson, Clara B. Gibson, D. L. Judkins and L. E. Judkins. The company proposes to furnish energy at Barnet and Ryegate, Vt., and Monroe, N. H. It already has a plant in Barnet and will extend its transmission lines.

WINNIPEG, MAN., CAN.—The Commercial Pwr., Lt. & Coal Co. has been incorporated with a capital stock of $250,000 by F. M. Burbridge, R. C. McPherson and R. W. Killey.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED AUG. 5, 1913

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,069,095. DYNAMO ELECTRICAL MACHINE; D. H. Andrews, Newton, and E. C. Ketchum, Boston, Mass. App. filed Jan. 17, 1912. Film of insulating varnish is prevented from bridging across between adjoining contact disks of the armature by tapered insulating ridges standing out from the periphery of the armature disks.

1,069,113. NON-CORROSIVE METALLIC ALLOY; John Coup, Marion, Ohio. App. filed April 1, 1913. A substitute for nickel plating and used in piano strings, bells, etc., where it is essential that it be non-corrosive to preserve the tone; consists of copper, nickel, zinc, aluminum, phosphor-tin, lead and iron.

1,069,121. PROCESS OF HEATING WATER; R. R. Foster, Colton, Cal. App. filed July 30, 1912. Heat is radiated downward directly onto an exposed thin layer of water.

1,069,125. ELECTRIC SWITCH; M. Guett, Hartford, Conn. App. filed June 25, 1909. Push-button switch operated by door bolt to insure lights being turned off when apartment is vacated, as in hotels etc.

1,069,126. ELECTRIC SWITCH; M. Guett, Hartford, Conn. App. filed June 28, 1911. Push-button type; racks on the push buttons mesh with a pinion on the switch spindle.

1,069,151. PROCESS FOR THE PRODUCTION OF AN INSULATING COATING ON ELECTRICAL CONDUCTORS; J. Loewenthal, Berlin, Germany. App. filed Dec. 6, 1912. Strongly adhering aluminum compounds from a suitable solution of aluminum salts are electrolytically precipitated on the conductor while the conductor is used as a cathode.

1,069,165. RAILWAY SAFETY APPARATUS; J. D. Nix, Ferriday, La. App. filed March 16, 1910. Third-rail contact system with solenoid valve controlling throttle, brakes and signal.

1,069,169. SEPARATING APPARATUS; H. Parker, Nashua, N. H. App. filed Feb. 28, 1911. Separates the solid matter in suspension in the waste water from a paper-making or like machine by liberating in the fluid a large amount of gas from an electrolytic gas-producing chamber, the gas bubbles attaching themselves to the solid matter and carrying it to the surface.

1,069,178. PROCESS OF RECOVERING ZINC; C. J. Reed, Philadelphia, Pa. App. filed June 3, 1912. Treats zinc-containing material with an excess of sulphuric acid, treats resulting solution with an oxidizing agent, purifies the oxidized solution with an excess of zinc-containing substance, further purifies with metallic zinc and finally recovers the zinc from the purified solution.

1,069,179. PROCESS OF ROASTING ORES AND RECOVERING ZINC THEREFROM; C. J. Reed, Philadelphia, Pa. App. filed June 3, 1912. Reduces metallic sulphide to fine powder, mixes powder with material containing a metallic oxide and subjects mixture to heat in presence of an oxygen-containing fluid.

1,069,187. METHOD OF AND MEANS FOR MEASURING POWER IN ELECTRIC CIRCUITS; H. J. Ryan, Palo Alto, Cal. App. filed Nov. 8, 1910. For measuring small power consumptions in alternating-current circuits of high voltage; produces an inclosed curve or diagram by means of a pencil of cathode rays displaced simultaneously in two directions at right angles.

1,069,197. MACHINE FOR ELECTRICALLY WELDING WIRE FABRICS; H. L. Smith, Clinton, Mass. App. filed Sept. 18, 1907. Stationary welding jaw and complemental welding jaw in the form of a heavy copper block having a curved seat or recess and flexibly connected with a transformer.

1,069,208. TROLLEY; S. F. Walker, Bozeman, and A. W. Walton, Butte, Mont. App. filed June 9, 1909. Upward pull on trolley rope when trolley leaves the wire throws the finder fingers up into operative position.

1,069,211. ELECTROLYTIC METER; E. Weintraub, Lynn, Mass. App. filed Feb. 14, 1910. Has a mercury anode and an osmotic membrane of goldbeater's skin separating the anode from the electrolyte, which contains potassium sulphocyanate.

1,069,252. ELECTRIC FURNACE; A. Helfenstein, Vienna, Austria-Hungary. App. filed June 5, 1912. Transformer is placed on the outside of and beneath the revolubly mounted tubular metal container and the secondary has brushes engaging with flanges on the container.

1,069,255. GLASS FURNACE AND PROCESS; P. L. T. Heroult, La Praz, France. App. filed Aug. 26, 1910. Treats liquid glass in an electric furnace with a current between electrodes consisting of pools of molten metal electro-negative to the metals of the glass.

1,069,259. TRANSFORMER; S. E. Johannesen, Pittsburgh, Pa. App. filed March 3, 1906. Magnetizable core is supported by frames, and ventilating passages are provided between the coils, between the core and the coils and between the frames and the core.

1,069,260. METALLURGICAL APPARATUS; W. McA. Johnson, Hartford, Conn. App. filed Sept. 20, 1909. For condensing vapors of zinc such as those obtained from a gas or electric furnace.

1,069,291. ELECTROMAGNETIC MOTOR; H. A. Rhodes, Denver, Col. App. filed Sept. 13, 1909. Series of electromagnets arranged in circular form and concentric rotatable armature having magnetic segments spaced by non-magnetic members.

1,069,305. PROCESS OF ELECTROLYTICALLY REFINING COPPER; G. D. Van Arsdale, East Orange, N. J. App. filed Oct. 2, 1908. Separates copper by electrolysis from an electrolyte containing copper in the cuprous state.

1,069,307. TELEPHONE RECEIVER HOLDER; A. Wetzel, Los Angeles, Cal. App. filed June 29, 1912. Wall bracket in which the receiver is placed when taken off the hook.

1,069,310. LIGHTNING ARRESTER; A. J. Wurts, Pittsburgh, Pa. App. filed Aug. 2, 1905. Horn-gap type; horns are of greater resistance toward their outer ends so as to introduce resistance in series with the arc.

1,069,326. SMELTING FURNACE; O. S. Emberg and O. J. D. Emberg, Chicago, Ill. App. filed Aug. 8, 1912. Has sectional jointed electrode.

1,069,[illegible] SWITCHING DEVICE; F. W. Harris, Wilkinsburg, Pa. App. filed Oct. 7, 1908. No-voltage knife-switch circuit-breaker; a voltage magnet coil operates a toggle which acts in opposition to the switch-opening spring.

1,069,347. SELECTIVE SIGNALING SYSTEM; A. C. Reid, Genoa, Ill. App. filed May 4, 1909. Step-by-step selectors at substations and a sluggishly moving circuit-closing element interposed between the step-by-step element and a signal.

1,069,371. METHOD AND APPARATUS FOR HEATING; G. G. Bell, London, and J. St. V. Pletts, Teddington, England. App. filed Sept. 25, 1909. Heats an iron accumulator with small quantity of electric energy and draws off the water to be heated through the center of the heated mass.

1,069,372. APPARATUS FOR HEATING WATER AND OTHER LIQUIDS OR FLUIDS; G. G. Bell, London, England. App. filed Dec. 17, 1910. Heat-storage mass surrounded by an external annular water chamber.

1,069,373. ELECTRIC HEAT CONSERVING, HEATING AND COOKING APPARATUS; G. G. Bell, London, England. App. filed Jan. 9, 1911. Has a hollow-iron heat accumulator forming an oven.

1,069,375. HEAT-STORAGE DEVICE FOR HEATING WATER OR OTHER LIQUIDS; G. G. Bell, London, England. App. filed Nov. 7, 1911. Heat-storage mass with water channels therethrough provided with removable stoppers to permit cleaning.

1,069,376. COOKING APPARATUS; G. G. Bell, London, England. App. filed Nov. 7, 1911. Heat-storage mass with a deflected air passage therethrough and an oven connected to the heated air passage by supply and return ducts.

1,069,377. APPARATUS FOR COOKING AND FOR CARRYING OUT LIKE OPERATIONS BY MEANS OF ELECTRICITY; G. G. Bell, London, England. App. filed Nov. 7, 1911. Has a common electrical heating element for both the air heater and the water heater and steam generator.

1,069,378. METHOD AND APPARATUS FOR HEATING; G. G. Bell, London, and J. St. V. Pletts, Teddington, England. App. filed Sept. 25, 1909. A heat accumulator heats to a high degree a relatively small body of water and to a lower degree a larger body of water, and the two bodies are mixed as they are drawn off to gain the desired heat.

1,069,401. ELECTRICAL APPARATUS; S. M. Esler, McHenry, Ill. App. filed June 9, 1910. For shifting arrangements at consumer's station from the central station to operate consumer's meter at different rates or percentages; magnet with differential armatures to operate a ratchet.

1,069,425. ELECTRIC SWITCH BOX; L. B. Hornbeck, Minneapolis, Minn. App. filed Nov. 14, 1910. The switch box has a flanged telescoping section adjustable in and out according to the thickness of the plaster.

1,069,434. COMBINED TRIP AND THROTTLE VALVE; P. W. Knauf, Cynwyd, Pa. App. filed May 14, 1912. Ordinarily operated through nut and screw, but may be tripped by electromagnet to close automatically.

1,069,440. DOMESTIC COOKER; J. Lawrence, New York, N. Y. App. filed Dec. 16, 1909. Cooking chamber surrounded by a metal mass of large heat-storage capacity.

1,069,441. OVEN; J. Lawrence, London, England. App. filed Nov. 9, 1911. Oven has an inner wall of refractory material and a surrounding wall of heat-storage material with an intervening air space.

1,069,458. TELEPHONE LOCKING SYSTEM; W. A. Morse, North Grosvenor Dale, Conn. App. filed Jan. 7, 1913. Subscriber on calling central automatically locks out all other telephones on the line.

1,069,472. SYSTEM OF ELECTRIC MOTOR CONTROL; C. Renshaw, Edgewood Park, Pa. App. filed Nov. 24, 1911. Time-limit relay switch for effecting the gradual acceleration of the motor.

1,069,493. CHEMICAL GENERATOR OF ELECTRICITY; O. Lozza, Naples, Italy. App. filed Sept. 9, 1912. Cell of Daniells type.

1,069,518. SWITCH; W. J. Barrett, Richmond, Va. App. filed Sept. 10, 1912. Incased knife switch with a projecting operating handle adapted to lock in notches in the casing.

1,069,519. TROLLEY; S. A. Bemis (deceased; E. M. Bemis, executrix, Springfield, Mass.). App. filed Oct. 12, 1910. Trolley head has a hinged jaw permitting removal of the trolley without removing the axle stud.

1,069,531. ELECTRIC SWITCH; L. G. Copeman, Flint, Mich. App. filed Dec. 23, 1911. Knife switch set in patch of actuating member and provided with a spring so that a slight movement will cause it to snap closed.

1,069,535. FAC-SIMILE TELEGRAPH; F. De Bernochi, Turin, Italy. App. filed March 23, 1911. Wireless transmission of pictures, writings, etc.

1,069,601. FURNACE; J. Churchward, Mount Vernon, N. Y. App. filed April 26, 1911. Furnace rotating on a vertical axis and electrodes projecting into the furnace. Furnace has converging walls forming an inclined discharging trough (fifty claims).

1,096,610. CIRCUIT-CHANGING DEVICE; W. H. Gaulke, Milwaukee, Wis. App. filed Sept. 26, 1911. Multiple step-by-step switch for starting purposes, etc.

1,069,627. ELECTRIC SIGN; A. C. Meyer, San Diego, Cal. App. filed Feb. 7, 1912. Motor-driven flasher mechanism.

1,069,635. ELECTRIC BOX CONNECTION; Frederick H. Ward, Brooklyn, N. Y. App. filed June 6, 1911. Ends of the conduits secured to the box by clamps which bind the conduits against the interior walls of the entrant portions of the box.

1,069,661. SWITCH; V. H. Carman, Indianapolis, Ind. App. filed Dec. 11, 1912. Plural-bladed switch with progressively engaging contacts for starting three-phase induction motors, etc.

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**e Southland nvention**

Seldom have the transactions of state or sectional conventions been marked with more fertile discussion than t which characterized the recent sessions of the South-tern Section of the National Electric Light Association, d at Macon, Ga., Aug. 14 to 16, and reported elsewhere this issue. The spirit of the new South was in evidence every hand during the meetings. It was the younger neration of central-station men—keen, intelligent and rt—that was largely represented on the program and in lively discussions provoked by the papers. And, with-respect to longitude or clime, this is the type which kes the central-station office invariably the "bright spot" its community and drafts into the company's policies the dern business decalogue. It is this subtle essence which, rth and South, East and West, characterizes the central-ion industry of to-day and finds its intangible expres-n in "square-deal" and "public-be-pleased" policies no than in the material evidences of attractive display dow, well-stocked showcase, and the electric vehicle at curb. And the South has its share of these progressive ons, which are carrying it forward to an electrical and mercial development that is sure to surprise both the tor from the conservative North and him from the West. pite the baking temperature which prevailed during Macon sessions, the recent Southeastern convention t closely to business and took part in discussions which ld have done much credit to a national convention. simple expedient, adopted through the foresight of sident Deal and his association co-workers, doubtless tributed considerably to the success of these meetings. s was the assignment of brief prepared discussions to ouple of members for each of the convention papers. ike the usual contributed efforts, these were purposely short, meaty and interesting. They were on hand in liness to bridge over that curious and difficult psycho-ical moment so generally experienced in conventions r the author has finished reading his paper and the iding officer has called for discussion. Once started, re are usually plenty of subjects and plenty of members ly to enter into the discussion, and the valuable char-r of the matter thus brought out at Macon will be evi-from a perusal of the accompanying report. The South-ern Section of the N. E. L. A. is to be congratulated on highly profitable inaugural convention. Although yet re-ving its chief support from the former membership of Georgia state association, a number of representatives he other four states included in the geographic section re present for this first annual meeting. With one of richest fields of central-station and transmission devel-pent to draw upon, it may be safely predicted that the ure conventions of the section will be as significant in numbers as the recent sessions were successful in both technical discussion and fellowship.

**The Condenser for Wave-Form Analysis**

We publish in this issue an article by Dr. Frederick Bedell describing with charming simplicity an experimental method for determining the form of an alternating voltage or current. It consists in the use of a condenser, a D'Arsonval type of current measurer, and a synchronous commutator with brushes capable of accurate mechanical phase displacement. A sufficient number of successive measurements having been made, at corresponding phase positions, the form of the wave can be accurately delineated, ready for subsequent Fourier analysis if desired. An advantage of the plan is that when measuring a voltage there is no danger of a short-circuit at the brushes. The degree of precision attainable in this way should far exceed that ordinarily obtained with the oscillograph.

**Labels for Station Apparatus**

One of the great central-station management companies makes its stations distinctive and easily understood by the liberal use of labels on machines, switchboards, pipes, etc. The idea here is hardly, of course, that followed in a certain other plant in this country where each engine and turbine is entitled, in beautiful gold-leaf letters, "Martha" or "John," after favored namesakes in the officials' families. But labels can be legitimately used with advantage to facilitate more general understanding of the station apparatus and to decrease the element of error in operation. Especially is this true of switches and valves, where a number of identical pieces of equipment may confuse the attendant. It seems worth while to letter oil switches, for example, both as to their functions and also so as to mark each phase. In one plant the three-compartment switch groups are even divided off by broad red bands to avoid confusion and the danger of accidentally entering a live phase of an adjoining group. Pipes for the water, oil, steam, air and vacuum systems are all painted distinctive colors and are in addition labeled at outlet points. The labor and expense of keeping up such a system of marking are likely to be pretty heavy, with the changes continually going on in the average plant, and such a system, to be of any value whatsoever must of course be held accurately up to date. In an emergency, however, the trouble thus taken will pay for itself, for a properly labeled station need no longer depend altogether for its intelligent operation upon the few attendants who handle with familiarity the intricate equipment.

## Surface Combustion

Considerable attention has recently been devoted to a type of flameless combustion which gives promise of an extended application. In the case of the familiar process of ordinary flame combustion a jet of gas enters into chemical combination with oxygen, at the external surface, in free air. If, for instance, the fuel is oil, this is carried up to the flame through the wick by capillary attraction. It is then vaporized, or gasified, at the top, within the flame. The hydrocarbon gases may be partially disassociated, if the flame is hot enough, just before entering the flame zone. This zone of flame is ordinarily a thin mantle, closely confined to the surface of union between the hydrocarbon gas within and the oxygen of the air without. The temperature of the flame tends to be lowered not only by the cooling action of the air washing its outer surface but also by that of the incoming relatively cool gas. That is, the temperature of any fuel flame is reduced somewhat by the relatively low temperatures of the fuel gases meeting in it. When the gas and air are separately prepared and are intermixed in the proper proportions, as when a jet of mixed coal-gas and air is fed through a tube like that of a Bunsen burner, a thicker layer of flame can be produced with a corresponding rise of temperature. Still higher flame temperatures can be obtained by heating the incoming gases and reducing the diluting nitrogen, and also by inclosing the flame in a refractory chamber. Curiously enough, a hot flame is not a good radiator of heat, and there is some difficulty in getting the heat out of it and into the substance which is required to be heated.

If a porous plate of refractory substance is fitted on one side with a close-fitting cup and supply pipe, and inflammable gas is driven through the plate outward from the cup, the gas issuing from the plate can be ignited, and the flame will cover the plate. If the right amount of air is now mixed with the gas in the cup, so as to produce an explosive mixture, the flame can be cut down to a mere surface film, the combustion occurring flamelessly inside the pores of the plate. The plate becomes thereby intensely heated, since all of the combustion of heat which previously was liberated at the surface of the enveloping gas flame is now liberated within the much smaller surface of the porous plate. The plate is thus able to radiate off a large proportion of the generated heat from the highly heated solid plate substance. It may be that the greatly increased luminous intensity of a gas burner produced by covering it with a Welsbach mantle and admitting air on the inside partly owes its effect to this phenomenon of flameless combustion

If, instead of using a porous refractory plate, use be made of a metal pipe filled with coarse granules of fireclay, and the explosive mixture of gases be admitted through a fireclay plug at one end, there will similarly be an intense heating of the granules and a flameless combustion within their pores. The metal tube containing the flameless burner may then be placed in a boiler to produce steam, or in a tank to melt lead. The explosion of the entering mixed gases in the case of a porous plate is prevented by the chilling effect of the pores on the cool or admission side. In the case of coarse granules the speed of the entering gaseous jet can be made to exceed that at which flame can b propagated backward through an explosive mixture.

The method above briefly outlined is called the Bonecour process, having been developed in England by Prof. W. A Bone and Mr. C. D. McCourt. A description of the proces appeared recently in the London *Electrician*. The evap orative power from a boiler heated by the Bonecourt proc ess is stated to have reached 35.5 lb. of water from an at 100 deg. C. per hour per square foot of heating surfac representing an efficiency of 92.5 per cent. It is claime that this high efficiency is attributable partly to the accu racy with which the admixture of air can be made to th entering fuel gas and partly to the low temperature of th emerging products of combustion—170 deg. C. being men tioned in one instance. Thus far the process is limited t gaseous fuel. That is to say, coal or oil, in order to b employed, must first be gasified. It was stated in *Meta lurgical and Chemical Engineering* last July that substan tially the same process had been discovered and patented i America by Prof. Charles E. Lucke, of Columbia Univer sity, some ten years ago, although it has only recently bee applied commercially in this country.

## Reconstruction of Existing Generating Stations

The problem of reconstructing old generating systems i rapidly coming to the front because consolidations and syn dicate control, based as they are on economic considera tions, call for centralized and modern generating station In a great many cases an entirely new station is erected and where conditions admit of it an old station is enlarge or rehabilitated. Even when consolidations do not obtain the increasing use of electricity in existing systems necessi tates additions and betterments, and the desire for larg industrial loads and intensive business is the incentiv which prompts the installation of the most reliable an efficient apparatus. Otherwise progress in the industr would not be so rapid as it is. The extensive improvement made in steam and electrical machinery since most of th present central stations were erected, and the fact that thes have passed the experimental stage, have also much to d with the tendency to scrap old equipment. A central-sta tion company which has been in existence for from ten t fifteen years should have by this time written off or liqui dated a large part of the original cost of machinery o established an amortization fund to assist in the purchas of modern apparatus. Certainly there are in many locali ties not connected to hydroelectric systems small steam sta tions, all obsolete and inefficient in character, which coul advantageously be replaced by a single steam plant, and th station which is suitably located as regards coal and wate supply should gradually absorb the loads of the other plant if properly manned and designed.

An excellent example of a reconstructed system is re corded elsewhere in this issue. The station carries both lighting and a railway load and has a large ice-makin plant as an adjunct. It therefore possesses greater poss bilities for economy than the average station, and henc may not be considered typical. Nevertheless, the eng neering problems involved do not differ from those c

er systems and the economies effected are also possible attainment elsewhere. The writer is careful to point the sources of trouble found in the old equipment, ny of which were due to faulty design, and it is from mining this phase of the subject that much good can btained. By rectifying errors of this kind investment be conserved and the day for scrapping equipment put until a more favorable opportunity exists for making substitution or for obtaining the necessary funds. nwhile some economy, even if not the maximum, may realized. The old station at Hampton was not so bad tations go, but that it was susceptible of much improve- t is shown by the facts presented in the article printed his issue. Great as are the economies effected by the nge, the feat of substituting an entirely different type rime mover and re-designing the condenser and piping em without interfering with the service may be con- red greater. Only those who have had such work to appreciate the immensity of the task as compared with building of an entirely new station. Every precaution is to have been taken to enable defective operation to letected by records, and that high efficiency was aimed s indicated by the care taken of the fresh water used ne station, none of which is permitted to go to waste.

## Three-Phase Transformers

veral years ago one of the large central-station sys- west of the Mississippi River introduced the use of type three-phase transformers for supplying motor ce to large customers. The manufacturers responded e demand with special three-phase units designed for company alone. Meanwhile the vogue of the three- e transformer for distributing purposes spread to cities, and recently pole-type three-phase units as as 150 kw in rating were installed in a Western fac- plant. The arguments for the use of single three- e units instead of three standard single-phase trans- ers are chiefly academic. Obviously with three wind- utilizing a single core and case the space occupied and otal weight are both less than for equivalent single- e units, there being thus a saving in both first cost ransportation charges. As compared with these single- transformers, the three-phase transformer is more ent. Those who have had to do with their main- nce and upkeep in the cities where extensive use has made of three-phase units are strong advocates of the riority of such three-phase equipment.

Heretofore, it must be emphasized, the application seen chiefly in the larger cities. For the small central tion with limited stock facilities the use of three-phase it cannot be unqualifiedly recommended. In such cases ility is an important factor which must not be over- ked. Although, bought outright, the polyphase unit is ser, such economy is questionable in cases where one to single-phase units will do the work for a long time one. As the load later increases, three-phase distribu- an be provided, using open-delta connection for the eeing, if desirable. And although a three-phase trans- r weighs less, it represents a single, bulky heavy unit nsiderably more difficult to hoist up to a cross-arm or platform than three single-phase units. The small central station manifestly cannot afford to carry in stock many reserve transformers of the various sizes needed, although if it is able to depend upon its regular single-phase equipment the matter of replacements becomes a simple problem. Here it is of the greatest importance that flexibility be attained even if at the sacrifice of minor technical advantages. And in turn the question of flexibility resolves itself into one of available reserve stock which can be carried. This is a function of the size of the company and, in general, of the population it serves. From the aspect of flexibility in making replacements, it seems evident that the small central station which is in any sense isolated from the large stock-distributing points should consider carefully all the points against as well as in favor of three-phase transformers.

## British and American Street-Lighting Specifications

An interesting comparison of British and American street-lighting specifications appears in a recent issue of the London *Electrician*, as noted in this week's *Digest*. Attention is called to the specifications of the (British) Illuminating Society discussed on pages 966 and 999 of our issue dated May 10, 1913, and the recommendations of the National Electric Light Association outlined on page 1223 of our issue for June 7, 1913. For various reasons there is no general consensus of opinion either here or abroad regarding the proper method of rating lamps for street-lighting purposes. The German practice is to rate arc lamps in terms of mean lower hemispherical intensity, while the English preference is for the measurement of illumination as such, the basis being the projection on the horizontal plane 1 m above the pavement. The German practice in measuring illumination on the street is the same as the English. In America the N. E. L. A. committee proposes that the lamp to be used be thoroughly and clearly specified, employing well-authenticated conservative values representative of the performance of the lamp, that its equipment also be specified, and that reasonable limits be set for the variation of the lamp above and below the luminous power taken as standard.

There seems to be great doubt as to whether the average intensity or minimum intensity is the thing particularly to be specified, and also as to how far the uniformity of the lighting should be considered. The N. E. L. A. committee proceeds upon the theory that it is most desirable in the contract to draw up such a specification as to leave the minimum chance for misundersanding and for the difficulties that come from uncertainties of measurement. To this end it advises, first, the exact specification of the lamps that are going to be used and, second, the establishment of a suitable procedure for the verification of these lamps with respect to their adherence to the specification. Both the British and American proposals represent preliminary attempts at the solution of a difficult problem. We believe that the N. E. L. A. committee recommendation is along practical and rational lines and when followed out, as we trust it will be, will lead to sound and reasonable specifications on which street lighting may be based.

# The News of the Week

**Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.**

## Illumination and School Hygiene

At a joint session of the Illuminating Engineering Society with the Fourth International Congress on School Hygiene to be held in the City Hall, Buffalo, N. Y., on Aug. 29 and 30, the following papers will be read and discussed:

"The Illumination Primer of the Illuminating Engineering Society," by Mr. E. L. Elliott; "The Relation of Illumination to Ocular Hygiene," by Dr. E. M. Alger; "The Efficiency of the Eye Under Different Systems of Lighting," by Prof. C. F. Ferree; "Glare from Paper," by Mr. M. Luckiesh; "Influence of Blackboard's Position on Lighting of Desks," by Dr. Mathilde G. Stettner; "Schoolhouse Lighting," by Dr. D. W. Weaver; "The Illumination of Class Rooms," by Dr. James Kerr; "Schoolhouse Lighting in General from the Standpoint of an Engineer," by Mr. B. B. Hatch; "Rural School Illumination," by Mr. W. L. Coffee, and "Testing Light in Schoolrooms," by Dr. George Fitz.

The chairman of the committee on arrangements for the joint session is Dr. Herbert E. Ives, 3101 Passyunk Avenue, Philadelphia, Pa., and the vice-chairman is Mr. W. R. Huntley, Electric Building, Buffalo, N. Y.

## Work on Mexican Hydroelectric Project Halted by Government

Through the enforced cessation of construction work upon the dam across the Conchos River at La Boquillas, in the State of Chihuahua, there is danger of that project being destroyed by flood or revolutionists operating in that section. The dam is a part of a large hydroelectric and irrigation project which the Mexican Northern Power Company, a Canadian concern, has been striving to complete. Up to this time approximately $5,000,000 gold has been expended on work, and were it not for the harassment of bands of rebels from time to time and the difficulty of securing laborers the project would have been completed before this. A few days ago the chief engineer received imperative orders from General José Mercado, federal military governor of Chihuahua, to cease all construction work and to abandon the enterprise. At the time this order was received it is said there were about 6000 native laborers employed in the different branches of construction work. In its present unprotected state it is claimed that a flood in the Conchos might destroy the dam and cause the devastation of homes and property in the valleys of the Conchos and Rio Grande Rivers. Costly machinery is also left exposed to the elements and the hands of vandals. Mr. Fuller, the chief engineer, made his way to El Paso, Tex., after closing down construction operations. He disclaims that he has been aiding voluntarily either the rebels or the federals. It is said that General Mercado, acting on instructions from the federal government, stopped the work on the ground that the dam was interfering with the flow of the Conchos River. The action amounts to practically a nullification of the concessions which were granted to the Mexican Northern Power Company by the federal government during the Diaz régime and by the government of the State of Chihuahua.

The Mexican Northern Power Company is composed chiefly of Montreal and Toronto bankers. The plans call for an investment of more than $25,000,000. The dam across the Conchos River is only one feature of the project. The water impounded by that structure was to be used to irrigate approximately 200,000 acres of land in the valley of the river and to generate about 50,000 hp. The construction of an extensive system of canals and ditches is involved in the plans for reclaiming the 200,000 acres of land. From the hydroelectric plant transmission lines were to be built to the cities of Chihuahua, Parral, Jimenez, Santa Rosalia and a number of mining districts scattered about within a radius of 200 miles of La Boquillas.

## Commonwealth Edison Absorbs Cosmopolitan Electric of Chicago

Official announcement was made on Aug. 14 of the consolidation of the Commonwealth Edison Company and the Cosmopolitan Electric Company of Chicago, which places the entire electric-service system of Chicago in the hands of one operating company. A special meeting has been called for Sept. 25 for the purpose of ratifying the plans of the consolidation. Provisions for increasing the capital stock of the company from $40,000,000 to $50,000,000 will also be made at that time.

Aside from the advantages resulting from the operation of the two properties by one organization, the Commonwealth Edison Company will acquire the fifty-year franchise granted in 1895 to the Cosmopolitan company. Although the franchise is a liberal one, including an electric railway line, the Cosmopolitan company has only supplied electricity in a limited territory and operated one car a day for the purpose of holding the railway franchise. The annual gross earnings of the Cosmopolitan company are nearly $1,000,000. The company was capitalized at $2,000,000 and has $2,000,000 in outstanding notes and floating indebtedness of about $750,000. The latter will be wiped out through the process of the merger.

## Progress Made by the Society for Electrical Development

A very largely attended and enthusiastic meeting of the board of directors of the Society for Electrical Development was held in New York City on Aug. 18. The feature of the meeting was the report of Mr. W. E. Robertson, chairman of the society's campaign committee, in which it was stated that applications had been received from more than 100 companies for membership since the last meeting of the board of directors, about a month ago. The membership at the present time is well over the 300 mark, and the amount of the subscriptions pledged to date is in excess of $134,000.

Mr. J. Robert Crouse handed to the chairman of the meeting, Mr. A. W. Burchard, twenty signed subscription blanks, amounting to $10,500, all of which had been recently secured by a special committee in the city of Cleveland.

The co-operative campaign undertaken by the Jovian Order in behalf of the Society for Electrical Development

vell under way and is arousing considerable enthusiasm. e campaign now being conducted through the concen- ed efforts of the 12,000 Jovians scattered throughout the ited States and Canada will undoubtedly be productive excellent results.

Ir. Robertson reported that the campaign committee eves that $200,000, and perhaps more, will be subscribed Nov. 1.

he next meeting of the board of directors of the Society Electrical Development will be held at Association nd on Sept. 5.

n order to assist most effectively in securing subscrip- ns to cover the initial minimum fund of $200,000, Mr. Robert Crouse, vice-president of the society, has entered personal subscription for $10,000. He has also dis- uted to all electrical supply dealers and contractors a phlet containing an article on the principles involved in society's activity written by himself; an article on prac- l plans by Mr. J. M. Wakeman, general manager of the iety, and an editorial on co-operation for business ex- sion from the *Electrical World*.

## nry L. Doherty on the Society for Electrical Development

Ir. Henry L. Doherty, president of the Society for ctrical Development, has brought forward many argu- nts to show the advantages obtained from membership his society, several of which are given below.

his society makes it possible for all to co-operate and tribute toward the more rapid development of the elec- al business. No such organization has heretofore ted. Without any particular solicitation, many sub- ptions have already been received from those who have tofore subscribed nothing toward such a movement ply because there was no way for them to do so. The ety provides the way to accomplish results vitally im- ant to every one connected with the electrical industry. he society will bring about a more general intensified ivation of the market. As matters now stand, a few ral stations and a few manufacturing companies are avoring to carry on intensified cultivation of their kets, while many other central stations and many other ufacturers are doing little or nothing. The benefits of nsive cultivation can no longer be questioned, and with- any particular expense to the society, many who are now carrying on an intensive cultivation of their mar- can be induced to do so; some need only to be told to proceed.

ough work has already been done to demonstrate that y manufacturing plants can be induced to make com- installations of electrical equipment; that is, they can e duced to use electricity in every way possible simply he advertising that each individual factory will receive being the first one to be equipped completely. With one type of factory equipped completely and thoroughly ribed in a proper bulletin, each central station having same character of factory on its lines can easily get additional business with a minimum sales effort.

he Society for Electrical Development provides the only where it is really feasible for every branch of the rical business to meet on common ground to bring bout the greatest application for electricity. In other ords, it is the focal point at which the manufacturers' iations, the central-station associations, the contrac- associations, the jobbers' associations and others can e and co-operate.

he society can undertake to handle national advertising aigns more effectively than any other organization, ecause it will represent all the interests necessary to make uch work productive and valuable.

he electrification of our steam railroads is not as remote as it seems to many people, and yet little is being done with this vast opportunity compared to what might be done. The Society for Electrical Development will exert a powerful influence for progress in this direction.

The society can meet, negotiate and co-operate with other national bodies, such as the architects and the various manufacturers. This would be impossible for an individual or a company. This one field of work alone, intelligently and aggressively handled under the society's plans, justifies the support required by the society.

The society will begin its activities in every branch when a minimum subscription of $200,000 has been received. It is impossible to visit every one personally. The men in the electrical business, as a rule, have been pioneers and not trailers. The genuine progressive spirit which has made the electrical industry what it is to-day can be shown by promptly volunteering to co-operate.

## Theodore N. Vail on Regulation of Public Utilities

Mr. Theodore N. Vail, president of the American Telephone & Telegraph Company, in discussing the suit brought by the national government against his company relative to the acquisition of certain telephone properties in the Pacific Northwest as well as the pending telephone investigations of the Interstate Commerce Commission, has outlined the policy and purpose of the company in the conduct of its business and the relations of the Bell system and the public. The broad policy which controlled the building up of the great Bell system as enunciated by Mr. Vail is as follows:

"We believe in and were the first to advocate state or government control and regulation of public utilities; that this control or regulation should be by permanent quasi-judicial bodies, acting after thorough investigation and governed by the equities of each case; and that this control or regulation, beyond requiring the greatest efficiency and economy, should not interfere with management or operation. We believe that these bodies, if they are to be permanent, effective and of public benefit, should be thoroughly representative; they should be of such character and should so conduct their investigations and deliberations as to command such respect from both the public and the corporations that both will without question accept their conclusions.

"We believe that the public would in this way get all the advantages and avoid all the manifest disadvantages of public ownership.

"We believe that the highest commercial value of the telephone service depends on its completeness. We believe that this highest commercial value can only be attained by one system under one common control, and that it cannot be given by independent systems unless they are operated under agreements which result in one common control and one common interest, in effect making them a single system.

"We believe that rates should be so adjusted as to afford the company sufficient revenue to pay such wages and compensation as will secure the most efficient service and to maintain the very highest and most advanced standards of plant and apparatus. We believe that in addition such fair charges should be paid upon the investment in plant as will enable the company at any time to obtain money necessary to provide the plant required to meet the continuing demands of the public.

"We believe that any surplus beyond that necessary to equalize dividends on a fair basis should be used by the company for the benefit of the public and should be inalienable for any other purpose, and should be either invested in revenue-earning plant until it is necessary to replace a plant which may become inadequate or obsolete, or should be used to make the service cheaper or better.

"We believe that under proper governmental control and regulation the profits from promotion or operation allowed to be distributed should not be so large as to warrant or tempt complete duplication of plant and organization, with its duplication of its capital charges and its organization, operating, maintenance and depreciation expenses, and we do not believe that utilities giving at fair rates an efficient and sufficiently comprehensive universal service should be subject to limited competition, not giving such service. Competition which ignores the obligation to furnish a complete and comprehensive service is not competition, is not for the benefit of the public in that it does not reach the whole public interested.

"If, therefore, complete duplication, with its dual exchange connection and dual bills for service, is a prerequisite to complete competition, government control and regulation cannot go hand in hand with competition."

## Convention Program of Northwest Electric Light & Power Association

The Northwest Electric Light & Power Association will hold its annual convention in Seattle, Wash., Sept. 3, 4 and 5. Companies throughout the States of Washington, Oregon, Idaho and Montana have promised large delegations, and it is thought that the convention will be the largest and most enthusiastic ever held by the organization. The following program is announced by Secretary Norwood W. Brockett, morning and afternoon sessions being held daily:

Address of welcome, by Mr. J. E. Childberg; address of President W. J. Grambs; announcements; report of secretary-treasurer; reports of committees; "Management and Operation of an Electric-Light Plant in a Small Town," by Mr. E. G. Robinson, manager Jim Creek Water, Light & Power Company, Arlington, Wash.; "Some Operating Problems," by Mr. J. B. Fisken, superintendent light and power of the Washington Water Power Company, Spokane, Wash.; "The Tireless Farmer: Results from Ruralizing Electricity," by Mr. J. E. Davidson, vice-president and general manager Pacific Power & Light Company, Portland, Ore.; "The Regulation of Public Service Utilities," by Mr. George A. Lee, ex-chairman of the Public Service Commission of Washington; "Recent and Proposed Legislation Affecting Public Utilities," by Mr. Norwood W. Brockett, Puget Sound Traction, Light & Power Company, Seattle, Wash.; appointment of nominating committee; "Mechanical Devices in the Accounting Department," by Mr. Y. M. White, treasurer the Washington Water Power Company, Spokane, Wash.; "The Valuation of Electric Utilities," by Mr. Henry L. Gray, former chief engineer of the Public Service Commission of Washington; "Management of a Commercial Department," by Mr. A. C. McMicken, sales manager Portland Railway, Light & Power Company, Portland, Ore.; "Use of Protective Relays on Transmission Systems," by Mr. S. C. Lindsay, electrical engineer Puget Sound Traction, Light & Power Company, Seattle, Wash.; "Some Features of the Washington Construction Rules," by Mr. V. H. Greisser, electrical engineer the Washington Water Power Company, Spokane, Wash.; "The Industrial Application of Electrical Heating," by Mr. W. H. Lines, industrial power engineer Portland Railway, Light & Power Company, Portland, Ore.; "Electricity in the Lumber Industry," by A. E. Ransom, manager Seattle office Caldwell Machinery Company, Seattle, Wash.; "Synchronizing an Electric Light and Power Company's Records and Accounts with the Characteristics of Its Business," by Mr. O. B. Coldwell, general superintendent light and power department Portland Railway, Light & Power Company, Portland, Ore.; executive session.

On Thursday evening, Sept. 4, the Seattle Jovian League will hold a rejuvenation and a theater party will be given for the ladies. On Friday afternoon visitors will be shown about the city in automobiles, all of the important parl and boulevards being included in the itinerary. This ri will be followed by a banquet for the men and a separa dinner for the ladies. There will be an excursion to t United States Navy Yard at Bremerton on Saturday which a large attendance of delegates is looked for.

## Pacific Coast Convention, A. I. E. E.

The following papers will be presented at the Pacif Coast convention of the American Institute of Electric Engineers to be held in Vancouver, B. C., on Sept. 9, and 11, 1913: "Snow and Ice Loading on Transmissio Lines," by Mr. V. M. Greisser; "Mountain Railway Electr fication," by Mr. A. H. Babcock; "The Gulf of Georg Submarine Telephone Cable," by Messrs. E. P. La Belle ar L. P. Crim; "A Modern Substation in the Cœur d'Ale Mining District," by Mr. J. B. Fisken; "Logging by Ele tricity," by Mr. E. J. Barry, and "High-Voltage Circui Breakers," by Mr. K. C. Randall. The convention hea quarters will be at the Odd Fellows' Hall. Mr. E. Breed, 814 Dominion Trust Building, Vancouver, B. C., secretary of the convention committee.

## London's Transportation and Lighting

By Dr. Louis Bell

There is now a scheme afoot in London which mak railway and tramway managers rub their eyes and wond where their dividends will be in the near future. Of cours every one knows that the London bus system stretches no over a very wide area; to Windsor, for example. But t new organization, which rejoices in the inclusive name Greater Omnibus Services, Ltd., has plans which in the bearing on traffic are prodigious.

The scheme in brief is to initiate in every considerab city in England a branch of the new bus service, work from a central office with interlocking traffic zones so as give bus communications practically all over the countr The radii from some twenty-one projected centers overl so that one could travel from Southampton to the Scotti border or from Norwich to Cardiff with comparatively fe changes, no more than are needed in a similar distance ov American street railways.

Observe the beautiful thriftiness of the project. The b line has not an inch of track to lay, no overhead structur no pavements to keep in order and practically no rates pay. It is a "trackless trolley" with no trolley—a sort freebooter of traffic rushing in with its whole fleet whe plunder promises well, as at a race meet, and scattering lat to pick up anything that is not nailed down or red hot the adjacent counties. Labor, petrol, interest and maint nance on the buses make up the bill of expense—and mot buses pay a petrol tax of only 3 cents a gallon where pr vate cars pay 6 cents.

Already country councils are wondering who will pay f the road repairs, which will grow at a rate to stagger th imagination. In fact, local authorities are even now begi ning to plan a campaign of restriction which may be ab to force the invader to terms—on the one hand, directed road repairs; on the other, to the protection of tramwa that take care of their own tracks and the rest of the stre beside. The local powers to prevent the use of the roads b 5-ton marauders are somewhat limited, but there remain by an almost facetious turn of rate, the right to preve taking up or setting down passengers in the local domai It is a credit to the English sense of justice that in Oxfor such rights have been enforced to protect the interests a tramway company which has been paying liberally for use of the streets.

By the way, there still remains at Hastings a tramway

sectionalized, magnetic-switch variety, working, I am , rather badly, but unable to change to an overhead ley on account of the local authorities, or to a slotted duit on account of the invading sea. Between the board the deep sea it is rather hard pushed.

The lighting of London has changed wonderfully in a years and in remarkable ways. Part of the metropolis a carnival of press gas, another part a symphony in ne arcs, and as for the rest—well, if there is any co-ination between sound and light then the streets of ndon remind one of the state of Babel after the grand astrophe. Yet one must admit that, though the kinds many, each after its particular fashion is good. The ef streets of London are, in fact, remarkably well ted, and even the secondary streets rather better than America. The tertiary lighting is not so good.

The best of the lighting is by magazine flame-arc lamps by very high-pressure gas. Here the long-burning ne-arc lamp has hardly a show. When a 550-watt maga-e lamp can give in the useful direction more than 3000 and requires recharging only every seventy-five hours so, the long-burning carbon lamp at its wonted efficiency ses to be attractive where electrodes can be imported e. A few of the long-burning lamps are in service, but s the magazine lamp that is pushing to the front.

One good stretch of street is lighted with high-candle-ver tungsten lamps, three grouped in a single lantern and lacing a big arc lamp with admirable effect. Beside all se the old carbon lamps, of which some still survive, m about as luminous as white beans. The gas lamps as various and interesting as the electric ones. Pres-es are carried up to even 80 in. of water, and with, of rse, corresponding economy in gas. The most inter-ng thing, however, is the carrying of these powerful gas ps on cross-suspension. The pipe from the side is a l one to which the lamp, carried on a trolley from the nension, is affixed by an automatic connector so that the p may be dropped out of connection and trolleyed to the walk for inspection or repair.

ungsten lamps are seen everywhere, operated mostly at volts, as fits the major part of the distribution systems. ly come from all the corners of the Continent from ers scarcely heard of across the sea, and I have a strong icion from what I hear that they are mostly indiffer-n benevolently dumped perhaps on the English market. course, the best of English lamps are excellent, but the tation in London shows at least one of the possible re-l of too much competition.

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## Meeting of Electrical Contractors' Association of Wisconsin

The annual summer meeting of the Electrical Contrac-ors Association of Wisconsin was held on board the steamer *Georgia*, Aug. 7-14, while the boat was making a round trip on Lake Michigan between Milwaukee, Wis., and Sault Ste. Marie, Mich. Many stops were made en route, the longest being at Mackinac Island. No formal program had been arranged, but there was a very general discussion all during the trip on matters of general interest to the members. Two short business sessions were held at the first of which a number of electric contractors were elected to membership. The attendance was not as large, as expected, but what was lacking in numbers was made up by extra enthusiasm. The following members attended: Messrs. J. D. Warden, of Sheboygan; William Peeter, of Oshkosh; R. J. Nickles and L. W. Burch, of Mayson; A. C. Longstadt, of Appleton; D. E. Roberts, of Racine; G. T. Wacker, of Plymouth; George F. Rohn, Herman Andras, B. L. Burdick and Secretary Albert Petermann, of Milwaukee.

## Combination Single-Phase and Polyphase Locomotives for the Norfolk & Western

Many interesting features are embodied in the alternating-current locomotives being built by the Westinghouse Electric & Manufacturing Company for the Norfolk & Western Railway Company, outlined on page 268 of our issue for Aug. 9. The motors are of the polyphase induction type designed for three operating speeds. However, the locomotive will receive its energy from a single-phase, 11,000-volt system. A so-called "phase-splitting" device, which is in reality a rotating phase converter, will be used to produce the quadrature current relation necessary for polyphase excitation during normal operation as well as at starting.

The propelling equipment of each locomotive will comprise four polyphase induction motors of a total continuous rating of 1300 hp at 14 m.p.h. Each motor has windings for producing four and eight poles. The motors have wound secondaries for insertion of starting resistance and for connection in cascade for producing low speed in starting and switching only. There are two running speeds, 28 and 14 m.p.h., and a switching speed of 7 m.p.h.

The control of the motors will be through rheostats connected in the secondary circuits. In starting with the 7-mile combination the motor on each truck will be connected in cascade (series) and the two sets of cascades will be connected in parallel. Resistance will be inserted in the secondaries at starting. In this combination the primaries will be arranged for eight poles. With the 14-mile combination all motors will be in parallel connected for eight poles, and with the 28-mile combination the four-pole arrangement will be used, resistance being used on intermediate steps.

In choosing the induction motor in place of the commutator motor for this installation, important considerations besides those mentioned were those of cost and space.

Approximately balanced polyphase voltages will be applied to the primary circuits of the propelling motors. For this purpose there will be installed in the cab of the locomotive a rotating "phase splitter" or phase converter which will receive exciting and driving energy from the secondary of the single-phase step-down transformer in the cab and deliver current in time-quadrature phase relation in order to supply magnetism in time-quadrature to the direct supply single-phase magnetism in the propelling induction motors. The latter motors will therefore start from rest as polyphase induction motors. Being arranged for eight poles and connected in cascade, they will operate initially as though they were sixteen-pole machines and accelerate toward a corresponding synchronous speed, above which they will operate as induction generators to return energy to the supply system. When connected in parallel and arranged for eight poles the motors will reach a synchronous speed at twice the linear speed corresponding to cascade connection, and will return energy to the system when driven above this speed. A higher synchronous speed is again found at double the latter linear speed when the motors are arranged for four poles.

The three-speed arrangement was chosen for several important reasons. In the first place, the grades to be encountered are unusually heavy and regenerative control is of considerable advantage. This is true not so much on account of the saving in energy as from the consideration of safety in descending grades. Incidentally there is quite a saving in wear of shoes and tires. Second, the energy saving is considerable, although secondary. In descending the grades the two head locomotives will be connected to pump back into the line, and they will be fully loaded. When other trains are to be in the electric division this saving will be considerable, and it will lighten the load on the station and improve its load-factor. When the descending train is the only one on the line the energy will be absorbed in suitable rheostats in the power plant.

## Macon Convention of Southeastern Section, N.E.L.A.

At Macon, Ga., Aug. 14 to 16, was held the first annual convention of the newly organized Southeastern Section of the National Electric Light Association, the attendance numbering nearly 150. Judge Augustin Daly, of Macon, welcomed the delegates. In his presidential address, Mr. E. C. Deal, Augusta, Ga., called attention to the rapid development of the electrical industry in the South, and the growth of the local association as well.

While the large number of organizations in the field may involve duplication of effort, this can be largely prevented by proper precautionary measures, declared President Deal. He commended the broad policy of electrical manufacturers in rendering engineering assistance to small central stations. The industry is now well upon the threshold of its commercial age, although, he added, complete realization of this is still to be achieved. Better understanding on the part of the public is, however, needed to offset the anti-corporation spirit fostered by yellow journals and designing politicians. The downward trend in public-utility rates, despite the increasing scale of wages, supplies, and various material costs, is one of the aspects deserving more publicity. Failures of municipal ventures should also be brought to the attention of communities contemplating such plants. Standardization of rates among central stations is another of the essentials on which the fullest public confidence depends. Questions of legislation and those dealing with labor deserve the most careful study. The creation and stimulation of employees' interest in their work is also of paramount importance in utility management. President Deal, in fact, recommended the appointment of an association committee to study labor matters.

The report of the chairman of the finance and membership committee, Mr. T. W. Peters, Columbus, Ga., showed a total enrolment of over 200, drawn from five States.

### Outdoor Transformers

Mr. A. D. Fishel's paper, "Outdoor Transformers," was read in the author's absence by Mr. E. A. Thornell, of the Westinghouse company's Atlanta (Ga.) office. Current practice in the design and construction of apparatus for pressures of 2200 volts to 22,000 volts was described in detail. The comparative advantages and drawbacks of three-phase and single-phase units were also pointed out, the conclusion being that the single-phase grouping is more desirable and flexible for companies operating in cities of 100,000 population or less.

Discussion of Mr. Fishel's paper turned chiefly on topics of lightning protection. Lightning discharges, pointed out Mr. H. L. Wills, Atlanta, Ga., will always attack the weakest point in any apparatus. Efficiency, regulation, reliability, shipment in oil, moisture protection, etc., were among the transformer essentials which he enumerated. Mr. Wills also advocated pole-type three-phase transformers.

Mr. E. P. Peck, Atlanta, Ga., urged that all transformers should have excess ratings given them so as to stand overloads continuously. Owing to normal growth of the service distributing units almost invariably become overloaded before the results of inspections and surveys can be applied. Mr. Peck then described the effect of lightning and surges in applying sudden strains in windings. In service, transformers have often failed at potentials far below those previously withstood during shop tests.

Mr. C. M. Young, of Columbus, Ga., urged the standardization of regulating taps with respect to both ratio and number. He also recommended simplification of transformer-oil qualities and varieties, suggesting that a few standard kinds of oil might suffice for all purposes, in this way greatly reducing storage requirements. The severe lightning experienced in the Southeast makes the protection problem there especially difficult. In general, concluded Mr. Young, local conditions must largely determine the application of three-phase transformers.

Mr. R. M. Harding, of Columbus, Ga., remarked th although transient phenomena are largely excluded by tl low electrostatic capacity of 22,000-volt transformers, osc lations may nevertheless be set up, imposing voltage stra far in excess of the original value. Such oscillations m be caused by lightning and switching, and cannot be pr vented by the usual methods. Under such conditions, tl presence of reactance coils may actually increase the te dency of the transformer to destroy itself by its own stor energy. Horn-type apparatus, said Mr. Harding, well tak care of the protection required for cheap outlying install tions. The presence of high-frequency disturbances m often be detected by the raised frequency of the magnet reversals, the transformer hum rising to an actual shriek.

Mr. L. A. Magraw, Macon, Ga., recounted the loss transformers both with and without lightning arresters.

Others who contributed to the discussion were Messr H. E. Busse and Paul Lovejoy, both of Atlanta, Ga.

### Regulation of Transmission Lines

"Regulation of Hydroelectric Transmission Lines" w the title of a paper by Mr. E. P. Peck, assistant electric engineer Georgia Railway & Power Company, Atlanta, G The author discussed the effects of resistance, reactan and capacity in determining line regulation. For calcula ing lines under 20 miles in length he recommended tl approximate trigonometric method as preferable to tl graphic scheme. For longer lines, up to 100 miles, he su gested considering the capacity as distributed at the en and center. The convergent-series method of calculatio although involving complex quantities, requires less calc lation. To neutralize capacity effect large synchronous co densers may be installed at the receiving end, and equipp with Tirrill regulators set to keep a constant voltage that point. In conclusion the author referred doubtful to the existence of a satisfactory lightning arrester a urged that further development be carried on.

#### *Discussion*

Mr. C. M. Young, Columbus, Ga., predicted that in tl near future the transmission systems of the South will interconnected, energy being exchanged in much the san way that railways now exchange passengers and freigt By this arrangement it will be possible for whole systems be shut down while their load is carried from nearby st tions continued in operation. In high-tension transmissic work dependable intercommunication is absolutely essenti Mr. Young also voiced the need for lightning arreste which shall not be self-destructive.

Mr. L. A. Magraw, Macon, Ga., referred to the use 2300-volt motors which avoid the outlay for transformer but said that when attacked by lightning these high-tensic motors are invariably destroyed. Mr. O. H. Caldwell, Ne York, gave brief data concerning the 140,000-volt Ausab (Mich.) transmission line and the capacity effects the observed. Mr. E. H. Ginn also presented some details construction of modern lightning-arrester apparatus.

Mr. R. C. Camp, Ocala, Fla., cited instances where tran formers had burned up when one side of the line becam grounded, the transformer cases having been previous grounded. This, Mr. Peck explained, might have been d to the existence of arcing grounds setting up surges.

Mr. R. M. Harding, Columbus, Ga., compared star ar delta connections under service conditions, pointing out th factor of safety from the standpoint of lightning protectio

Mr. G. K. Hutchins, Columbus, Ga., emphasized the com mercial aspects of lightning-arrester installations as affec ing the customer. In some cases interruptions to servic are negligible. But for such applications as cotton mil and other characteristic Southern loads it is often a serio matter to start up the plant after a shut-down. M Hutchins urged frequent drainage of lines and again em phasized the point that protection to the customer's serv is in itself of the greatest importance.

Mr. H. L. Wills, Atlanta, Ga., also referred to the need for standard taps, but declared that no taps at all would be still better. He confirmed Mr. Young's plea for a standard oil, and also advocated that service transformers include all instrument windings in the single case. For intercommunication between plant and substations in case of line interruptions, Mr. Wills advocated the use of wireless-telegraph apparatus, pointing out that such equipment would be invaluable in the usual cases of system paralysis.

Mr. J. H. Robertson, Greensboro, N. C., described conditions of regulation received from a transmission-line supply service.

### Work of the National Association

On Thursday evening Secretary T. Commerford Martin, of the National Electric Light Association, delivered an eloquent address on the accomplishments and aims of the national association, of which the Southeastern Section is a new branch. Mr. Martin spoke glowingly of the electrical development of the South and the electric operation of the cotton mills, declaring that the steel towers and shining cables which span the countryside will eventually mean more to the nation than even the steel rails which interweave its cities.

With 13,000 members the N. E. L. A. is now the largest



PRESIDENT-ELECT T. W. PETERS

engineering organization of the world. Eighteen State associations are affiliated with it, and there are forty-five company sections embracing 9000 central-station employees. In fact, its membership includes 90 per cent of the invested capital of the industry, which Mr. Martin placed at $2,500,000,000 with total earnings of $450,000,000 per year. The association's income now averages $140,000 annually.

Private management and ownership under proper regulation is the essential principle which the N. E. L. A. is pledged to support. This economic principle is indeed winning out as shown by the decrease in municipal undertakings. The secretary also sketched briefly the work of the association committees, publication of rate-research bulletins, use of the question-box and lecture bureau, co-operation of the public-policy committee with other national bodies, formulation of resuscitation rules, and the association's part in shaping the National Electrical Code and the forthcoming electrolysis rules. The labor question is one of the most vital and intricate problems which confront the central-station industry, but to-day central-station companies are absolutely divided on the "open-shop" question. In conclusion the speaker read from "Crowds," a recent psychological study which has attracted much attention, the high tribute therein paid to the work of President Dunham, of the Hartford (Conn.) Electric Company.

### Election of Officers

Officers for the ensuing year were elected on Saturday morning, the nominating committee having been made up of Messrs. W. R. Collier, Atlanta, Ga.; P. M. Miller, Key West, Fla., and E. A. McCoy, Columbia, S. C. The officers chosen were: President, Mr. T. W. Peters, Columbus, Ga.; first vice-president, Mr. J. E. Bingham, Tampa, Fla.; second vice-president, Mr. C. D. Flanigan, Athens, Ga.; executive committee—Messrs. R. L. Lindsay, Durham, N. C.; G. K. Dustin, Columbia, S. C.; E. S. Roberts, Savannah, Ga.; H. C. Adams, Jacksonville, Fla., and M. Webb Offutt, Birmingham, Ala. President-elect Peters then appointed Mr. A. A. Wilbur, Columbus, Ga., to be secretary-treasurer for the year, also naming as members of the public-policy committee Messrs. P. S. Arkwright, Atlanta,, Ga.; M. Webb Offutt, Birmingham, Ala., and Z. V. Taylor. Mr. W. L. Southwell, Macon, Ga., was appointed chairman of the membership and finance committee.

Mr. Thomas W. Peters, president-elect of the Southeastern Section of the National Electric Light Association, is commercial agent for the Columbus (Ga.) Railroad Company. He was born at Dublin, Md., thirty-two years ago and received his scholastic training at St. John's College, Annapolis, Md., and at Lehigh University, where he took special courses in 1904. Mr. Peters entered the business world in the employ of the Viaduct Manufacturing Company, of Baltimore, Md., later taking up operating work with the Potomac Electric Company, Washington, D. C., and the Philadelphia Electric Company, Philadelphia, Pa. Later he joined the commercial staff of the Consolidated Gas & Electric Company, of Baltimore, Md., and six years ago removed to Columbus, Ga., to become associated with one of the Stone & Webster properties, where he has since been in charge of commercial work.

A detailed report of the technical sessions of the remaining two days of the convention will be presented in a later issue.

## Public Service Commission News

### New York Commissions

The Public Service Commission, Second District, has denied the application of the Western Vermont Power & Light Company for permission and approval to exercise a franchise granted by the village of Granville, Washington County, to supply electricity to consumers in that village. It has approved the application of the Kanes Falls Electric Company to construct a transmission line from its generating station at Kanes Falls, through the towns of Fort Ann and Granville to the village of Granville.

### Ohio Commission

Attorney General Hogan has notified the Cincinnati Gas & Electric Company and the Union Gas & Electric Company, lessee, that unless the orders of the Public Service Commission in extending service to Delhi and Seyler Park are complied with, he will institute suit to recover penalties of $1,000 a day. The Cincinnati Council ordered the extensions made and the commission sustained the order.

Officers of the village of Port Clinton, a small city on Lake Erie, have filed a complaint with the commission against the Northwestern Ohio Railway & Power Company, in which it is stated that the property of the Port Clinton Light & Power Company has been purchased by the Northwestern Ohio Railway & Power Company and the real estate by the Lake Shore & Michigan Southern Railroad Company. The plant, which has been used as a distributing station since the purchase, is now being dismantled. The city officials claim that, under the franchise, the municipality has an option on the plant at the expiration of the franchise and that the sale of the property and the removal of the equipment will destroy its opportunity of

# Current News Notes

License Fee on Electric Signs in Montreal.—Following the passing of a recent by-law a license fee of 10 cents per sq. ft. will be collected annually in Montreal on all electric signs in that city.

* * *

New Alloy of Platinum.—A new hard alloy of platinum is said to have been produced by the addition of osmium. It is claimed that this alloy, which contains from 0.5 to 10 per cent of osmium, has physical and electrical properties fully equal to the platinum alloy containing a much higher percentage of iridium.

* * *

Westinghouse Relic Burns.—The old factory of the Westinghouse Electric & Manufacturing Company in Pittsburgh, where George Westinghouse's inventions were first executed on a substantial scale, was destroyed by fire on Aug. 9. The building was occupied by the Nernst Lamp Company, the Pittsburgh Electrical Specialties Company and a printing and publishing company.

* * *

Canadian Officials Recommend Instruction in Resuscitation to Railway Employees.—The Board of Railway Commissioners for Canada has issued to the railways a circular calling attention to the advisability of warning employees about the absolute necessity of keeping away from all electric wires and also to the advisability of employees becoming familiar with the recently revised rules for resuscitation from apparent death from electric shock.

* * *

Wireless Not Yet Feasible for Railroad Use.—The superintendent of telegraph of the Atchison, Topeka & Santa Fé Railway, who has been investigating the practicability of wireless telegraph for railroad purposes, has concluded that for the present the expense of installation and maintenance is too heavy and that the ease with which interference is accomplished also militates against its use for railroad purposes. Until these troubles are overcome the railroads will cling to dots and dashes and the telephone system.

* * *

Electrification of Berlin's Suburban Railways Probable.—Prussia's Minister of Public Works has expressed himself in favor of the proposed electrification of the Berlin city belt and suburban railways. The traffic has doubled on these lines within the last twenty years and steam traction is no longer adequate to handle it. Electric drive would give practically double the number of trains each hour, besides securing all the advantages of the electric system. The Prussian Parliament recently voted a credit of $5,000,000 for carrying on preparatory work upon this important scheme.

* * *

Automobiles in Perry Victory Celebration.—The plans for celebrating the centenary of Commodore Perry's Lake Erie victory in Chicago on Aug. 23 provide for a large automobile parade. A number of prizes and trophies have been offered. For the best decorated electric pleasure car the first prize will be $100 and the second prize $75. Similar prizes will be offered for the best decorated truck. The dealer having the greatest number of electric cars of one make in the parade will receive a trophy valued at $85, and to the dealer having the greatest number of electric pleasure cars of one make in the parade there will be given a trophy of equal value.

* * *

Electrical Process for Purifying Clay.—The electrical process for purifying clay brought to the notice of the English Ceramic Society by Dr. W. R. Ormandy depends upon the fact that clay is electro-negative, while its chief impurities are electro-positive. The emulsified clay is partially coagulated by adding electrolytes and is further purified by being passed through a vessel with electrodes having a difference of potential between them of from 60 to 100 volts. The clay substance, with as little as 18 to 20 per cent of water, is deposited as a continuous blanket 4.5 ft. wide and 0.25 in. thick. Even fine particles are removed, and the solid product may contain as much as 99.5 per cent of china clay.

* * *

Glasgow to Send Delegates to Study Electrical Development in America.—The Glasgow City Corporation has arranged to send on a tour to this country Mr. W. W. Lachie, the engineer of the electricity department, together with the convener of the electricity committee, for the purpose of collecting information regarding the cost and operation of the largest electrical installations of this country. The deputation will visit New York and Chicago on the advice of Dr. Ferranti, who has suggested that the Glasgow City Corporation install large units in its proposed new generating station and that before it commits itself to definite plans it should ascertain directly the best methods followed in the United States, where the work of large units can be seen to best advantage.

* * *

Ocean to Ocean Highway.—The Lincoln Highway Association, formed to secure the establishment of an ocean-to-ocean highway as a memorial to Abraham Lincoln, has established headquarters at Detroit, Mich. The highway is to cost approximately $10,000,000, of which $4,200,000 has been subscribed. The association proposes to co-operate with local communities in procuring the establishment of the highway and in improving and reconstructing existing highways which will constitute a part of the route. Several states along the line are said already to have taken steps toward the construction of improved highways from east to west to connect with the coast-to-coast route, and it has even been suggested that the highway be lighted by electricity. Mr. H. B. Joy is president of the association.

* * *

Control of Flood Water by Reforestation Impracticable.—According to Colonel C. McD. Townsend, of the United States Corps of Engineers, it is generally accepted that the leaves falling from forest trees as they decay form a humus which has a large capacity for absorbing water. It requires from twenty to fifty years to produce a good forest growth, and a century for the leaves of that forest to decay in sufficient quantities to produce the humus which will be satisfactory as an absorbent of rainfall. It is therefore apparent that even under the most extravagant claims of forestry advocates reforestation as a means of reducing flood heights requires the conversion of too much farming land into a wilderness to be practicable. The waste land that can profitably be converted into forest reservations is too limited in area to produce an appreciable effect on floods.

* * *

Hydroelectric Possibility on the Columbia River.—At a total cost of about $23,000,000, it is claimed that a large hydroelectric development can be located at Big Eddy, on the Columbia River, a few miles above The Dalles, Ore. The gorge at this point is of such a character that little work will be required to impound sufficient water to develop 300,000 hp. The river can be entirely closed by the construction of a dam 300 ft. long and 180 ft. above its foundations and the construction of a canal 300 ft. wide, 20 ft. deep and 1.5 miles in length. The head of water at low tide would be 73 ft. and at high tide 42 ft., the mean flow of the river throughout the year being 235,000 cu. ft. per second. At the present time the section of the country in which this plant would be located is plentifully supplied with electrical energy, so that, ignoring entirely the difficulty of raising the $23,000,000, the possibility of such a development is rather remote.

# Combination Railway, Electric and Ice-Making Plant

**Turbines displace engines in reconstructed station of the Newport News & Old Point Railway & Electric Company at Hampton, Va.—Rearrangement of auxiliaries and economies effected. By A. R. Smith**

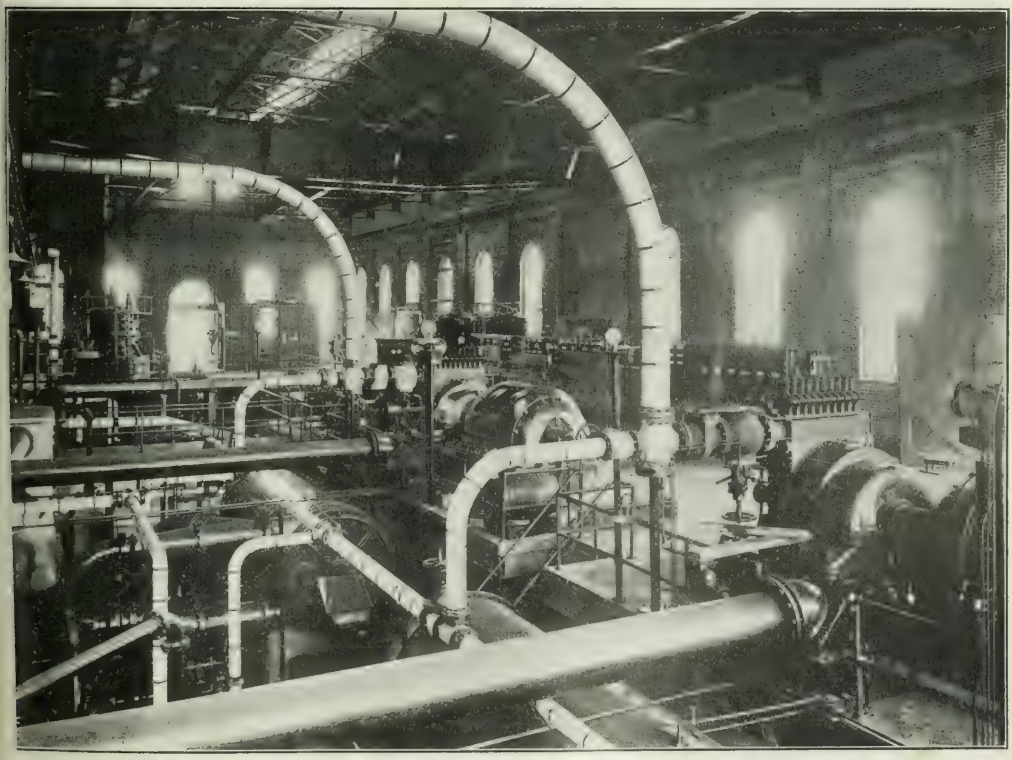
JUDGING from the condition of many small steam-electric power plants, it is obvious that too little attention is given to possible improvements which would reduce the operating costs and improve the service. Frequently the obsolete equipment is kept in operation at an enormous expense and with such poor service as not only to make it impracticable to secure new business but often to result in a loss of existing trade. In most communities the lighting business has increased steadily, aside from the efforts of the lighting company to increase the output, and many cases have come to the writer's attention where the lighting and motor load has increased at the rate of 10 per cent a year. A careful study of the loss of business or the failure to secure new business should be made to determine the real cause, and the trouble will frequently be found in the power house.

Intended improvements and extensions are commonly made to old power stations without obtaining the results expected. This is due to the lack of proper engineering advice. In many cases such improvements and extensions have really been a detriment to changes made necessary at a later date. It is true that no one can foresee the future of any power house, and therefore no one should define a limit and thereby restrict the possibilities of future growth.

### OPERATING COST RECORDS

The absence of detailed operating cost records or the confusion of such records with the cost of operating other branches of the business is largely responsible for many mistakes which have been made on extensions and improvements. If the proper operating cost records are kept, it is a comparatively simple matter to ascertain if certain improvements are economical or if the fault lies in the operation of the station. There are certain salient factors that enter into the operating cost which should preferably be kept month by month in the form of a curve to illustrate any increase in cost or decrease in output, as follows:

Heat units per pound coal.
Cost of coal per ton delivered.
Net pounds steam generated.
Load factor of boilers.
Temperature of feed water.
Cost of city water used.
Pounds steam per pound coal.
Cost of steam per 1000 pounds.
Vacuum.
Load-factor (monthly).
Pounds coal per net kilowatt-hour.
Cost per net kilowatt-hour (excluding repairs).
Total cost per net kilowatt-hour.
Repairs to boilers.
Repairs to prime movers.
Repairs to piping.
Other repairs.



When making extensions to an existing plant great care should be exercised in arranging the new apparatus to permit of still further enlargements and replacements, thus directing the growth of the plant along broad and well-defined lines. This advice will be appreciated by those who have observed the growth of many plants which have expanded far beyond the management's expectations and where this has resulted in a conglomerate mass of machinery difficult to operate and repair and unreliable in service

POWER-HOUSE RECONSTRUCTION

One of the most striking examples of remodeling an old power house will be found in the improvements made in the generating station of the Newport News & Old Point Railway & Electric Company of Hampton, Va., under the management of Allen & Peck, Inc., of Syracuse, N. Y. Reference to Figs. 3 and 4 will show changes made in the generating room while the system was kept in continuous operation without outside assistance. The writer does not purpose to give a lengthy description of the work but to enumerate some of the interesting features and record the equipment for reference. Before the change the equipment was as follows:

One 1500-kw, 10,000-volt, three-phase vertical Curtis turbine.
One 750-kw, 3450-volt monocylic cross-compound McIntosh & Seymour engine set.
Two 300-kw, 3450-volt monocylic tandem-compound Rice & Sargent engine sets.
One 500-kw, 500-volt direct-current cross-compound St. Louis engine set.
One 325-kw, 500-volt direct-current tandem-compound Rice & Sargent engine set, together with miscellaneous exciters, condensers, transformers, switchboards, etc.

All of this equipment with the exception of the turbine was disposed of as junk, and the engine foundations, which consisted of brick laid in cement, were completely removed. The vertical turbine-generator was rewound for 3450 volts at 1800 kw and two new 2000-kw, 3600-r.p.m. horizontal Curtis turbines were installed, making an aggregate capacity of 5800 kw, with space for a 5000-kw unit, as against a previous maximum capacity of 3675 kw.

The power-house equipment now consists of:

Six 250-hp Babcock & Wilcox boilers with Murphy stokers.
Two 400-hp Babcock & Wilcox boilers with Murphy stokers
One 570-hp Heine boiler with stationary grates.
One coal-handling equipment, Exeter Machine Works.
One "Brownhoist" 10-ton steam locomotive crane.
Two General Electric 2000-kw, 3450-volt, 60-cycle, 3600-r.p.m. horizontal turbo-generators.
One General Electric 1800 kw, 3450-volt, 60-cycle, 900-r.p.m. vertical turbo-generator.
Two C. H. Wheeler 6000-sq. ft. surface-condenser equipments.
One C. H. Wheeler surface-condenser equipment.
One Cochrane 300-hp open-feed-water heater.
Two Alberger 185-gal. per minute turbine-driven boiler-feed pumps.
Three General Electric 750-kw, 3450/10,000-volt, single-phase oil-cooled transformers.
Six General Electric 165-kw, 3450/430-volt, single-phase oil-cooled transformers.
Two General Electric 500 kw, 720-r.p.m., six-phase converters.
One General Electric switchboard.
Piping furnished and installed by the Best Manufacturing Company.

Many of the frequent and continued interruptions of service were attributed to the loss of circulating water during low tides. As a matter of fact, the real trouble was poorly constructed intakes and long suction lines. The intakes were of wood of insufficient depth and provided with fixed screens which could not be removed for cleaning. One suction line was over 300 ft. long and the other approximately 200 ft. long with a vertical lift of 8 ft. to the pump floor. At times four hours have been consumed in regaining the suction by means of the vacuum pump. During the process of reconstruction a leak developed at a joint, previously repaired, in the 300-ft line, and it was sealed with water by building a temporary well around the defective joint until the old line was abandoned. Trouble from this source has now been eliminated by the construction of a concrete intake, the bottom of which is 5 ft. below extreme low tide and which has double removable screens having an effective area of four times the area of the intake tunnel. New concrete intake and discharge tunnels 4 ft. wide and 8 ft. deep

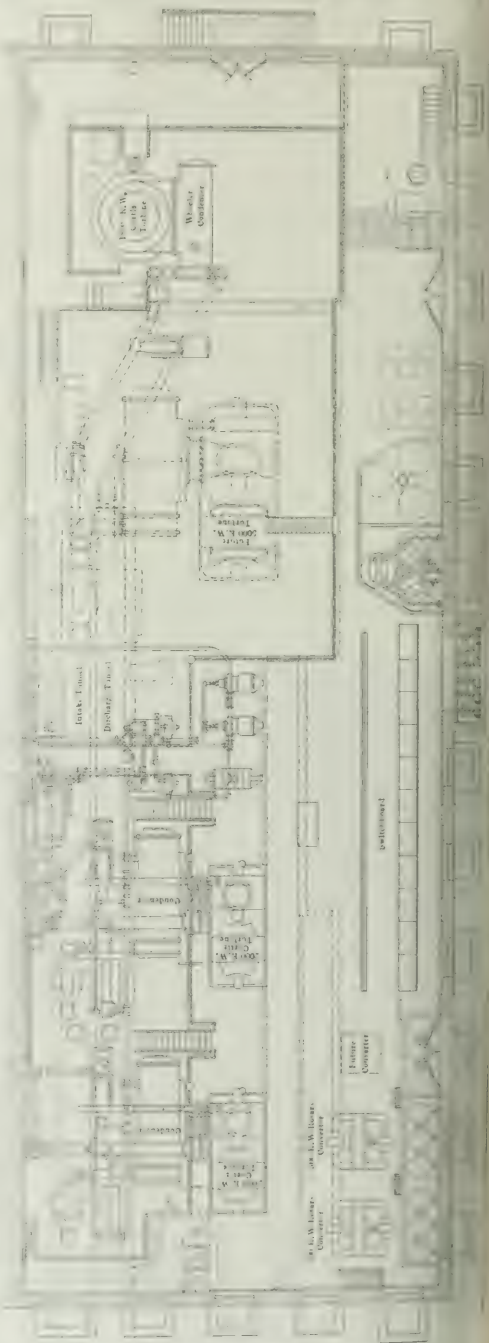



FIG. 2—PLAN OF RECONSTRUCTED GENERATOR ROOM

were constructed to carry the water by gravity to points directly under the circulating pumps. At extreme low tide

the tunnels will contain 4 ft. of water, which permits of their being cleaned without interruption of service and with little discomfort to the workmen.

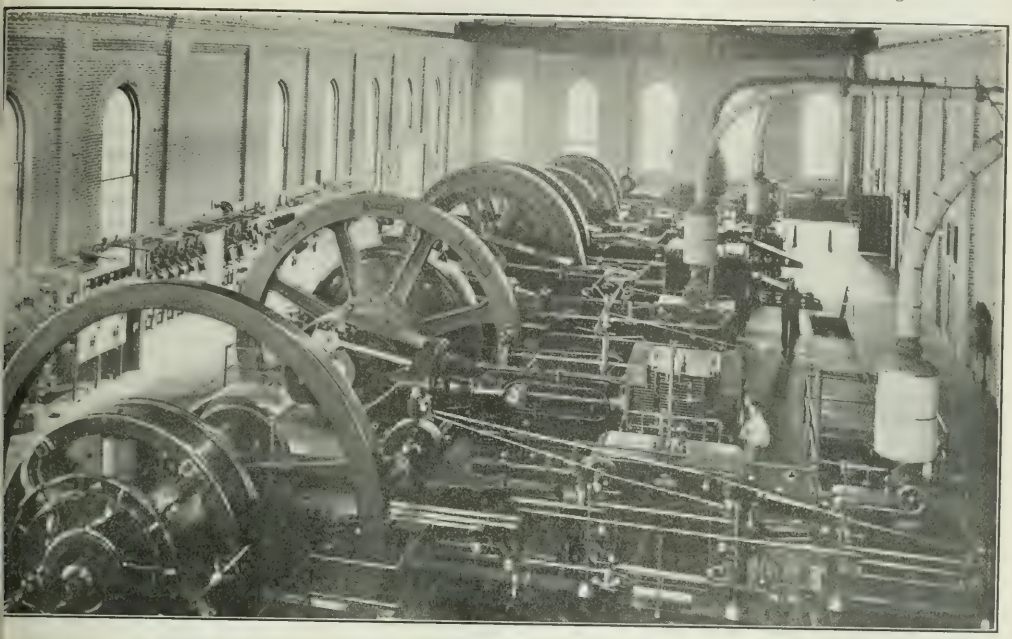


FIG. 3—GENERATOR ROOM OF NEWPORT NEWS & OLD POINT RAILWAY & ELECTRIC COMPANY BEFORE THE CHANGE



FIG. 4—GENERATOR ROOM OF NEWPORT NEWS & OLD POINT RAILWAY & ELECTRIC COMPANY AFTER THE CHANGE

Another source of trouble with the old equipment was clogging of condenser tubes with floating material, fish and barnacles. This has been remedied by installing 1-in. condenser tubes in place of ⅝-in. tubes and providing facilities for flushing the condensers by reversing the flow of circulating water through them. A still further precaution against loss of circulating water in case of the combination

of a severe westerly wind and low tide, which has a tendency to empty the creek, was to install 42-in. valves between the turbines and condensers to permit of non-condensing operation.

The old piping was typical of that installed in engine stations of that period, (about 1900), having many runs in duplicate and a double steam header in a most inaccessible



FIG. 5—OLD COAL-HANDLING EQUIPMENT AT HAMPTON

position back of and above the boilers. The losses due to leaks in steam piping just previous to placing the new piping in service required the operation of an additional 250-hp boiler. The new steam header has been erected in the turbine room, together with a steel gallery, where every valve and fitting is readily accessible and may be repaired without any discomfort. All the main steam piping is made up of cast-steel fittings and Van Stone joints, so there will be no changes necessary when the superheaters are added to the boilers. The boiler-feed piping is of standard-weight brass pipe with cast-iron fittings. It will be noted from Fig. 1 that that portion of the turbine room near the boiler-room wall is entirely open down to the basement floor, which insures good ventilation and light, accessibility to all piping and auxiliaries, and keeps all moving apparatus under direct supervision of the engineer.

The old plunger boiler-feed pumps which were formerly in the boiler-room basement were discarded and replaced by two turbine-driven centrifugal feed pumps in the turbine room. The boiler room is now devoid of moving machines except for the stoker engines. These pumps were installed without regulators of any kind, as it was found that without any boilers feeding the pressure increased only 5 per cent. Of course, care should be taken to avoid this condition, as the churning of the water in the pump casing will raise the temperature to a dangerous limit. It was interesting to note the steady pressure of the rotary pump as against the fluctuations produced by the plunger pumps. The steam drums of the 40-hp boilers were considerably higher than on the 250-hp boilers, and it was frequently necessary to change the speed of the plunger pumps to apportion properly the feed to the two sizes of boilers. With the new pumps this is accomplished perfectly by the throttling of the feed valves.

As there is no fresh water available except the city supply, and as it is very desirable to utilize all water heated above the temperature of the supply, the city water used for turbine-bearing cooling, pump thrust-bearings and vacuum sealing is collected in a tank above the open heater and fed to the heater as make-up water. City water is automatically fed into this tank in case of deficiency.

The floor supporting the boilers consisted of steel resting on steel columns and arched between I-beams with brick and concrete, leaving the bottom flanges of the floor beams and the main girders exposed to the corrosive action of moisture and fumes from the ashes. Many of the beams were set in pairs and the presence of the arches at the side precluded the use of protecting paint. The steel had deteriorated to such an extent that in some instances the beams sagged 1 in. at the center. What really sustained the weight of the boilers was difficult to ascertain. New steel beams were placed under the old ones and the girders and columns were incased in concrete with reinforcing rods to form arches. The new ash hoppers, which are of ⅜-in. sheet steel, are bolted in place to permanent angles protected by concrete so that they may be easily replaced. The folly of not protecting boiler-room steelwork with concrete, or at least eliminating all vapors and leaks, was very forcibly illustrated in this station.

To preserve the boiler blow-off water and to furnish a storage in event of the failure of the city water supply, a concrete tank 40 ft. long, 11 ft. wide and 4 ft. high was constructed just to the rear of the boiler room. The tank is divided at the center by a charcoal filter. The one compartment forms a receptacle for the blow-off and is provided with a stack vent baffled with perforated sheet iron. The blow-off water then passes through the filter to the other compartment and thence by gravity back to the station, where it is pumped into the heater. This tank also acts as an equalizer to prevent the overflow of condensate during load fluctuations when the boiler feed is less than the condensate supply.

### COAL AND ASH-HANDLING EQUIPMENT

Coal is supplied by 500-ton barges at the dock. The old coal-handling equipment had a capacity of 10 tons an hour and required the services of six men. It had no outside storage facilities and little reclaimable bunker capacity. The new coal-handling equipment has a capacity of 50 tons an hour and can be operated by one man except for the trimming of the barges. Coal is delivered to the crusher and scales by a "Brownhoist" 10-ton steam locomotive crane, thence to an outside 500-ton steel suspended bunker by a belt conveyor. Coal is delivered to the boilers by an electrically operated 2-ton weigh larry, which runs on tracks



FIG. 6—GENERATOR ROOM DURING RECONSTRUCTION PERIOD

over the Murphy stoker and under the bunker. By way of explanation, it should be stated that there was not sufficient space in the boiler room to erect an overhead bunker. An outside storage of 2000 tons of coal is available.

The ashes were previously removed by push-cars and a hand elevator, the ashes being handled five times before delivery to the track as ballast. Now a standard-gage track

is carried in the basement under the ash hopper and the ashes are removed in a single handling..

AIR SUPPLY

The air supply and discharge for the turbines is taken care of by two parallel air chambers 9 ft. high and 4 ft. wide running longitudinally and separating completely the electrical equipment in the basement from the steam aux-

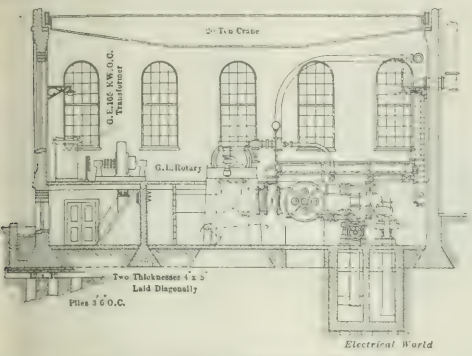



FIG. 7—SECTION OF REMODELED STATION

liaries. Dampers in the intake to each turbine make possible the correct apportionment of air to each unit. The discharge of the air outside the building materially reduces the noise. Space has been reserved for the installation of an air washer at some future date.

METERING STEAM AND ELECTRICITY

Particular attention has been given to the metering of all steam and electric energy, to facilitate the proper allocation of expenditures. The steam and water-flow meters are of General Electric manufacture.

The water and electricity are metered as follows:

*Total Water to Boiler.*—Steam to each turbine; steam to ice plant; steam to auxiliaries (that part chargeable to the boiler room is estimated).

*Electric Energy Generated by Each Turbine.*—Railway service; commercial light and motor load; municipal lighting; turbine-room lighting; turbine-room motors; boiler-room lighting; boiler-room motors; ice-plant lighting; ice-plant motors.

SUBSTATION

The substaition at Newport News is a new fireproof structure containing two rooms, one for the transformers and the other for the switchboard and converters. Automatic fire-doors cover the connecting opening. The arrangement is simple, with oil switches in concrete cells and open high-tension wiring. The cost of the building was 11 cents per cubic foot of content; if it had been used exclusively for railway service it would have cost $2.25 per kw, including plumbing.

The only unusual feature of the substation is the ventilation of the transformer room. Besides the usual number of windows twelve cast-iron louver panels were placed in the outside wall down near the base of the transformers and three 24-in. metal ventilators were placed in the roof. No provision is made for shutting off the ventilation, thereby insuring sufficient fresh air in all kinds of weather.

ICE PLANT

The Hampton ice plant, which is adjacent to the power house described in the foregoing, had a rated capacity of 150 tons of ice and contained two ammonia compressors, one a 40-ton 14-in. by 28-in. tandem compound-condensing Corliek machine, and the other a 60-ton 16-in. by 24-in. tandem compound-condensing York machine. The 40-ton freezing tank had fallen into disuse, and, owing to inadequate auxiliaries, both compressors were operated on the 60-ton tank during hot weather without getting full capacity.

The plant has now been completely overhauled, and recent records show that with an outside temperature of 100 deg. in the shade a regular output of 105 tons of ice per day can be maintained aside from the refrigeration of storage rooms, estimated as equivalent to 3 tons or 4 tons of ice production.

The Shipley type of atmospheric ammonia condensers were constructed out of the old atmospheric condenser of

TABLE I—PRESSURES AND TEMPERATURES OF CONDENSERS

| Item | 60-Ton | 40-Ton |
|---|---|---|
| Head pressure, lb | 220 | 21 |
| Back pressure, lb | 20 | 20 |
| Output, ice, tons..... | 90 | 4[illegible] |
| Incoming water, deg. Fahr | 80 | 80 |
| Outgoing water, deg. Fahr. | 98 | 98 |
| Air temperature, deg. Fahr | 100 | 100 |

the 40-ton equipment by purchasing ejectors and sprinkling troughs. The stands are 20 ft. long and are made up of 2-in. pipes twelve pipes high. Seven stands were erected for the 60-ton and five stands for the 40-ton compressor. Each stand takes approximately 60 gal. of water per minute, and on the warmest day recorded the temperatures and pressures were as shown in Table I.

TABLE II—TEMPERATURE OF COOLERS

| Item | 60-Ton | 40 Ton |
|---|---|---|
| Incoming Wort, deg. Fahr. | 210 | 210 |
| Outgoing Wort, deg. Fahr..... | 84 | 90 |
| Incoming cooling water, deg. Fahr | 80 | 80 |
| Outgoing cooling water, deg. Fahr... | 110 | 118 |

The Wort coolers are of similar construction to the condensers, but are made of standard-weight galvanized-iron pipe and consist of three stands for the 40-ton equipment. These are supplied from the same water and pumps as the condensers, but use only 30 gal. per minute per stand. Table



FIG. 8—NEW COAL-HANDLING EQUIPMENT

II shows the temperatures with an outdoor temperature of 100 deg. Fahr.

The 40-ton freezing tank, containing 12,880 ft. of 1¼-in. pipe and 596 300-lb. cans, which was formerly operated on the dry-gas system, has been changed to a wet-gas system by installing a 30-in. by 8-ft. accumulator set down in the tank. A 6-in. air space underneath the tank was filled with

fine regranulated cork by blowing it in with compressed air and thoroughly sealing it with waterproof paper and hard pine. The sides, which were formerly of wood and were badly decayed, were replaced by walls of hollow tiles and 8 in. of regranulated cork.

The 60-ton freezing tank, containing 12,036 ft. of 1¼-in. pipe and 720 300-lb. cans arranged for the flooded system, was changed to a wet-gas system by the addition of two 20-in. by 8-ft. accumulators. The bottom of this tank is insulated with cinders, to change which would necessitate raising the tank, an operation that hardly seemed justifiable.



FIG. 9—SECTION SHOWING AUXILIARIES AND BUS COMPARTMENTS

New handling rooms of 450 sq. ft. and 750 sq. ft. were devised for the 40-ton and 60-ton tanks respectively, and these, together with two storage rooms of 680 tons capacity, are refrigerated by direct expansion.

All old piping was replaced or re-erected, all screw joints on ammonia piping being well soldered. The ammonia condenser headers in the freezing tanks are made continuous with welded nipples.

The Wort storage tanks are cooled by direct expansion and not by passing the return gas from the freezing tanks through the coils. Each tank contains 300 ft. of 2-in. pipe, and the water leaves these tanks at 40 deg. Fahr. for the freezing cans.

## Electric Service in Connection with the Cape Cod Canal

In the progress toward completion of the Cape Cod Canal, in Massachusetts, connecting Buzzards Bay with Cape Cod Bay and planned to establish a shorter water route between Boston and New York, electricity is performing valuable service. Although this is one of the oldest engineering projects in the country in point of its early conception and investigation, it is only within the last four years that construction has been carried forward continuously in a comprehensive and successful manner, under the financial backing of Mr. August Belmont, of New York City.

The idea of a canal was conceived soon after the landing of the Pilgrims at Plymouth, Mass., early in the seventeenth century. Surveys and governmental reports were features of the later history of the Bay State, and construction was undertaken in a haphazard way at various times but without making much headway. It is interesting to note that as far back as 1883 on one of the many attempts to carry the enterprise ahead night work was done with the aid of electric lighting. The actual start of the present work, which is to be completed in 1914, under the engineering direction of Mr. William Barclay Parsons, of New York, followed no less than forty years of failures to build the canal.

The value of the new waterway to Eastern coastwise shipping cannot easily be exaggerated, as the annual toll in lives and property through shipwrecks occurring on the outer coast of Cape Cod and the loss in time by vessels being obliged to delay their passage around the storm-swept headlands crowned by Highland Light have been heavy burdens for many years. Upward of 500,000 passengers and 25,000,000 tons in vessels and cargoes yearly round the cape, and the canal will not only shorten the distance between Boston and New York by 66 miles but will also save a great deal of time in rough weather.

The canal is about 8 miles long, extending from Buzzards Bay, in the town of Bourne, to an outlet in Cape Cod



FIG. 1—METER, SWITCH AND FUSE HOUSE

Bay in the town of Sandwich, following the general course of the Monument River. The minimum width of the bottom is 100 ft. and it has a depth of 25 ft. below mean low water. The first part of the work was done by sand suction dredges, but as the contractor encountered stones and boulders in the later portions toward Sandwich, it became necessary to employ steam shovels. There at once arose a demand for pumping service between two temporary dams which had been built to discharge the Monument River into Cape Cod Bay, and this service is being furnished by the Buzzards Bay Electric Company from its Falmouth generating station. Two highway bridges and a railroad bridge also cross the route of the canal, and these are electrically operated by energy at present supplied by the New Bedford & Onset Street Railway Company. When the canal is completed it is probable that all this service will be handled by the Buzzards Bay company, and it is also planned to light the entire route of the canal by 40-c series tungsten lamps installed in pairs on opposite side of the waterway and longitudinally 400 ft. apart, to guid passing vessels through the artificial channel.

Energy is brought from the Falmouth station by a tem porary 6000-volt transmission line with grounded neutra which will ultimately be rebuilt on another location fo 33,000-volt three-phase service. The present line is carrie



FIG. 2—MOTOR-DRIVEN PUMPING INSTALLATION

into a home-made meter, switch and fuse house shown Fig. 1. The house is 6½ ft. long and 5 ft. wide and carried 3 ft. above the ground, with drip loops and t paper walls. The connections are made on the outsi of two sets of strain insulators installed between adjace poles. At Bourne the pressure is reduced to 2300 volts i

former station illustrated in Fig. 4, this installation isting of three 100-kva, 60-cycle, oil-cooled transform- housed in a temporary 19-ft. by 9-ft. by 11-ft. wooden k with asbestos paper roofing, the house being built slatted sides to facilitate ventilation. At this point nection is made with the 2300-volt lines of the Marion



IS. 3 AND 4—THREE-PHASE LINE AND TRANSFORMER STATION

Company, providing an alternative means of energy ly in emergencies.

ie canal electric service is provided by a three-phase 4 copper line paralleling the route of the channel as n in Fig. 3 and located beside the railroad right-of- used by the contractors on the job. The poles are . in length and are installed 125 ft. apart. About 2 from Bourne a 100-hp pumping installation, illus- d in Fig. 2, is in service twenty-four hours per day, ntering the westerly end of the canal channel behind mporary dam. Two 50-hp, 440-volt motors are in ser- each being directly connected to a 12-in. centrifugal which discharges the water from the channel loca- into the Monument River to maintain clear working itions for the steam shovels. All the pumps on the are directly coupled to their respective motors. Three or transformers of 100-kw rating are installed for bove pumping equipment, with a No. 6 secondary t from the transformers to the pump house.

Near the easterly end of the canal section now inclosed dam is an installation of four centrifugal pumps, two of the 6-in. size and driven by 10-hp motors, and thers 12-in. pumps driven by 50-hp motors. All the

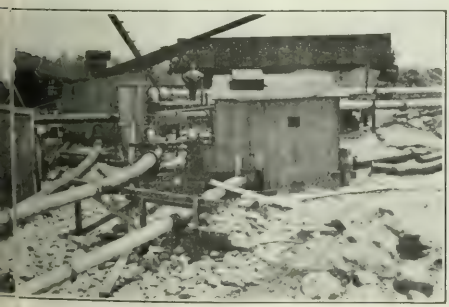


FIG. 5—MOTOR-DRIVEN PUMPING INSTALLATION

ots are of the induction type and are operated about rte hours per day. The transformer equipment pro- dechere includes six units of 150-kw total rating and e secondary distribution is at 440 volts. At this portion thcanal the water is also discharged into the Monument ver and thence into Cape Cod Bay, pending the com-

pletion of the work. The river was diverted in its course some months ago to enable the steam-shovel work to be carried on successfully. The heads are low, varying from 25 ft. to 30 ft. General Electric and Westinghouse motors are used, the pumps being chiefly of Jeanesville or Lawrence make. Two 1½-in. centrifugal pumps are also in



FIG. 6—MOTOR-DRIVEN BRIDGE AT BUZZARDS BAY

service, each driven by a 2-hp motor. They supply water to feed tanks from which the boilers of the contractor's small locomotives are replenished, and the motors are provided with automatic float switches governed by the height of water in the feed tanks.

The railroad bridge at Buzzards Bay is a double-track structure of the Strauss trunnion bascule type and carries the main line of the New York, New Haven & Hartford Railroad on the Boston-Provincetown route. Its span is 160 ft. and it is operated by two 65-hp General Electric direct-current motors designed to make 440 r.p.m. on a 550-volt circuit. The bridge is also provided with a 3-hp locking motor and an electric locking mechanism controlled from a signal tower at the Buzzards Bay station, about 600 ft.



FIG. 7—MOTOR-DRIVEN ROLLER-LIFT BRIDGE

north of the bridge. The operating cabin from which the bridge motions are immediately governed is at the side of the bridge and contains a main switchboard, with ammeter, voltmeter, fuses and controllers, meter and pilot-light equipment, the latter showing the position of the bridge and its lock at all times.

Each of the highway bridges is of the Scherzer rolling-lift type, 160 ft. long, with a 30-ft. roadway and a 6-ft. sidewalk, and is driven by two 25-hp, 550-volt direct-current railway type motors. Each motor is provided with two electrically operated brakes and a hand brake. On each end of each highway bridge is a safety gate operated by a 2-hp motor through a worm and gear drive, these being controlled from the bridge tender's cabin. Red and white indicating lamps, cut in and out by switches in the drawtender's cabin, are located on standards at each end of the bridge, and incandescent lamps are also employed in "spotting" the railroad bridge targets to insure accurate adjustment of the leaves and to govern the movement of vessels toward the bridge openings in the canal.

## Condenser-Current Method for the Determination of Alternating Wave-Form

By Frederick Bedell

The early and well-known methods for determining wave-form by instantaneous contact have seen good service for many years but have their recognized limitations on account of variations in the duration of the contact and in its resistance and the lack of sensitiveness of the reading instrument when the duration is made very small. In theory the duration of contact should be infinitely small whereas in actual practice it must be finite. The condenser-current method for determining wave-form is an integrating method, the instrument being in circuit all the time. In

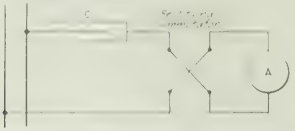


Fig. 1—Condenser bridged across the line

range and in sensitiveness it surpasses all other methods. The voltage may be a fraction of a volt or the highest voltage obtainable, and with suitable shunts a current of practically any magnitude can be measured.

For determining wave-form of voltage, a condenser $C$ is bridged across the line as in Fig. 1. The condenser current, rectified by a synchronous rectifying commutator, is measured by a direct-current milliammeter $A$, or a millivoltmeter, or by any low-resistance galvanometer of the D'Arsonval type. The commutator reverses the ammeter connections every half cycle. By shifting the brushes and reading the position of the brushes on a suitable scale, this commutation may be made to take place at any desired part of the cycle. Let $C$ be the capacity of the condenser in farads, $f$ the frequency of the circuit in cycles per second and $A$ the current reading of the ammeter in amperes for any brush setting. The corresponding instantaneous voltage is $e = A \div 4fC$. Readings of $A$ are taken for successive positions of the commutator brushes and the wave-form of voltage is thus determined.

To determine the wave-form of current, a shunt resistor $R$ is placed in series with the circuit, as in Fig. 2. The condenser $C$ is connected across its terminals, the commutated condenser current being measured by the ammeter or galvanometer $A$. The wave-form of current is then determined in the same manner as the wave-form of voltage.

The sensitiveness of the arrangement, either for current or voltage, can be varied by changing $C$ or by means of a resistor in shunt with the galvanometer on either the line side or galvanometer side of the commutator.

The theory of the method is as follows: The relation at any instant between the charge $q$ of the condenser and the current $i$ is $dq = i\,dt$. During any time interval of ha period $T$—that is, from any time $t = t_1$ to $t = t_1 + T$ the charge changes from $+q$ to $-q$, the positive and n tive waves being similar. Integrating for half a per one obtains

$$\int_{-q}^{+q} dq = \int_{t_1}^{t_1 + \frac{T}{2}} i\,dt.$$

But the reading of the ammeter is

$$A = \frac{2}{T}\int_{t_1}^{t_1 + \frac{T}{2}} i\,dt,$$

this being the average value of the current during a cycle subsequent to any time $t_1$. Hence one may $2q = TA \div 2$; or $q = TA \div 4$. Writing $1/f$ for $T$, $Ce$ for $q$, one obtains $e = A \div 4fC$.

It will be seen that the method can be applied onl waves in which the negative wave is a repetition of positive—that is to waves in which there are no even monics.

An integrating method for determining wave-form of is well known and a somewhat similar method, emplo an air transformer, has been used for determining w form of current and voltage. The air transformer met however, is restricted in range and is liable to error, ticularly on very low voltages, if the constants of the cuits are not properly selected. On very high voltages air-transformer method can scarcely be used on acc of the necessity of drawing current through a resistor

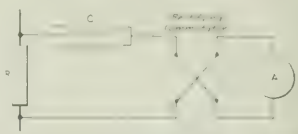


Fig. 2—Condenser shunted around a resistor

absorbs energy instead of through a condenser that ab practically none.

In the condenser-current method there is little diffi in selecting an instrument and a capacity that make negligible. For accuracy the resistance $r$ of the instr and circuit, including the commutator, should be sm compared with the reactance $x$ of the condenser. lations for a particular case will show how small is the introduced by the resistance. For example, using a c millivoltmeter on a 110-volt, 60-cycle circuit: $r$ ohms; $C = 0.4$ mf; $x = 6640$. The phase angle of th rent in the condenser is shifted by an angle tan $\tan^{-1} 0.0004$, a little over one minute. The effect resistance upon the amplitude of the current is neg for the impedance $\sqrt{r^2 + x^2} = 6640.00057$ is practical termined by $x$ alone. A much greater value of $r$ much smaller value of $x$ could be used without introd significant error. Where a number of current and age curves are to be taken and their phase positio to be accurately compared, for greatest accuracy $r/x$ have the same value in taking each curve; that is is changed, $r$ should be changed to correspond. In cases, however, this refinement is unnecessary.

The condenser-current method has been found sat tory and is recommended for its general usefulnes a paper* soon to be published on "The Use of the S ous Commutator in Alternating-Current Measurement writer discusses more fully the use of the commuta alternating-current measurement and gives a résu methods that have been used or proposed, with a ography.

* Journal of the Franklin Institute

## A Study in Depreciation

By Dr. Louis Bell

This year is the twentieth anniversary of long-distance energy transmission in the United States. Near the beginning of the year 1893 the San Antonio Canyon plant, started late the previous year, got settled down to regular business on the San Bernardino line, this being the first 10,000-volt transmission system used for commercial purposes. It was a single-phase line operated without a motor load. Early in September, the first of the American three-phase plants was started at Redlands, where there were two 250-kw generators, directly connected to Pelton wheels in what is now the No. 1 Mill Creek power house. The voltage at the machines was carried between 2600 and 2700, the rated terminal value being 2500 volts. The arc lighting of Redlands was carried by Brush arc machines installed in the same station and directly coupled to Pelton wheels. The distance of transmission in this case was only about 8 miles, but the plant enjoyed the unique distinction not only of beginning American three-phase transmission work but of being part of the splendid system which now covers southern California with its gigantic network.

There had been in the year or two previous some other praiseworthy attempts at energy transmission on the Pacific Coast. At the Falls of the Willamette a couple of years previously some single-phase machines had been installed for lighting Portland, Ore. These generators operated at 3000 volts, each over a separate line, if the writer remembers correctly. Fig. 1 shows the interior of this plant as it was twenty years ago. There was also at Bodie, Cal., an early single-phase transmission system in which two machines of the type and voltage of those in the Portland plant were utilized as generator and synchronous motor respectively.

Fig. 2 is a reproduction of a photograph of the north end of the original Redlands power house, taken about three years ago, quite unchanged from its appearance when the writer first lined up the machine in September, 1893. The remarkable thing about the case is that this particular machine, the old "T Y 10-250-600," is still in service after twenty years at the old stand, playing its regular part in the supply of energy to the system of which it was the be-



FIG. 1—WILLAMETTE PLANT OF TWENTY YEARS AGO

inning and on which it impressed its original frequency of 0 cycles per second. It is a very substantial generator, designed with a large factor of safety, able to carry considerably over its rated load and with a full-load efficiency of 5 per cent. The writer is inclined to think also that this ant was the first polyphase installation in which the machines were regularly run in parallel.

The story of these early Western plants might serve as a curious text for a sermon on the vicissitudes of electrical equipment and particularly concerning the relation of that sinister and somewhat mysterious thing known as "depreciation" to change in the art. The Portland plant, as shown, went out of existence within two or three years from the date of its installation and was replaced by another plant

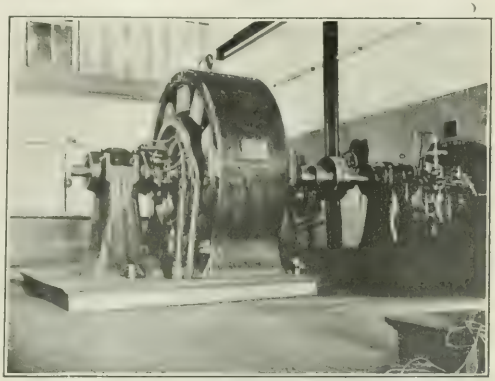


FIG. 2—NORTH END OF REDLANDS POWER HOUSE

which itself has in turn been replaced. The single-phase plant was actually installed within three or four years of the practical disappearance of single-phase working for the transmission of energy on any considerable scale. The machines were put out of service when still new with every prospect of a considerable length of life before them. In the next plant use was made of 6000-volt vertical-shaft three-phase generators.

The San Antonio Canyon plant, also single-phase, was changed over later, and what has become of the Bodie transmission equipment the writer does not know. Later calls for very much larger output again caused a shifting of the equipment at Portland, so that twenty years have seen practically three equipments at the Falls of the Willamette. The Redlands plant, on the other hand, was a year or two ahead of its time instead of a year or two behind its time, and has gone straight on for twenty years with a probability of a considerable useful life still ahead of it.

There have been some changes in the hydraulic situation, but this is not extended to the three-phase equipment Probably the thing which has approved it for service so long is in part that the original installation has become one of the contributory generating stations of a large network, being originally developed to fairly near its maximum permissible hydraulic output. There was then no incentive to change by reason of enlarging the original equipment and increasing greatly the size of the units, while in point of efficiency and reliability the original generator has continued to give a good account of itself in spite of increased knowledge of design and a general transition from the revolving-armature to the revolving-field type of machine. The generators of even twenty years ago were built to give long useful life so far as actual physical service was concerned. Their actual depreciation due to change in the art or change in the conditions of suitability has generally been very great. The uncertainty of this phase of the matter is by nothing better shown than the persistence of the original three-phase commercial generator at Redlands as contrasted with the repeated and wholesale changes frequently observed elsewhere. Any engineer may make a shrewd guess at the probable useful life of a physical structure, but it takes a prophet to tell what is going to happen in the way of change enforced by other conditions.

# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Remarkable Performance of Electric Truck

Five 5-ton electric trucks manufactured by the General Vehicle Company of Chicago have been purchased by the Manhattan Brewing Company of Chicago at different times during the past few months. It is reported that these trucks have been performing work away beyond what they were expected to do. On Aug. 4 one of the 5-ton trucks was driven to South Chicago with a load of thirty-three barrels and two half-barrels, having a total weight of about 6.5 tons. After delivering its load the truck returned to the brewery for a second load, taking out twenty-nine full barrels and eight half-barrels. After conveying this load to its destination, the batteries received a thirty-minute boost, and directly after luncheon a third load of thirty-three full barrels was delivered. The total deliveries for the day with this truck amounted to 100 full barrels, a total weight of approximately 40,000 lb., or 20 tons. The total mileage for the three trips was 64.3 miles, and the reading of the ampere-hour meter at the end of the day's work showed 70 amp-hr. left in the battery, which represents approximately 7 miles of travel. This performance is considered quite remarkable for a 5-ton electric truck, as it shows that it is able to do the work that was formerly considered strictly in the field of gasoline vehicles. All of these trucks are equipped with Edison storage batteries.

## Accounting System for Small Lighting Companies

In a paper recently presented before the Arkansas Association of Public Utility Operators, Mr. R. B. Fowles, auditor of the Pine Bluff Corporation of Pine Bluff, Ark., explained the N. E. L. A. system of accounting as it applies to electric-service companies whose gross annual income is less than $25,000. The author stated that in the N. E. L. A. classification accounting is treated under three general heads, namely, operating expenses, operating revenue, and construction accounts. The general head operating expenses is divided as follows: (1) manufacture—operating, (2) manufacture—maintenance, (3) distribution—operating, (4) distribution—maintenance, (5) general expenses.

### Operating Expense

The operating expense charges for manufacture include wages, fuel, water, lubricants, waste and miscellaneous power-house expenses and supplies. The maintenance expense charges for manufacture are composed of maintenance of steam plant, maintenance of electric plant, and maintenance of building and fixtures. The charges to maintenance of steam plant should be all expenses of repairing boilers and all their appurtenances, piping to the prime movers, auxiliaries and all repairs to tools other than fire-room tools. Maintenance of electric plant covers repairs to the generators, cables, switchboard and instruments. Under the classification of maintenance of buildings and fixtures are charged all repairs to the power-house building and grounds, including all sheds, stables and the like on the same property.

Operating distribution accounts consist of operating arc lamps, operating meters and transformers, and miscellaneous distribution supplies and expenses. Operating arc lamps covers the cost of trimming, inspecting, testing and repairing arc lamps on the customers' premises and in the shop. Where the central station has the municipal lighting, this account could be separated so as to keep the operation of commercial arc lamps separate from that of municipal arc lamps. Operating meters and transformers includes all costs of setting and removing meters and transformers and connecting and disconnecting services. A small company, however, can dispense with this account, as it probably will not have enough work of this nature to be able to separate it from the other work the linemen or metermen do.

Maintenance of distribution accounts are grouped as follows: maintenance of overhead system, including services, maintenance of arc lamps, maintenance of meters, customers' repairs and renewals. Maintenance of overhead system should be charged with all labor and material in repairing and renewing poles, cross-arms, excavations for poles and similar items. While the text on the N. E. L. A. classification does not state that salaries of linemen and their foremen should be charged to this account, it would be satisfactory to the small company and would give it sufficient cost figures to charge such salaries to this account. Expenses in repairing service wires could very well be charged here and still give the small company all the information it would require regarding the up-keep of the overhead system. If the company supplies energy for the municipal street lighting it might wish to separate this charge in order to secure the cost of maintaining the service rendered the city.

Maintenance of meters covers all cost of repairing and testing meters, including such items as salary of meterman, parts and all miscellaneous expenses in connection with repairing meters and testing, either in the customers' premises or in the shop.

It is the policy of most companies to furnish some service free of charge in order to encourage and stimulate the use of electricity. Where free wiring inside the house, hanging fixtures, installing electrical appliances, etc., is done, any expense occasioned is chargeable to customers' repairs and renewals. This account also includes expenses incurred in attending to complaints of service and in improving the service on the customers' premises.

The general expense item includes commercial and general expenses. These two classes can very readily be combined by the small company. Under this combination are found salaries of general officers, salaries of clerks, printing and stationery, miscellaneous office expense, advertising and soliciting, miscellaneous general expenses, damages, legal expenses, insurance and taxes. Salaries of general officers provide for salaries and expenses of any officer of the company whose jurisdiction extends over the entire property and which cannot be charged to any specific account, such as chairman of the board of directors, president, vice-president, secretary, treasurer and general manager. Under the head of miscellaneous office expense are included sundry supplies, postage, telephone and telegraph service, bond and stock expenses, maps, etc., which are connected with the general office.

The damage account provides for all damages to property and all expenses on account of persons killed or injured through the operation of the plant. These damages include doctors' fees, hospital expenses, claims settled, con

tributions to hospital funds, accidents to employees and attorneys' fees. Occasionally a company will have to pay a damage claim for the death of a person, perhaps caused by a fallen wire, amounting to several hundred or probably a thousand dollars. If this amount should be charged against the operation of the current month, the earnings would in most small companies be unable to bear the burden. In such cases it would be permissible to open an account in the general ledger entitled "Suspense" or some similar title and charge the payment of the claim to this account. The claim could then be spread out over the operations for several months or years, making a prorated entry each month to the damage account. When the full amount has been closed out from the general ledger to operating expenses, the accumulation of the damage account will show to the management the cost of the damages for the period in hand.

### Operating Revenue

The revenue of a small company should be classified as: commercial lighting, commercial motor service, municipal lighting, and profit on miscellaneous sales.

Commercial lighting should be credited with all revenue from consumers for electric lighting, whether by meter or flat rate. It has been found to be of statistical value, however, to keep the metered revenue separated from the flat-rate revenue. When kept in this manner the manager can always determine the revenue per kilowatt-hour for each class of business and know which should be encouraged.

Commercial motor service is credited with the revenue from customers using energy on motor circuits where the energy is registered by a meter separate and independent of the lighting meter. This also includes revenue from flat-rate energy customers. This is a class of business which every electric-light company is anxious to encourage. It is practically a day load, and thus the company can offer a low rate.

To municipal lighting is credited all revenue from the city for lighting the streets and buildings of the municipality.

The N. E. L. A. classification states that the profit on lamps, wiring, appliances and the like should be credited to an account of profit on miscellaneous sales. However, it is the opinion of the writer that this profit should be credited to some expense account, as, for instance, advertising and soliciting, because any expense incurred in handling these items is classed as being an expense for promoting business, and if any profit should result from this work, it would be proper to credit it to the account which bears the expense.

### Construction Accounts

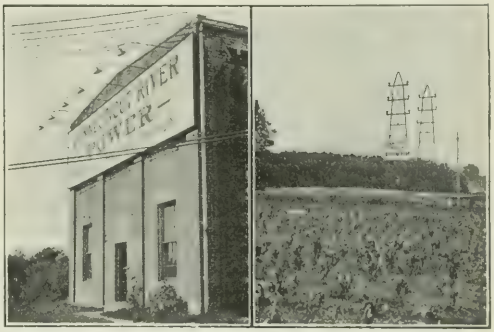
Construction accounts cover all expenditures for extensions to lines, additions to the power house and all betterments which increase the value of the property. A capital charge for construction means that the cost of enlarging a property is placed on the books of the company as an asset and represents the physical value of the system. For this reason a company should be careful that it makes no charge to capital for betterments unless each dollar upon the books has a corresponding value in the plant and equipment. The following accounts should answer the purpose of the small company and should result in concise construction classification: meters, arc lamps, plant extensions, line extension, transformers, furniture and fixtures.

In order to put a classification of accounts into practice it is necessary first to make and adopt the accounts needed for the property. Copies of these should then be circulated among the different departments and some means taken to explain the charges on each account and point out the difference between the several groups. The head of each department understanding the classification would then be able to dispose of the labor and material affecting him. All charges should be made in a thoughtful manner, to insure that the department charged would benefit by the money spent.

The inauguration of such a cost system lays the foundation for a plan of accounting which will furnish accurate data whereupon all estimates of future extensions and additions may be based. It also affords a check upon the operating expenses of each portion of the entire corporation which is reliable and applicable to immediate conditions.

## An Effective Hydroelectric Energy Advertisement

Among the hydroelectric corporations of the East which believe in vigorous publicity is the Connecticut River Transmission Company, whose 66,000-volt system now supplies a large portion of central New England, with headquarters and offices at Worcester, Mass. The accompanying photograph shows an 8-ft. by 45-ft. electrically illuminated sign recently installed at the company's Greendale substation, in



FIGS. 1 AND 2—ELECTRIC SIGNS OF CONNECTICUT COMPANY

a manufacturing section of Worcester. The substation is located on a low hill facing two important railway lines and a highway frequented by much automobile traffic. The lighting is provided by six 100-watt, 110-volt tungsten lamps carried in metal reflectors 10 ft. from the wall of the building and about 30 ft. above the ground. The sign is one of the most striking sights in the neighborhood both by day and by night. The second view shows a sign installed by the company on its 66,000-volt steel-tower transmission line at Millbury Junction, near Worcester, at a crossing of the Worcester Consolidated Street Railway and facing the Boston & Albany Railroad's east and west trunk line.

## Investigation of Cost of Motor Drive in a Six-Story Factory

In connection with the centralization of the power-plant equipment for a large group of factory buildings an investigation was recently made of the comparative cost of steam and electric operation in a six-story structure used for the production of machinists' supplies. The general methods followed and the data secured are of interest to the solicitor so far as they are available, and indicate the importance of taking as many factors as possible into account in determining the type of motive power to be used in specific instances. As in many cases of this kind, still more complete data would have been desirable, but enough were secured to be suggestive to engineers working in this somewhat specialized field.

The power plant serving the building contained two 200-hp Stirling boilers and two Harrison boilers housed in a boiler room measuring 60 ft. by 75 ft. Hand-firing was employed and the two Stirling boilers, operated at 150 lb.

steam pressure and [illegible] superheat, were equipped with an automatic [illegible] to enforce the draft when it fell below [illegible]. The Harrison boilers were much older, and were used only for heating purposes and for operating an elevator pump. In the engine room, measuring 24 ft. by 56 ft., there was installed about ten years before the test a 20-in. by 42-in. Rice & Sargent simple non-condensing engine, delivering about 200 hp at 90 r.p.m. Its exhaust was led to a feed-water heater which raised the feed temperature to 176 deg. Fahr., none of the exhaust being returned again to the boiler. Power was transmitted to the six floors of the building by means of belting and jack shafts. On each floor friction clutches were placed between the line and jack shafts, to permit disconnecting a part of the equipment on the floor when desirable.

### Plans for Electrical Operation

In taking up the electrical operation of the installation three different plans were considered. The first was to install one motor of about 300 hp rating to drive the entire mill; the second was to employ individual drive, and the last, to use a group plan of drive. The first was deemed impracticable since the space occupied by the jack shafts and belting would not be available for manufacturing purposes, and since the loss in the jack shafts, which was found to be about 25 per cent of the total load, would not be eliminated. The second plan would have necessitated costly changes in the arrangement of line shafting and called for the abandonment of most of it, besides tending to cause serious interruptions in the operation of the machines. The group-drive plan was considered best for the building, since it would result in no interruption in the service and would eliminate jack shafts and jack-shaft belting.

In order to determine what sizes of motors would be needed on the different floors a 30-hp motor was set up to drive the separate line shafts and the input noted by a Westinghouse curve-drawing wattmeter. As a result of these tests it was decided to install fifteen three-phase, 230-volt induction motors to drive the departments concerned, the total rating being 4380 hp.

Before the steam plant was removed, opportunity was offered to secure data on the operation of the shop by steam. The load on the engine was found by taking indicator cards at frequent intervals throughout three days. Two tests on the steam plant were made, one with the Stirling boilers supplying the engine alone and one with the boilers supplying the auxiliaries and engine. The object of the first test was to obtain the efficiency of the engine and boilers, and of the second, to secure data as to the amount of coal and water used in the boilers to supply steam to the auxiliaries and engine.

### Methods of Power Measurement

In order to obtain roughly the power delivered to each of the six floors the following method was used: With all the floors in operation indicator cards were taken at the engine; then the sixth floor was thrown off by means of the clutch connecting the line to the jack shaft, and cards were again taken. The difference between the two engine hp readings was then assumed to be the power delivered to the sixth floor, plus the friction losses due to the transmission to that floor. Then the clutch was again thrown in and the operation repeated for the other floors in turn. The engine efficiency was found to be 10.12 per cent and the boiler efficiency 54.3 per cent in the tests above referred to. The buckwheat coal used cost $3.60 per net ton and was found to contain 12,100 lb.-Fahr. heat units per lb.

With all the machines idle, and with only the shafting load on the engine, the output of the latter was 163.4 indicated hp. The power required to drive the jack shaft, or in other words the shafting and belting from the engine to the clutches on the various floors, was 78.4 hp. The total power delivered to the floors, according to data obtained by throwing out each floor in succession, was 223.4 hp. This, added to the power required to drive the jack shafts, aggregated 301.8 hp.

The determination of the cost of steam power in the installation was made as follows:

| | |
|---|---|
| [illegible] | |
| Plant is shut down two weeks for repairs) | |
| 9 weeks at 5 days or 45 hours and 1 day of 3 hours, less 6 [illegible] gives per year, in working hours | 2699 |
| Coal used per year in tons, including 119 tons for banking (5 lb. per brake-hp per day) | 1664 |
| Water per year, in thousands of gallons | 2338 |
| *Operating Costs:* | |
| Water per year at 20 cents per 1000 gallons | [illegible] |
| Oil and waste at 0.033 cent per indicated hp-hour | 259.40 |
| Ash removal, 399 tons at 25 cents per ton | 99.80 |
| Coal per year at $3.60 per ton | 5,980.00 |
| Repairs at 2 per cent of investment (see below) | 339.00 |
| 1 engineer, 52 weeks at [illegible] | [illegible] |
| 1 assistant engineer at $15 | 750.00 |
| 1 fireman at $[illegible] | [illegible] |
| Total operating cost with steam | $9,395.80 |
| *Investment Costs and Fixed Charges:* | |
| Two 200-hp Stirling boilers (at $13 per hp) | $5,200.00 |
| Feed pump and heater | 850.00 |
| Piping | 2,000.00 |
| 20-in. x 42-in. simple non-condensing engine | 8,000.00 |
| Stack, at $2.25 per boiler hp | 900.00 |
| Total investment | $16,950.00 |
| *Fixed Charges:* | |
| Interest at 5 per cent on $16,950 | $847.50 |
| Profit, 10 per cent on $16,950 | 1,695.00 |
| Insurance and taxes, 2 per cent | 339.00 |
| Amortization of boiler, 1.5 per cent, 30-year life | 108.00 |
| Amortization of auxiliaries, 3 per cent, 20 years | 25.50 |
| Amortization of engine, 1.5 per cent, 30 years | 120.00 |
| Amortization of stack, 0.5 per cent, 50 years | 4.50 |
| Total | $3,139.50 |
| Grand total steam cost per year, operating expenses and fixed charges | $12,535.30 |

### Determination of Electrical Cost

| | |
|---|---|
| *Cost of Motors:* | |
| 3 50-hp motors, 900 r.p.m., at $450.00 | $1,350.00 |
| 2 35-hp motors, 1200 r.p.m., at $360.00 | 720.00 |
| 2 25-hp motors, 1200 r.p.m., at $301.50 | 603.00 |
| 3 20-hp motors, 1200 r.p.m., at $277.20 | 831.60 |
| 2 15-hp motors, 1200 r.p.m., at $233.10 | 466.20 |
| 1 10-hp motors, 1200 r.p.m., at $201.60 | 201.60 |
| 2 5-hp motors, 1800 r.p.m., at $71.10 | 142.20 |
| Total, less 10 per cent discount | $3,883.10 |
| (Cost of motors included starting compensators, with motors in service, excluding wiring.) | |
| Cost of wiring | $200.00 |
| Total cost of electrical installation | 4,083.10 |
| *Fixed Charges, Electrical Installation:* | |
| Interest, 5 per cent on $4,083.10 | $204.20 |
| Profit, 10 per cent on $4,083.10 | 408.30 |
| Insurance and taxes, 2 per cent | 81.70 |
| Depreciation, including repairs and obsolescence, figured at 10 per cent | 408.30 |
| Total | $1,102.50 |
| Energy consumption of installation per year, on basis of energy supply to mill directly from central-station mains, requiring [illegible] kwhr. at [illegible] cents | [illegible] |
| Fixed charges | 1,190.50 |
| Total cost of electrical service | $11,875.50 |
| Net saving by use of electric drive, $669.80. | |

In this installation the survey indicated that the usual labor economies of the electric drive could not be assumed for the reason that without the complete electrification of the factory group as a whole the existing force would probably be retained. Electricity has been installed in the six-story building, however, and has introduced substantial improvements in the operating conditions, notably in connection with the release of highly valuable real estate for manufacturing purposes and the facilitation of overtime work through subdivision.

# Illumination and Wiring

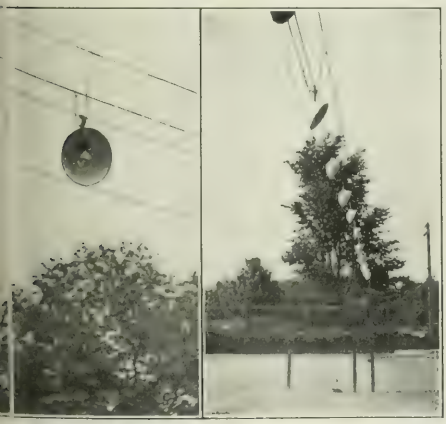
## An Electrically Illuminated Tennis Court

novel installation of electric lighting designed to per- ennis playing at night has been made at the grounds e Newton Center (Mass.) Squash Tennis Club, bor- g the Commonwealth Avenue boulevard. The equip- consists of twenty-four 250-watt tungsten lamps in-



IG. 1—ELECTRICALLY ILLUMINATED TENNIS COURT

d in Holophane type RE No. 486 white-enameled steel olic reflectors. These reflectors measure 15¼ in. in ter and 14 in. deep, the lamps being hung in two rows messenger cables on the right-hand and left-hand rs of the standard gravel court. The reflectors are led outside and in and are secured by clips at their ns to a ⅛-in. stranded steel guide wire which pre- swaying in case of wind. The messenger wire is of stranded steel, and the lamps are hung in four groups each, each group being supported between two 4-in. in. North Carolina pine poles. The latter are set ncrete to a depth of about 8 ft. and stand from 14 ft. ft. above the ground. They are guyed at the ends of urt by ¼-in. stranded steel wire, and the center poles 3 in. outside the posts supporting the net, all poles



FIGS. 2 AND 3—DETAILS OF LAMP SUSPENSION

56 ft. apart parallel to the court axis of play and ft apart laterally. Experience indicates that 6-in. by . oles would be preferable in a second installation. lamps are supplied with energy through taps dropped arallel circuit of No. 8 insulated copper wire, the eing carried on glass insulators. The lamps are g 2 ft. to 13 ft. above the court level in catenary suspension and are 8 ft. apart horizontally. Each half of the installation is wired through a common three-pole switch to the regular 110-volt alternating-current secondary distribution circuits of the clubhouse, energy being supplied by the Edison Electric Illuminating Company of Boston. The energy consumption for the area inclosed by the installation is approximately 1.2 watts per sq. ft., and the cost of illumination at the Edison company's regular 10-cent rate is about 60 cents per hour.

In the first few evenings of play a bank at one end of the court was covered with a black cloth, as the ground showed too light and it was not easy to see a swiftly moving ball; but dark gravel has now been substituted and no screening is necessary. The net is black to facilitate play still further. Tournaments in which the best players from outside compete with the local membership are frequently held, and the court is in almost constant demand in the summer evenings. The contractors for the installation were the firm of Deane & Lobdell, Boston. One of the first persons to play upon the court at night was Mr. Earl J. Ovington, the well-known aviator, who states that the illumination is very even, with a soft and diffused light, absence of glare and with generally pitch-black backgrounds. The cost of the installation was approximately $250.

## The Development of Rubber-Covered Wire Specifications for House Wiring

By Hugh T. Wreaks

In discussing rubber-covered wire one should consider the characteristics of the copper, the question of tinning and the characteristics of the braid, as well as those of the rubber insulating compound. This is seldom done, however, as there is relatively little disagreement as concerns copper, tinning and braid tests, while there is much difference of opinion in regard to value and function of tests on rubber insulating compounds.

The history of rubber-covered wire specifications is an interesting one and uncovers a problem which has vexed many engineers for a considerable length of time, owing to the great difficulty of determining whether the rubber insulation used will last and whether it will afford an adequate protection against deterioration of the copper underneath. Various attempts have been made to make adulteration impossible by specifications carefully and ingeniously drawn, and these have culminated as regards house wire in the National Electrical Code rubber-covered wire specifications of to-day, which represent the last word on this material.

As of interest, Table No. 1, showing the development of National Electrical Code specifications for house wiring from 1901 to date, and including the New York city specifications of 1910 as really constituting and playing a very active part in this development, is reproduced.

### Chemical Analysis

It will be noted that in both the New York City specifications of 1910 and the National Electrical Code of 1911 physical tests were added to previous National Electrical Code specifications, the latter to a greater extent than the former. To both was also added a one-year physical test or guarantee, that of New York City being the same as its initial test and that of the 1911 National Electrical Code allowing for a materially lower value. The Underwriters also introduced a chemical analysis, this latter along lines differing from other previous rubber-compound analyses. Whether this chemical analysis strengthened the specifications is, however, questionable, and the city of New York, while adopting in 1912 the rest of the National Electrical Code specifications, omitted to adopt this chemical test. Relatively it is an expensive test considering the grade of the compound, and theoretically it is supposed to insure 20 per cent of rubber or more in the compound.

Table II indicates how these tests work out in practice, the different letters designating different manufacturers, and the percentage showing the variations in different compounds and the leeway afforded under chemical tests in question.

TABLE I.—NATIONAL ELECTRICAL CODE RUBBER-COVERED WIRE SPECIFICATIONS, 1901-1911 INCLUSIVE

1.—Code Rule, Rubber Compound Characteristics

| | N. E. Code 1901 | N. E. Code 1907 | N.E.-N.Y.C. Code 1910 | N. E. Code 1911 |
|---|---|---|---|---|
| Thickness insulation wall..... | 3-64 in.—size 14, to 6-64 in.—size 1,000,000 circ. mil. | No change | No change | No change |
| Physical tests | None | None | Pressure test with wire 0.04 in. diameter at 5 lb. for five minutes. Wrapping test under tension for twenty-four hours around mandrel | Stretch, 2 in.-5 in. Recovery, 2 in. Final stretch, 6 in. or more |
| Tensile strength... | None | None | As above | 400 lb. per sq. in. |
| Specific gravity... | No requirements | No requirements | No requirements | No requirements |
| Chemical tests.... | None | None | None | Acetone extract, alcoholic potash extract, chloroform extract, free sulphur and ash determinations shall total by weight 80 per cent or less |
| Electrical tests, voltage | Tests on 1 ft. samples after seventy-two hours in water, 3,000 volts per 1-64 in. of insulation wall | Additional tests on all coils at factory after twelve hours in water, 1500 volts, one minute, all sizes | No change | Same as before, but with increased voltages for larger sizes, up to 2500 volts |
| Electrical tests, insulation resistance | Sample coils, after thirty days in water, to show at least 100 megohms per mile at 70 deg. Fahr. | Additional tests at factory after twelve hours in water, No. 14—200 megohms, 1,000,000 circ. mil. 100 megohms per mile at 60 deg. Fahr | No change | Changing of temperature on sample coils from 70 deg. Fahr. reading and adjusting factory test values in proportion |
| General requirements | Rubber or other approved substances | No change | No change | Rubber compound homogeneous in character |
| Aging tests | None | None | Same as Clause 2 for one year after manufacture | Clause 2 modified Clause 3, the same one year after manufacture |

## Electrical and Physical Tests

In the specifications will also be found electrical and physical tests which bear the earmarks of higher-grade specifications and which in themselves may or may not mean the 20 per cent rubber as specified.

For a great many years there has been a common impression that because good rubber possessed certain qualities when properly cured compounds which possessed these qualities must of necessity contain a certain given percentage of good rubber. Another common assumption has been that because a compound contained a certain amount of rubber it was bound to have a long life and give good service value. This contention is probably more nearly true than the first, but the facts are difficult to obtain bec many compounds which were certified to contain gi quantities of pure rubber as indicated by tests have fa in a way that left this assumption open to suspicion.

Concerning the rubber-covered wire as made up to t code specifications, and as certified to by the Underwr Laboratories labels, two points are of interest: (1) W have a long life and give good service? (2) Does it tain 20 per cent of rubber?

The second question is relatively unimportant, and t will determine the first. However, it may be of interes analyze its good and bad points. Mechanically the must be strong enough to withstand ordinary handlin transportation and installing as well as a certain amou abuse. Electrically it must be suitable for from 125 to 250 volts, and rarely 500 volts, for ordinary house wir

The condition of rubber insulation most feared fro point of safety is that of brittleness or drying out, wh causes cracks and possible exposure of the copper an noticeable in a majority of wires, especially at the out after they become from five to twenty years old.

The 1911 code rubber-covered wire specifications hav ample factor of mechanical strength as far as the ins tion is concerned, and yet this is really unimportant, cause the real strength of a rubber-covered wire lies in braid, and if this is defective, the rubber will have l value from a mechanical point of view. Electrically th is little change in these specifications from those repla

TABLE II.—1911 NATIONAL ELECTRICAL CODE SPECIFICA COMPARATIVE CHEMICAL TESTS

| Company Letter | Acetone Extract, per Cent | Chloroform Extract, per Cent | Alcoholic Potash, per Cent | Ash, per Cent | Total Sulphur per Cent |
|---|---|---|---|---|---|
| K..... | 13.05 | 1.30 | 0.33 | 56.63 | 7.34 |
| BB..... | 2.89 | 2.85 | 14.10 | 23.60 | 8.5 |
| V..... | 9.33 | 2.26 | 0.70 | 55.70 | 7.3 |
| V..... | 8.40 | 1.98 | 4.00 | 61.30 | 4.8 |
| V..... | 9.46 | 1.51 | 0.43 | 61.20 | 5.77 |
| A | 13.31 | 2.05 | 1.10 | 53.82 | 8.08 |
| A | 13.54 | 1.12 | 1.28 | 54.27 | 8.53 |
| E..... | 8.82 | 2.53 | 1.37 | 58.25 | 6.4 |
| C..... | 8.29 | 3.25 | 1.40 | 61.95 | 4.99 |
| C..... | 6.88 | 1.60 | 0.86 | 62.92 | 4.0 |
| D | 10.47 | 1.80 | 1.09 | 57.81 | 7.49 |
| B | 6.23 | 5.60 | 0.95 | 63.25 | 4.14 |
| W | 3.57 | 1.46 | 1.31 | 63.19 | 7.6 |
| T..... | 10.82 | 6.81 | 0.66 | 53.52 | 4.5 |
| Y..... | 8.47 | 3.16 | 0.79 | 59.20 | 5.54 |
| Y..... | 7.20 | 3.70 | 1.80 | 59.60 | 7.34 |
| Y..... | 7.46 | 3.24 | 1.37 | 58.93 | 7.1 |
| R..... | 11.88 | 2.90 | 1.05 | 57.32 | 5.66 |
| Q..... | 9.94 | 1.64 | 0.56 | 60.32 | 4.04 |
| X..... | 16.08 | 1.11 | 0.51 | 56.42 | 5.06 |
| Z..... | 7.24 | 2.22 | 0.50 | 58.30 | 5.45 |
| Z..... | 8.59 | 0.96 | 0.89 | 59.40 | 7.41 |
| N | 15.02 | 2.56 | 0.84 | 57.80 | 2.56 |
| N | 13.44 | 2.92 | 0.75 | 58.64 | 2.42 |
| L | 6.00 | 3.74 | 1.19 | 62.15 | 4.17 |

and the factor of safety is ample in each case, barr mechanical injury.

Whether the rubber will dry out or not is, of cou purely speculative, and whether it will dry out faster t that on some of the brands of wire which it replaced n be judged by time.

The physical tests prescribed in the 1911 code specif tions call for a stretch before breaking from 2 in. to 6 when wire is new, and allow the same wire to stretch from 2 in. to 4 in. when one year old. This means a ph cal change or "setting" of this compound from a valu one to three to one to two in one year. If the curve physical change in the rubber is a normal curve, this year change will continue during the second and fu years until the condition of non-stretch or drying out been reached.

Comparing this with the rubber-covered wire of the York City Code specifications, which it immediately

placed, one finds a much smaller original stretch, about 33 per cent, when the wire was new, and a similar stretch at the end of the first year. Theoretically and practically a wire made up under these latter specifications which had little difference in the stretch value between new and one-year-old wire might easily have a curve of deterioration or setting or drying out which at the end of four or five years would show a higher value than the National Electrical Code wire described.

Again, there is a distinct relation between stretch and curing of rubber or vulcanization, and it is conceded that vulcanization continues during the life or aging of the insulated wire. That is to say, compounds contain in themselves a tendency to become more and more cured the older they get. Again, it is claimed that compounds slightly undercured and without qualities of stretch have less tendency toward after-vulcanization or drying out than those with the original stretch and harder cure. In other words, the theory of the latest specifications is to make the physical conditions so high that the drop must be considerable before the compound becomes poor or dead, while those they superseded allowed a lower physical condition with a lesser rate of change.

Judging results from an engineering viewpoint, it is safe to argue that under either specifications some makes of wires will show good service value and others the reverse, while in the long run different makes will doubtless classify about the same. In other words, the making of a compound to meet certain tests is only one feature in the value of the finished product. The way it is mixed and handled, the newness of the rubber material and the vulcanizing and freedom from intentional or accidental adulteration all play an important part.

In a measure, correct drying, mixing, compounding, handling and vulcanizing are indicated in uniformity of tests, physical, electrical and chemical, and the question of adulteration is indicated by price and manufacturer's reputation.

Unfortunately, these two latter forces do not have as full recognition as they should. Rubber-covered house wire to-day is largely sold with labels of the Underwriters' Laboratories attached, certifying the approval of the Underwriters and being accepted by the trade as evidence that the coils of wire to which they are attached are up to the National Electrical Code specifications and will be accepted by the inspection departments having jurisdiction. Incidentally, this indorsement by the underwriters and inspection departments takes away from the trade any further responsibility and makes difficult any effective criticism in case this wire should deteriorate appreciably within a few years. The entire incentive under pressure of commercial conditions is for a manufacturer to make a wire which will pass all tests when new and show up well for at least one year after.

If the contention of the Underwriters that the drying out of the insulation on the wire in service induces a fire hazard is correct, it would seem that the electrical industry, together with the inspection departments, should frame standards indicating what degree of brittleness of insulation constitutes a hazard. Then any wire failing in such tests would have to be replaced. Probably this rule would affect many installations throughout the country, but it need not be made retroactive. Certainly it would allow a fairer play for manufacturers' reputations than exists to-day and permit an intelligent comparison between first cost of rubber-covered wire and cost per year of service. In the absence of such a clearly defined standard the age of a wire in buildings, generally set for about twenty years, is more often considered a reason for its condemnation than its actual quality.

One point which has not been mentioned is the effect of insulation on the copper. Corrosion from this cause does not appear to be as frequent in house service as in underground service, and when it occurs it causes such obvious trouble that it carries its own remedy with it.

### Braid on Rubber-Insulated Wire

The braid covering on a wire serves two functions—it adds strength to the wire and compound underneath and it serves as a protector to prevent deterioration of the compound and conductor underneath.

This means that when the braid is exposed to the atmosphere it should withstand temperatures varying from, say, 130 deg. Fahr. to 0 deg. Fahr., or such temperatures as service conditions may require, without any deleterious effect on the braid itself or the preservative and air-excluding compound with which it is saturated. A braid which continually absorbs moisture and then dries out will rot in a relatively short time. The braid should be strong, of good-quality cotton, and flexible enough to protect the conductor during the ordinary process of handling, and if it fills these qualifications it is likely to give a good account of itself in service.

Unfortunately waxes which best exclude water may tend to stiffen the wire and crack the braid when bent, or if put into the braid at a temperature high enough to saturate it thoroughly, may slightly char the braid fiber. Again, those waxes which best withstand high temperature will not best withstand low temperature, although of the two the former is considered more important. Moreover, the strongest braids are not necessarily the most flexible.

To cover these points properly requires specifications which will give the best mean average on points enumerated and which are individualized for different manufacturers' methods. It is wise to make moisture absorption, high and low temperature tests and bending-under-tension tests on braid, and also tests of physical strength whenever the wire may be subject to rough handling. Aging tests on braid could be made with advantage, and their importance made more prominent in specifications.

As pertinent it might not be amiss to quote a series of tests made by Mr. Frank R. Shields at the Massachusetts Institute of Technology several years ago to find some quick means of determining the service value of rubber compounds by exposure for a short time to severe chemical or oxidizing conditions.

These tests were as follows: (a) Exposure of samples bent over tubes so that the rubber surface was under some strain to an atmosphere of ozone generated by oxidation of phosphorus by air; this for varying periods of time and at different temperatures. (b) Exposure of similar samples to an atmosphere of pure oxygen for varying periods and exposed to sunlight. (c) Sun-cracking test, by exposing samples similarly bent to the action of sunlight for varying periods so as to hasten oxidization.

In addition, nitric acid, chromates, permanganates, hydrogen peroxide and acetone peroxide tests were referred to all as powerful oxidizing, or quick aging, agents.

Mr. Shield's conclusions after about two years of experiments were as follows: (1) That the opinion of the majority of engineers, as quoted in different discussions, is not to specify a certain composition for insulation, but to leave it to the manufacturer, the important thing being for the insulation to do the work. (2) That, of the different qualities possessed by insulation, durability is the most difficult to obtain and the most important, and any test to be successful must decide this point, the insulation resistance and dielectric capacity being of varying importance. (3) The ozone test gives results which are practically worthless. (4) There are many reasons for believing that exposure of the samples to the action of sunlight and oxygen under pressure can be made the basis of a reliable and practical test.

The experiments and conclusions of Mr. Shields, which match with those of other engineers and the writer, recognize the difficulty of insuring "service value" in rubber-insulated wire compounds by any known specifications or tests

pplied at or shortly after the time of manufacture, and dicate the importance of treating such specifications and sts as only one factor (important if properly applied) and lowing full consideration to the price and reputation or and of manufacture when attempting to judge the value f the product. In the estimation of the writer, the sooner is viewpoint is recognized the sooner real progress will e made in rubber-covered wire specifications, and the ob-ct of inspection and tests then will be to identify recog-ized brands rather than to call for wire made up under ntinually changing specifications.

## Recent Telephone Patents

### Party-Line Devices

It is at times considered advisable on party lines for ose using the line to obtain notice of the attempt of a ird station to interrupt. According to the invention of r. A. Schlosser, of Dodge, Neb., an auxiliary transmit-r and gong are included within the set, and in case the ook switch is allowed to rise, the gong is struck through e agency of the auxiliary transmitter, impressing its aracteristic tone upon the line.

A harmonic ringer is the subject of a patent granted to r. C. J. Erickson, of Chicago. The novelty lies in the ethod of mounting the clapper rod. This rod is thinned its lower end to form a reed-like slip. This end is then amped in a hole in the pole of the polarizing magnet. he armature is slipped onto the clapper rod and held in e proper position by clamping screws.

A lock-out switch for party lines has been patented by r. J. G. Roberts, of Chicago, Ill., the patent being as-gned to the Western Electric Company. This switch is f the step-by-step type and is operated by a polarized lay, impulses in one direction serving to advance a ratchet vitch while an impulse in the second direction withdraws e pawls and permits the switch to return to zero. Each gular position of the switch corresponds to one station.

# Letter to the Editors

## Waterloo Transformer Connections

*o the Editors of the Electrical World:*

SIRS:—In connection with the description of the steam ant and substation equipment at Waterloo, Ia., which ap-eared in the *Electrical World* dated July 26, use was made f a diagram of transformer connections which, although milar in many respects to the connections actually em-oyed, fails to represent the true idea of the method of ntrol devised and installed by the writer. Fig. 1, which the diagram used in the article referred to, shows two in-ependent systems—a straight open-delta motor service sys-m with the two outside transformers and a straight mul-le primary, three-wire-secondary lighting system with the o inside transformers, the two systems not being inter-nnected in any way but fed from the same three-phase eder. In Fig. 2 are shown the connections used by the riter. The four transformers are interconnected and erate as a complete unit, from which may be taken energy r three-phase motor service and for three-wire single-ase lighting service. Use is made of standard regulators, hich give absolute control of the voltage in either side of e three-wire lighting secondaries. This is the feature of e design that is unique.

An examination of the arrangement of the regulators at and *C* will show that the secondary coil at *C* is reversed ith respect to the secondary coil at *B*, whereas the excit-g coils have the same sense in both regulators. The re-lt of this arrangement is to cause one regulator to "buck" and the other regulator to "boost" coincidentally, or vice versa. As a matter of fact, use is made of a single regulator having two secondary circuits and one exciting circuit, one of the secondary circuits being reversed when connecting it up.

Normal regulation in the primary lighting phase 1—2 is taken care of by the straight single-phase, double-circuit

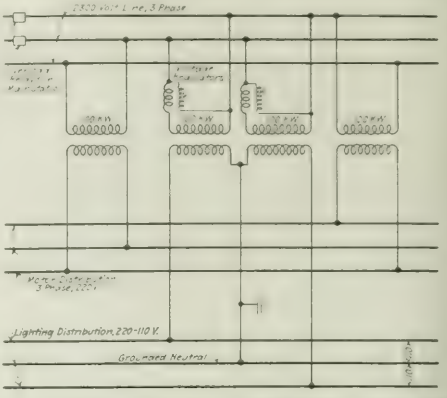



FIG. 1.—INCORRECT DIAGRAM OF TRANSFORMER CONNECTIONS

regulator shown at *A*, located at the main station. The purpose of a double-circuit regulator is to boost equally in two of the leads, instead of in only one, thus maintaining a more uniform triangle of voltages.

By placing the regulator secondary *B* in the line feeding energy to transformers 1 and 2 and the secondary of *C* in the line feeding to transformers 3 and 4, one bucking and the other boosting an equal amount, no circulating current can be produced in this system, the principal effect being to control the secondary voltage in transformers 2 and 3 at will.

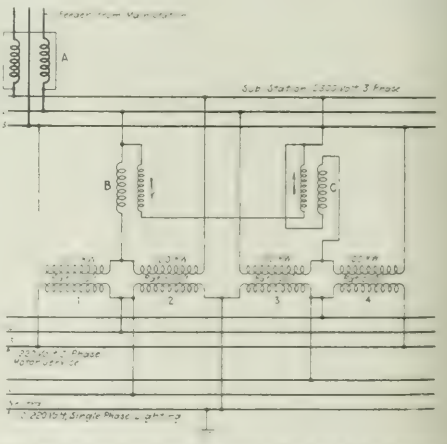



FIG. 2.—CONNECTION OF TRANSFORMER BANK TO UNDERGROUND SYSTEM

Merely for the sake of clearness, separate secondary buses are shown for lighting and motor service; as a matter of fact, the neutral bus is added to the three motor-service buses, thus making a single four-wire lighting and power bus, and all of the underground feeders are four-wire, being connected to this one bus.

*Waterloo, Ia.* AUSTIN BURT.

# Field of the Operating Engineer

**A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers**

## Heavy Service on a Plant Engine

r the last fourteen years, twenty-two hours a day and ays in the year, the Ball & Wood engine in the power supplying New York University and the Hall of Fame, ersity Heights, has been rendering continuous service, shing light and power to eight buildings and exhaust- heating service to four. These building are scattered the 37 acres of grounds which make up the campus of York University. There is no other engine in the r plant so that the university buildings have been ether dependent upon this unit for service. The present ple is of special interest in contrast with the impres- prevailing in some quarters that reciprocating machin- f this kind is of limited life. Mr. Galezio, chief engi- of the plant, declares that the engine is still in the best erating condition and good for many years yet. The al installation was made under the direction of Messrs. im, Mead & White, architects, and Pattison Brothers, ical engineers.

## k Change-Over from 12,000 Volts to 33,000 Volts

e Gary & Interurban Railway Company holds trackage between Hammond and Laporte, Ind., and at present erating interurban cars over about 20 miles of track ll as the local cars in Gary. A large portion of the y used in operating these cars was supplied by the Service Company of Northern Illinois over a circuit tapped the electric service company's 12,000-volt line ng between Blue Island and Chicago Heights, Ill. The nission line in the State of Illinois is owned by the Service Company, and the section in Indiana is l by the railway company. One substation of the lat- West Gary, containing two 500-kw rotaries, was fed this line and supplied energy for the operation of the ver practically the entire road.

ore the railway company's substation at East Gary ut into operation it was necessary to extend the trans- n line and raise the tension to 33,000 volts. The ment at East Gary consists of two 300-kw rotaries

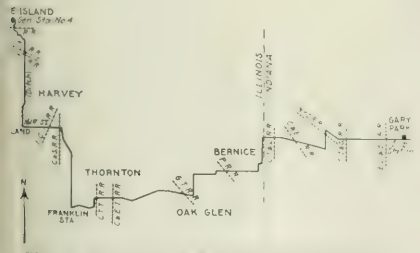



FIG. 1—MAP OF GARY & INTERURBAN SYSTEM

e accompanying transformers, which are designed to re on 33,000 volts. As the 1000-kw installation at the 00 volt substation in West Gary was carrying a large rld, it was impossible to shift this load over onto a k station when the change from 12,000 volts to 33,000 ts as made.

Electricity supplied by the Public Service Company to the railway is generated at Blue Island, and two 12,000-volt transmission lines are run between the station and Chicago Heights. For this reason it was considered better practice to install the step-up transformers at the generating station rather than at the point where the railway company's transmission line taps the Public Service Company's lines. Four 3000-kw, 33,000-12,000-volt oil-filled, water-cooled transformers were purchased by the electric-service company, and two of them were connected open delta and installed in a temporary shed outside of the generating station. These transformers were connected through oil

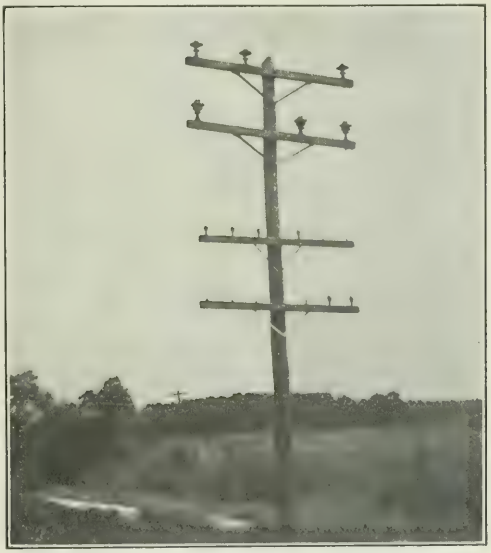


FIG. 2—LINE CONSTRUCTION BETWEEN BLUE ISLAND STATION AND TIE-IN POINT

switches to the station busbars and to a 33,000-volt transmission line which was constructed on the same poles with the 12,000-volt line. The 33,000-volt line was supported below the 12,000-volt line, so that the men could work without hazard in the daytime with the upper line energized. The wires on the new line were strung as far as the tie-in point previously mentioned, and the job of dead-ending and connecting to the railway's line was postponed until the time set for the cut-over.

A 33,000-volt substation was being built by the railway company at Wilkinson, Ind., in which two 300-kw transformers are to be installed. These transformers were brought to the old substation at West Gary and set up in a temporary structure. Connections were made from them to the substation buses and to the transmission line with the necessary disconnecting switches, and the final connections were left open until the line could be de-energized without interrupting the service.

At midnight, one hour before the railway service or-

dinarily ceases, the transmission line was de-energized; the old equipment at West Gary was cut out of service and the final connections on temporary transformers were made. At the same time men stationed at the tie-in point on the Public Service Company's lines dead-ended the 33,000-volt line from Blue Island, erected a buck-arm for a right-angle turn, disconnected the line paralleling the railroad tracks from the 12,000-volt line and connected it to the new 33,000-volt line. While this work was going on tests were made to see that the transformers were installed with proper phase relations and the entire line was tested for stability. Meanwhile the construction men were kept on the grounds so that the connections could be changed back to the 12,000-volt line in case any serious difficulties were encountered. At 4 a.m. the oil switches at Blue Island were closed and the line was energized. No difficulty was experienced in executing the plan, and the line has been working satisfactorily ever since.

The original branch line feeding the railroad having been



FIG. 3—BUCK-ARM CONSTRUCTION AT TIE-IN POINT

designed for 12,000 volts, a sufficient factor of safety was not left by using the old insulators. This line, which was about 15 miles long, was re-equipped with insulators suitable for 33,000 volts between the hours of 1.30 a.m. and 4.30 a.m. on the nights preceding the final change. During this time the line was de-energized and the men did not have to work under any hazard. In fact the entire work was carried on with careful guard for the lives of the men.

All of the connections and installations which were made during the night on which the line received its first energy at 33,000 volts are not permanent. The line construction is, however. What remains to be done is to rewind the old transformers which were formerly used in the West Gary substation so that they can be used on 33,000 volts. After this is done the transformers which are now being used in the substation will be replaced by those rewound, and the new ones will be installed in the substation at Wilkinson, for which they were originally purchased. An addition is being made on the generating station at Blue Island to re-

ceive the 3000-kw transformers when they are permanen installed. As soon as this extension is made two of the 3000-kw transformers which were purchased by the Pu Service Company will be set up and connected in open de Between 1:30 and 4:30 a. m., when the energy is not need the 33,000-volt line will be shifted over to them from t temporary transformers outside of the station. One of

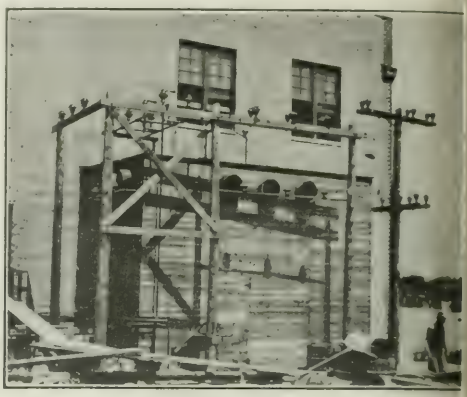


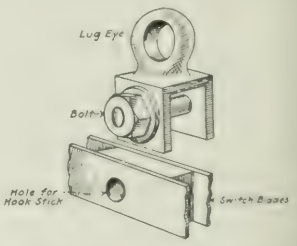
FIG. 4—TEMPORARY TRANSFORMER INSTALLATION AT BL ISLAND

temporary transformers will then be connected in the op delta and the system will be in its final form.

The method adopted by the Public Service Company installing the transformers and converting the system fr a 12,000-volt to a 33,000-volt system without any service terruptions is ingenious and worked out well in pract Mr. J. C. Gapen, engineer of electrical distribution, h charge of the construction, and Mr. Alfred Herz was ta ing engineer in charge of the final inspection which det mined whether the connections were correct.

## Extra Eye Lugs for Disconnect Switches

In a certain railway substation the converting equipm consists of three 500-kw, 600-volt rotaries supplied thro step-down transformers from a pair of 25,000-volt tra mission lines. These supply connections are in duplic so that if one line breaks down the load can be transfer to the other by means of a double set of disconnect switches. The switches have double blades, the holes




ADDITIONAL LUG AND SWITCH BLADES

the puller hook being drilled through two bla

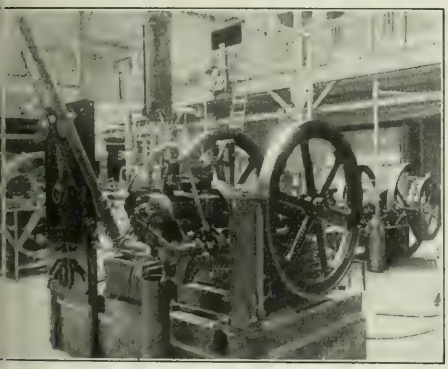
The operators, however, experienced difficulty in fin the holes quickly when necessary, so the extra eye illustrated were added. Without changing the sw blades in any way, this lug fits over the blades and is cured by the threaded bolt passing through the orig hook-hole in the blades.

## Test of a Kerosene-Oil Engine

By H. D. Wile

soline engines as prime movers for isolated electric s are no novelty; but an internal-combustion engine of ordinary type that can successfully burn any oil of a ty over 40 deg. Baumé, run smoothly, and give close gh regulation for electric lighting purposes, deserves nition. This engine, the Falk kerosene engine, li- d under the Secor-Higgins patents, was tested out in team and gas laboratory of the University of Wis- n.

e engine resembles closely the ordinary four-stroke- throttling-governor, stationary engine, with mechan- operated valves and make and break ignition. The shaft, driven by the crank through a worm gear, work- n oil, operates the fuel pump, the governor gear, both s and the igniter tripper. The gasoline for starting is ed into the mixer by a hand pump. A 7.5-kw com- d-wound generator is directly connected to the engine. e important part is the mixer, a rectangular box mount- top of the cylinder, as shown herewith. It is very e, has no moving parts, and is divided into two com- nents—one for fuel and one for water. The fuel and ater are drawn down through special needle valves and ed by the swift passage of air currents, caused by



KEROSENE-OIL ENGINE UNDER TEST

action of the piston. This mixture of oil and water, ng through the double-balanced throttle governor, en- ne cylinder through the inlet valve port. The governor ry sensitive, regulating the volume of successive charges ordance with the conditions of the load.

engine is easily started and it is necessary only to e it a very short time on gasoline before feeding it kerosene, as this system of combustion does not re- a hot cylinder to burn the fuel successfully.

r series of tests were made in the following order: acket water temperature; (2) time of ignition; (3) nt of water in cylinder, and (4) economy run. results of the first three tests were used in obtaining ttings for the economy runs. The data and results iven in the table. During the runs readings were at stated intervals of the gages on the kerosene and ixer water tanks, the speed, the temperatures of the and outlet jacket water, the amount of jacket water e electrical load, and an indicator card was taken.

results of the tests showed that the engine was en- satisfactory in its operation. It was easy to start, no more difficult than a gasoline engine of the same The most efficient jacket-water temperature was l 175 deg. Fahr., and the best angle of advance of in was 36—the average angle for gasoline engines is 16. This would naturally be expected, because kerosene burns more slowly than gasoline. Water is essential in the cylinder of a kerosene engine, as it performs four duties—prevents rapid explosions, excessive pressures and high temperatures, and also prevents the heavy deposit of carbon on the walls of the cylinder. The deposit of carbon after three months of intermittent operation was about the same as would be found in a similar gasoline engine.

TEST OF KEROSENE OIL ENGINE

| | | | | |
|---|---|---|---|---|
| Cooling water, lb. per hr. | 632 | 445 | 391 | 244 |
| Inlet temperature, deg. Fahr. | 47.5 | 44 | 71 | 47.5 |
| Outlet temperature, deg. Fahr | 106 | 123 | 157 | 182 |
| R.p.m. | 448 | 448 | 449 | 446 |
| Brake-hp. | 9.05 | 9.05 | 8.73 | 9.05 |
| Indicated hp. | 11.04 | 11.31 | 10.65 | 11.84 |
| Mechanical efficiency, per cent | 82 | 80 | 82 | 76 |
| Kerosene, lb. per bhp-hr. | 1.14 | 1.09 | 0.98 | 1.0 |
| Thermal efficiency | 11.2 | 11.7 | 13.1 | 12.8 |

| | | | |
|---|---|---|---|
| Angle ignition, deg. | 34 | 38 | 41 |
| R.p.m. | 446 | 450 | 442 |
| Brake-hp. | 8.73 | 9.05 | 8.73 |
| Indicated hp. | 11.7 | 10.65 | 12.0 |
| Mechanical efficiency | 77 | 82 | 75 |
| Kerosene, lb. per bhp-hr. | 0.97 | 0.98 | 0.95 |
| Thermal efficiency | 13.2 | 13.1 | 13.4 |

| | | | |
|---|---|---|---|
| Mixer water-kerosene, per cent | 34.4 | 62.8 | 85 |
| R.p.m. | 442 | 440 | 444 |
| Brake-hp. | 8.7 | 8.7 | 8.7 |
| Indicated hp. | 12.3 | 11.7 | 11.4 |
| Mechanical efficiency | 71 | 74 | 76.7 |
| Kerosene, lb. per bhp-hr. | 1.06 | 1.14 | 1.19 |
| Thermal efficiency | 12 | 11.1 | 10.5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Brake-hp. | 4.2 | 5.5 | 7 | 8.73 | 10.3 | 11.9 |
| Indicated hp. | 6.4 | 7.5 | 9.17 | 11.2 | 12.5 | 14.38 |
| R.p.m. | 457 | 457 | 450 | 448 | 437 | 436 |
| Mechanical efficiency | 66 | 74 | 76 | 77 | 82.5 | 82.8 |
| Cooling water, lb. per hr. | 236 | 290 | 306 | 262 | 309 | 304 |
| Kerosene, lb. per bhp-hr | 1.55 | 1.26 | 1.05 | 0.93 | 0.87 | 0.94 |
| Thermal efficiency | 7.3 | 10.1 | 12.1 | 13.8 | 14.7 | 13.6 |
| Maximum pressure, lb. per sq. in. | 68 | 94 | 124 | 170 | 206 | 242 |

Some of the interesting points brought out in this test were that the best ratio of kerosene to water in the mixer was as three to one, and that the addition of more water decreased the thermal efficiency; that the percentage of heat absorbed by the jacket water was approximately 16 per cent, and the heat lost in radiation and exhaust was approximately 55 per cent. This differs widely from gasoline-engine practice, where 40 per cent of the energy in the fuel is absorbed by the jacket and 30 per cent lost through the exhaust. The fuel economy was good, 0.872 lb. kerosene per brake-hp-hr being the lowest. The tests show that non-volatile or low-grade fuels can be burned successfully in small units.

Assuming kerosene at 10 cents a gallon, the fuel cost in operating this outfit according to the test would be 2.1 cents per kw-hr. By using a cheaper grade of oil and purchasing it in large quantities, this cost may be cut 40 per cent.

## Half-Speed Generator Operation

Can a 120-volt direct-current generator be operated at one-half speed to produce 60 volts? J. H.

When separately excited the voltage produced by a direct-current generator varies directly with the speed and at half-speed has one-half full-speed value. Since an emf of 60 volts is insufficient for exciting a 120-volt generator, this machine would not be self-exciting at one-half speed. However, by dividing the field coils into two equal parts and connecting these in parallel instead of series the current in each field coil will be the same as formerly and the operation should be satisfactory, provided the field circuit rheostat is arranged to withstand double current strength. The voltage being lowered to one-half, the total field current doubled, and the permissible armature current not increased, the permissible output is somewhat less than 50 per cent of the original value.

# Digest of Current Electrical Literatur

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*Relative Direction of Rotation of Phases in Alternating-Current Diagrams.*—Strecker quotes the rule adopted by the International Electrical Congress in 1911 in Turin as to the definition of sense of rotation of phases in alternating-current diagrams, and refers to the fact that considerable opposition to this definition has manifested itself among German engineers. The matter is, therefore, now subjected to a thorough discussion. H. Goerges summarizes the arguments which can be raised against the rule of the International Electrical Congress, while E. Breisig and K. W. Wagner summarize the arguments for the commission. The discussion is to be continued.—*Elek. Zeit.*, July 31, 1913.

*Commutation Theory.*—M. LATOUR.—Some notes on commutation in the really neutral zone. He refers to his theory pronounced in 1902 and explains how the mixing up of two different explanations of the same thing has led to curious misunderstandings. With Richter he is now in complete agreement. As to Menges' theory, the present author considers it to be an "exaggeration" of his own theory which he cannot accept.—*Elek. u. Masch.* (Vienna), July 27, 1913.

*Commutation of Repulsion Motors.*—M. LIWSCHITZ.—In order to reduce the detrimental effect of the emf of transformation in repulsion motors, the author connects the short-circuited windings in opposition to each with respect to the emf of transformation. By this means the formation of sparks at the commutator is diminished not only during normal operation but during starting.—*Elek. u. Masch.* (Vienna), Aug. 3, 1913.

### Lamps and Lighting

*Street-Lighting Specifications.*—A long editorial reviewing the recent report of the committee of the National Electric Light Association on street lighting and comparing its conclusions with those of the recent joint British committee of the Illuminating Engineering Society and others. The American specification would consist of a study by an engineer who would be responsible for the whole scheme. He would determine what illumination was necessary and what lamps should be used, how they should be spaced and at what height, etc. He would then draw up a specification and rely upon candle-power measurements to see that his specification had been carried out. The specification submitted by the British committee, although it would not preclude the specifying of details, would render necessary only the specifying of minimum illumination in all the more important contracts. The present writer thinks that whether we can depend upon the measurement of illumination for a specification of this kind is largely a question of accuracy. Engineers are accustomed to the measurement of candle-power; they are not so used to the measurement of illumination. There is a doubt in the minds of many whether illumination measurements can be made with sufficient accuracy for the purpose.—London *Electrician*, Aug. 1, 1913.

*Church Lighting.*—An illustrated article on the electric lighting of Westminster Abbey in London. The electroliers in the main body of the building are six-lamp and four-lamp fittings, provided with 50-watt, 220-volt metal-filament lamps. These lamps being supplied with energy at 200 volts, about 10 per cent below their rated voltage, will have substantially increased life; at the same time they give a more subdued tint to the light, thereby providing the restful effect necessary in church illumination. The main part of the building, the nave, is illuminated by two rows of eight six-lamp electroliers suspended from the roof by opposite cables of steel wire surrounded by the necessary electric leads. These are spaced 18.5 ft. apart and 13.5 ft. above floor level.—London *Electrician*, Aug. 1, 1913.

*Incandescent Lamps.*—M. VON PIRANI.—The author sketches the development of the modern incandescent lamp from the carbon lamp, osmium lamp, Nernst lamp, tantalum lamp to the tungsten lamp with squirted filament and wire-drawn filament. Fig. 1 shows four different scales giving for a normal 1.1-watt-per-hefner-candle-power lamp

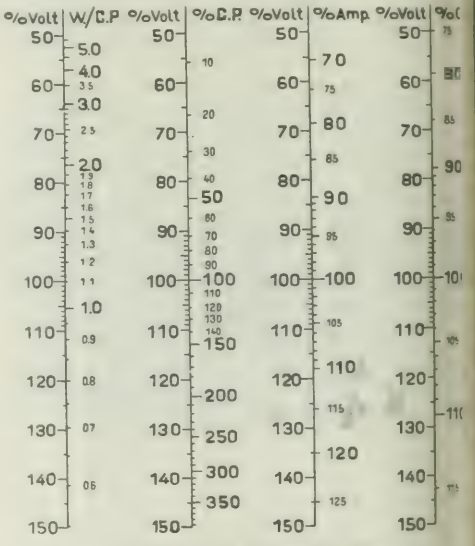



FIG. 1—SCALES OF LAMP VALUES

watts per candle-power as a function of the voltage, amperes as a function of the voltage, and the ohms as a function of the voltage, respectively. The values marked 100 per cent for the conditions under which lamp consumes 1.1 watt per hefner candle. For instance, increasing the voltage by 10 per cent above normal raises the candle-power by 39 per cent and raises the amperes 5.6 per cent, so that the watt per candle-power is reduced to 0.92.—*Mitteilungen a. d. Ges. Siemens & Halske, Siemens-Schuckertwerke*, Vol. I, No. 1, July, 1913.

*Alternating-Current Metallic-Filament Lamps.*—A. ...SEN.—An illustrated English translation in abstract of a German paper recently noticed in the *Digest* on a new experimental method for determining the fluctuation of light from a metallic-filament lamp during half a cycle.—London *Electrician*, Aug. 1, 1913.

### Traction

*Freight Locomotive.*—R. RICHTER.—An illustrated description of the regulation of the electric freight locomotive built by the Schwartzkoff company for the Prus...

State Railways. The speed of the motor is controlled by means of an induction regulator in connection with a step transformer. The induction regulator is operated by compressed air. The motor has two separate armature windings which are connected in series through the commutators. The commutators are arranged at both sides of the armature so that the design is perfectly symmetrical, and an excellent cooling action is obtained. The main advantage of the two armature windings is, however, the reduction of the armature current to one-half of the value in a motor with the same emf at rest between adjoining commutator segments and with only one commutator. This result is important since it permits the use of comparatively cheap and safe switching arrangements.—*Elek. Zeit.*, July 31, 1913.

### Installations, Systems and Appliances

*Ventilation of Buildings.*—J. W. MEARES.—A paper in abstract presented before the Calcutta section of the (British) Institution of Electrical Engineers. The author emphasizes the advantages of hollow-wall construction of buildings in tropical countries, with the modification that, in place of an ordinary still-air jacket, artificially cooled air is circulated between the inner and outer walls by means of an exhaust fan, the cooling being effected by drawing the current of air through a wetted screen or other contrivance such as is described in this paper.—London *Electrician*, Aug. 1, 1913.

*Electricity Supply in Jersey.*—A note stating that the gas company of the city of St. Heliers, on the island of Jersey, in England, intends to erect an electric station. Energy is to be sold at 10 cents per kw-hr. for residential lighting, 9 cents for business lighting, 3 cents for motor service and heat, with special rates for large consumers. A three-wire system is to be used, with 240 volts for lighting and 480 volts for motor service. For the present there will be installed two sets of 200-kw rating, and there will be a large battery of accumulators, which is to be capable of dealing with the entire supply for a prolonged period.—London *Electrician*, July 25, 1913.

*Burton-upon-Trent.*—An illustrated article on recent electricity extensions at Burton-upon-Trent. It includes the provision of turbo-generating plant and the installation of a motor-generator link with the existing single-phase supply and a rotary-converter to link up the direct-current railway supply with the new three-phase generating plant.—London *Elec. Review*, July 25, 1913.

### Wires, Wiring and Conduits

*Alternating-Current Conductors for Heavy Currents.*—MICHALKE.—The author discusses the difficulties in the design of conductors and switches for carrying very heavy alternating currents. The enlargement of the conductor cross-section is impaired by the skin effect. When subdividing a thick conductor into a number of conductors in parallel, there is trouble due to non-uniformity of distribution of the current over the different conductors and therefore non-uniformity of temperature. The author describes suitable arrangements by which these troubles can be overcome. For instance, the formation of non-symmetrical magnetic fields with their resulting troublesome induction effects is avoided by mixing up the conductors carrying the three currents (*a*, *b*, *c* respectively) of a three-phase system, according to the following scheme:

$$\begin{array}{cccccc} a & b & c & a & b & c \\ b & c & a & b & c & a \\ c & a & b & c & a & b \\ b & c & a & b & c & a \\ a & b & c & a & b & c \end{array}$$

This arrangement also reduces the inductive voltage drop. The author finally describes the construction of a 4000-amp overload circuit-breaker for three-phase currents.—*Mitteilungen Siemens & Halske*, Vol. I, No. 1, July, 1913.

*Dielectric Measurements of Cables.*—M. KLEIN.—The first part of a paper in which the author gives the result of systematic tests of the perforation voltage of cables. A distinction should be made between perforation strength in general and the degree of safety of the cable. The former depends on the mean value of the results, while the degree of safety is the ratio of the minimum observed perforation voltage to the voltage of operation. A single-conductor head cable was used for the tests, and in order to determine the influence of conductor cross-section and insulation thickness cables were built for three conductor cross-sections ($q$ = 16, 50 and 240 sq. mm) and for two thicknesses of insulation (3 mm and 6 mm). Otherwise the different cables were made as uniform as possible; the same quality of paper was used for all of them, they were dried in the same oven, and were impregnated with the same kind of material. The cables were divided into equal sections and these were tested. In all of the tests the voltage was increased from an initial low value at equal intervals by equal amounts. The results of the tests are given in the following table:

| PERFORATION EMF IN KILOVOLT | INSULATION THICKNESS | | | | | |
|---|---|---|---|---|---|---|
| | 3 MM | | | 6 MM | | |
| $q$ = cu. in. cross section in sq. mm | 16 | 50 | 240 | 16 | 50 | 240 |
| 20 to 30 | 1 | 2 | 3 | . | . | . |
| 30 to 40 | 22 | 35 | 41 | 2 | 2 | . |
| 40 to 50 | 47 | 28 | 21 | 3 | 11 | 3 |
| 50 to 60 | . | . | 5 | 33 | 11 | 3 |
| 60 to 70 | . | . | . | 26 | 33 | 26 |
| 70 to 80 | . | . | . | 1 | 18 | 27 |
| 80 to 90 | . | . | . | . | 3 | 19 |
| 90 to 100 | . | . | . | . | . | 3 |

As was to be expected, the perforation voltage varied between rather wide limits, although the mean values follow certain rules. The paper used for insulation was specially tested and was found to be practically perfect. The results of the tests showed the approximate correctness of the O'Gorman law with the exception that the specific perforation strength increases somewhat with decreasing copper cross-section. Tests made with heated cables show that the perforation strength certainly does not decrease with increased temperature. For the cables tested the no-load power-factor tends to approach a limiting value with increased voltage and reaches this limiting value the more quickly the greater the copper cross-section and the insulation thickness of the cable. In connection with the loss determinations a zero method is described which may be used as a basis for the design of sufficiently sensitive needle instruments for measuring the dielectric losses of cables —*Elek. Zeit.*, July 24 and 31, 1913.

### Electrophysics and Magnetism

*Volta Effect.*—A. E. HENNINGS.—An account of an experimental investigation of the nature of the Volta effect. The Volta effect depends, under all circumstances, on the nature of the opposing surfaces of conductors which have been brought near, or in contact with, each other. Indeed it depends only on the surfaces exposed to and within range of each other. All, and only, such surfaces or portions of surfaces of conductors contribute to the general effect. The results of experiments purporting to prove otherwise are spurious. Hence Sanford's recent chief argument against an electrolytic theory of the Volta effect fails because of a misapprehension in the premises. The surfaces of con-

ductors which have been discharged to earth act just as though they were definitely and characteristically charged. In the case of a homogeneous surface, this postulated electrification is uniformly distributed, while for a surface of dissimilar parts its nature and intensity vary from part to part. The surfaces being the seat of such electrical manifestations exhibit, as a consequence, a definite potential difference, the so-called emf of contact, between each other. It is only in terms of these potential differences that the phenomenon lends itself to quantititave treatment. The effect observed with composite surfaces has been shown to be the average effect of the constituent parts, each of which contributes in exact proportion to its extent, its relative proximiy and its own potential difference with reference to the opposing surface. The effect is practically completely "screened" when the lateral dimensions of the openings in the screen are not greater than their depth. An increase in the ratio from unity upward between the width and depth of the holes results in an increasing effect through the openings. Taken as a whole, the results show that the phenomenon has its seat in the surface. The fundamental question, then, reduces to one in regard to the actual conditions on the surface of a conductor. Is there an insulated electric layer brought into existence by chemical or other means, or are the manifestations due to intrinsic properties of the conductor which make themselves felt at its boundaries? This question is still an open one so far as the present investigation goes.—*Phys. Review*, July, 1913.

*Condenser Discharges.*—J. A. Fleming.—An abstract of a (British) Physical Society paper in which the author discusses the discharge of a condenser through an inductive circuit and gives oscillograms which confirm the theory qualitatively and quantitatively. He then passes over to the discussion of coupled oscillatory circuits and gives diagrams which show the effect of gradually increasing the coupling of two inductively coupled circuits and thus creating in the oscillation trains beats indicating the presence of two frequencies.—London *Electrician*, July 25, 1913.

*Transmission of Canal Rays.*—A. N. Goldsmith.—An account of an experimental investigation of the transmission of canal rays through thin partitions. Canal rays made up of ions of hydrogen or helium can have sufficient velocity given them to cause them to pass through a thin material partition. When the discharge tube is filled with air, carbon dioxide or argon the only rays that pass through a thin partition are hydrogen. When helium is used both helium and hydrogen atoms pass through the partition, the helium in great abundance. When hydrogen is used only hydrogen atoms pass through the partition, and these in large quantities. The atoms which pass through such a partition are not capable of causing fluorescence on screens.—*Phys. Review*, July, 1913.

### Electrochemistry and Batteries

*Hypochlorite Disinfectant.*—A note on last year's report of the medical officer of health of the borough of Poplar on the use of hypochlorite for disinfecting purposes. The fluid, prepared by the electrolysis of a saturated solution of chloride of magnesium, with a proportionate amount of salt and caustic soda, is manufactured by the borough plant at a total cost of $10 per 1000 gal., including the cost of electricity at 3 cents per kw-hr., the chemical materials and the water. The use of the disinfectant for the year amounted to 54,388 gal., rising from a minimum of 1400 gal. for January to a maximum of 8610 gal. for the month of July, in which month and other summer months the fluid is in use for the public baths. Since the plant has been installed, nearly 250,000 gal. has been manufactured, at a total cost of $2,400, the cost of electricity being 57 per cent of this amount. The Public Health Department is credited with 2 cents per gallon for the fluid supplied to the work department. Four elementary schools were supplied with 960 gal. for spraying and floor-cleansing purposes. For public bath purposes a 39,000-gal. bath receives an initial dose of 10 gal. of fluid, and subsequent additions at two-day or three-day intervals, according to the condition of the water, the water being changed at periods of from seven to ten days. The fluid is used in connection with baths, not with a view to the economy of water by less frequent refillings, but to provide a clean and invigorating bath for bathers. The water, it is found, becomes purified both chemically and bacteriologically by the oxidizing and germicidal properties of the fluid.—London *Electrician*, July 25, 1913.

### Units, Measurements and Instruments

*Alternating-Current Potentiometer for Measuring Telephone Currents.*—C. V. Drysdale.—An illustrated article in which, after giving a description of the alternating-current potentiometer, the author describes its application to telegraph and telephone measurements, such as attenuation constants and polar diagrams showing the distribution of potential difference and current in telephone cables. Applications are also suggested in radio-telegraphy. The principle of the alternating-current potentiometer is shown in Fig. 2. It is that of balancing any sinusoidal alternating potential difference to be tested by a potential difference of equal magnitude and phase derived from the potentiometer. This is attained by feeding an ordinary potentiometer (wound with coils of the smallest possible inductance and capacity) with current derived from the secondary of a

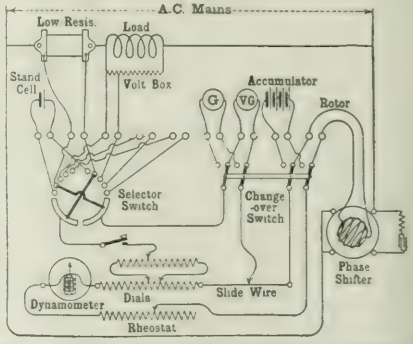



Fig. 2—Potentiometer for Telephone Currents

phase-shifting transformer, which turns in a rotating field generated from the supply mains by "splitting the phase." The movement of the ordinary potentiometer slides alters the magnitude of the potential difference between them in the usual way, while the turning of the secondary of the phase-shifting transformer through any given angle alters the phase of the potential difference by precisely the same angle. In order to obtain the magnitude and phase of any alternating potential difference it is, therefore, necessary merely to balance it in the same manner as in the case of a direct potential difference, except that a vibration galvanometer, telephone or other alternating-current detector is substituted for the ordinary galvanometer, and that balance is secured by the two processes of turning the phase-shifter secondary as well as altering the potentiometer slides. As soon as balance is obtained the potential difference to be measured is read off both in magnitude and in phase, or as a vector, by the indications of the potentiometer and phase-shifter dials.—London *Electrician*, Aug. 1, 1913.

### Telegraphy, Telephony and Signals

*Semi-Automatic Telephone Exchange.*—An illustrated description of the new semi-automatic telephone exchange of the city of Posen, Germany. This replaces the old hand-operated exchange, the capacity of which had reached its limit. The new exchange was opened last July with 3200

ctions, and 800 more connections have recently been . The final connections will number 10,000—*Mit-gen Siemens & Halske*, Vol. I, No. 1, July, 1913.

*h-Frequency Oscillations from Direct-Current.*—IAM I. BOOK.—A description of a new method for pro- g electric oscillations of high frequency from a direct- nt source. The converter consists of a powerful elec-

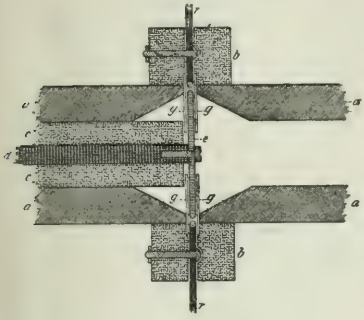


FIG. 3—CONVERTER

agnet with heavy tubular pole pieces, *a* (Fig. 3). The of these pole pieces are reamed out, or tapered, at the Fitted on the end of each of these pole pieces is a ring, *b*. To this fiber insulation is attached a copper ode) ring, *r*. One of the tubular pole-pieces is filled a plug of fiber, *c*. A brass rod, *d*, neatly fits into a tudinal hole through the center of this fiber plug. rod is thus insulated from the pole pieces. There is ned to the end of this rod by means of a machine a zinc or carbon (anode) disk, *e*. The faces of the rings, mentioned above, project slightly beyond the of the pole pieces, making sockets into which are fitted of mica, *g*, over the ends of the pole pieces. These disks with the fiber rings insulate both the anode disk he cathode ring from the pole pieces. If an emf of olts is impressed across the gap between the anode disk he cathode ring, which has a regularly roughened or d surface, a spark discharge will take place and by tion of the magnetic field this discharge is made to v around and ground the circular gap. In Fig. 4 there wn a general diagram of the connections of the appa- u. The source of difference of potentials used, *e*, was ¼-hp, 500-volt direct-current generators jointed in l. $R_0$ is a resistor of variable resistance consisting a ank of carbon-filament lamps in series with a slide- r contact resistor capable of carrying the main current about 0.1 amp to about 1 amp. $I_0$ is a direct-current lli meter with which to measure the current in the main cu. $L_0$ is a choke coil. *G* is the gap between the anode k nd the cathode ring. $C_1$ is a condenser of variable

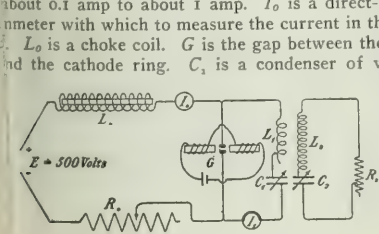



FIG. 4—DIAGRAM OF CONNECTIONS

pacy in oil. $C_2$ is a similar condenser in the secondary cilling circuit. $L_1$ is the primary of a closely wound in- uctic coil. $L_2$ is the secondary of this coil. $I_1$ is a hot- ire mmeter with which to measure the current in the rima oscillating circuit. $R_2$ is a resistor of variable re- stan consisting of a bank of carbon-filament lamps. Be-

the sparking distance alternates rapidly from a given minimum to a given maximum as the discharge passes around the gap, and, therefore, the resistance of the gap likewise varies with this varying length. The choke coil maintains a constant supply of energy, but on account of the notched surface of the cathode ring the length of the spark-gap and its resistance vary periodically so that there is rapidly alternating flow and ebb of energy into the primary circuit. The author discusses the effect which the different conditions have on the production of oscillations and notes the application of this converter in wireless telegraphy and telephony.—*Phys. Review*, July, 1913.

# Book Review

A HANDBOOK OF WIRELESS TELEGRAPHY. Its Theory and Practice. By James Erskine-Murray, D. Sc. Fourth edition, revised and enlarged. New York: D. Appleton & Company. 442 pages, 195 illus., 11 tables. Price, $3.

The fourth edition of Dr. Erskine-Murray's "Handbook" will be welcomed, since in it the author connects recent experimental data with several of the old problems of radio transmission and, in his characteristically clear manner, discusses the newer developments of sparks and sustained wave transmitters. The material of the 1911 edition has been revised and largely supplemented, the new data concerning high-power Marconi stations being of especial interest. Although there are given many design details of the instruments used in the early years of wireless signaling, the book cannot be considered a completely descriptive treatise, since the most significant and useful portions are the lengthy quotations from reports of numerous researches by various experimenters and Dr. Erskine-Murray's interpreting comments and discussions thereon. The consideration given to the electrical design of antenna systems is especially worth noting, since the permissible deductions from many years' labor are crystallized and cleanly set forth. Likewise the discussions of "hump-wound" oscillation transformers and the relative importance of static and magnetic transfer of energy in their several forms are of much interest. It is not likely that all the conclusions in respect to the theory of transmission (which is the subject of a long chapter containing much new material) will be generally accepted by radio engineers, especially since consideration of what appear to be reflection-interference effects is very brief. The new chapter on the telegraphic efficiency of a pair of radio stations, in which there are differentiated the efficiencies of energy transmission, of signal transmission and of operation, contains a number of very practical suggestions which should help to put into more general use intelligent methods of traffic engineering. In the future editions of this handbook a little more care might be given in the scrutiny of statements concerning the practical achievements of various types of radio apparatus. From page 126 one would gain the impression that electrolytic anti-coherers of the "bridge-breaking" type are in common use at present, though actually the few that were installed in commercial radio plants have been replaced by instruments of the rectifier type. On page 208 the statement that 35 kw of power has proved sufficient for regular working between Honolulu and San Francisco by the arc method leads one to believe that commercial communication is maintained by daylight, but evidence adduced during the Marconi investigation in England throws this into grave doubt. These matters, however, are really trifling when contrasted with the high standard set by the book as a whole, and the author is to be congratulated on his further modernizing of a volume

# New Apparatus and Appliances

## An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

### Temporary Lamp Receptacle

The receptacle herewith illustrated has been designed primarily for temporary work. It can easily be connected in circuit, because it is unnecessary to strip the insulation from the wire. The wire is placed opposite the screw,



TEMPORARY LAMP RECEPTACLE

which is then tightened so that the point at the end will puncture the insulation and make contact. This receptacle is made of mica compound and will withstand rough handling. It has been placed on the market by Pass & Seymour, Inc., Solvay, N. Y.

### Tests of Wooden Poles Reinforced at Ground Line

Some interesting tests were conducted in Pittsburgh on July 30 and 31 by the Pittsburgh Reinforcing Pole Company to determine the break-down limits of poles which had been equipped with its Orr reinforcing collar. In this system of prolonging the useful life of a wooden pole, a collar and sleeve of concrete reinforced with rods and expanded metal are applied at the ground line—the part which is most subject to decay. The poles under test comprised five 40-ft. and ten 30-ft. chestnut and ten 30-ft. cedar poles which a certain large company had reinforced several months before in accordance with the manufacturer's specifications.

When tested, the cedar poles broke off above the reinforcing collar at an average pull of 2000 lb., and the chest-

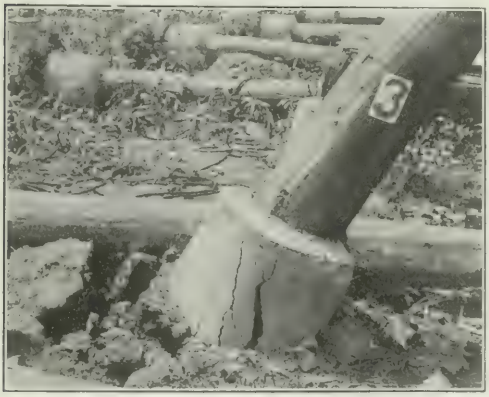


FIG. 1—CRACKING OF REINFORCEMENT UNDER EXCESSIVE LOADING



FIG. 2—REINFORCEMENT SURVIVING THE BREAKAGE OF P TO WHICH IT WAS APPLIED

nuts at an average pull of 3000 lb. The load was applied 30 ft. above ground on the 40-ft. poles and 19 ft. above ground on the 30-ft. poles. The ultimate strength of the reinforcement was satisfactory, but in nearly every case cracks developed in the concrete collars at 1500 lb. The customer expressed the opinion, however, that a steel and concrete reinforcement should be able to withstand a pull of 2000 lb. under similar conditions without developing cracks in the concrete. The poles for the second test were therefore reinforced to meet this requirement by substituting a heavier expanded metal and by adding 1 in. to the thickness of the concrete in the collars and sleeves.

Under test, five of the strengthened 40-ft. poles withstood an average pull equivalent to 2335 lb. applied 30 ft. from the ground before developing any cracks in the collar and withstood a pull of 3040 lb. before failure. In three cases the upper part of the poles split or broke. Six 30-ft. poles withstood an average load equivalent to 2444 lb. with a 19-ft. lever arm before developing cracks in the collar and 2961 lb. before failure.

The average load on the base of the 40-ft. poles was 91,000 lb.-ft. at the time of failure. Eight rods were used in these, and four rods in the 30-ft. pole, which withstood 57,000 lb.-ft. As both sizes had the same weight of expanded metal and approximately the same thickness of concrete in the sleeve and collar, the better results on the 40-ft. reinforcements were undoubtedly due to the extra rod. Two poles similarly reinforced were saved to be broken later.

Eight other reinforced poles were broken on which reinforcing rods lighter and shorter than the standard rod were used, so that a thorough experimental test of the reinforcement was obtained.

#### Details of Material and Conditions of Test

The poles were new class B chestnuts, artificially weakened by reducing a section extending 15 in. below the ground to 29 in. in circumference on the 40-ft. and fr

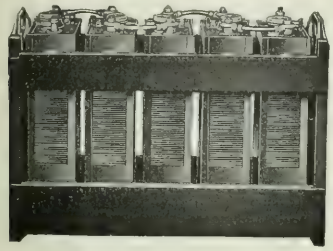
in. to 25.5 in. on the 30-ft. poles. The original circumference 6 ft. from the butt was between 43 in. and 47 in. the 40-ft. poles and from 33 in. to 38 in. on the 30-ft. es.

The poles were concreted on June 6, 7 and 9 and were ted on July 30 and 31, having set about fifty-four days. e poles were set in refilled ground and not only yielded her easily in places during the test, but in one or two tances, probably because of dampness, the concrete did seem to have set well.

The test was made by making a direct horizontal pull ft. above ground on the 40-ft. poles and 23 ft. above ound on the 30-ft. poles, the deflection for every 100-lb. l being registered.

## Nickel-Iron Cell for Light Vehicles

The battery illustrated herewith has been developed for with electric pleasure cars, 1000-lb. delivery wagons, ustrial and baggage trucks and similar vehicles. It is of nickel-iron alkaline type and is rated at 187.5 amp-hr. is claimed that the battery is not injured by occasional h rates of discharge, and that the driver may draw any



FIVE EDISON CELLS IN TRAY

unt of current from the battery in emergencies without injury. The battery may be left "on charge" indefily, and may even be charged in the reverse direction out harm. The container, grids, poles, etc., are made teel, and it is said to be practically impossible to damany part of the cell by falls, jars or collisions. This ery has been placed on the market by the Edison Stor- Battery Company, Orange, N. J.

## "Golden Glow" Automobile Head-Lamp

rhaps no theory which has been advanced up to the ent time in the illuminating engineering field is of as h practical significance as the one advanced by the rline Company, of Indianapolis, Ind., and which is apin the so-called "Golden Glow" head-lamp recently loped by that company. According to statistics, a derable portion of the automobile, electric-railway and n-railroad accidents can be traced directly to the blindglare of dazzling head-lamps. In fact, such accidents become so prevalent in Chicago that the City Council been forced recently to amend an ordinance passed on 23, 1913, so that it is unlawful to use a head-lamp ng a condensing lens or a parabolic reflector without g down the glare by some means. This ordinance does rohibit the use of intensifying reflectors, but it does ate their use in the city streets. Similar ordinances are ect in New York, Philadelphia and London, and the it of a new type of reflector which does not cut down e enetrative effect of the rays, and still eliminates the or dazzle, is of utmost importance at this time.

the cities where these ordinances are in effect users silvered-glass intensifying reflectors and condensing lenses have been compelled to put a screen over the front of the reflector, thereby reducing the efficiency of the outfit. Several methods of meeting this ordinance have been devised, such as rubbing soap on the glass, closing the front of the reflector, using a translucent glass, or dropping a thin silk screen over the front of the reflector.

The non-dazzling quality of the "Golden Glow" reflector is accounted for by the greenish-yellow glass of which the reflector is composed. This glass absorbs the light waves having a higher frequency than the green. By eliminating these rays, it is asserted that the penetrative power of the yellow rays is surprisingly increased in fogs. It is claimed that the light from the head-lamp, although possessing great illuminating and penetrating power under all atmospheric conditions, is free from glare. The reflectors are parabolic in shape and are provided with an opening at the back in which the base of the incandescent lamp can be inserted and screwed into its receptacle. Eliminating glare by cutting out the higher frequency rays seems more logical than accomplishing the same result with screens which produce internal reflection.

## Electric Washing Machine with Novel Reversing Device and Safety Attachment

An electric washing machine is about to be placed on the market by the Conlon Electric Washer Company, of Chicago, which embodies many new features in the way of gear drive, reversing device and safety attachments. The reversing device is especially interesting because of its applicability to other machinery. These machines are made in three sizes suitable for washing six, nine and twelve sheets and are equipped with electric motors rated at 1/6 hp, 1/3 hp and 1/4 hp respectively. All of the washers are equipped with electrically driven wringing attachments, one being shown in Fig. 1.

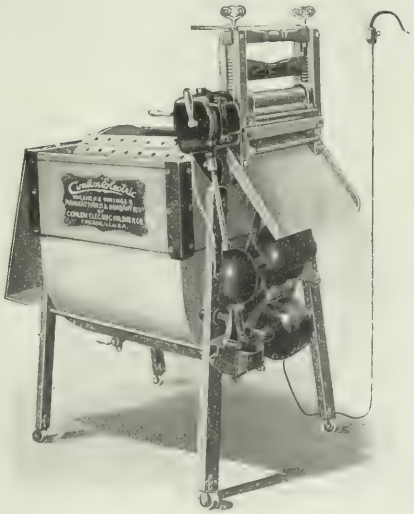


FIG. 1—ELECTRIC WASHING MACHINE

The tub containing the horizontally supported cylinder is mounted on malleable-iron legs, those on one end of the tub forming a framework on which the electric motor and gear drive are mounted. The motor is supported with its shaft horizontal and drives a worm which meshes with a bronze worm-gear attached to a vertical shaft. The worm and its meshing gear are inclosed in a cast-iron housing

which is filled with grease. The vertical shaft extends up through a sleeve supporting a bevel gear and terminates in a control box located on a level with the top of the washing machine within convenient reach of the operator's hand. Communicating with the interior of the control box are two levers, one of which operates the clutch driving the wash-

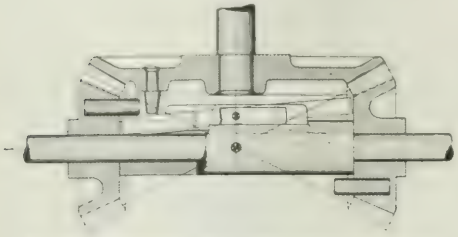


FIG. 2—CROSS-SECTION OF REVERSING MECHANISM

ing machine cylinder and the other operates a clutch driving the wringer, which is of the two-roll reversible type.

The bevel gear which is supported on the sleeve on the vertical shaft runs free except when the washing machine clutch is closed, at which time it revolves integrally with it, driving a horizontal shaft on which are mounted two small bevel gears which mesh with a larger bevel gear opposite

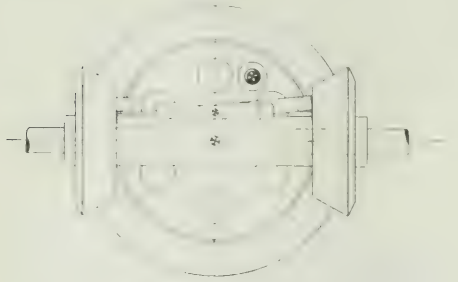


FIG. 3—AUTOMATIC REVERSING MECHANISM

to its diameter, as shown in Fig. 2, and both of the two small gears run free on the horizontal shaft and are at all times in mesh with the larger bevel gear driving the washing-machine cylinder.

Secured permanently to the horizontal shaft between the two smaller bevel gears is a collar. Pivoted to it midway between the small gears is a square rod of hardened steel,

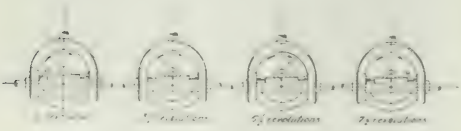


FIG. 4—REVERSING PIN SET FOR VARIOUS REVOLUTIONS OF CYLINDER

which revolves with the collar and tilts in the plane of the shaft (similar to the "walking beam" on a Mississippi River steamboat). Protruding from the face of the disk bearing the large bevel gear is a steel pin which tilts the "walking beam," after a certain number of revolutions of the gear, causing either end of it to engage alternately with one of the small bevel gears. By locking the small pinions alternately with the shaft, the reversing operation of the cylinder is accomplished without the use of a complex arrangement of gears and clutches.

With any given gear ratio in the reversing device, the pin which tilts the rocker arm can be arranged to allow a different number of rotations of the cylinder before it is reversed. Several different views of the reversing device are shown in Fig. 4 with the pin placed in different positions to allow different numbers of rotations before reversal occurs. The entire gear train between the motor and the cylinder is arranged to give a speed reduction of forty to one. To avoid injuring the motor and prevent tearing anything up which might accidentally become caught between the cylinder and the tub of the washing machine, a slip clutch is interposed between the motor and the shaft driving the cylinder.

No innovations are embodied in the driving mechanism between the vertical shaft and the wringer, except that a minimum number of parts are used, but a safety device is attached to the frame of the wringer whereby the rolls may be instantly separated in case the operator's fingers are drawn in between them or should clothing become twisted around the rolls.

Every gear and revolving part is inclosed in an individual housing having a lid which may be raised for inspection, thus obviating any possibility of the operator's hands or clothing being caught in these parts of the apparatus. The motors operating the machines run at 1750 r.p.m. and may be of either the alternating-current or the direct-current type as may be desired by the purchaser.

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## Cooling Coils for Large High-Tension Transformers

Generators and transformers with a rating of from 14,000 kw to 20,000 kw and operating at a transmission pressure of from 100,000 volts to 150,000 volts cannot be successfully developed in the same way as that in which the 1000-kw units were formerly produced, or with the same machines. It is evident that any emf over 100,000 volts calls for the most dependable construction possible in a transformer.

In a recent California installation the generators feed energy directly through cables and oil switches to four 14,000-



COILING COILS FOR HIGH-TENSION TRANSFORMERS

kw transformers, the cooling pipe coils for which are shown herewith. These coils, which were built by the National Pipe Bending Company, of New Haven, Conn., for the General Electric Company, are 7 ft. 4 in. wide and 22 ft. long and required 15,200 linear ft., or nearly 3 miles, of 1¼-in. brass tubing

## Electric Fireless Cooker

An electric fireless cooker has been brought out by the otpoint Electric Heating Company, of Ontario, Cal., re-ntly, which requires so little current that it can be oper-d from any electric lamp receptacle. While the cooker erates on the heat-storage system, the lining of the oven not made of any substance which will absorb a large ount of heat. The insulation is so arranged that valu-e time is not consumed in attaining the temperature cessary for cooking.

The "El Cooko," as it is called, measures 17.5 in. wide, in. deep, 22.75 in. high, outside measurements; 9.5 in. le, 10 in. deep and 12 in. high, inside measurements. The side casing of the cooker is of blued steel with nickeled ners, legs and handles. The lining consists of one piece

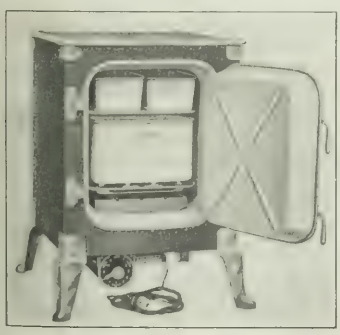
COST OF ELECTRIC AND GAS COOKING

| | |
|---|---|
| t of 5 lb. beef roasted in El Cooko: | |
| irst cost of cut, at 20 cents per lb. | $1.00 |
| hrinkage in weight, ounces | 9 |
| ost of energy, at 10 cents per kw.-hr., cents | 9 |
| t of 5 lb. beef roasted in a gas oven: | |
| irst cost of cut, at 30 cents per lb. | $1.50 |
| hrinkage in weight, ounces | 22 |
| ost of gas at $1 per 1000 cu. ft., cents | 8 |

drawn aluminum without seams or crevices. Between lining and the casing is a space which is filled with it-insulating material. On the front of the stove is a r which swings outward having two clamp levers which t it tightly so that there is very little chance for heat to ape. The door is also aluminum-lined and filled with same heat-insulating material.

he heater of the cooker consists of four units, made of ssed steel, each containing separate heating elements. four heating elements are clamped in a pressed-steel ne which is installed in a compartment directly below the king pan. With the added radiating surface, which is ined by dividing the heater into four units, it is asserted the time required to bring the oven to a working heat nsiderably reduced below what would be required with ordinary disk-type heater. In addition, no energy is ired to raise the temperature of intervening air spaces torage plates.

hree aluminum cooking utensils are furnished with the it. One is a 7-quart seamless aluminum dish with cover, h can be used for roasts, stews, etc.: the other two are



ELECTRIC FIRELESS COOKER

t pressed aluminum dishes used for cooking vegetables nd baking bread, etc. These three dishes can be used at e ame time.

C the bottom of the outside of the cooker is a dial which e tes a thermostatic temperature control. By means of is dial the maximum temperature at which the oven operates can be regulated, and the energy is automatically shut off as soon as this temperature is attained. This automatic control insures the heating element against any damage from overheating. If desired, the heating element can be used for frying purposes by leaving the oven door open. The oven consumes 600 watts, or about as much power as an ordinary electric flatiron.

According to a recent test which was made by the manufacturer of this fireless cooker, it required 1 cent more to cook a 5-lb. roast of beef in the cooker than it would in a gas oven, but the elimination of shrinkage occasioned by the use of the electric cooker more than offset the extra cost of energy. The results of this test are shown in the accompanying table.

## Electric Coal Truck

In the accompanying illustrations are shown a 3.5-ton electric coal truck built by the Couple-Gear Freight Wheel Company, Grand Rapids, Mich., for the Blackstone Valley Gas & Electric Company, Pawtucket, R. I. On account of peculiar basement conditions, the truck has been built

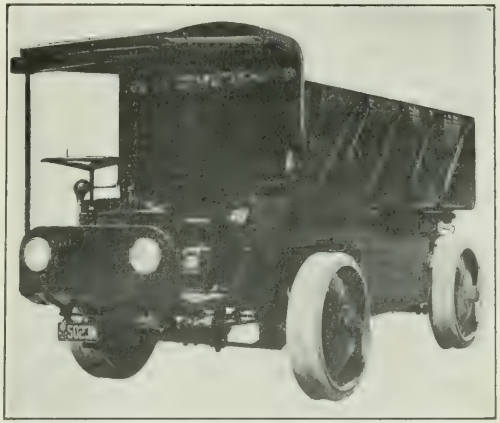


FIG. 1—ELECTRIC COAL TRUCK

with a low height and arranged for making sharp turns It can be turned completely around in a street 24 ft. in width without manipulating the steering gear when once

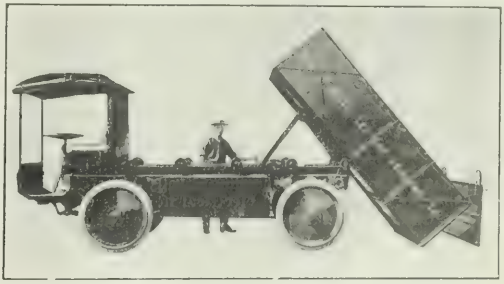


FIG. 2—TRUCK IN DUMPING POSITION

set at the proper angle. All four wheels are used for driving and steering. The equipment is arranged for a speed of from 5 to 10 miles per hour.

This truck is equipped with nickel-iron alkaline cells manufactured by the Edison Storage Battery Company, of Orange, N. J.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Electric Drive Equipment for a Pennsylvania Factory.**—Electric drive is to be installed in the factory of the Summerill Tubing Company, at Bridgeport, Pa., also crane equipment, in connection with some changes now in progress, aiming at an increase in capacity of the plant.

**New Factory for the Diehl Manufacturing Company.**—On Aug. 11 ground was broken for the new factory building of the Diehl Manufacturing Company, at Elizabeth, N. J. The building is to be three stories in height, on a ground area of 60 ft. by 300 ft. The Turner Construction Company, of 11 Broadway, New York, is doing the construction work, which is expected to be completed on Dec. 1.

**Supply Trade Conditions in Richmond.**—Robinson, Nelson & Company, of Richmond, Va., state that business with them continues very good, considering the fact that money is tight. Their collections have improved considerably in the last week or ten days, however, and the outlook is much brighter, they think, than it has been for the past sixty days. They hope that by the middle of September business will have reached its normal condition.

**Lamp Colors Survive Severe Test.**—Information comes from C. E. Franche & Company, of 440 Orleans Street, Chicago, to the effect that their Cefco weather-proof lamp coloring has just completed a year's test out-doors, on roof signs, and that the coloring is still intact, has not faded to any noticeable extent, and has not chipped, peeled or cracked. They claim that this system produces lasting and brilliant effects, and that it is economical as well.

**Sales of Small Turbines.**—The Kerr Turbine Company, of Wellsville, N. Y., recently sold a 500-kw Economy turbo-alternator unit for installation in the municipal lighting plant at Concord, Mass. The Owl Creek Coal Company, of Gebo, Wyo., bought a 200-kw direct-current turbo-generator set, and a mixed-pressure geared turbine was sold to the Columbia Plate Glass Company, of Blairsville, Pa. This last-mentioned machine is to drive a 300-kw slow-speed direct-current generator.

**Business in Three-Wire Generators.**—The C & C Electric & Manufacturing Company, of Garwood, N. J., states that its type G three-wire generator, with external balancing coil, has had a good sale lately for direct connection to steam and gas engine drive. Its line of motors from 1-hp to 7½-hp rating, of the two-pole commutating-pole type (which was developed to meet a growing demand for a small high-speed motor for centrifugal pump and similar service) is also experiencing a heavy demand.

**Electrical Novelty Company to Locate in New York.**—The Beacon Miniature Electric Company will have its offices, salesrooms and plant at 108-110 Duane Street, New York, and expects to be in full operation by Sept. 1. It will make a specialty of manufacturing novelty batteries, flash-lamps, bulbs, auto-lamps and electrical novelties of various kinds. Bernard Tauber is president of the company and Ludwig Gaertner is its secretary. Both have been previously interested in similiar enterprises in managerial capacities.

**Change in Conduit Prices.**—An announcement was made on Aug. 15 by M. B. Austin & Company, of Chicago, Ill., to the effect that on and after that date an advance of 1 point (2½ per cent) would be made in the price of "galvaduct" and "loricated" conduits on deliveries from Chicago stock, no change being made in factory prices on which the card prices recently issued were based. Chicago prices are secured by lowering the Pittsburgh basing discount one point. Thus if the correct discount from factory is 60 per cent the Chicago discount would be 60 per cent less 2.1 per cent for l. c. l. freight and one point for stock delivery, making the f.o.b. Chicago discount 55.4 per cent. To secure delivered price at some point outside of Chicago, but based on Chicago shipment, further freight deduction would be made from the Chicago price. For instance, assuming that the freight from Chicago to destination is 20 cents per 100 lb., there would be deducted an additional two points, making the delivered discount on shipment from Chicago stock 50.4 per cent.

**Public Utility Companies Add to Their Electrical Equipment.**—The Willapa Harbor Electric Company, of Raymond, Wash., Great Falls (Mont.) Power Company, Adirondack Electric Power Corporation, Glens Falls, N. Y., and Mark S. Wilder, of Watertown, N. Y., are some of the public-utility interests which have lately placed large orders with the General Electric Company for generating and auxiliary electrical equipment. The apparatus purchased includes turbo-generator units, transformers, switchboards and accessories.

**Flanders Electric Cars to Be Put Out Under a New Name.**—E. LeRoy Pelletier, of Detroit, has purchased from Harris Brothers & Company, receivers, one of the plants of the Flanders Manufacturing Company at Pontiac, Mich. and has organized the Tiffany Electric Company to continue the manufacture of the Flanders electric car under the name of the "Tiffany de Luxe" and the "Tiffany Mignon." Associated with Mr. Pelletier in the venture are many well-known business men of Detroit who are stockholders in the five-hundred-thousand-dollar company being incorporated.

**Cooper Hewitt Quartz Lamps Give Satisfaction.**—In response to a recent inquiry concerning the electrical equipment of its new plant, the Pittsburgh (Pa.) Screw & Bolt Company sends the following letter: "We have probably one of the largest plants in this country using motor drive. We are thoroughly equipped with power apparatus and our lighting system is the most effective that we have seen, consisting of a series of Cooper Hewitt quartz lamps so arranged and spaced that at night our shop is lighted almost as well as in the daytime." The Economy Fuse & Manufacturing Company recently sold a large order of fuses for the above plant.

**Allis-Chalmers Manufacturing Company to Move Chicago Plant.**—According to a statement made recently by President O. H. Falk of the Allis-Chalmers Manufacturing Company of Milwaukee, Wis., the company has decided to move its Chicago plant to Milwaukee, the change being made gradually so as to avoid interfering with the regular progress of business and probably covering a period of several months. The following statement was made by President Falk in this connection: "The large contracts now taken by the company comprise machinery made at different plants and the cost of assembly and shipment of such contracts is necessarily larger than if they were built in one place."

**The American Engine & Electric Company, Bound Brook, N. J.,** has taken over the business of the American Engine Company and will have increased facilities for the manufacture of the American-Ball high-speed steam engines which have been built by the latter company for the past seventeen years, as well as a complete line of electric motors and generators from the designs of Mr. W. T. Hensley, who is now associated with the company. The officers of the American Engine & Electric Company are as follows: Mr. Hugh C. Pierce, president and treasurer; Mr. William T. Hensley, vice-president and secretary; Mr. F. O. Ball, general manager, and Mr. F. H. Ball, consulting engineer.

**opper-Wire History.**—Of historical interest are some figs given out recently on the copper-wire industry in this ntry in 1909. In that year there were seven mills in the ted States drawing copper wire exclusively and the State New Jersey led in production with 63,452 tons, or 43.1 cent of the total. The manufacture of insulated wire cable to the value of $9,806,989 was reported by the ve-mentioned plants, and the total value of these prods manufactured during that year was $51,624,737 includ the product of establishments devoted entirely to this .

**Vestinghouse Sales to Public Utility Companies.**—Re- t heavy purchasers of generating and drive equipment, ary converters, motor-generator sets, transformers and tchboard apparatus made by the Westinghouse Electric Manufacturing Company have been the Dayton (Ohio) ver & Light Company, Boston (Mass.) Elevated Rail- Company, Marquette City (Mich.) & Presque Isle lway Company, Interborough Rapid Transit Company New York, Los Angeles (Cal.) Gas & Electric Corpora- and the Merchants' Power Company, of Memphis, n.

**Vagner Transformers Installed.**—The Manufacturers' lway Company, of St. Louis, Mo., is building a new ndhouse at the present time, the work being under the ervision of G. E. Wells. About 300 hp of connected d, including energy used for both lighting and power poses, will be gained from this development by the on Electric Light & Power Company, of the same city. ee 50-kw and one 25-kw, three-phase, 25-cycle transners have been installed on this job, all of them of the gner Electric Manufacturing Company's make. The rantee Electrical Company, of St. Louis, is the contor.

**irginia Motor Manufacturer on Trade Conditions.**— m the Richmond Electric Works, of Richmond, Va., following letter on trade conditions in that section of country is received: "Business continues very good us; in fact, our plant is extremely busy, last month g the largest, from the standpoint of production, that have ever had. At the same time, we find collections icularly bad not only among the small people but also ng some of the largest to whom we sell. Regarding contracts our work consists at this time of a large ber of small orders, although we have outstanding at ent a number of large inquiries."

**klahoma Mine Telephone Equipment.**—To the Western tric Company, of Chicago, Ill., has been awarded the ract for supplying 800 of its standard mine telephone for use in the mines of the Oklahoma Coal Operators' ciation. This order is stated to be the largest ever d with this company at one time for such equipment, t follows the passage of a law by the Oklahoma Legisre making it compulsory for mine operators in that to provide telephonic intercommunicating systems in mines. Incidentally, it is expected that these installaill mark a long step toward increased efficiency of ation in each case by putting the executives in constant h with every part of the mine.

**ussian Field for American Machinery.**—At the close of a er tendered recently in Brooklyn, N. Y., to a delegation ussians just completing a tour of the United States, Dr. rt A. Snowden, editor of *American Industries,* made a e speech on the importance of the Russian export field, which the following abstract is taken: "American rts to Russia have about doubled within a single year. products shipped there are mainly along the line of inery, particularly agricultural implements, automo- typewriters and electrical apparatus. Russia has vast ultural resources. Her cereals and dairy products are rted in large quantities to the neighboring states of pe. The greatest migration to the farms—the most tworthy 'back-to-the-land' movement of the twentieth ry—is the colonization of the black-soil wheat district beria. During each of several successive years more 500,000 colonists have settled upon the fertile Siberian lands. This vast army of farmers is now adopting most modern methods and modern machinery for delking these farms."

**Cooperage Plans to Install Electric Drive.**—The J. Schwarzwalder & Son Company, a Louisville (Ky.) cooperage concern, has announced plans for the use of electric drive in a new plant shortly to be put under construction. It has a steam plant and generating equipment, and motors will be purchased in the near future. The installation is of considerable interest because the use of electricity in cooper shops is decidedly unusual, practically all of the plants in the central part of the country using the mechanical system exclusively. Arthur B. Herb is general manager of the company and will be in charge of equipment purchases.

**Interborough Rapid Transit Makes Large Purchase of Generating Equipment.**—Orders have been placed recently with the Westinghouse interests of East Pittsburgh, Pa., for a large amount of generating equipment for use by the Interborough Rapid Transit Company of New York. In addition to the three 30,000-kw double-unit, steam turbine-driven sets ordered from the Westinghouse Machine Company for use in the Seventy-fourth Street station, there has been placed an order for two 300-kw, 250-volt compound-wound direct-current generators to be driven by steam turbines through reduction gears. This latter order was placed with the Westinghouse Electric & Manufacturing Company.

**Connecticut Incandescent Lamp Manufacturer Enlarges Plant.**—The Franklin Electric Manufacturing Company, of Hartford, Conn., continuing its policy of expansion to meet the growth of its business, has purchased two large factories in Middletown, Conn., and will shortly move its present plants at Pittsburgh, Pa., and at Newark, N. J., into the new quarters, adding to them the plant already located in Middletown as soon as its present lease expires. Some repairs will be necessary before the new premises can be occupied, and the alterations will include the addition of two stories to the existing buildings. It is expected that the new plant will begin operations on or about Jan. 1.

**Pittsburgh Utility Places Big Boiler Order.**—The Duquesne Light Company, of Pittsburgh, Pa., has recently ordered from the Babcock & Wilcox Company, of 85 Liberty Street, New York, 16,440 hp of boiler equipment with auxiliary superheaters. Other utility companies that have recently bought equipment of the same make are the Muncie (Ind.) Electric Light Company, the Central Heating Company, of Detroit, Mich., and the Piedmont Railway & Electric Company, Burlington, N. C. The largest recent industrial buyer was the George W. Blabon Company, of Philadelphia, Pa. Over 26,000 hp in boiler equipment and auxiliaries is represented in the latest report on Babcock & Wilcox sales.

**Bruce-Macbeth Gas Engines Sold.**—The following orders for its vertical multi-cylinder gas engines have been received recently by the Bruce-Macbeth Engine Company, of Cleveland, Ohio: Two 100-hp four-cylinder engines for the Snow Steam Pump Works, for installation in their Louisiana plant; one 60-hp twin-cylinder engine for the American Glove Company, of Dunkirk, N. Y., and one 150-hp engine for the Interstate Cotton Oil Refining Company, at Sherman, Tex. Among recent shipments of this type of engine were one of 150-hp rating for the Fry Glass Company, Rochester, Pa.; one of the same size for John Eichleay, Jr., Pittsburgh, Pa., and a 350-hp unit for the Suydenham Glass Company, of Canada.

**Electric Typewriter Concern Plans Factory in Springfield, Mass.**—On condition that a reasonable amount of its stock be subscribed for by the financial and business interests of the city and vicinity, the Crawley Power Driven Typewriter & Adding Machine Company, which has headquarters at present at 185 Madison Avenue, New York, proposes to build a large plant for the manufacture of its product at some favorable location in Springfield, Mass. This company was incorporated under the laws of the State of Delaware with a capital stock of $5,000,000, all of it common having a par value of $10. It controls the patents and manufacturing rights on the Crawley electrically operated typewriter, a description of which appeared in the July 5 issue of the *Electrical World.* The Board of Trade of Springfield has taken the company's offer under advisement and is investigating the possibility of making the necessary arrangements to secure the new industry for that city.

**St. Louis Plant of the Busch-Sulzer Brothers Diesel Engine Company.**—The Busch-Sulzer Brothers Diesel Engine Company has recently completed construction work on its St. Louis plant (consisting of six buildings), and at the present time the electric equipment is being installed. Three 160-kw direct-current, three-wire generators of Crocker-Wheeler make are being put in and about 300 hp in. motors as well as extensive lighting apparatus. The contracting work is being done by the Guarantee Electrical Company, St. Louis.

**New Minnesota Lamp Factory.**—Work is under way for the new incandescent-lamp factory to be located midway between Minneapolis and St. Paul. It will be known as the Minnesota Mazda Lamp Works of the National Quality Lamp Division of the General Electric Company. Fostoria tungsten lamps will be made here, and it is said that when completed the factory will be able to turn out about 20,000 lamps a day, furnishing employment to nearly 1000 hands. The building will consist of three stories and a basement. It will be of reinforced-concrete construction, with large and numerous window openings. The property comprises over five acres of land, railroad spurs running direct to the plant. An assembly room, restaurants, rest rooms and a gymnasium will be features of the welfare-work equipment. It is expected that lamps will be delivered from this factory in about a year.

**Electric Welding of Water-Tube Boiler Headers.**—The Electric Welding Company, of 220 West Forty-second Street, New York, recently completed an interesting piece of work in connection with the Worthington water-tube sectional steam boilers, manufactured by James Beggs & Company, of 36 Warren Street, New York. These boilers are compact in construction and therefore particularly adapted to marine work. The headers are made from rectangular charcoal-iron tubes, drawn in long pieces and cut to correct length. It was in closing the end of these tubes that arc welding was employed. Rectangular plates, of proper size to fit into the ends of the square header tubes, were stamped from sheet metal and welded into these tube ends. Samples of tubes thus welded were subjected to a pressure of 2000 lb. per sq. in., and in every case the pipes bulged out of shape before the flat-welded heads gave way. This company is prepared to do electrical welding of all kinds and on parts of any size. It specializes on repair of broken ship parts and on boiler work, but can handle railway and industrial welding work as well.

**Electrical Equipment for a Korean High-Tension Installation.**—From G. A. Harris, chief engineer for Takata & Company, of 50 Church Street, New York, large exporters of mechanical and electrical equipment to Japan and other Eastern countries, it was learned that at present a very heavy export movement is in progress in generating-station apparatus and auxiliaries as well as in other electrical lines. A big shipment of such nature is to be made shortly to the Seoul Mining Company, in Korea, for equipping its generating station at Pyeng Yang and its substations at Sokutari, Tul Mi Chung and Hol Kol. The Westinghouse Electric & Manufacturing Company is supplying the generating and auxiliary electrical equipment, which includes two 1250-kva, three-phase, 60-cycle, 2200-2400-volt steam-turbine generator sets, each with a direct-connected exciter; two Westinghouse-Leblanc motor-driven surface condensers, step-up, step-down and distributing transformers, electrolytic lightning arresters and switchboards for the central station and substations. Six Heine water-tube boilers of 225-hp capacity each are to be installed, together with two Knowles feed pumps and two Wainwright vertical feed-water heaters. The storage battery is to be furnished by a German manufacturer.

**Change in Brooklyn Edison Directorate.**—At a meeting of the board of directors of the Edison Electric Illuminating Company of Brooklyn on Aug. 18, Mr. N. F. Brady was elected president to succeed the late Anthony N. Brady, and Mr. J. C. Brady was elected a director and vice-president to succeed Mr. N. F. Brady.

**Pacific Coast Utility Doing Good Business.**—During the six months ended June 30 the Pacific Gas & Electric Company earned a surplus over interest charges amounting to $1,561,331, a sum sufficient to meet a half year's 6 per cent dividend on the $10,000,000 outstanding preferred stock and 3.94 per cent on the $31,998,750 common stock outstandin The company is doing at the present time the largest bus ness of its history. It is also making very heavy expend tures on improvement work and extensions of its generatin capacity. There is under construction a large reserv which, when completed, will supply an ultimate capacity 153,000 hp in six developments.

**Westinghouse Earnings Increase During July.**—The n earnings of the Westinghouse Electric & Manufacturin Company during July were in the neighborhood of $500,00 bringing the total for the first four months of the company fiscal year up to approximately $2,400,000. Present indic tions point to even a larger net for the month of August, b it is not expected that the flood of business enjoyed durin the first part of the year will continue throughout the whol year. The foreign subsidiary companies are in a stron financial position. A dividend is expected in a short tim for the stockholders of the British company, and the Italia company is also in a good position, having done conside able work during the past year for the Italian government

**Large Utility Holding Company in Prosperous Conditio** —The annual meeting of the American Public Utilit Company was held in Grand Rapids, Mich., on Aug. 18, an the annual report rendered showed the company to be in prosperous condition. An increase in the board of directo was considered necessary because of the steady growth the company's business, and accordingly the number w raised from seven to sixteen, thirteen of whom were electe with power to select the remaining three. No action w taken toward increasing the dividend rate on common stoc although the company's earnings would warrant su action. It was decided best to turn the surplus into in provements. The old officers of the company were r elected as follows: C. B. Kelsey, president; J. H. Brewe vice-president and general manager; Blain Gavitt, secr tary, and W. H. Snow, treasurer.

## Industrial Securities

| Security | Capital Stock Listed | Dividend Per Cent | Dividend Period | Quotations Aug. 19 | Quotations Aug. |
|---|---|---|---|---|---|
| Allis-Chalmers, t.r., 5th pd | $19,800,000 | | | 8½* | |
| Allis-Chal., pf.,t.r.,5th pd.. | 16,050,000 | | | 16½* | |
| American Agricultural Chemical | 153,887,900 | 1½ | Q | 74 | |
| American Tel. & Tel. | 344,471,400 | 2 | Q | 129½ | |
| Electric Storage Battery,c. | 16,074,425 | 1 | Q | 48 | |
| General Electric | 101,363,600 | 2 | Q | 142½ | |
| Mackay Cos., c | 41,380,400 | 1½ | Q | 82 | |
| Mackay Cos., pf. | 50,000,000 | 1 | Q | 67* | |
| Western Union Tel. | 99,747,600 | ¾ | Q | 68 | |
| Westinghouse, E. & M., c. | 31,400,400 | 1 | Q | 68 | |
| Westinghouse, E. & M., pf. | 3,998,700 | 1¾ | Q | 114* | |

*Last price quoted.

## NEW YORK METAL MARKET PRICES

| | Aug. 12 Bid | Aug. 12 Asked | Aug. Bid |
|---|---|---|---|
| Copper: | | | |
| [illegible], spot* | 14 7 2½ | to 15.85 | |
| | Selling Prices £ s d | | Selling Prices £ s d |
| [illegible], standard, spot* | [illegible] | [illegible] | 69 |
| [illegible] base | 15 7 5 | to 15 8 7 | |
| [illegible] | [illegible] | 15.75 | 15 8 5 |
| [illegible] | [illegible] | 15.50 | 15 5 0 |
| Copper wire base | 16.75 | to 17.00 | 16 7 5 |
| Lead | [illegible] | 4.50 | 4 5 |
| [illegible] | 40.00 | to 45.00 | 40 0 |
| [illegible] | | 7.50 | 7 7 5 |
| Spelter, spot | [illegible] | 5.75 | 5 7 |
| Tin, spot* | 41 7 5 | to 42.00 | 41 10 |
| Antimony: | | | |
| [illegible] delivery | 22 7 5 | to 23.25 | 22 10 |
| [illegible] | 21 0 0 | to 22.00 | 21 0 |

## *OLD METALS

| | |
|---|---|
| Heavy [illegible] and wire | [illegible] |
| Brass, [illegible] | 9.25 |
| Brass, light | 8.25 |
| Lead, [illegible] | 4.40 |
| Zinc, [illegible] | 4 6½ |

## *COPPER EXPORTS

Total tons to Aug. 19 [illegible]

*From daily transactions on the New York Metal Exchange

## Business Notes

**George Bender,** dealer in second-hand dynamos, motors nd machine tools, is removing his plant from 82-84 Centre Street to 122-130 Centre Street, New York. This makes Mr. Bender's fourth move in the past fifteen years, each time to arger quarters. He is equipping his plant with three 18-ft. pan cranes and a trolley system for convenience in handling nd overhauling his goods.

**The Chelton Electric Company,** of 314 Armat Street, Philadelphia, Pa., manufacturer of electrical specialties, has ppointed G. M. Cox & Company, of 1156 Monadnock Block, as its representatives in Chicago and immediate icinity. The latter concern is in a position to furnish iterature and quotations, and carries a consigned stock on and from which deliveries can be made.

## New Industrial Companies

**The Pacific Storage Battery Company,** of Los Angeles, Cal., has been incorporated with a capital stock of $10,000 y J. B. Chase, W. P. Chase, R. P. Morgan and others.

**The Electric Welding Studding Company,** of San Francisco, Cal., has been incorporated with a capital stock of 25,000 by H. K. Eells, E. T. Cooper and C. T. White.

**The Zamak Control Company,** of Chicago, Ill., has been ranted a charter with a capital stock of $100,000 to manuacture electrical supplies. The incorporators are: N. B. Cole, H. J. Locke and G. H. Grant.

**The Electrical Supply Company,** of Tulsa, Okla., has been ncorporated with a capital stock of $2,500 to deal in electrical supplies. The incorporators are: H. K. Herbst, R. J. ohnson and W. H. Stueve, of Muskogee,, Okla.

**The J. T. H. Company,** of Chicago Heights, Ill., has been ncorporated with a capital stock of $5,000 to manufacture nd sell electrical and mechanical patents and inventions. he incorporators are: Joseph Sekavec, Hugh Kennedy and ohn T. Hume.

**The Dommers-Walters Electric Company,** of Canton, hio, has been incorporated by Ray H. Walters, John ommers, August Dommers, V. P. Meese and H. L. Graber. he company is capitalized at $5,000 and proposes to do an ectrical engineering and contracting business.

## Trade Publications

**Magnetos.**—The "Comet" magneto is the subject of a lder recently issued by the Wesco Supply Company, St. ouis, Mo. The folder gives details of construction and a mber of illustrations.

**Sectional Switch Boxes.**—Much information relating to e construction and installation of various types of secnal switch boxes is given in a folder being distributed by e Chicago Fuse Manufacturing Company, Chicago, Ill.

**Outdoor Substations.**—The Delta-Star Electric Company, 8 West Jackson Boulevard, Chicago, issues a technical lletin entitled "Outdoor Substations," which gives a deiled description of high-tension outdoor low-cost subations.

**Lighting Fixtures.**—The F. W. Wakefield Brass Comny, Vermilion, Ohio, is sending out advertising matter reing to its patent ceiling attachment, which eliminates the nger of marring expensive decorations when the fixture is stalled.

**Pamphlet on Light.**—"Correct Practice in Control of ght" is the title of a pamphlet recently issued by the Nanal X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, which contains a discussion on the origin and velopment of indirect lighting, by Augustus D. Curtis.

**Electric Supplies.**—The Columbia Electrical Company, ectrical supplies, 280 Frederick Avenue, St. Joseph, Mo., ntinues its progressive advertising policy. Its latest appeal the prospective customer is in the form of a folder refring to its electrical heaters, their comforts and conveniences.

**Fixtures.**—Colonial prism fixtures are described in a booklet of twelve pages recently issued by the F. W. Wakefield Brass Company, Vermilion, Ohio. These fixtures may be had with Wakefield receptacle complete, ready for wiring. The receptacles and holders are also illustrated in the pamphlet.

**Oil Switches.**—Bulletin A-4139, issued by the General Electric Company, is devoted to central-station oil switches of high rupturing capacity. The switches are made both automatic and non-automatic and for voltages from 15,000 to 70,000. The bulletin also contains a list of central stations in which these switches are in use.

**Lamp Dimmers.**—The Wirt Company, Germantown, Pa., has issued a booklet entitled "The Dim-a-Lite Mother Goose," which contains some striking nursery rhymes relating to its device for varying the light from incandescent electric lamps. The booklets are arranged to carry the imprints of the lighting companies distributing them to their customers.

**Oil Separators.**—These form the subject of Section "C" of the Cochrane separator catalog, issued by the Harrison Safety Boiler Works, 3159 North Seventeenth Street, Philadelphia, Pa. The introduction to this pamphlet contains interesting information regarding the removal of cylinder oil from exhaust steam, and the pamphlet also discusses various applications of separators and the manner of using them.

**Locomotives.**—The Baldwin Locomotive Works, Philadelphia, Pa., have printed as Record No. 73, a paper which appeared in the *Journal of the Franklin Institute,* entitled "The Recent Development of the Locomotive," by the consulting engineer of the company, George R. Henderson. Of much interest is the section devoted to the electric propulsion of locomotives. The general subject is comprehensively treated, and a number of illustrations are given.

**Slide Rule.**—The Roylance electrical slide rule is fully described in a leaflet printed by the Keuffel & Esser Company, Hoboken, N. J., which makes this device. Complete directions for its use are given. By means of a series of scales the different properties of copper wire, such as size, conductivity, weight, etc. may be determined without the use of tables. Scales showing the carrying capacity of different kinds and sizes of wire are placed in the groove in the body of the rule beneath the slide. Other features are the improved runner and the special gauge mark for the conversion of horse-powers and kilowatts.

**Centrifugal Pumps.**—An artistic and dignified pamphlet is the new eighty-two-page catalog on centrifugal pumps just issued by the Platt Iron Works Company, of Dayton, Ohio. The booklet is well bound, printed in large, clear type, on a good grade of paper, and profusely illustrated. At the same time it is devoted to a straightforward exposition of Platt pumps, without any of the "frills" so common to present-day pamphlets, which serve often to distract the mind from the subject of principal importance. This book gives a summary of the different services to which Platt pumps are adaptable and, following that, a description of the various styles of pumps made for these different uses. Instructions for the estimating and erection of pumps are also given, and at the end of the catalog there are included several useful hydraulic tables.

**Small Alternating-Current Motors.**—Motors for alternating-current, both single-phase and polyphase, ranging from 0.125 hp to 7.5 hp, are briefly described in Pocket Catalog No. 11, issued by the Advance Electric Company, of St Louis. These motors are built in two general forms designated as S (short) and W (wound). Form W has an extended end-plate on one end to accommodate a commutator or collector ring. Single-phase motors, both constant-speed and variable-speed, and wound-rotor polyphase motors are furnished in this form. Form S has both end-plates short and is used for motors having a squirrel-cage rotor. Polyphase squirrel-cage motors are furnished in this form. The booklet contains a drawing showing the short-circuiting device of the single-phase, constant-speed motors, with dimensions, prices and other necessary information in relation to all types. The company will furnish a copy of this condensed catalog to any person interested in the sale of electric motors.

# Personal Mention

**Dr. Peter Cooper Hewitt** was a passenger on board the steamship *Olympic* returning to New York from Liverpool Aug. 20.

**Mr. L. W. McLellan** has been appointed new-business manager for the United Gas & Electric Company, of New Albany, Ind.

**Mr. Thomas B. Rhodes** has been appointed general manager of the Consumers' Electric Light & Power Company, New Orleans, La. Mr. Rhodes was formerly commercial manager for the Elmira Water, Light & Railroad Company, Elmira, N. Y.

**Mr. G. B. Taylor,** of Petersburg, Ind., has been appointed electrical expert for the Indiana Public Service Commission. Mr. Taylor is a graduate of Indiana University and for the last five years has been engaged in consulting engineering work in Petersburg and Winslow.

**Mr. T. Commerford Martin,** secretary of the National Electric Light Association, was tendered a dinner at the Hotel Dempsey, Macon, Ga., Aug. 14, by the officers and executive committee of the Southeastern Section of the association, whose convention was in session at Macon Aug. 14 to 16.

**Mr. F. M. Caldwell** has been appointed general commercial agent of the gas and electric properties in Michigan operated by Messrs. Hodenpyl, Hardy & Company. Mr. Caldwell will establish headquarters at Detroit, and the new industrial department of which he will have charge will devote its attention to a study of the industrial conditions prevailing in the cities fed from the circuits of the Commonwealth Power, Railway & Light Company, with which Messrs. Hodenpyl, Hardy & Company are also affiliated.

**Mr. C. Herbert Sanderson,** formerly connected with the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa., has been appointed electrical engineer of the Havana (Cuba) Electric Railway, Light & Power Company. Mr. Sanderson is a graduate of the Ohio State University and has just completed twelve years of service with the Westinghouse Electric & Manufacturing Company. Part of this time was spent in the switchboard and power station division of the engineering department and part with the general engineering department.

**Mr. A. E. Grant** has succeeded his brother, Mr. Lawford Grant, as managing director of the Canadian British Insulated Company, Ltd., Montreal. Mr. A. E. Grant has had a wide experience as a marine, mechanical and electrical engineer and has supervised some extensive contracts. His first position as an electrical engineer was with the Notting Hill (London, England) Electric Light Company, for which he erected some three-phase machinery, the second of its kind used in the British Isles. Subsequently he joined the engineering staff of the British Insulated & Helsby Cables, Ltd., of England, which has a large interest in the Canadian British Insulated Company. During his fourteen years' connection with the British company, Mr. A. E. Grant had charge of important work, including the complete equipment of the Chesterfield tramways, and also the laying of extra high-tension mains of the Metropolitan tramways. In 1906 he was appointed manager and chief engineer of the Cardiff office, which takes care of the company's business in south Wales and the southwest district of England. He went direct from Cardiff, Wales, to Montreal and has taken over the duties of Mr. Lawford Grant, who resigned to accept an important position with the Eugene F. Phillips Electrical Works, Ltd., of Montreal.

**Mr. R. P. Stevens** has resigned as president and general manager of the Lehigh Valley Transit Company, Allentown, Pa., which operates about 150 miles of electric railway from Philadelphia to Allentown, Bethlehem, Nazareth, Slatington and points in the Lehigh Valley, and three electric light plants, the company being a consolidation of nine electric companies. Mr. Stevens was born in Eastport, Maine, on April 3, 1877. He was graduated from the University of Maine with the degree of bachelor of mechanical engineering and electrical engineering, and took post-graduate work in the Massachusetts Institute of Technology. For a time he worked for the Electrical Wiring & Supply Company in Boston, and later took the student's course of the American Bell Telephone Company. He then went with the General Electric Company and assisted in building a number of electric-light plants in the South. Because of fever he left the South and accepted a position with the Automatic Fire Alarm Company of Boston. Later he invented an apparatus for automatic fire alarms and was appointed superintendent of the Western department, with headquarters at Chicago. In February, 1900, Mr. Stevens went to Everett, Wash., to rehabilitate the system of the Everett Railway & Electric Company, of which he later became general superintendent. He supervised the construction of the interurban line and the electrification of the tracks of the Northern Pacific Railway from Everett to Snohomish under an agreement with the Northern Pacific Railway. Mr. Stevens left Everett to accept the position of general superintendent of the Auburn & Syracuse Electric Railroad in Auburn, N. Y. He was later appointed general superintendent of the Auburn & Northern Electric Railroad and general manager of the Skaneateles Lake Transportation Company and manager of the Interurban Electric Express Company. He was elected president of the Lehigh Valley Transit Company in July, 1907. Mr. Stevens has been selected as president of the Mahoning & Shenango Railway & Light Company and its subsidiaries, effective Oct. 1.

**Mr. William G. Bee,** who has been associated with Mr. Edison for the past eleven years, has been elected vice-president and general sales manager of the Edison Storage Battery Company of Orange, N. J. Mr. Bee first entered the electric vehicle field in 1897, when he joined the forces of the Pope Manufacturing Company of Hartford, Conn. He served with the colors during the war with Spain and returned to the Pope Manufacturing Company, afterward the Electric Vehicle Company of Hartford, spending a year in Mexico in its interests. It was while he was with the Pope company that Mr. Bee came in contact with Mr. Edison, and since the perfection of the Edison storage battery Mr. Bee has directed the sales policy of the Edison Storage Battery Company. Mr. Bee is well known in the automobile industry, and his promotion is a substantial recognition of his long and faithful work for the company.



WILLIAM G. BEE

# Obituary

**James R. Wiley,** of Chicago, Western manager of the Standard Underground Cable Company, died of pneumonia in the Washington Park Hospital, Chicago, Aug. 17. Mr Wiley was one of the most popular and best known of the electric men of Chicago and also was one of the telephone pioneers. He was born in Newark, Mo., May 1, 1847, and spent his early manhood in St. Louis, graduating from the St. Louis City University. He engaged in mercantile and banking pursuits and became an expert accountant. In 1878 he entered the service of the Metropolitan Telephone & Telegraph Company of New York City and remained with that company and its successors until 1895, when he became affiliated with the Standard Underground Cable Company and removed to Chicago as Western manager, a position he filled until the time of his death. In his eighteen years' residence in Chicago Mr. Wiley acquired a wide acquaintance among electrical men. He possessed a winning personality. The funeral was held in Chicago on Aug. 19 The deceased was unmarried. He was a member of the Jovian order and of the Chicago Association of Commerce He is survived by three brothers and two sisters. One brother, Mr. George L. Wiley, is Eastern manager of the Standard Underground Cable Company at New York.

# Construction

## New England

BARTON, VT.—A three-phase, 2200-volt transmission line from the nicipal electric-light plant to the granite quarries, 3 miles out, has st been completed. It is also expected soon to contract with other rties who have opened new quarries and also to furnish electrical rvice to farmers along the route. Hazen Clerke is chief electrician.

MERRIMAC, MASS.—The managers of the municipal electric-light ant expect to purchase 300 incandescent lamps within the next two nths. W. A. Bailey is manager.

NORTH ATTLEBORO, MASS.—Within the next two months the anagers of the municipal electric-light plant expect to erect 1¼ miles 2300-volt distribution line (No. 0 cable) to supply energy to the welry factory of J. F. Sturdy, Sons & Co. in Attleboro. William Platt- r is engineer.

PEABODY, MASS.—The damage to the municipal plant by the fire as much exaggerated, the loss being under $20,000, instead of $40,000 reported in the issue of Aug. 16. Not much of the work will be bject to contract, except the building repairs, which will be handled rough F. W. Dean, Inc., Boston, Mass. Warren D. King is manager the municipal plant.

SPRINGFIELD, MASS.—Bids will be received at the office of the mmanding officer, Springfield Armory, Springfield, Mass., until Sept. for furnishing one worm-gear direct-connected motor-driven elevator. rther information may be obtained by addressing the commanding ficer, referring to proposal No. 12.

SPRINGFIELD, MASS.—The Board of Supervisors has decided to stall magnetite-arc lamps on Bridge Street, which later will be extended other side streets in the business district. Main Street will continue be lighted by the present style of arc lamps, to be attached to trolley les. William E. Hodges is deputy superintendent of street lighting.

WAKEFIELD, MASS.—The Wakefield Municipal Commission is con- ering securing energy from the municipal electric plant at Reading to erate the municipal electric-lighting system here.

WESTFIELD, MASS.—A special town meeting will soon be held determine what action the town will take regarding the proposition of Amherst Pwr. Co. to enter Westfield. Two propositions will be mitted to the voters. One will ask for an appropriation to erect a nsmission line to the outskirts of the town to connect with the line the Amherst company and the other will call for an appropriation $25,000 to improve the municipal electric-light plant.

PROVIDENCE, R. I.—Plans have been completed by the City Council mmittee on lights for extending the installation of the new street ps in the down-town district into the principal residential sections, luding Angell and Waterman Streets and a number of other streets.

## Middle Atlantic

ALBANY, N. Y.—Bids will be received by the purchasing committee state hospitals, Room 138, Capitol, Albany, until Sept. 3 for furnish- the New York State Hospitals for the Insane with incandescent ps for such a period as indicated on the specifications, deliveries inning Oct. 1, 1913. For further information apply to the purchasing mmittee.

AUBURN, N. Y.—The Public Service Commission has granted the pire Gas & El. Co., of Auburn, permission to issue capital stock to amount of $400,000, the proceeds to be used for the purpose of uiring the capital stock of the Central New York Gas & El. Co., of eva.

BABYLON, N. Y.—The Babylon R. R. Co. has applied to the Town ard of Babylon for a franchise to furnish electricity for lamps. The mpany, which now secures energy from the Babylon El. Lt. Co., pro- ses to build a power plant to furnish power for the railway and the general public.

BROOKLYN, N. Y.—Bids will be received by the president of the rough of Brooklyn, Room 2, Borough Hall, Brooklyn, until Aug. 27 for electric work required in making alterations at various offices in the rough hall. Plans, forms and further information may be obtained at plans and drawings may be seen at the office of the Bureau of Public Buildings and Offices, Room 29, Municipal Building. Lewis H. Pounds is president.

BROOKLYN, N. Y.—Bids will be received by the commissioner of ter supply, gas and electricity, Department of Water Supply, Gas and Electricity, Room 1903, 13 to 21 Park Row, borough of Manhattan, New York, until Aug. 28 as follows: (1) For dismantling and trans- porting one pumping engine and appurtenances from the New Lots pumping station No. 1 to the New Lots pumping station No. 2, and re-erecting it with piping and other appurtenances complete. (2) For remodeling and extending the buildings at the North Portland Avenue repair yard, No. 98 North Portland Avenue: (a) for all mason work, slate and iron work, carpentry work, sheet metal work, roofing, glazing, painting and electrical work; (b) plumbing and gas fitting; (c) steam-heating work. (3) For furnishing and erecting platforms and railings for the Davis & Farnum engines at Ridgewood North Side station, Atlantic Avenue and Logan Street, being contract abandoned by the City Contracting Co. Blank proposal forms, together with copy of contract, including specifications, can be obtained upon application to the office of the department, room 1903, 13 to 21 Park Row, borough of Manhattan. J. W. F. Bennett is deputy and acting commissioner.

CANAJOHARIE, N. Y.—The Montgomery El. Lt. & Pwr. Co. expects to purchase within the next two months two 50-kva, 15,000-220-volt transformers. W. J. Roser is manager.

FORT ANN, N. Y.—The Public Service Commission has granted the application of the Kanes Falls El. Co. to erect a transmission line from its generating station in Kanes Falls, to Washington County, through the towns of Fort Ann and Granville, to the village of Granville.

JAMESTOWN, N. Y.—At an election held Aug. 9 the proposition to issue $40,000 in bonds, to be used for extensions and improvements to the municipal electric-light plant, was carried.

MARCELLUS, N. Y.—The Public Service Commission has authorized the Marcellus Ltg. Co. to issue $10,000 in capital stock, the proceeds to be used to purchase the electric-light plant in Marcellus, now owned by F. W. Knapp, and for improvements to the lighting system.

NEW YORK, N. Y.—Bids will be received by Henry S. Thompson, commissioner of water supply, gas and electricity, Department of Water Supply, Gas and Electricity, Room 1903, 13 to 21 Park Row, borough of Manhattan, New York, until Aug. 28 for installing a pumping plant at Grant City, borough of Richmond, as follows: (1) For furnishing material and making excavations, building foundations and erecting a radial brick smokestack complete at the main pumping station at Grant City. (2) For furnishing and installing a boiler plant complete in main pumping station. (3) For furnishing materials (except such parts as are furnished by the city) and installing a pumping plant complete. (4) For furnishing and installing a generating plant with switchboards, etc., complete in the main pumping station. Blank proposal forms, together with a copy of contract, may be obtained upon application at the office of the department, Room 1903, 13 to 21 Park Row, borough of Manhattan.

ROCHESTER, N. Y.—Arrangements are being made by the Rochester Ry. & Lt. Co. for the installation of 129 additional magnetite-arc lamps on several streets in the city. Thomas H. Yawger is superintendent.

SYRACUSE, N. Y.—The Oswego River Pwr. Transmission Co., of Syracuse, has received authority from the Public Service Commission to erect a transmission line in the town of Schroeppel to furnish electrical service in that town; also to erect a transmission line in the towns of Ira, Cato and Hannibal, Oswego County, to furnish energy for lamps, heaters and motors, and to extend its line from Fairdale south through the towns of Hannibal, Ira and Cato, through the settlements of Hannibal Center and Ira Hall, to the villages of Cato and Meridian.

UTICA, N. Y.—The Utica Gas & El. Co. has been granted permission by the Public Service Commission to extend its lines to Sauquoit and Holland Patent to furnish energy in both villages. The street-lighting system in Sauquoit will consist of 60 lamps. The installation will cost about $4,000 and is nearly completed. The lighting system in Holland will be installed later and will cost about $3,000.

WATERTOWN, N. Y.—The Public Service Commission has authorized the Watertown Lt. & Pwr. Co. to issue $21,311 in capital stock and $60,000 in bonds, to be sold at not less than par, the proceeds to be used to acquire the property of the Dexter El. Lt. & Pwr. Co., of Dexter, and to take over the property, rights and franchises.

ERIE, PA.—The Erie County El. Co. is building an addition to its power plant on West Fourth Street, to be used as a boiler house. The building when completed will provide space for eight Babcock & Wilcox boilers of 500 hp each. The company is also building a reservoir at a cost of $25,000.

JOHNSTOWN, PA.—Plans are being prepared by the Citizens' Lt., Ht. & Pwr. Co., of Johnstown, for placing its wires underground within the fire limits of the city.

LEBANON, PA.—Extensive changes are being made by the American Iron & Steel Co. at its central works to increase its power plant to enable the company to equip more departments for electrical operation, substituting electrically driven machinery for steam-driven machinery. Five more engines will be installed in the power house.

PITTSBURGH, PA.—Bids will be received at the office of the controller of Allegheny County, Pittsburgh, Pa., until Aug. 29 for installing four electric elevators and for making alterations to the four hydraulic elevators in the Allegheny County court house. Plans and specifications can be seen and blanks for bidding obtained at the office of the county engineer, room 38, Court House, Pittsburgh. R. J. Cunningham is county controller.

SCHWENKVILLE, PA.—The City Council is contemplating the installation of an electric-light plant. It is proposed to build a plant with sufficient output to supply electrical service in the towns of Gratersford, Spring Mount and Zieglersville.

LITTLE FALLS, N. J.—Bids will be received by the commissioners of street-lighting district No. 1 for lighting the streets of said district with 41 incandescent lamps of 32 cp. W. A. Lang is clerk.

NEWARK, N. J.—A large addition is to be made to the manufacturing plant of Whitehead & Hoag, to cost about $175,000, and will include a five-story building, 150 ft. by 356 ft., built of reinforced concrete; also a concrete building for power plant, 50 ft. by 60 ft.

ANNAPOLIS, MD.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 26 for furnishing and installing at the naval engineering experiment station, Annapolis, one Diesel engine, one alternating-current generator and one direct-current oil-driven exciter unit. Application for proposal should refer to Schedule 5679. Blank proposals will be furnished upon application to the navy pay office, Baltimore, or to the above bureau. T. J. Cowie is paymaster general, U. S. N.

CAMBRIDGE, MD.—The Cambridge Gas, El. Lt. & Pwr. Co. expects to erect within the next six months a transmission line (18 miles long) and to purchase transformers, etc., for distribution system and also miscellaneous electrical appliances and supplies. Gustave Lobo, 78 Wall Street, New York, N. Y., is secretary and manager.

FROSTBURG, MD.—The Frostburg Illg. & Mfg. Co. expects to erect within the next three months a transmission line 1½ miles long to a neighboring town to furnish electrical service; also to purchase within the next six months one small direct-connected unit, with a rating of from 50 kva to 75 kva, two-phase, 100 or 2200 volts, and a panel to control small unit. Charles H. Leatham is general manager.

LOGAN, W. VA.—The Logan Land Co., recently incorporated, proposes to deal in real estate, own and operate electric and water plants. The company is capitalized at $50,000. S. A. Draper and F. P. Hurst, of Logan, are among the incorporators.

FREDERICKSBURG, VA.—Arrangements have been made between the Rappahannock El. Lt. & Pwr. Co. and Henry Warden, of the Hazel Hill Canning Co., of Fredericksburg, for the installation of a 125-hp auxiliary steam power plant at the plant of the Hazel Hill company.

WYTHEVILLE, VA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 30, for construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Wytheville. Drawings and specifications may be obtained at the above office or from the custodian of site at Wytheville. O. Wenderoth is supervising architect.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until Aug. 29 for furnishing the signal corps with one 2-kw radio set complete for installation on shipboard in accordance with specification No. 566. Motor to operate from 110 volts, direct current. Major W. L. Clarke is disbursing officer.

WASHINGTON, D. C.—An American consul writes that a city in the Levant is to install an electric-light system. The street-lighting system will consist of 500 lamps, of which 200 are to be 50 cp, 150 of 32 cp, and 150 of 16 cp. For further information address No. 11,497, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., Aug. 28 for furnishing 35,000 ft. of cable type 55, in accordance with specifications 431-D, 554-B, to be delivered, in one length coiled, on the Signal Corps cable boat *Joseph Henry* in New York Harbor. Major W. L. Clarke is disbursing officer.

WASHINGTON, D. C.—An American consular officer reports that a business man in his district is prepared to receive propositions for electrical supplies from interested firms in the United States. He confines himself to electrical work exclusively, having under way several contracts among which are the installation of an electrical equipment for a wharf, railroad station, docks, telephone service, etc. He also proposes soon to organize an electrical supply and construction company in the city in which he is located. For further information address No. 11,448, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 2, for furnishing at the various navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 5758—Miscellaneous ¼-hp multopolar, portable ventilating seats, etc.; one indicating temperature system complete for refrigerator room for U. S. S. *New York*; Schedule 5750—Switchboards for use in operating 35-hp motors. Washington, D. C., Schedule 5746—One automobile ambulance for Naval Hospital, Washington, D. C. Bids will also be received at the same place until Sept. 9 as follows: Mare Island, Cal., Schedule 5741—48,000 lb. electrolyte. Bids will also be received until Sept. 23 for furnishing at Pearl Harbor, Hawaii, the following supplies: Schedule 5733—Miscellaneous lead-covered, paper-insullated cable, miscellaneous lead-covered, rubber-insulated cable, 34,000 ft. fiber conduit, etc., miscellaneous vitrified clay duct in 24-in. and 36-in. lengths, miscellaneous recording watt-hour meters and miscellaneous 60-cycle, 220-volt oil-cooled transformers. Applications for proposals should designate the schedule desired by number. T. J. Cowie is paymaster general, U. S. N.

## North Central

CADILLAC, MICH.—Plans have been prepared for the construction of a new power plant for the Cummer-Diggers Co., to cost from $40,000 to $60,000.

MANISTIQUE, MICH.—The Manistique & Marquette Lt. & Pwr. Co. expects soon to purchase one 200-kw motor-generator set with switchboard to furnish power for street-railway service. Edward Daniell is general manager.

NILES, MICH.—Plans are being considered for the installation of an ornamental street-lighting system in the business district. It is proposed to replace the present arc lamps with tungsten-lamp clusters. The cost of the installation will be paid by the business men.

PETOSKEY, MICH.—Within the next three months the managers of the municipal electric-light plant expect to purchase two Jones underfeed stokers and coal and ash-handling machinery. J. W. Lovelace is manager.

READING, MICH.—The managers of the municipal electric-light plant will erect a new boiler room and coal shed and install two 72-in. by 18-ft. high-pressure horizontal tubular boilers. B. K. Goodman is chief engineer.

REED CITY, MICH.—The Osceola Lt. & Pwr. Co., of Reed City, expects to build a steam auxiliary steam plant and to purchase one 75-kw and one 120-kw, three-phase, 60-cycle generator, one 150-hp engine and one boiler for same. The company was granted a 30-year franchise on Aug. 4. B. J. Stall is secretary and treasurer.

ST. CLAIR, MICH.—The Board of Public Works is contemplating the purchase of recording meters and the erection of a distribution line 1 mile out of the city, using No. 6 wire. The city has just completed the erection of ornamental lamp posts for lighting the park and may erect more ornamental posts this season. W. M. Barron is superintendent.

SAULT STE. MARIE, MICH.—The application of the Edison-Sault El. Co., of Sault Ste. Marie, for the construction of an addition to its power house and for the installation of additional generating machinery has been approved by the War Department. The plans provide for a 58-ft. extension to the present building, the installation of two additional generating units and an exciter unit, together with an entrance for a railroad track from a siding to be put in by the government.

CANTON, OHIO.—Plans are being prepared by Service Director Herbert for lighting the Waterworks Park by electricity. It is proposed to generate electricity at the central pumping station in the park to maintain the lamps.

ORRVILLE, OHIO.—The installation of a municipal electric-light plant, to cost $40,000, is under consideration by the City Council. The proposition to issue bonds for same will be submitted to the voters on Aug. 26. Frank B. Rae, Engineers' Building, Cleveland, is engineer.

TOLEDO, OHIO.—The Willys-Overland Co., of Toledo, it is reported is planning to install a small motor generator set in its plant.

YOUNGSTOWN, OHIO.—The City Council has passed an ordinance granting Michael Liebel, Jr., for the Youngstown Steam Htg. Co., a franchise to furnish energy for lighting in Youngstown.

BARDSTOWN, KY.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 17, for construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches, of the United States post office at Bardstown, Ky. Drawings and specifications may be obtained from the custodian of site or from the above office. O. Wenderoth is supervising architect.

HOPKINSVILLE, KY.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 29 for construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches, of the United States post office at Hopkinsville. Drawings and specifications may be obtained at the above office or from the custodian of site at Hopkinsville. O. Wenderoth is supervising architect.

LOUISVILLE, KY.—Bids will be received by the Commissioner of Fisheries, Washington, D. C., until Sept. 1 for the installation of two electrically driven pumps to be installed at a fish hatchery now being established at Louisville.

OLIVE HILL, KY.—The installation of an electric-light system and ice plant in Olive Hill is reported to be under consideration. Charles Gray and Walter Rankin, of Portsmouth, Ohio, are reported to be interested in the project.

ROCHESTER, IND.—The Rochester El. Lt., Ht. & Pwr. Co. is installing a 375-kva turbine and switchboard, and is erecting a 12-mile transmission line to Argos. The company expects to purchase within the next six months two boilers with a rating of from 200 to 300 hp each, to be equipped complete with stokers and probably coal-handling machinery. C. A. Davis is operating manager.

CHICAGO, ILL.—Bids will be received by John McGillen, clerk of the Sanitary District of Chicago, 900-910 South Michigan Avenue, Chicago, until Aug. 28 for furnishing the following apparatus: Division A—Round-pattern manhole frames and covers; division 2—Alternating-current synchronous condensing apparatus. All bids must be made upon blank forms of proposals furnished by the Sanitary District of Chicago, which may be obtained at the above office. Thomas A. Smyth, is president of board of trustees.

FARMINGTON, ILL.—The city of Farmington would like to receive estimates on the following apparatus: (1) One single-acting, triple geared pump with a capacity of 150 gal. per minute against a head of 60 lb. per sq. in., geared to a suitable size, three-phase, 60-cycle motor to operate at either 220 volts or 2200 volts, and the necessary starting [illegible] electric motor driven centrifugal pump for fire purposes

have sufficient capacity to pump water for three lines of 2½-in. fire e with 1-in. nozzle at a pressure of not more than 75 lb. per sq. in. timates to include motor and starting devices); also one 35-hp motor, ting apparatus, jack-shaft, pulleys and bearings, but no belting, suit- e to drive an air-compressor, belt wheel of which is 44 in. in diam- with 9-in. face and runs at 140 r.p.m. J. C. Findley is city clerk.

HARVARD, ILL.—The City Council has closed a contract with the nois Northern Utilities Co., of Chicago, for lighting the streets of city for a period of 10 years. The contract calls for 115 lamps he residence district, 15 arc lamps and 42 ornamental lamp standards the business district. The property owners are to pay for the in- lation of the ornamental standards, the city paying for energy and lamp renewals. The city has also signed a five-year contract with company for 90 hp in motors to be installed in pumping station.

AU CLAIRE, WIS.—Bids will be received by John C. Fennessey, clerk, until Sept. 2 for lighting the city by gas and electricity, cifications for which may be obtained at the office of the city clerk.

ILWAUKEE, WIS.—A resolution favoring the installation of an amental street-lighting system on West Water Street between Grand enue and State Street and on Second Street between Grand Avenue West Water Streets has been adopted by the West Water Street siness Men's Association. Ornamental iron pedestals carrying flaming lamps will be used. Ninety-seven lamps will be erected on West ter Street and 23 lamps on Second Street. Contract for installing system will be awarded to the Commonwealth Pwr. Co.

PRAIRIE DU CHIEN, WIS.—The electric plant of the Prairie City Co. was recently destroyed by fire, causing a loss of about $8,000.

ANNANDALE, MINN.—The Annandale El. Lt. & Pwr. Co. expects purchase some incandescent lamps within the next two months. G. G. ver is manager.

BELLE PLAINE, MINN.—The Northern Pwr. Co. expects to erect in the next three months two series street-lighting circuits, one at zatta, and the other at Deephaven, Lake Minnetonka, and to chase within the next four months one 150-kva, three-phase, 60-cycle, 0-volt alternator (star-connected) for the Excelsior plant; one 80-hp ilar boiler for the Belle Plaine plant; three distributing panels for 0 volts with instruments for the Excelsior plant; one generator panel one distributing panel for Belle Plaine; one tub transformer, one es street-lamp regulator, series street tungsten lamps and equipment. L. Rauchwarter is treasurer.

DULUTH, MINN.—Bids will be received by the Great Northern Pwr. of Duluth, Minn., until Sept. 16, for the construction of a storage on the Cloquet River, about 20 miles north of Duluth. Plans, ifications, contracts, forms of proposal and further information may obtained from Gardner S. Williams, consulting engineer, Cornwell ding, Ann Arbor, Mich.

FOLEY, MINN—The Foley El. Lt. & Pwr. Co. expects to purchase in the next year one engine (crude-oil type), directly connected to a w, 220-volt direct-current generator, with one direct-current generator tchboard panel complete and line material for extending present dis- ution system. Harmon E. Becker is president and general manager.

GRANITE FALLS, MINN.—The city of Granite Falls has entered into ntract with the village of Wood Lake to furnish energy to operate proposed electric-light system to be installed there from the munic- electric light plant in Granite Falls. C. Dickerson is superintendent the municipal electric plant.

HELLIHER, MINN.—The managers of the municipal electric-light nt expect to purchase within the next three months a new boiler C. I. Kobe is village recorder.

KYLE, MINN.—Extensive improvements are contemplated to the local tric-light plant next summer, including the erection of a new power se. The purchase of an oil engine and poles is also contemplated. M. Fortune is manager.

MINNEAPOLIS, MINN.—Bids will be received by George H. Hayes, comptroller of the University of Minnesota, Minneapolis, Minn., until Sept. 8 for the construction of the Educational Building, University of Minnesota, including general contract work, heating and ventilating, plumbing and electrical work in accordance with plans and specifications furnished by C. H. Johnston, architect, 715 Capital Bank Building, Minneapolis. Bids will be received collectively and separately. Copies of the above may be seen at the Builders' Exchange at St. Paul and Minneapolis, at the office of George H. Hayes, comptroller of University of Minnesota, Minneapolis, and at the office of the State Board of Control, State Capitol Building, St. Paul.

ST. ANTHONY PARK, MINN.—Bids will be received by the State Board of Control, State Capitol Building, St. Paul, until Sept. 2 for construction of the Home Economics Building, University of Minnesota, St. Anthony Park, including general contract work, heating and ventilating, plumbing and electrical work and fixtures, in accordance with plans and specifications furnished by C. H. Johnston, architect, 715 Capital Bank Building, St. Paul. Bids will be received collectively and separately. Copies of plans and specifications may be seen at the Builders' Exchange in St. Paul and Minneapolis, at the office of the Dean of the University Farm, St. Anthony Park, and at the office of the State Board of Control, State Capitol Building, St. Paul.

ATLANTIC, IA.—The purchase of two 30-kva transformers for the municipal electric-light plant is contemplated. T. E. Nichols is manager

BURT, IA.—Steps have been taken toward the installation of an electric-light plant in Burt. The Town Council is said to have donated a site for the proposed plant.

DES MOINES, IA.—The Des Moines El. Co. has applied for a franchise in the village of Valley Junction, and if granted the company will extend its lines to that village, purchasing the present system. W. H. Thomson, Jr., is general manager.

FONTANELLE, IA.—Bids will be received by H. J. Stuhlmiller, town clerk, Fontanelle, Ia., until Sept. 3 for furnishing material and construction of substation, overhead distribution system and a transmission line between Fontanelle and Greenfield, 5 1-6 miles in length, and for furnishing meters, transformers, lamps, etc. J. B. Hill, of Iowa City, Ia., is engineer; C. A. Baker is mayor.

FORT MADISON, IA.—At an election held recently the Fort Madison El. Co., controlled by the Stone & Webster Corpn., of Boston, Mass., was granted a 25-year franchise to furnish electricity for lamps and motors in Fort Madison. The company, it is said, will begin work immediately on extensive improvements to the plant.

MONTICELLO, IA.—The capital stock of the Monticello El. Co. has been increased from $48,000 to $60,000.

MOUNT VERNON, IA.—The Wapsie Pwr. & Lt. Co., of Mount Vernon, expects to erect within the next six months a 33,000-volt, three-phase transmission line to Clarence and Lowden (14 miles long), and to purchase within the next six or eight months a five-panel switchboard, one 23,000-volt oil switch and low-tension circuit-breaker, and within the next six months one aluminum-cell arrester (33,000 volts). Kenneth Lindsay is manager.

NEVADA, IA.—The Nevada El. Co. has placed orders for a 150-kva three-phase, 60-cycle alternating-current Westinghouse generator, one 200-hp Bates Corliss engine (heavy duty) and new switchboard fully equipped, including Tirrill voltage regulator, to be installed about Sept. 15. The company also expects to purchase within the next two months one open heater, from 1500 ft. to 2000 ft. of safety cable for electrolier system and 50 five-lamp standards for curb-lighting system.

CAINSVILLE, MO.—The Missouri El. Gas & Wtr. Co, of Cainsville, expects to erect within the next two months ½ mile of distribution line and to purchase within the next three months one new engine, one alternating-current generator and one rotary converter, and also miscellaneous electrical appliances and devices. L. J. Beauregard is superintendent.

CHAFFEE, MO.—At an election held recently the citizens authorized the City Council to enter into a five-year contract with J. J. Astor for street-lighting, provided the said contract is turned over to the Missouri Public Utility Co., of Cape Girardeau, which has agreed to purchase the Astor plant and improve the service. A. M. Tinsley, of Cape Girardeau, is manager of the company.

DEXTER, MO.—Benjamin F. Eicholtz, owner of the local electric-light plant, expects to purchase within the next 30 days one 125-kw, three-phase, 60-cycle, 2300-volt, 600 to 900 r.p.m. generator (belted), complete switchboard for one 75-kw and one 125-kw generator and outgoing lines.

PURCELL, MO.—At an election held recently the proposition to grant a franchise to a company (represented by A. M. Baird, of Cartersville) to construct and operate an electric-light plant in Purcell was carried.

RUSSELLVILLE, MO.—Petitions have been presented to the City Council, asking that an election be called to submit the proposition to establish a municipal electric-light plant in Russellville to a vote.

MOHALL, N. D.—Application has been made to the City Council by George H. Todd, of Minot, for the installation of an electric-light plant in Mohall. The cost of the proposed plant is estimated at $8,000.

RULO, NEB.—Plans are being prepared for the installation of a municipal electric-light plant, for which bonds to the amount of $20,000 have been voted. C. I. Stocking, of Hiawatha, Kan., is engineer.

YORK, NEB.—The Continental Gas & El. Co., of York, expects to rebuild its distribution system, changing the system from direct current to alternating current, within the next three months; also to purchase one 250-hp boiler, equipped with automatic stokers, one 300-kw and one 200-kw generator directly connected to cross-compound Corliss engine, complete alternating-current switchboard and generator feeder panel, and two circuits for series street-lighting system. James B. Harvey is general manager.

CANEY, KAN.—The Caney El. Lt. & Pwr. Co. expects to purchase within the next two months one 75-kva, 2200-volt, 60-cycle, three-phase generators, voltmeters and ammeters, poles, cross-arms and wire to rebuild the entire distribution system. The company is now installing a 120-hp Miller gas engine. O. C. Lindsley is manager.

ESBON, KAN.—Plans are being prepared for a municipal electric-light plant and water-works system in Esbon. Henrici, Kent & Lowry, 1526 Grand Avenue, Kansas City, Mo., are consulting engineers.

FORT LEAVENWORTH, KAN.—Bids will be received at the office of the constructing quartermaster until Sept. 5 for construction, including plumbing, heating, wiring and fixtures, of schoolhouse at this post. Blank forms of proposals furnished upon application. Plans, etc., may be seen at Fort Leavenworth and at office of quartermaster, Scarritt Arcade, Kansas City, Mo. Major G. G. Bailey is constructing quartermaster

MEVERN, KAN.—At a special election held recently the proposition to issue $8,000 in bonds for the purpose of erecting an electrical distributing system was carried. Energy for operating the system will be obtained from Lyndon, 10 miles distant.

ST. GEORGE, KAN.—A company has been organized in St. George for the purpose of furnishing electrical service here and in Zeandale, about 2 miles distant. The company proposes to erect a transmission line to the power plant of the Manhattan City & Interurban Ry. Co. at Rocky Ford to secure energy for distribution in the two towns and to farmers along the line.

TOPEKA, KAN.—The State Board of Control has authorized the installation of electric wiring and lamps at the State Soldiers' Home at Dodge City, the Mother Bickerdyke annex at Ellsworth and the Soldiers' Home at Atchison. Electric fans will be installed in the hospital at the Soldiers' Home.

WELLSVILLE, KAN.—The City Council is considering the question of purchasing the local electric-light plant, owned by E. T. Pendleton and J. H. Hay. If the plant is taken over it is proposed to extend the distribution system into the residence section of the city.

## Southern States

NEWBERN, N. C.—The Board of Aldermen has voted to purchase a new arc-lamp machine for the municipal electric-light plant, at a cost of about $3,500. Bids will soon be asked for the machine and also for an electrically driven pump. The new machine will have sufficient output to maintain 100 arc lamps and a number of incandescent lamps. H. H. Hodges is superintendent of the water and light plant.

McDONOUGH, GA.—J. C. McDonough, owner of the local electric-light plant, expects to purchase within the next three months a street-lighting system complete; also pipe insulation for entire plant.

STATESBORO, GA.—The managers of the municipal electric-light plant and water-works system expect to purchase within the next four months one 150-hp return tubular boiler (150 lb. working pressure). Daniel L. Gould is superintendent.

TALLAPOOSA, GA.—At an election to be held Sept. 13 the proposition to issue bonds to provide funds for the installation of an additional generating unit and for extension to distribution system will be submitted to the voters.

WHIGHAM, GA.—The installation of a municipal electric-light plant is under consideration, for which, it is understood, bonds have been voted.

TARPON SPRINGS, FLA.—The Southern Utilities Corpn., Heard National Bank Building, Jacksonville, it is reported, will make improvements to its local electric plant, involving an expenditure of about $25,000.

TULLAHOMA, TENN.—The Tennessee Utilities Co., recently incorporated, expects to build a hydroelectric plant on the Elk River in Franklin County. The capital stock is placed at $25,000, which will be increased for the purpose of development. The present plans provide for a development of 20,000 hp. G. M. Whitson is president and L. E. Womack is secretary, both of Tullahoma.

WHITEVILLE, TENN.—Plans are being considered by Henry Rhodes, of Whiteville, for the installation of an electric-light plant. The proposed plant will furnish energy for street-lighting and for power purposes.

BIRMINGHAM, ALA.—The Birmingham Ry., Lt. & Pwr. Co., it is reported, has entered into a contract with the Alabama Trac., Lt. & Pwr. Co., of Talladega, for hydroelectric power generated at the power plant on the Coosa River at Lock 12, near Birmingham. The contract calls for a minimum supply to the amount of $367,500 per year. The Alabama company has also contracted to furnish energy to two cement plants and other customers, guaranteeing an additional revenue of $200,000 annually.

OPELIKA, ALA.—The city of Opelika expects to purchase within the next six months one 150-kva generator and a Ball engine to drive same. Charles Schaefer is superintendent of light and water plant.

NEW ORLEANS, LA.—The Orleans-Kenner El. Ry. Co., of New Orleans, has announced that all options on terminal property have been obtained and that work will soon begin on construction of the proposed railway which is to extend from a terminal station on University Place to the towns of Shrewsbury, Harahan, Kenner and Hanson City, a distance of from 15 to 20 miles. The cost of the project is estimated at from $500,000 to $700,000. A. Smith Bowman is president and E. F. Ullmer is secretary and treasurer.

WELSH, LA.—At an election to be held Sept. 9 the proposition to issue bonds for the installation of a municipal electric-light plant will be submitted to the voters. L. A. Robinson is chairman of light committee.

MEDFORD, OKLA.—The municipal electric-light plant was destroyed by fire on Aug. 12, causing a loss of about $48,000. The plant, it is understood, will be rebuilt at once. At present the town is without electrical service.

HOUSTON HEIGHTS, TEX.—Plans are being considered by the citizens of Houston Heights for the installation of a municipal electric-light and water-works system.

## Pacific States

EATONVILLE, WASH.—At an election held recently the proposition to construct a municipal electric-light plant was carried. The proposed plant is to be located on Lynch Creek, near Eatonville.

STEVENSON, WASH.—A final water-power permit has been granted by Acting Secretary of Agriculture Galloway to E. P. Ash and Samuel Samson, of Stevenson, the power to be used in logging operations in the vicinity of Wind River. The water-power project is located on national forest land of the Columbia Forest, about 30 miles northeast of Stevenson. By means of a timber dam about 10 ft. in height water will be diverted into a wood-stave pipe 4 ft. in diameter, in which it will be carried about 1 mile to the power plant, which will be equipped with one 750-kw generator directly connected to a Pelton waterwheel.

WINLOCK, WASH.—The Veness Lumber Co. is contemplating the construction of a 1000-hp electric power plant in Winlock, for which, it is said, plans are practically completed. About 200 hp will be used by the company to operate the machinery in its plant and the remainder will be sold to the Independent El. Co.

ALBANY, ORE.—Plans have been approved by the City Council for the erection of a cluster-lamp lighting system on several streets of the city.

BAKER, ORE.—Plans and specifications for the proposed municipal electric-light plant which is to be built near here have been submitted to the City Commissioners, and if same are approved, bids for construction of plant and erection of transmission lines, etc., will soon be asked.

SALEM, ORE.—In accordance with an act of the last Legislature a committee consisting of State Engineer Lewis and four others has been appointed to make an investigation of the practicability of developing hydroelectric power at Cello Rapids for distribution by the State. An appropriation of $15,000 was made by the Legislature to carry on the work.

BODIE, CAL.—The Pacific Pwr. Co., of Bodie, expects to erect within the next three months 70 miles of high-tension transmission line (55,000 volts) connecting the plant of the Pacific Pwr. Co. with the plants of the Nevada-California Pwr. Co., located on Bishop Creek, Inyo County. W. N. Chatfield is manager.

CALISTOGA, CAL.—The Calistoga El. Co. contemplates the purchase of circuit-breakers, meters, lamps and some electrical appliances and supplies. C. W. Crouch is secretary and manager.

CORONA, CAL.—Within the next 30 days the Corona Gas & El. Co. expects to rebuild its series incandescent street-lighting system. C. C. Barlett is superintendent.

CORONA, CAL.—The Southern Sierras Pwr. Co., of San Bernardino, expects to extend within the next 30 days its 33,000-volt distribution lines into the territory south of Corona to gain a pumping load.

NAPA, CAL.—The Legislature has passed a bill appropriating $15,300 for rewiring (electrical) of building and conduits at the Napa State Hospital.

OCEANSIDE, CAL.—The Oceanside El. & Gas Co. has recently erected a 6600-volt transmission line (8 miles long) into the San Luis Rey Valley to furnish energy for lamps and motors in that district, and has also just installed a 72-in. by 16-ft. Pennsylvania overhead suspension boiler. Eugene V. Griffes is manager.

SAN DIEGO, CAL.—The State Railroad Commission has granted the San Diego Consol. Gas & El. Co. authority to issue $102,000 in bonds.

SANTA CRUZ, CAL.—The city of Santa Cruz expects to install within the next three months through the Coast Counties Gas & El. Co., of Santa Cruz, 50 additional luminous-arc lamps and to erect from 10 miles to 15 miles of line, which will give the city 200 4-amp luminous-arc lamps, the arc-lamp circuit covering about 50 miles throughout the city. Within the next 30 days the city expects to purchase an auxiliary sewage pumping plant, consisting of one 40-hp motor directly connected to a No. 6 open-runner sewage pump, to be used in emergency cases. J. C. Geyer is superintendent of electrical department.

TORRANCE, CAL.—The Torrance Wtr., Lt. & Pwr. Co. has received authority from the State Railroad Commission to issue bonds to the amount of $115,000 and $34,000 in capital stock.

VISALIA, CAL.—The Board of Trustees has entered into a contract with the Mount Whitney Pwr. & El. Co., of Visalia, for street-lighting for a period of five years. The contract provides for 80 luminous arc lamps at $72 each per year. The new system is to be installed by Nov. 1. V. M. Maddock is vice-president.

KOOSKIA, IDAHO.—The Kooskia Milling & Pwr. Co. is erecting a transmission line to Stites, which will be completed in about 30 days for which all material has been purchased. The company expects to purchase in the near future a waterwheel governor for a 40-in. Sampson turbine. E. J. Hartman is manager.

SAND POINT, IDAHO.—The Northern Idaho & Montana Pwr. Co., of Sand Point, expects to purchase within the next 30 days one 100-kw induction motor-generator set to operate the street-railway system, which heretofore has been operated by a 55-kw outfit. George N. Rooker is manager.

SHOSHONE, IDAHO.—The substation of the Great Shoshone & Twin Falls Lt. & Pwr. Co. in Shoshone was recently destroyed by fire. It is understood that the plant will be rebuilt at once. The main office of the company is located in Twin Falls.

BOUNTIFUL, UTAH.—The Utah Lt. & Ry. Co., of Salt Lake City, is planning to build a power plant at Bountiful to furnish energy to operate the extension of its street-railway system.

PARK CITY, UTAH.—The City Council has granted Lewis A. Jeffs a franchise to construct and operate an electric-light and power plant in Park City for a period of 25 years.

FLAGSTAFF, ARIZ.—The Board of Trustees of the Flagstaff Normal School has awarded the contract for the installation of a complete light, water and heating plant for the school to F. A. Slattery, of Flagstaff, for $34,226. The contract for construction of power house was awarded to Joseph Slosser, of Phoenix, for $4,700.

KINGMAN, ARIZ.—The Desert Wtr. & Pwr. Co., of Kingman, expects to erect next month extensions to its high-tension power lines in the Gold Road and Kingman districts, including the installation of three additional 250-kva Wagner transformers and auxiliaries at Gold Run. Duplex copper-clad wire will be used for that portion of the 45,000-volt line crossing the Gold Road Camp.

DENVER, COL.—Estimates have been submitted by J. J. Abbott, a civil engineer associated with J. I. Carper, of Denver, in what is known as the Fraser Sources Irrigation & Pwr. Co., of the cost of diverting the water from Fraser River and its tributaries in Grand County for domestic and power purposes in Denver. The cost of construction of canal, conduit and reservoir, exclusive of distribution system, is estimated at $3,250,000. The project calls for the construction of collecting canals on each side of the Fraser River, making a junction near the west portal of the proposed Moffat tunnel, costing about $400,000; also the construction of a storage reservoir at the eastern portal of the tunnel at a cost of $1,500,000. The project also includes 200 second-ft. of water dropping down an incline of 4400 ft., which it is estimated will develop 130,000 hp.

PLATTEVILLE, COL.—The Village Board is considering the question of installing an electric-lighting system in Platteville. A proposition has been submitted to the board by the Northern Colorado Pwr. Co., of Boulder.

ELKO, NEV.—Water rights have been secured by California capitalists on the South Fork stream above the Clayton ranch in Elko for the purpose of constructing a hydroelectric power plant. It is estimated that 10,000 hp can be developed and the initial unit installed will be from 3000 hp to 5000 hp. Energy developed at the plant will be transmitted to mining camps at Bullion, Round Mountain and Ely, which will receive the larger portion. Investigations have been made by Leon O. Hall, Kohl Building, San Francisco, consulting engineer.

## Canada

INNISFALL, ALTA.—A by-law will be submitted to the ratepayers on Aug. 26 authorizing an expenditure of $6,000 to complete the municipal electric-light plant.

ROGERS PASS, B. C.—Work will soon begin on the construction of the Rogers Pass tunnel, contract for which has been awarded to Foley, Welch & Stewart, of Vancouver. New equipment required to carry out this contract will represent an investment of about $500,000. Separate steam plants will be used on each end of the tunnel.

VANCOUVER, B. C.—The Western Canada Pwr. Co., Carter Cotton Building, Hastings Street, Vancouver, expects to erect within the next 12 months an extension to its present hydroelectric station at Stave Falls, B. C., to provide space for two additional 9000-kw units, making a total of four 9000-kw units. The company also expects to purchase within the next 12 months two 13,000-hp turbines and two 9000-kw, three-phase generators, orders for which have been placed with Escher, Wyss & Co. Contracts have been placed with the Canadian General El. Co. for turbines, for generators and eight 3000-kva, 60,000-volt transformers, and with the Canadian Westinghouse Co. for additional switchboard equipment. R. F. Hayward is general manager.

ERINDALE, ONT.—The Erindale Pwr. Co. has made application to the Toronto Township asking its consent to the raising $50,000 of mortgage on its property. The dam which was carried away by the flood two years ago has not been completely replaced. The company, which has an output of between 400 and 500 hp, will be able to increase its generating capacity of the plant by 500 hp upon completion of the dam. A meeting of the bondholders will be held on Aug. 29 to authorize the company to issue $10,000 in bonds for working capital and general purposes.

FERGUS, ONT.—The Hydro-Electric Power Commission has submitted an estimate to furnish energy in Fergus and Elora.

HAMILTON, ONT.—Tenders will be received by John Allan, Mayor, Chairman Hydro-Electric Board, care of city clerk, Hamilton, until Aug. 26 for the installation of a joint underground conduit system for the Hamilton Hydro-Electric system, the Dominion Pwr. Co., the Transmission Co. and the telegraph companies. Plans and specifications can be seen at the office of E. I. Sifton, consulting engineer of the Hydro-Electric Department, where form of tender, specifications and other information can be obtained.

ORILLIA, ONT.—The town of Orillia has petitioned the Ontario Government to assist the town in connection with its power plant. The work being done by the Canadian government on the Georgian Bay canal has rendered it necessary to remove the present power plant 1½ miles farther up the rapids of the river. The Canadian government has consented to erect a new power house and dam at a cost of $25,000, and the Ontario government is being asked to assist the town to secure a right-of-way for its new pole line and to contribute something toward the installation of new machinery made necessary by moving the plant.

SMITH FALLS, ONT.—The Smith Falls El. Pwr. Co. expects to erect within the next three months about 5 miles of new lines for a new three-phase, 60-cycle system to be installed next month and to install within the two months one 275-kw Westinghouse three-phase, 60-cycle, 2220-volt generator; also to purchase within the next two months a hot-water heater having a rating of 350 hp for a 500-hp Goldie & McCullough high-speed auxiliary unit and switchboard apparatus for handling the new generator; also to purchase 200 60-cycle, 5-amp and 10-amp ammeters and to erect about twenty 5-kva and 10-kva transformers within the next four months, and to install from six to twelve new arc lamps. George B. Frost is general manager.

WATFORD, ONT.—The Town Council is considering the installation of a lighting system, energy to maintain same to be supplied by the Hydro-Electric Power Commission of Ontario.

MONTREAL, QUE.—Tenders have been asked for the installation of the second portion of the underground conduit on Catherine Street—from Craig Street to Pine Avenue and between Atwater Avenue and Guy Street.

## Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Sept. 10 for transformers, switchboard, wire and cable, conduit, panelboards and miscellaneous electrical apparatus. Blanks and general information relating to this circular (No. 789) may be obtained at the above office or at the office of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whiney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

# New Incorporations

CHICAGO, ILL.—The Interocean Lt. & Pwr. Co. has been incorporated with a capital stock of $50,000 by Herman H. Kohlsaat, Samuel S. Sherman and D. W. Beardsley. The company proposes to generate and distribute light, heat and power, etc.

OLYMPIAN SPRINGS, KY.—The Olympian Springs Ry., Pwr. & Lt. Co. has been incorporated to construct and operate an electric railway between Olympian Springs and Olympia, a distance of 4 miles. S. F. Crecilius, of Louisville, engineer, has already begun a survey for the proposed railway. J. D. Wilson, of Greensburg, is president. Post Office address Olympian Springs, R. F. D. from Elixir Springs.

PIKEVILLE, KY.—The Sandy Valley Lt. & Pwr. Co. has been incorporated with a capital stock of $20,000 by John M. Hopkins, James G. Serey and L. S. Wilson.

WILLIAMSTOWN, MASS.—The New England General Utilities Co. has been incorporated with a capital stock of $1,000 and the following named officers: H. S. Dickinson, president, and Minnie E. Sherman, treasurer.

SAULT STE. MARIE, MICH.—The Michigan Northern Pwr. Co. has filed articles of incorporation with a capital stock of $3,000,000. The incorporators are: W. D. Gregory, R. L. Benson, E. J. H. Wright, G. H. Moore and A. F. Bordwell, all of Chicago, Ill. The company will maintain watercourses in Chippewa County, in the township of Sault Ste. Marie and within the city limits, and will supply energy for manufacturing purposes.

DULUTH, MINN.—The St. Louis Pwr. Co. has filed articles of incorporation with the Secretary of State with a capital stock of $1,000,000. The company proposes to generate electricity by steam or water-power and distribution of same for lamps, heaters and motors within the State of Minnesota. The incorporators are: J. B. Crane, A. G. Gillette, J. A. Sinclair and Harry Carmichael, all of Duluth.

RICH SQUARE, N. C.—The Rich Square El. Co. has been incorporated with a capital stock of $50,000 to furnish electrical energy to light the town. The incorporators are: M. Bolton, J. T. Bolton, R. B. Boyce and others.

WELLINGTON, TEX.—The Wellington Pwr. & Lt. Co. has been incorporated with a capital stock of $10,000 by D. E. Goodwin, J. S. Goodwin and R. E. Elison.

OLYMPIA, WASH.—The Washington Public Service Co. has been incorporated with a capital stock of $1,500,000 to operate electric railways, etc. The incorporators are: Millard Lemon, W. B. Foshay and others.

MONTGOMERY, W. VA.—The Montgomery Utilities Co. has been chartered with a capital stock of $50,000 for the purpose of operating water-power, electric and gas plants. The incorporators are: J. S. Lilly, Wesley Wilkes, of Beckley, W. Va.; A. A. Lilly, J. E. Brown and A. H. Curry, of Charleston, W. Va.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED AUG. 12, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York]

1,069,679. ELECTRIC WATER HEATER; H. De Wallace, Syracuse, N. Y., App. filed Sept. 18, 1912. Plurality of electric coils disposed in separate compartments of a common boiler, each surrounded by water and controlled independently.

1,069,695. VAPOR-ELECTRIC APPARATUS; P. C. Hewitt, New York, N. Y. App. filed May 13, 1904. Plurality of negative electrodes and a common positive electrode and a separate work circuit connected with each negative electrode.

1,069,696. STARTING DEVICE FOR VAPOR APPARATUS; P. C. Hewitt, New York, N. Y. App. filed June 4, 1904. The high-potential impulse from a choke-coil starts one of two vapor lamps when the other one goes out.

1,069,697. ELECTRODE HOLDER; G. Hills, Westfield, N. J. App. filed Nov. 26, 1912. Hand-operated clamp for holding an electrode for like purposes.

1,069,707. ARRANGEMENT OF INCANDESCENT FILAMENTS IN ELECTRIC METAL-FILAMENT LAMPS; O. Krause, Berlin, Germany. App. filed Jan. 10, 1910. Two concentrically disposed circles of longitudinally extending filaments.

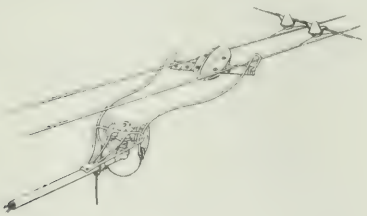
1,069,709. ELECTROMAGNETIC RECIPROCATING MOTOR; A. Le Blanc, New York, N. Y. App. filed May 18, 1909. Has a number of isolated solenoids with a corresponding number of isolated core pieces, the solenoids being energized all at once.

1,069,777. SWITCH BOX; W. O. Fowler, Wenatchee, Wash. App. filed June 7, 1911. The switch mounting arms are adjustable upon the box to bring the switch flush with the plaster.

1,069,780. DISTRIBUTION SYSTEM; J. H. Hall, Cleveland, Ohio. App. filed Oct. 2, 1911. All the motors in a system are caused to slow down quickly after the opening of a circuit-breaker and indication is given to switchboard attendant that motors have stopped.

1,069,782. ELECTRIC INSULATOR; J. D. Hilliard, Albany, N. Y. App. filed Aug. 11, 1908. For high-tension lines; has a nest of insulator shells detachably held one within another by cement with an embedded wire coil for breaking the cement.

1,069,791. STORAGE CELL; A. C. Krueger, Milwaukee, Wis. App. filed Aug. 1, 1912. Uses antimony electrodes with a saturated hydrochloride acid solution of compounds of antimony and chlorine as the electrolyte.



1,069,887.—Pole System.

1,069,800. HANGER FOR TROLLEY WIRES; W. A. McCallum, Cincinnati, Ohio. App. filed May 19, 1910. Tubular shank with clamp at its upper end engaging messenger cable and clamp at its lower end engaging trolley wire.

1,069,809. STORAGE BATTERY; W. A. Prince, Quincy, Mass. App. filed Feb. 4, 1913. Pasted-grid type; positive grid having two lugs at opposite corners and diagonally extending cross-ribs.

1,069,811. TELEPHONE APPARATUS FOR TRAINS; P. Robinson, Sudbury, Ontario, Canada. App. filed May 13, 1912. Reel on the train carrying supply of wire for temporary connection with telephone line adjacent to the track-way.

1,069,815. CIRCUIT-BREAKER; W. E. Sands, New York, N. Y. App. filed June 30, 1909. Movable member carrying the switch contacts; closely fits the side walls of an inclosing box so that switch is inclosed both in the open-circuit and closed-circuit conditions.

1,069,819. CABLE-END BELL; E. O. Sessions, Chicago, Ill. App. filed Oct. 20, 1910. Coupling and clamping members for excluding moisture and dissipating static electricity.

1,069,820. CABLE-END BELL; E. O. Sessions, Chicago, Ill. App. filed Feb. 9, 1912. The armor of the cable is mechanically and electrically connected to the shell of the end bell.

1,069,877. CONDUIT BOX; F. J. Hurst, Denver, Col. App. filed Oct. 13, 1911. Openings in conduit box are of size of largest conduits, and for smaller-sized conduits reduction plates are used.

1,069,887. POLE SYSTEM; J. Ledwinks, Philadelphia, Pa. App. filed Oct. 27, 1909. Sliding contact for trackless trolleys.

1,069,888. ELECTRICAL TESTING BATTERY; E. Marcuson, New York, N. Y. App. filed July 6, 1912. The unit-battery cells are provided with insulated envelopes containing an insulating oil.

1,069,899. MICROPHONE; G. A. Nussbaum, London, Eng. App. filed May 4, 1912. A compressible rubber ring surrounds the body of carbon granules to permit movement of the granules at right angles to the plane of the sound waves.

1,069,902. ARMATURE; R. H. Pyle, Indianapolis, Ind. App. filed Jan. 11, 1912. Longitudinal movement of the armature upon the shaft is prevented by clamps holding the laminated core.

1,069,922. ELECTROMAGNETIC RECEIVER; T. C. Coykendall, Kingston, N. Y. App. filed Oct. 17, 1907. Feeble current of electricity is received and indicated by an electrical unbalancing of coils.

1,069,924. ELECTRIC FURNACE; W. N. Crafts, Oberlin, Ohio. App. filed Dec. 4, 1911. Induction furnace for both and U-shaped passageway for molten metal, the bath portion being separable from the supporting body of the furnace.

1,069,938. SOCKET FOR INCANDESCENT ELECTRIC LAMPS; H. F. Goetz, Waterbury, Conn. App. filed Jan. 4, 1913. The screw shell is held in place by the clamping together of the two halves of the porcelain block.

1,069,949. APPARATUS FOR ELECTRICALLY HEATING WATER AIR OR OTHER MEDIUM BY MEANS OF A HEAT MAGAZINE; C. L. F. Hassler, Stockholm, Sweden. App. filed Dec 16, 1912. Heat-storage magazine distributing means and means for controlling the amount of heat to be stored and distributed.

1,069,981. METHOD OF RECOVERING COPPER FROM ITS ORES; E. Schaaf, St. Mary's, Mo., and S. G. Martin, Chicago, Ill. App. filed Aug. 27, 1909. Converts copper content of the ore to a solution, charges solution with gaseous peroxide of nitrogen and subjects solution to heat and pressure.

1,069,993. ELECTRICAL PURIFICATION APPARATUS; R. W. Amos, Paterson, N. J. App. filed Oct. 3, 1908. Electrical purification of sewage for killing germs and precipitating the material portions of the substance treated.

1,070,007. ALLOY; A. L. Brooke and R. D. Mackintosh, Mortlake, England. App. filed June 25, 1910. Produces an alloy of aluminum, nickel and magnesium.

1,070,017. ELECTRIC FURNACE; W. N. Crafts, Oberlin, Ohio. App. filed Dec. 4, 1911. Heats the contents by electric induction acting on a fused bath at the base of the shaft, heat from the bath rising in the shaft causing chemical reactions in the contents.

1,070,080. CAR-LIGHTING SYSTEM; H. G. Thompson, Glen Ridge, N. J. App. filed Aug. 22, 1908. Charging generator rendered imperative upon its functions being accomplished and resuming action independently of the speed at which the train is running.

1,070,099. ELECTRIC-LIGHTING SYSTEM; H. Baluss, Kennett Square, Pa. App. filed April 3, 1911. To prevent going out and fluctuation of the lights in a trolley car because of drops in current and to indicate drop in current so that car can be slowed down to accommodate condition of power.

1,070,102. ELECTRIC-CURRENT BRUSH STRUCTURE; A. E. Berdon, Lafayette, Ind. App. filed July 8, 1912. Inter-engaging links limit inward movement of spring-pressed brush-holder to prevent holder from engaging rotating element.

1,070,104. TELEPHONE SYSTEM; G. A. Betulander, Saltsjo-Nacka, Sweden. App. filed Nov. 22, 1910. To prevent loss of current by leakage.

1,070,130. RAILWAY SIGNALING SYSTEM; J. S. Hobson and L. F. Howard, Edgewood Park, Pa. App. filed Jan. 24, 1911. Trolley or third-rail divided into blocks by insulation.

1,070,151. INSULATOR; W. H. Martin, Ukiah, Cal. App. filed March 14, 1912. Vitreous blocks having meshing corrugations and ridges crimp the wire between them.

1,070,172. HANDLE OR BUTTON; J. G. Peterson, Hartford, Conn. App. filed Sept. 22, 1911. For snap switches and the like; the yoke which is molded into the handle is flexible, to contract and expand with the composition of which the handle is made.

1,070,289. TELEGRAPH APPARATUS; A. Rappenecker, Bremen, Germany. App. filed July 8, 1912. Copying apparatus with a ray of light acting as a receiver.

1,070,290. DEVELOPING APPARATUS FOR WRITING-TELEGRAPHS AND THE LIKE; A. Rappenecker, Bremen, Germany. App. filed July 8, 1912. Exposed portion of the receiving film is cut off by gearing operated from the transmitting station.

1,070,291. DEVICE FOR LOCKING DESK TELEPHONES; C. D. Rhinehart, Jr., and L. P. Saponoff, New York, N. Y. App. filed Jan 31, 1913. Two-part clamp with a concealed screw.

1,070,307. SWIVEL JOINT FOR ELECTRIC CONDUCTORS; C. Twining, Locust Point, N. J. App. filed June 29, 1912. Relatively rotatable cord terminals.

1,070,310. INDEX NEEDLE OR HAND FOR USE WITH ELECTRICAL MEASURING INSTRUMENTS; E. Weston, Newark, N. J. App. filed Nov. 9, 1909. Non-vibrating index needle comprising a plurality of diverging and converging spaced members.

1,070,311. INDEX NEEDLE OR HAND FOR USE WITH ELECTRICAL MEASURING INSTRUMENTS; E. Weston, Newark, N. J. App. filed Nov. 9, 1909. Has a balance cross with diverging members and converging members which are flattened together to constitute a pointer top.

1,070,337. ELECTRIC FURNACE; A. E. Greene, Chicago, Ill. App. filed Nov. 12, 1909. Maintains electric arcs in proximity to the material, draws out the arcs to obtain uniform heating, utilizes a gas to react with the material.

1,070,345. APPARATUS FOR OPERATING MERCURY-VAPOR LAMPS; F. H. Von Keller, New York, N. Y. App. filed Aug. 6, 1908. Starting switch and movable exhausted container with portions connected by U-shaped tube.

1,070,370. MULTIPLE NEEDLE HOLDER FOR ELECTROLYSIS; E. K. Willison, Chicago, Ill. App. filed Dec. 15, 1911. Adjustable support for carrying a plurality of needles, particularly instruments for the removal of superfluous hair by electrolysis.

1,070,371. SIGNALING SYSTEM; E. R. Gill, Yonkers, N. Y. App. filed July 27, 1908. Train-dispatching messages and independent messages are transmitted by different operators without interference over single-line wire, and train dispatcher at any time may take possession of the line.

1,070,376. MEANS FOR MEASURING OR CONTROLLING THE FREQUENCY OF WAVE-LENGTH OF ALTERNATING CURRENTS; G. Seibt, Schöneberg, Germany. App. filed Aug. 2, 1912. Movable part of the instrument is inductively acted upon by the fields of fixed coils acting in opposite directions.

13,605 (re-issue). ELECTRICAL CONNECTOR; R. H. Welles, Kenosha, Wis. App. filed April 19, 1913. (Original patent No. 1,054,80[illegible] March 4, 1913.) Detachable connection for small fixtures such as automobile lamps

# Electrical World

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**ogress in andescent Lamps**

Numerous papers read at recent conventions show how far the present metallic-filament lamps are in advnce of those produced only a few years ago. As our aders thoroughly appreciate, the great change has been the substitution of the drawn-wire filament for the older tered filament, a change which has practically at least ubled the strength of the filament so far as tests under nsverse load go. What is less well known, however, is very great improvement in both types of filament since beginning of their manufacture. The best sintered fila-nt is immensely stronger than that produced half a en years ago when the tungsten lamp first came into use, even since the drawn filament has come into use great provement in its strength has been made. Another and y important matter is the use of chemical absorbents the globe to check the blackening of the bulbs. This ctice has not yet become standardized, but the results extremely promising. One feature of the manufacture h to be commended is the standardization of the size the bulbs, so that from now on one may hope to get ps in regular dimensions which will give consistent re-s when used with their suitable shades. There have n so many changes up to the present time in the dimen-s of the lamps that it is exceptional to find in actual lamps which really fit the reflectors in which they are alled. Another change for the better due to the ad-ce of the drawn-wire filament is the possibility of using ments wound into a helix which gives a powerful source ght of very small dimensions, suiting it admirably for with concentrating reflectors and also enabling it to be loyed usefully in miniature bulbs of the types utilized andelabra and for decorative purposes. Until very re-ly small lamps could be obtained only with carbon fila-s, while in the future tungsten will be very largely loyed, the illuminating engineer thus obtaining a cor-onding greater degree of freedom in planning artistic effective fixtures.

**gning for the itimate Consumer**

Individually driven machine tools have been used long enough now for the problem of their disposal at second r to receive consideration from motor-service engineers designers. It is not necessary, of course, to give to the ion of ultimate ownership too much weight in plan-n an individual electric drive for a machine tool, but a electrical engineers do not realize that the second-hand lt of such a tool complete may be much increased if a ble motor arrangement is provided, and particularly if a ard motor can be adapted to the initial requirements. h things being equal, a machine will bring more when re-sold if its motor is detachable, if the brackets and gearing spaces allow for the substitution of another motor to adapt the tool to different service, and if the motor application is simple mechanically, reasonably quiet in operation and provided with a flexible control From this point of view it is possible to build a motor-operated machine with too crowded a drive and to pay too little attention to the possible needs of the later owner in lines of industry subject to rapid changes in productive equipment. Machine-tool users sometimes complain that the market for second-hand motor-driven apparatus is too narrow, and while the subject has not yet attained serious importance, it is a matter to which the experienced designer may well give more thought.

**The Hotel Customer**

Among the few comparatively large prospective users of central-station service in the average community, the local hotel load is altogether too often regarded as impossible of attainment by the commercial department, and an isolated plant is installed, costing its owners oftentimes unwarranted operating outlays and taking from the central station desirable and appropriate business. The difficulty seems to be to get the hotel management to count all the costs of manufacturing its own service. Hence data like those presented by Mr. C. A. Collier before the recent Southeastern convention will help greatly in demonstrating to the hotel-keeper the actual economy of purchasing electricity and steam heat. The hotel business is one of infinite detail, and the management that devotes its talents to purchase of provisions and supplies and to catering to the tastes of its guests can hardly be expected to apply engineering analysis to the study of its engine-room problems. In fact, the wise manager will aim to relieve himself of all such unnecessary detail. Evidence of this is afforded in the insistence with which hotel men argue for flat blanket prices for electrical energy and for steam heat. If central-station companies will furnish them all the electric and steam-heating service they need at a fixed price per month, many of them declare they would willingly contract for central-station service and shut down their isolated plants. The thing to do, however, is to point out to a hotel man that a flat rate for electric service is as irrational as the decadent "American plan" in his own business, a wasteful flat-rate principle which progressive central-station and hotel managers everywhere are drawing away from. It ought not to be difficult to convince the manager of a modern European-plan hotel that it is inconsistent for him to demand a blanket price from the central station any more than from his butcher or grocer for all the supplies his hostelry might demand, while he at the same time is insisting on a schedule of charges to guests which itemizes

room, meals and each miscellaneous service. The matter must be handled with diplomacy, however. As a user of energy the average hotel has a large connected load, as well as a load-factor about double that of the usual office building, department store or newspaper office, and although this class of business may have been overlooked or misjudged in the past, it is nevertheless a central-station opportunity calling for the concentration of all possible selling talent.

### Combination Generating Systems

Of the advantage of grouping a number of local distribution systems into a single network little need be said. By generating electrical energy on a large scale and distributing it efficiently the cost of production and the ultimate selling price are greatly reduced. Besides, there are the other advantages of reliability of service brought about by better engineering and more expert supervision. Reconstruction work such as that outlined in connection with the Gorge station of the Northern Ohio Traction & Light Company gives an excellent insight into the needs of such combinations and the economies resulting therefrom. Wherever uniformly good methods supplant a mixture of good and bad, wherever inefficient stations are replaced by a single modern plant, and wherever operating problems are dealt with as a whole instead of in fragments, economy is to be found, and invariably financial stability as well. It is not sufficient, however, to bring properties under a common ownership; their prosperity depends just as much upon a unified system of management, and particularly one which has not lost local touch. The station described in this issue is built along standard engineering lines modified somewhat in order to take advantage of the favorable site upon which it is erected. One commendable feature possessed by it is a pleasing exterior, and it is refreshing to note that the tendency in the industry is more and more toward structural design which will be in keeping with the dignity and importance of the utility and will not jar the sensibilities of the community in which it is located. Electricity, unlike gas, has always been associated with what is clean, neat and artistic and it is fitting that the power house should also convey the same impression.

### Suspension Insulator Defects

Transmission companies have experienced more or less trouble of late with insulators owing to the cracking of the porcelain. In a great many cases in both Canada and this country interruptions in service have resulted and in not a few instances a thorough inspection of entire transmission systems has been necessary in order to locate and throw out the faulty insulators. This is a defect which no designer could foresee and which only time would bring to light. However, it is a problem which ceramic engineers must investigate and solve, because transmission lines are becoming too important for such a condition long to be tolerated. In this connection it will be remembered that Mr. A. O. Austin in discussing the mechanical and electrical stresses in high-tension insulators before the recent convention of the National Electric Light Association pointed out that dead-end strings of insulators are often subjected to severe mechanical stresses, not merely by reason of the dead-end tension they carry, but also becaus of the differences of expansion with temperature i the steel and porcelain, or in the cement, of which they a built. Special attention should, therefore, be paid to t mechanics of strain insulators, or dead-end insulators, in high-tension transmission line.

As a protection against heavy surge over-voltages, lateral air path has proved useful for strings of insulato The lateral air path must be capable of breaking down i mediately when a severe over-voltage occurs and before t insulators in the string, or any of them, can spill over. O the other hand, the lateral air path must mend itself as so as the voltage falls to normal and must never break do under normal voltage. The ratio of the total dielectr strength of the insulator string to that of the lateral a path—called the factor of safety of the string—under tho conditions may vary from 1:6 to 2:3 according to t observations quoted.

### Rate Regulation by Commissions

The most remarkable feature of rate regulation by so of the prominent public service commissions is the bol ness with which the problems have been attacked. T charge is frequently made that the chief sources of t boldness are inexperience and an absence of any respo sibility for the income account; but the commissions f that they have been appointed to regulate, and that th have no choice but to act. That their action is sometim ill-timed, that emphasis is frequently misplaced, that th often do violence to old-established and cherished custo and traditions, and that the immediate results are n always happy, cannot be denied. However, able and co scientious commissions in some of the states have giv scientific consideration to rate and other matters over whi they had jurisdiction and have had co-operation from t companies in these activities.

The difficulties of the rate problem itself and those the commission which attempts to solve the problems discussed in a stimulating paper by Mr. William J. Nort secretary of the rate research committee of the Natio Electric Light Association, abstracted in this number. T suggestion of "preliminary" and "final" periods of r regulation raises the question of the responsibility of t commission to the company as well as the responsibil of the commission to the public. A preliminary per should vary in length and importance according to the c cumstances affecting each case and it should give a co pany all possible protection of the reasonable investm before complete regulation takes place. A loss of time, the time is devoted to the perfection of a permanent, sat factory solution, is not a grave matter in so serious a pr lem. The entire structure on which a great industry l been built should not be disturbed hastily. The end desi in regulation is a working arrangement that protects company and its employees against the ill-judged dema of the public and protects the public against unreasona practices on the part of the company. Such an arran ment should not be sought by methods that exclude financial fabric of the structure from consideration.

nt was given existence and efficiency by investment, and ulation should be tempered by the desire to render jus- e to those whose hazard of capital made the property sible.

Since the advent of commissions many operating men l others making a study of rate schedules have been pelled to go on the witness stand and submit to search- questions as to the basis on which the schedules are lt. Sometimes the result of these questions has shown schedules to be a kind of conglomerate without ar limits. The excuse of commercial necessity is not one t a commission could adopt without analysis. By law a mission was created to regulate, and it had to be in position to give some explanation for the particular ion it took. It has chosen to regard a set of rate sched- s, not as a conglomerate, but as a structure of closely re- d parts, which must have the qualities of reasonable- s, maximum consistency and minimum discrimination— sometimes the factor of commercial availability, which regard as a necessary one, has been included.

The commissions should realize clearly that perfection in chedule composed of varying rates to meet different con- ons and requirements is impossible of attainment. The edule must stimulate the business or it is useless. If a does not take into consideration "what the traffic will r" the business will be diverted to other channels. Strong uments are advanced in favor of schedules based on consideration. These arguments, if honestly made, me the existence of a free or natural rate which will liscovered by the exigencies of getting the business. uch a system were always to be established by sagacious ness men, controlled by intelligent self-interest, all the ures of a schedule insisted upon by a commission would subtedly be introduced, and the final result would prob- not be very different from that obtained by any other ue of approach.

Enlightened self-interest on the part of the company d recognize the interest of the public in its affairs. why should not enlightened self-interest, inducing peration between the public and corporations, be keynote of the solution of the whole problem? Could the companies more frequently take up the regula- of their rates themselves and, with the aid of long rience and ample knowledge, leave as little as possible the commission to do?

The germ of commission control is that the public has an erest in the business and that it should have an agent to ect its interest. A frank acknowledgment of this erest and a practical demonstration of it by real co- ation would do much to remove any existing differences imaginary menaces. With both interests properly ected, the public should have no more desire to with- reasonable franchise conditions than the company to draw its investment. Unfortunately the public can hold proper franchises while the company cannot with- its investment. If extraordinary operating ability rewarded simultaneously with proper adjustment of schedules, would not the shadow of periodic enforced tion downward be removed? Co-operation is asked d it ought to be given, by all means, by both the commissions and the companies, not in a spirit of give and take or of idle compromise, but in one of constructive progress.

## Radio-Telegraphy and Clouds

The consistency of the observations from which Prof. A. H. Taylor draws the conclusions presented in his article on "Wireless and Weather," printed in this issue, invites further speculation as to the explanation of the connection between absorption and cloudiness. Such conditions as those reported for the night of March 19, when the effect of prejudicial previous impressions was practically nullified by complete alteration in the meteorological situation as it bore on radio-transmission, together with the impartial method of recording which becomes the habit of a skilled physical observer, make it appear unnecessary to question the existence of a functional relation between ease of night transmission and earlier cloudiness in the region between the sending and receiving stations. The problem would seem, rather, to determine just how these effects are connected.

Professor Taylor's suggestion that the absorption is atmospheric, and that it is caused by a sun-created conductivity close to the earth's surface (below the normal cloud layers) is a possible explanation of the phenomena. It would appear, however, that the solar ionization at these small altitudes would be too slight to account for such tremendous changes in transmission distance as are noted from night to night. It is generally believed that if conducting layers of atmosphere exist at all they are high above the earth and make themselves felt in radio-signaling mainly by giving rise to reflection effects. There are also supposed to be small conducting portions of atmosphere moderately near the earth (say from 5 to 10 miles above) which may produce transient reflections affecting nearby wireless stations. While these may be involved in the "cloud effect," if it may be so called, it does not seem likely that their action could extend over a territory 1500 miles wide if they were below the usual level of rain clouds.

The role of high-frequency currents in the earth's crust is daily being more seriously considered in connection with the problems of radio-signaling. There is a strong probability that at great distances a very large portion of energy received by wireless is set up by free transverse earth currents. It is known that transmission over water or damp ground is easier than over desert or other dry land. It, therefore, seems easily within the bounds of possibility that the observations of Professor Taylor might be further interpreted by considering that after a cloudy day the earth's surface retains more of the moisture deposited nightly and so permits the passage of radiated waves and their accompanying earth currents with smaller conduction losses. However this may be, the material presented is of interest, and it is hoped that other investigators who have made studies of similar conditions may be prevailed upon to place their data before the radio-engineering public, through our correspondence columns or otherwise. Only by comparison of many observations is there any hope of securing sound explanations of phenomena so complicated as those involved in radio-transmission.

# The News of the Week

**Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.**

## International Electrotechnical Commission

A meeting of the International Electrotechnical Commission will be held in Berlin, Germany, Sept. 1-5. On Monday, Sept. 1, the special committees on nomenclature and on rating of electrical machinery and prime movers will hold a meeting, and on Tuesday, Sept. 2, the committee on symbols will meet, while the committees on nomenclature and rating of electrical machinery will continue their deliberations. The official opening of the convention will take place on Sept. 3, when the whole commission will be in session to draw up in definite form various resolutions for ratification at the plenary meeting, which will be held on Sept. 5, Sept. 3 and 4 being devoted to the working sessions of the commission. The special committees on nomenclature, symbols and rating of electrical machinery and prime movers, which have been in correspondence and have held sessions from time to time since the 1911 meeting at Turin, will hold meetings in Berlin prior to those of the full commission in order to have further opportunity of discussing the latest modifications to their reports suggested by the national committees. The result of these meetings will be embodied in the reports, which, thus modified, will be considered at the working sessions of the commission. When agreed to in their final form they will be submitted to the plenary meeting for ratification. It is probable that the honor of the presidency of the commission, which would have been conferred on the late M. Mascart had he lived, will be offered to an eminent French electrical engineer by the council of the commission at its closing meeting on Sept. 5.

## Electric Service at the Panama-Pacific Exposition

Rules and requirements for electric lighting and motor service at the Panama-Pacific International Exposition, to be held at San Francisco Feb. 20 to Dec. 4, 1915, are contained in the book of general regulations just issued by the Exposition division of works.

In the Exposition buildings 115-volt, 60-cycle, three-phase service will be available, the lighting elsewhere being furnished from 230/115-volt, single-phase, three-wire mains. For motor operation 230-volt, 60-cycle, three-phase and 115-volt, single-phase energy will be supplied. Direct current at 125 volts and 250 volts will also be available during exposition hours in the Machinery, Mining, Transportation and Manufactures buildings, under special restrictions.

All electrical construction work must receive approval and permit from the director of works and is subject to inspection by the Board of Fire Underwriters, the usual fees being charged. Service connection charges will be made at the rate of $25 per service for metered customers in the underground district and $15 elsewhere in the buildings and grounds. For flat-rate customers the respective charges are $15 and $5. Fuse boxes capable of being sealed must be installed.

Service will be furnished under three schedules—flat, metered and special rates. For connected loads of less than 2 kw the flat-rate charge will be $15 per month per kw, and for loads under 166 watts $2.50 per month. Above 2 kw meters will be installed, the customer paying $2.50 per month per kw of connected load, plus an energy charge of cents per kw-hr. for quantities less than 1000 kw-hr. per month. For consumptions above 1000 kw-hr. the 5-cent rate will be reduced 0.1 cent per kw-hr. for each 1000 kw-hr consumed. Exhibitors not requiring electricity except during night hours will have special service rates 25 per cent below the foregoing rates. Energy to operate moving exhibit machinery will be charged at the rate of 3 cents per kw-hr.

## Educating the Public in the Use of Light

Within the past month the Illuminating Engineering Society has printed for several large lighting and manufacturing companies throughout the country an edition of more than 250,000 copies of its illumination primer, "Light: Its Use and Misuse." This little publication presents in brief and popular form the principles of good illumination. It is being widely circulated for the purpose of creating an appreciation and demand for more and better light. For the companies which are going to issue this pamphlet to their customers during the coming lighting season, the society is arranging to publish two new large editions, which will be available at prices that merely cover the publication costs involved.

## Celebrating the Inauguration of Keokuk Water Power Plant

Keokuk, Iowa—which now styles itself "the Power City"—entered with great zest into its water-power celebration of Aug. 25-28, which marked the realization of a cherished desire extending back fifty years that the available water power of the Mississippi River at the Des Moines Rapids estimated at 200,000 hp, should be utilized.

Now, as the readers of the *Electrical World* know, the Mississippi River Power Company is doing the trick with its great hydroelectric plant which dams the river between Keokuk and the little town of Hamilton, Ill. The initial half of the generating station, with fifteen 7200-kw units, is now nearly complete, and the plant is carrying a load of between 30,000 kw and 40,000 kw, and could supply 100,000 kw in a week if customers were ready for it. Eighty per cent or more of the output is transmitted to St. Louis.

The installation is the world's largest individual water power plant. Mr. Hugh L. Cooper, vice-president and chief engineer of the company, did more than any other one man to bring the plant into being. He is in Europe, but his work was extolled in the highest terms by the various speakers at the Keokuk celebration.

The exercises began in Hamilton on Monday, when Governor Dunne of Illinois was the guest of honor and made a speech. He said it was unusual for the executive of a great state to assist in the opening of a private enterprise, but understood that this corporation was rather an exception to being fair in its dealings.

Tuesday was the principal day of the celebration at beautiful Rand Park, in Keokuk. There was speechmaking after a fine parade. The Power City was handsomely decorated in honor of the occasion, and its people and thousands of visitors made carnival. Governor George W. Clarke delivered an oration, and there were speeches by Mayor Elder of Keokuk, Lientenant-Governor Tenant of Missouri, Mr. W

n Logan, the historian of the day, and Hon. W. H. Hepn, for twenty-two years a representative in Congress m Iowa and still vigorous and eloquent at eighty. Mr. burn was sarcastic in his references to modern theories tendencies in relation to the conservation of natural urces. Mayor Elder said that when the plant is fully loyed it will save the burning of coal at the rate of 0,000 tons a year. Mr. Cooper sent a cablegram of eting from Berlin.

Other features of a very successful celebration were band certs, an inspection of the dam, generating plant and s, a motor boat and hydroplane regatta on Lake Cooper, sheet of water impounded by the dam, and displays of works.

## German Patent Legislation

he German government has published the text of three s which will be read before the Reichstag when it recones. The bills provide for a reform of patent and tradek legislation and are intended to replace the existing s on the subject. Of particular interest is the new patbill, which affords a greater protection to the inventor renouncing the existing point of view that the patent ngs to the party who first applies for it and stipulating it is the property of the inventor. The vexed question he rights of employees making inventions on behalf of r employers will thus be settled, since the proposed sure specifies that the patent shall only be the property he employer if the invention lies in his sphere of busi; and if the work that has led up to it is part of the emee's duties. In this case the latter is entitled to receive rtain recompense from the employer. Another impor point is a reduction in the Patent Office fees. At pres the fees increase annually and amount to $132.50 for first five years in addition to the application fee of $5. provided in the new bill that the fees shall be increased the sixth year only, that they shall aggregate $62.50 he first five years, and that the application fee shall be eased to $12.50. The bill also contains revised provis regarding the procedure and constitution of the nt Office.

## nk E. Watts on the Electrical Development Society and the Individual

connection with the work of the Society for Electrical elopment, the question has often been asked by indials "What will the society do for me?" Mr. Frank E. tts, reigning Jupiter of the Jovian Order, has essayed nswer that question simply and concisely.

"In the first place," he says, "a man must understand that as an industry or business in which he is engaged s can he grow. He will prosper in the same measure e company with which he is connected prospers and business is developed and enlarged. A greater volume usiness for his company means greater opportunity dvancement and promotion to him.

"No man is likely to look into the future with much gratiation when he is connected with a business which is on decline, but he is much happier if he sees the possibility growth and knows that with that growth will come the portunity of benefiting himself. The purpose of the ety for Electrical Development is to create a greater and for the use of electricity and thereby create a r market for electrical apparatus and appliances of all A greater demand for electricity means that more s will be wired, more apparatus for generating elec will be installed, and more appliances for consuming city will be purchased. This, in turn, means that the ntractor or individual working for the contractor will more work to do; therefore the contractor will purchase more electrical supplies and the jobber or jobber's salesman will sell him more material. The jobber, in turn, will necessarily purchase a greater quantity of electrical goods from the manufacturer through his representatives, and in the final analysis the central station will sell more energy, and every man in its employ should benefit thereby.

"Every branch of the industry is affected by an increased demand for electricity, and this means greater opportunity for every man in the business, whether he be in the factory, in the office, in construction work, a salesman for jobber or manufacturer or a member of the company.

"The more rapidly the electrical business develops, the larger the opportunity of the individual. To develop the business more rapidly is the purpose of the Society for Electrical Development, and for this reason alone it deserves the support of every man who will be affected by such development and growth."

## Electric Heating and Lighting in England

By Dr. Louis Bell

One of the things which seem to be uppermost in the minds of the municipal plant operators in England is the heating and cooking campaign, which is now fairly under way. The apparatus seems to be good and cheap, and with energy at 2 cents per kw-hr. or less the outlook for business should be good, or as good as it could be at so low a figure. Thanks to the relatively great density of service of every kind, the price quoted is a possible one.

One thing which is constantly forgotten in comparing the English with the American situation is that the former for a given output shows a much shorter average radius of distribution. An English town is ordinarily rather compact and the scattered suburbs stand a fair chance of getting no service. An English operator simply will not as a rule serve a rural community of the kind that an American operator feels bound to serve. In fact, the necessary cost of the practically universal underground distribution makes rural service out of the question. Add to this the fact that a somewhat wider margin in voltage regulation seems to be common, and it is not difficult to see that distribution costs run fairly low and business, when well developed, is really secured at a good density.

The high-service density seems to be at the root of the low prices referred to. In fact, a rather violent discussion is now going as to whether 1 cent per kw-hr. is not the right level for motor and miscellaneous load, and such a rate is now being offered in several municipalities. In taking on heating and cooking work a separate meter is used and the cost of special wiring to the consumer acts as a check on rapid increase. But there seems to be fresh trouble ahead, and those who make rates are sorely perplexed.

We have heard recently in America whisperings of a half-watt-per-candle lamp. Over in England the whisper has risen to a stage volume easily audible over a rumble of strong language from the supply companies. Thus far the half-watt lamp seems to be located, like malaria, always in the next county. There are plenty of skeptics, in fact, who have their doubts as to whether the half-watt lamp is more than a bad belief.

There seems to be a growing opinion that if the situation becomes fully developed it may lead to selling light as light, and not merely selling energy to produce it. Some of our own cities are experimenting with such a plan—practically a fixed charge per candle-power-year or month with liberty to use the lamps all the time if desired. The actual result is a reasonably good price on the energy basis and no very serious abuse of continuous-service privileges. But English opinion is really quite at sea in the matter; and the one thing plainly evident is that the whole scheme of

selling is likely to require radical revision ere long. From the American viewpoint there is consolation in the thought that it is the foreign municipal plants that are doing the worrying just now. One solution of the difficulty which might work out well in the long run would be a fixed price per candle-power-year, including lamps, plus a direct meter rate on all energy used for whatever purpose. The effect of highly efficient lamps has never yet been destructive, and halving the present specific consumption would be really less of a shock than the plunge from 3.5 watts to 1.25 watts per candle already taken without disaster. The fact is that a change in the situation might actually prove a blessing in disguise by building up a huge miscellaneous electricity supply business now hardly imagined. Electricity supply ought to be a genuine household necessity instead of still standing out as somewhat of a luxury.

## Convention of the International Association of Municipal Electricians

The annual convention of the International Association of Municipal Electricians was held at Watertown, N. Y., Aug. 19-22. The convention was representative of a new appreciation by members of their responsibilities for advance in electrical construction and for the adoption of uniform regulations by concerted action. Representatives of the National Fire Protection Association, National Electric Light Association, Western Association of Electrical Inspectors and the Bureau of Standards were present and took an active part in the discussions. By resolution the new work of the Bureau of Standards in investigating electrical life hazards was indorsed and assistance offered in gathering data and in making any regulations promulgated by the bureau effective. Dr. C. P. Steinmetz spoke quite fully on the proper standards from which electrical problems must now be viewed and how these problems were passing beyond the confines of cities and states. He suggested the possibility of federal regulation of construction and methods of operation. As consulting engineer for the city of Schenectady he was by acclamation made a member of the association.

## Two Epochs of Rate Regulation

In a paper presented before the Michigan Section convention of the National Electric Light Association, held at Ottawa Beach, Mich., on Aug. 19-21, Mr. William J. Norton, secretary of the N. E. L. A. rate research committee, dealt with the two epochs of rate regulation, namely, the preparatory and the final.

After commenting upon the fact that ten new public service commissions have been established in 1913, the author stated that of the older commissions the really successful ones have considered that a period of preparatory regulation must be allowed, and that their main duty in this period consists in so making the orders that the public-service companies can adjust themselves to the new set of theoretical conditions which heretofore have not obtained. Mr. Norton remarked that the preparatory period will probably extend through the average life of the plant furnishing service, so that for the electric utilities one may consider that the preparatory epoch of regulation should last for from fifteen to twenty years.

In discussing valuation, the author claimed that a public service commission could well establish a joint valuation board which would have the confidence of both the commission and the companies. Such a board without any undue haste could begin to establish values throughout the state where such work was considered absolutely necessary or required by law. The men in charge of such valuation should be men of experience and integrity, and the bases of valuation should be carefully worked out.

Capitalization as it exists should be considered not as a crime committed by the company, but as a method of finance heretofore approved and often encouraged by the laws of the state. If there are any elements in the capitalization which cannot be approved in the future, the commission should provide means for the gradual amortization of such capitalization during the preparatory epoch of it regulation. Through it all there should be the greatest amount of co-operation between the companies and the commission. The advice of the ablest utility operators in the state should be frankly sought and considered by the commission in the effort to reach the second epoch of theoretical regulation as early as possible.

Concerning depreciation Mr. Norton said that it is always a most difficult matter to build up a depreciation fund, and both the public which is being served and the company are better off if a fund is too large rather than too small. Any minute discussion of the advantage of such theories as the sinking-fund basis or straight-line basis, etc., in the early preparatory epoch is entirely out of place and the commission should direct that depreciation funds be built up just as fast and just as liberally as the rates will allow.

The modern theory of regulation demands that, as utilities are monopolies, the commercial basis should be discarded and a strict and definite rate of return should be established immediately. The municipalities generally, and the commissions sometimes, entirely neglect to consider that this means a complete reversal of the entire financial and executive policy of the company. If the newer policy is a good one and is to be maintained, commissions should again make such adjustment as would allow the companies in their financial transactions slowly but gradually to accommodate themselves to the stated rate of return. The public in the end is better served by liberality on this score, even if such liberality is only temporary, than it would be by a ruling so drastic that it would injure the financial stability of the company and make future extensions and development difficult.

Maximum or residence rates are generally reduced to a point which is determined either by force, through ordinances, or solely as a matter of policy. The large wholesale rates are again determined somewhat upon the additional cost of the service to the companies, but mainly upon the cost of supplying his own service by the individual user, and therefore the lowest rates are determined by a policy which is guided by a careful consideration of how much of the private-plant business the company wishes to obtain.

One might think that there would be some large retail business or some small wholesale business to which the pure cost-of-service theory might be applied, as this is profitable business and comes to the utility through it limited monopoly. As a rule, however, the company rate makers are so busy in adjusting the schedule and making it logical between the low maximum rate and the low competitive rate that even in the center of the scale there is no room for the cost-of-service theory.

To careful observers the above condition shows that valuations and the rate of return are at best only approximate indications of what an electric rate should be, and that they should be used by a commission with a great deal of care in the regulation of electric rates.

The policy that has long been adopted by the executives of the companies is probably more efficient than any method based upon valuation. The usual policy has been carefully to study the balance sheets and the statistics of the growth of the business and to apply any surplus that is available at the point where it would accomplish most in acquiring new business or where it would relieve the most urgent stress. This has absolutely nothing to do with cost except in a most general sense, and more often it absolutely disregards cost for the sake of expediency. Utility execu-

es have become experts in the application of rate reduc-
ns, and as a rule, while the different companies may not
ee entirely as to method, the actual rate curves of most
the companies throughout the country are theoretically
nd. That they are practical and effectual is evidenced
the rapid growth in the business.
Mr. Norton expressed the belief that commissions should
he very beginning of their administrations assume that
y have before them an epoch of from ten to twenty
rs which can best be used by them in assisting in ad-
tments to be made by the companies themselves in
paration for a second or final period of regulation in
ich pure theory may be applied, without harm either to
public or the companies. Such a position will produce
ly in their administrations a spirit of co-operation on the
t of the companies and eventually with the public which
l do a great deal more to accomplish the desired result
n any drastic or bitter regulation could ever accomplish.
argued that it is a very poor policy indeed for a com-
y to wait until the public or a commission forces it to
things it should have done on its own initiative. In
h matters as the form of schedules and uniform ac-
nts the commission can greatly help the entire situa-
, but in the matter of the publicity of rate schedules,
he adoption of a proper method providing for depreciа-
, or in a study of rate forms, and in the actual making
rate adjustments or reductions, an energetic and up-to-
e company should act in advance of any suggestion or
mand from the commission.

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## Convention of Michigan Section, N. E. L. A.

he second annual convention of the Michigan Section
he National Electric Light Association was held at
wa Beach, Mich., Aug. 19, 20 and 21, marking also the
nth annual meeting of the original state organization.
sions were held at the Ottawa Beach Hotel, the pro-
n for the half-day meetings including ten papers and
addresses. Of the total convention attendance, num-
ng 132, twenty were ladies.
resident F. B. Drees, Lansing, opened the first session
an address pointing out the better relationships be-
n public and corporations which have resulted from the
k of the N. E. L. A. and its sections. Formerly a cor-
tion was a mystery. Mystery spelled distrust, distrust
led antagonism, and antagonism meant failure. But
, he commented, utility corporations work hand in hand
employees and public. In closing, the president sug-
ed that committees be appointed on the subjects of
ic policy and the installation of lightning arresters.

### Indirect and Semi-Indirect Lighting

the absence of Mr. James R. Cravath, consulting engi-
, Chicago, his paper, "The Practical Application of In-
ct and Semi-Direct Lighting," was read by Secretary
bert Silvester, Detroit. The author predicted that there
be no decline in the use of indirect lighting as long as
is obtainable only from intensely concentrated
ces. Three reasons were given for the increasing use
e indirect system: (1) Avoidance of uncomfortable
injurious glare from the lamps themselves; (2) reduc-
in annoying glare of specular reflection from paper;
elimination of sharp shadows. While a given average
ination can be obtained by direct lighting with 60 per
of the energy consumed by the most efficient indirect
m, the human efficiency and comfort which are ob-
d with the latter nevertheless more than counterbal-
e the reduced lighting efficiency. Advantages of semi-
ect lighting over direct lighting were brought out.
attention was called to the effect of the shape of
e translucent bowl, its composition and interior finish
n he efficiency of such a system. From tests it has been found that when more than 15 per cent of the light received on a book comes directly from the translucent bowl of a semi-indirect fixture the shadows become annoying. To get satisfactory results from semi-indirect lighting the use of several scattered units was advised as being preferable to concentrated lighting.

### Handling Customers' Complaints

Mr. D. B. South, Detroit, next read a paper on "The American Kicker," which discussed methods of holding business already secured and described the procedure followed by the Edison Illuminating Company of Detroit to satisfy a customer that his meter is recording correctly. Methods of tabulating complaints and inspection reports were also outlined. The number of complaints received by this company in 1912 was less than 2 per cent of the customers on its lines. Of these only 18 per cent had reasonable justification. Investigating these complaints and clearing up the trouble cost approximately $2.70 each on the average. Of the total sum expended over 70 per cent went for investigating complaints which had no substantial backing. The latter expenditure was warranted, however, by the good-will obtained. The cost per capita amounted to 5 cents, and the cost per bill rendered amounted to 0.4 cent. Similar figures were given on the complaints received by telephone and letter. The author also discussed methods of adjusting customers' bills affected by grounded circuits.

*Discussion*

The contents of the paper aroused an interesting discussion on the part of Messrs. H. C. Sterling, Three Rivers; E. A. Lucky, Detroit; H. A. Fee, Adrian; F. B. Drees, Lansing; R. W. Hemphill, Ann Arbor; T. L. Hinks, Detroit, and F. C. Vieson, Detroit.

Mr. Sterling said that complainants always like to talk the matter over with someone. He therefore makes it a point to receive them in his office a few days each month rather than have them argue with the cashier.

Mr. South declared that inspectors should also visit customers who don't complain, ascertaining whether the service is satisfactory and thus helping to hold the good-will of the people.

Mr. Fee said that the Citizens' Light & Power Company, of Adrian, maintains an inspector who in his spare moments repairs flatirons, etc., and solicits new business.

Mr. Hemphill emphasized the fact that an aggressive complainer is a very desirable customer if he can be won over to the company's side, as he will then be just as aggressive in boosting the company. Mr. Hemphill also employs an investigator who keeps the company in personal touch with its customers.

Mr. Hinks advised having an inspector to investigate complaints, leaving the office, if necessary, to settle the affair with the customer diplomatically.

Mr. Fee told of sending out circulars asking for suggestions for improving the company's service. Prizes such as electric flatirons and energy-consuming devices were awarded for the best replies.

### Contractor and Central Station

Mr. C. J. Litscher, of Grand Rapids, read a paper on "The Relation of the Central Station to the Electrical Contractor," which was in general similar to that delivered at the Electrical Jobbers' Association convention held in Chicago several months ago. The paper dealt with the subject of central-station companies merchandising electrical appliances at a value below that at which contractors and supply dealers could furnish them.

### Staff Co-operation

Mr. Thomas Chandler, of Sault Ste. Marie, read a paper entitled "The Chain," likening the various departments of a central-station company to the links and showing how

important each one is to the strength of the company's business. The appearance of the meter reader and the impression he leaves behind him as a representative of the company were also dwelt upon forcibly. In clearing up complaints the troublemen must make a good impression both as to personality and as to ability to do the work assigned to them. Rendering bills to customers is another link in the chain. When one monthly meter reading has been omitted, the author advised stamping on the next statement "Two months' bill," to attract the customers attention to the fact that the previous month's bill was not paid. In addition he advised sending a blank statement stamped "Meter not read this month."

Messrs. Silvester, Hinks, Sterling, Fee, South, Hemphill, Drees and Eugene Holcomb, Lansing, took part in the discussion which followed.

Mr. Sterling advised rendering a minimum bill even when the meter is not read, later deducting this amount from the second bill. His suggestion did not, however, meet with much favor.

Mr. Fee told of the use of blank-dial post cards at Adrian. Mr. Hemphill favored mailing bills instead of delivering them.

Mr. Silvester reported that the Edison Illuminating Company of Detroit delivers its bills at a cost of $0.5 cent each, which is cheaper than mailing them.

### Secretary Martin's Address

The Wednesday morning session was opened with an address by Mr. T. C. Martin, secretary of the N. E. L. A., who mentioned the difficulties experienced in holding the large national conventions. Several solutions have been suggested—one to divide the association into group associations, such as the New England Section and Southeastern Section, and hold meetings at different times. Another might be to have the accounting, commercial and technical sections held at different times of the year.

### Rates and Accounting

Mr. William J. Norton, Chicago, delivered a paper on "The Two Epochs of Rate Regulation," an abstract of which appears elsewhere in this issue.

Mr. Fred L. Dennis, of South Bend, Ind., gave a talk on the formation and work of the committee on uniform accounting. The N. E. L. A. classifications were boiled down to meet the requirements of the Michigan Railroad Commission, retaining only the essentials. Forms devised for the reports were also made so to give direct comparison between large and small companies.

### Franchise Matters

Mr. James V. Oxtoby, of Detroit, gave an interesting talk on the subject "Public Utilities as Affected by the New Michigan Constitution." In general his address was similar to that he gave at the Ohio convention, July 17, a brief report of which was given in the *Electrical World* of Aug. 2. Topics having special application to Michigan were, of course, added, including the subject of franchises and home rule.

The Hon. Lawton T. Hemans, of Lansing, chairman of the Michigan Railroad Commission, spoke on the position of the commission as a medium between public and corporation. His talk dealt with the value of commissions as clearing houses for grievances. "Individuals who are versed in all phases of engineering are hard to obtain, so the commissioners can do the next best thing, and that is to use 'horse sense,'" said Mr. Hemans.

The closing session of Thursday was opened by Professor Sawyer, of the electrical department of Michigan Agricultural College. Formerly his duties were in educating agricultural students in the use of electricity. Now the aim is to get central-station men to supply the farmers. Just as the public are dependent on farmers for food supplies, so should the farmers, he said, be dependent on electricity.

### Accident Prevention

Mr. R. L. Drake, secretary of the Industrial Accident Board, spoke of the influence which the new compensation law has had on accident prevention. Before it was enforced there were on an average two fatal and 100 non-serious accidents in Michigan every day. Since the passage of the law the accidents have been reduced to an average of one and one-half fatal and sixty-five non-serious accidents a day.

In the discussion Messrs. Sterling, Fee, Hamphill and Vieson took part.

### Grounded One-Wire Distribution System

"High Tension Distribution by Means of a One-Wire Grounded System" was the subject of the paper read by Mr. J. A. Cavanaugh, of Benton Harbor, who told how a single-phase transmission line 2.5 miles long was built on telephone poles with one side grounded. The possibility of accidental grounds between various parts of the system was avoided by using 1:1 or 1:2 transformers. The primary circuit is fused to ground but the secondaries are not grounded. The total cost of line construction amounted to $228.65, including labor and material. According to the author of this paper, the same line constructed with two wires instead of one would have cost $151.65 more per mile.

A description of an automatic pumping station at Farmington, Mich., was given by Mr. A. R. Cary, of Rochester, Mich., and accompanied by pictures. Forty-eight consumers are now supplied, the minimum charge being $1.5 per quarter, allowing the use of 9000 gal.

### Street Lighting

Mr. D. W. Hayes, of Ann Arbor, read a paper describing "The Series Luminous-Arc Rectifier System of Ann Arbor, Mich.," where 181 direct-current magnetite-arc lamps and 159 tungsten street lamps are operated. The methods of supporting, cleaning and repairing lamps and rehabilitating rectifier tubes were also described.

Mr. F. R. Mistersky, superintendent of public lighting, Detroit, related his experience with a similar system, where 6400 arcs are installed, 4000 of which are the luminous type. Although guaranteed for only 500 hours, some of the rectifier tubes have lasted as long as 12,000 hours with an average life of 3500 hours. When the tubes begin to deteriorate they are washed and baked at a temperature of 80 deg Fahr., prolonging their life for additional service.

The last paper on the program, entitled "Alternating Current Motors and Their Efficient Operation," was read by Mr. W. J. Fitzgerald, Detroit.

Various types of single-phase and polyphase motors were described, with their advantages and disadvantages. Mr. Fitzgerald advised the use of high-speed motors in every case. A few suggestions were also given on belting, line shafting and lubrication.

### Election of Officers

At the executive session the following officers were elected: President, Mr. H. C. Sterling, Three Rivers; vice-president, Mr. H. A. Fee, Adrian, and secretary, Mr. Herbert Silvester, Detroit. Mr. Sterling is the manager of the Constantine Hydraulic Company at Three Rivers. The executive committee which was appointed is as follows: Mr. William Chandler, Sault Ste. Marie; Mr. R. H. Richardson, Kalamazoo; Mr. J. A. Cavanaugh, Benton Harbor; Mr. J. E. Stanton, Belding, and Mr. R. W. Hamphill, Jr., Ann Arbor.

On Wednesday evening a rejuvenation of the Jovian Order was held at which twenty-three candidates were initiated. Messrs. H. A. Roseberry and W. J. Trott, state men, were in charge of the ceremonies.

## Public Service Commission News

### Wisconsin Commission

The Railroad Commission of Wisconsin has issued a re-sed set of rules and regulations relative to the standard gas and electric service to supersede the rules established July 24, 1908. The order follows a public hearing given the commission at Milwaukee on April 22, 1913. The vised rules were prepared by the engineers of the com-ission after a study which covered the period of five ars since the original order was issued. Without mate-ally changing the standards themselves, the revised rules fine somewhat differently the practices required of the ilities in order to maintain those standards.

In the rules for gas service the chief changes have been ade in the rules for testing meters and the maintenance meter-test records. In the matter of periodic tests the vised rules require that each meter shall be tested and erhauled once in four years, instead of once in three years has been the custom, and that at least two consecutive st runs which agree within 0.5 per cent must be made. ie records of meter tests are to be kept more carefully d complete information concerning every meter must be ailable at any time. The original standards of heating lue are to be retained, but the gas utilities are required determine the heat value of gas on at least three days of ch week instead of periodically as formerly. The rule vering gas-pressure variation has been revised so as to ake the minimum gas pressure at the consumer's outlet in. instead of 1.5 in. of water pressure. The maximum ast not exceed 6 in., as heretofore, and must not be greater an twice the minimum pressure. The rule requiring the lities to submit monthly summaries of complaints is andoned but such records must still be kept.

A number of modifications are made in the rules regard-g electric service. The rule which limits the error of any ter to 4 per cent on light load, half load or full load has en changed to include any load between one-tenth and l load. No attempt was made to define average accu-y of watt-hour meters, since it was recognized that this ries with conditions to such an extent that it is better actice to take this into account in adjusting bills for incor-t meters. Instead of merely requiring each meter to be ted and adjusted for accuracy at the time of its instal-on, the new rule provides that "each watt-hour meter ll be checked for current connection, mechanical condi-ns, suitable location and accuracy of measurement at proximately three-quarters and one-tenth connected load comparing the meter with approved standards in its manent position in place of service within thirty days er installation. Meters operating at low power-factor ll also be tested at approximately the minimum power-tor under which they will be required to operate. Meters alled with instrument transformers or shunts must be ed jointly with the transformers or shunts, otherwise transformation of the transformers or calibration of shunts must be determined at least once every five rs." The rule providing for the testing of each meter at st once a year has been abandoned, and henceforth all ters requiring periodic tests must be tested according the following schedule and under the conditions pre-bed above:

Single-phase induction-type meters having current acities not exceeding 50 amp shall be tested at least e every two years and as much oftener as the results tained shall warrant.

All single-phase induction-type meters having current acities exceeding 50 amp and all polyphase and commu-tor-type meters having voltage ratings not exceeding 250 lts and current capacities not exceeding 50 amp shall be ted at least once every year.

All other watt-hour meters shall be tested at least once ery six months.

"In no case shall commutator-type meters having heavy moving elements and sapphire jewels be allowed to make more than 1,000,000 revolutions between tests. Where meters are found to register considerably in error when tested on the above schedule the commission reserves the right to order the particular meter or class of meters tested more frequently."

Each electric utility is required to own suitable work-ing standards for the testing of meters and these standards must be correct within 0.5 per cent or proper corrections applied.

Considerable difficulty has been experienced by the commission in the past owing to the absence of complete station records, and the following new rule has been added: "Each utility furnishing electric service shall keep a record of the time of starting and shutting down power-station equipment and feeders, together with the indication of the principal switchboard instruments at sufficiently frequent intervals to show the characteristics of the load, and shall maintain a record of all interruptions of service upon the entire system or major divisions of its system and include in such record time, duration and cause of each interrup-tion." An interruption is defined as a period of over thirty seconds during which the voltage on the circuit is less than 80 per cent of its normal value.

The old rule covering the pressure variation has been left intact in so far as it applies to utilities operating in cities of less than 1500 population. In cities of over 1500 the new rules provide that the utilities shall adopt a standard voltage for the entire constant potential system and shall maintain the voltage within 3 per cent of such standard on all lighting circuits during lighting hours; on motor circuits and during other than lighting hours the voltage shall be maintained within 10 per cent of the standard. To insure compliance with the above rule with-out the necessity on the part of the commission's staff of making practically all the voltage surveys, a rule has been added which requires all utilities to make a sufficient num-ber of voltage surveys to indicate the service furnished from each transformer and feeder. Utilities serving more than 250 consumers are required to own and to keep in constant service at least one portable graphic recording voltmeter.

All the other rules are essentially the same as before. The question of maximum demand received attention, but it was felt that the development of meters and instruments for determining maximum demand is in such a state that definite rules governing the determination of maximum de-mand and the testing of demand-indicating apparatus should not be included in the present order. The commis-sion reserves the right, however, to add rules covering the matter whenever such addition shall appear advisable.

The revised rules and regulations will go into effect on Oct. 9.

### California Commission

The California Railroad Commission has authorized the Pacific Gas & Electric Company to execute a general-lien mortgage to the Guaranty Trust Company of New York and William C. Cox, and to issue thereunder $5,000,000 face value of ten-year 6 per cent convertible bonds. Permission is given to exchange these bonds for stock issued at 80. Moreover, the company is authorized to issue demand notes to the amount of $4,500,000, the collateral being $5,000,000 thirty-year 5 per cent general and refunding mortgage bonds.

The California Railroad Commission has issued an order permitting the renewal of notes issued by public-utility cor-porations for not more than a twelve-month period, with-out formal application for such renewal to the commission; but no such notes may be re-funded by stocks, bonds, notes or evidences of indebtedness, without the consent of the commission.

# Current News Notes

Ohio Public Utilities Commission.—Governor Cox of Ohio has appointed as members of the Public Utilities Commission Messrs. O. H. Hughes, W. L. Dechant and E. L. Doty. Mr. Hughes was a member of the former commission, which on Aug. 8 was dissolved, the present commission succeeding it.

* * *

Outing of Doherty Employees.—H. L. Doherty & Company, well-known bankers and public utility operators of New York, held an outing at the Terra Marine Inn on Aug. 16. The day was given over entirely to water sports, field sports and numerous games and ended with a dinner in the evening followed by the presentation of prizes, a few speeches and dancing.

* * *

English 25,000-Kw Unit for Fisk Street Station.—The 25,000-kw horizontal Parsons turbo-generator designed for the extension of the Fisk Street station of the Commonwealth Edison Company of Chicago is being shipped from the works of C. A. Parsons & Company, Newcastle-on-Tyne, England. This is the largest electrical generating unit yet completed, but it will be some time before it is erected and in operation.

* * *

Radio Institute Formed.—The Institute of Radio Engineers, Inc., filed organization papers in Albany on Aug. 23 under the membership corporation law. The object of the society is to advance the art and science of radio transmission and to publish works of literature, science and art for such purposes. The incorporators are Messrs. R. H. Marriott, Lloyd Espenschied, A. N. Goldsmith, J. Stone, E. Simon, R. A. Weagant, G. W. Pichard, J. H. Hammond, Jr., and J. L. Hogan, Jr.

* * *

City Buys Power Site.—To provide cheap electrical energy for its industries, the city of Spooner, Wis., has bought 40 acres of land 9 miles below the city on the Namekagen River. There is one of the best remaining sources of water-power that are undeveloped in Wisconsin, and the purpose of the city officials is to supply energy at cost from a proposed plant at that point to manufacturers locating in Spooner. The city already owns a municipal electric light plant on the Yellow River.

* * *

Jovian Day at Rivercliff-on-the-Sound.—On Jovian Day, Sept. 6, 1913, the Jovians of New England will hold a rejuvenation, shore dinner and field day at Rivercliff-on-the-Sound, Conn. Special cars will leave Bridgeport at 12:30 p. m. for Rivercliff. Mr. Frank E. Watts, reigning Jupiter of the Jovian Order, and Hon. Clifford B. Wilson, Mayor of the city of Bridgeport, will be among the guests of honor. The Jovian degree will be conferred by the members of the Bridgeport team.

* * *

Development Work to Begin at Sault Ste. Marie.—The Edison-Sault Electric Company has been informed by the Secretary of War that its application for the construction of an addition to its power house and for the installation of additional generating machinery has been approved. The company has been instructed to proceed with the work and will make an addition 58 ft. long and considerably wider than the present structure to its power house. The plans provide for the installation of two additional generating units and one exciter unit.

* * *

Election of Officers of the Schenectady Section, A. I. E. E.—At a recent meeting of the Schenectady Section of the American Institute of Electrical Engineers the following officers were elected: Honorary chairman, Dr. C. P. Steinmetz; chairman, Mr. George H. Hill; vice-chairmen, for two years, Messrs. H. M. Hobart, C. E. Eveleth and A. H. Kreusi; managers for two years, Messrs. J. A. Dewhurst, W. L. Upson, W. L. Merrill and H. P. Broderson. Mr. John R. Hewett is secretary of the section, and Mr. A. I. Sundheimer is treasurer.

* * *

Omaha Electric Light & Power Company Wins Suit.—The United States Supreme Court has decided against the city of Omaha in its suit against the Omaha Electric Light & Power Company to prevent the latter from selling electricity in Omaha. The company's charter expired in 1894 and the city contended that the company thereby lost its lighting franchise. The Supreme Court decided that the Omaha Electric Light & Power Company has by accepting the terms of the City Council in 1884 and living up to them gained a perpetual franchise. There is some talk of starting a municipal plant from the profits derived from the municipal water-works.

* * *

Studies of Atmospheric Electricity.—The study of atmospheric electricity is carried on much more actively in Germany than in any other country. A joint commission on this subject has been established by several German academies of science, and the recently published report of its Munich meeting constitutes a document of much interest to physicists and meteorologists as an example of the latest views and theories of experts in this somewhat neglected and highly specialized field of science. The report is entitled "Protokoll der Sitzungen der luftelektrischen Kommission der kartellierten deutschen Akademien zu München" and is published by the Bavarian Academy of Science.

* * *

Opening for Assistant Electric Railroad Inspector.—The State Civil Service Commission, Albany, N. Y., will hold examinations on Sept. 13 for an assistant electric railroad inspector for the Public Service Commission of the Second District. The position, which has a salary of $1,500 per annum attached to it, requires ability to pass judgment on the construction, equipment and operation of electric roads, including the examination of tracks and roadbeds, structures on electric railroads, examination of cars and equipment, investigation of methods of operation and efficiency of service, and examination into the efficiency and reliability of energy supply for maximum requirements of operation. No written examination will be held and applicants will be rated solely from the statements of experience in training found in the application form and from such other information as the commission may obtain regarding them.

* * *

Automobiles in Perry Victory Parade.—About 300 passenger and commercial vehicles constituted the automobile parade given as a part of the Oliver Hazard Perry victory celebration in Chicago on Aug. 23. For the best decorated electric passenger car a first prize of $100 was awarded to the Anderson Electric Car Company, of Detroit, and the second prize, $75, to the Chicago Electric Motor Car Company. Similar prizes for the best decorated trucks were awarded to the Commonwealth Edison Company and the Firestone Tire & Rubber Company. The American Express Company received a trophy valued at $85 for the greatest number of entries from one firm, it having forty-five vehicles in line. The trophy for the dealer having the greatest number of electric cars of one make went to the Anderson Electric Car Company, of Detroit. The trophy for the concern having the greatest number of trucks of one make went to the Baker Motor Vehicle Company, of Cleveland. About 120 of the automobiles in the parade were electric vehicles.

# Combination Railway and Lighting System

**Description of the Gorge steam station of the Northern Ohio Traction & Light Company, of Akron, Ohio, at Cuyahoga Falls. By J. C. Lathrop**

HIEF among the numerous improvements now being made by the Northern Ohio Traction & Light Company, of Akron, Ohio, is the system for the generion and distribution of electrical energy. This includes steam station, known as the Gorge power station, with a esent rating of 30,000 kw and an ultimate rating of ,000 kw, a hydraulic station of 2000-kw rating, eight bstations and the necessary transmission lines.

The company owns and operates approximately 216 miles single track, consisting of the city lines in Akron and nton and the interurban lines from Akron north to Clevend, south to Canton, Massillon, Urichsville, Canal Dover, ., east to Kent and Ravenna, and southwest to Barberton d Wadsworth. In addition, it supplies electricity for all rvices in the city of Akron and numerous towns and vilges on the railway lines. The latter business has develed more rapidly during the past few years than the mpany's facilities for handling it, and in several inances proffered business has necessarily been refused. e gross receipts of the company during 1912 exceeded se of 1911 by 11.2 per cent.

The territory through which the company's suburban es pass is one teeming with manufactures—in fact, a ritable beehive of industry. The road has as its northern minal Cleveland, which is the sixth city in the United tes in population. Cleveland alone has an extremely fersified line of manufacture, including steel mills, brick rks, oil refineries, etc. As stated before, this company ns all the city lines in Akron, which is noted for its ber works and the manufacture of cereal and clay prodts. Two other cities on its lines which are of considble commercial importance are Canton and Barberton.

### Existing Generating Stations

At the present time electrical energy is generated in power stations at Canton, Akron, Silver Lake Junction and Bedford. The existing Canton power station has a rating of about 3300 boiler-hp and carries little but the railway load, as the central-station service in the city of Canton is controlled by another company.

The Beech Street power station in Akron, with 5400 boiler-hp, generates alternating current for lighting and industrial service in the city of Akron at 1080 volts, which is transmitted at the same voltage and stepped down to the proper voltage for service use by pole-type transformers. This station also furnishes energy to three motor-generators in the turbine room, which deliver direct-current energy to the railway feeders, and 22,000-volt alternating-current energy, which feeds the substation at Barberton. The power station at Silver Lake Junction, with 1750 boiler-hp, and that at Bedford, with 1000 boiler-hp, generate 600-volt direct current only, for the railway lines.

The Gorge power station, supplemented by the hydraulic station, will replace the stations at Akron, Silver Lake Junction and Bedford and furnish all energy required north of Canton, and the existing station at Canton, generating alternating current at 25 cycles, will supply the city lines in Canton and the interurban lines south of Canton.

The reason the latter station has been retained in service is because it is the most modern and economical of all of the existing stations and also was specifically described in one of the mortgages on subsidiary properties and more or less trouble was anticipated if dismantling was attempted. Also in order to change the system be-



FIG. 1—GENERATOR ROOM, GORGE STATION OF THE NORTHERN OHIO TRACTION & LIGHT COMPANY

low Canton to 60-cycle operation it would be necessary to scrap a large quantity of 25-cycle machinery. Furthermore, the losses in transmission from the Gorge power station would be greater, and it was therefore decided that it would be advantageous to continue the operation of this station for the present.

The Bedford and Silver Lake power stations will be replaced by substations No. 1 at Bedford, No. 2 at Northfield, No. 3 in the Gorge power station, No. 5 at Kent and the necessary high-tension lines feeding these substations from the Gorge power station. The Beech Street power house at Akron will be replaced by Substation No. 4, which will receive current from the Gorge power station at 22,000 volts, which will be transformed in this station for lamp, motor and railway loads. This station will also be a switching station for high-tension lines which will feed the Barberton substation and Substations A and B between Akron and Canton, which are now fed from the Canton power station.

been used for some years as a pleasure resort. The pon formed by the dam will add considerably to the beauti of this spot and should increase the revenues of the con pany.

The coal for this station will be delivered over th Pennsylvania Railroad, the only railroad which runs nea the site. The company has a siding from this road whic runs along the top of the bank at an elevation about 90 f above the boiler-room floor. A trestle with coal bunker underneath is now nearing completion on which loade cars will be shifted by the company's motor car. Fror the bunkers the coal will pass through valves into th crusher car and through this crusher car into individua bunkers for each boiler. In passing from these sma bunkers to the stokers the coal will pass through Richard son automatic scales so that a fairly accurate record o the amount of coal that is delivered to each boiler will b kept.

The station structure was designed with sufficient ca

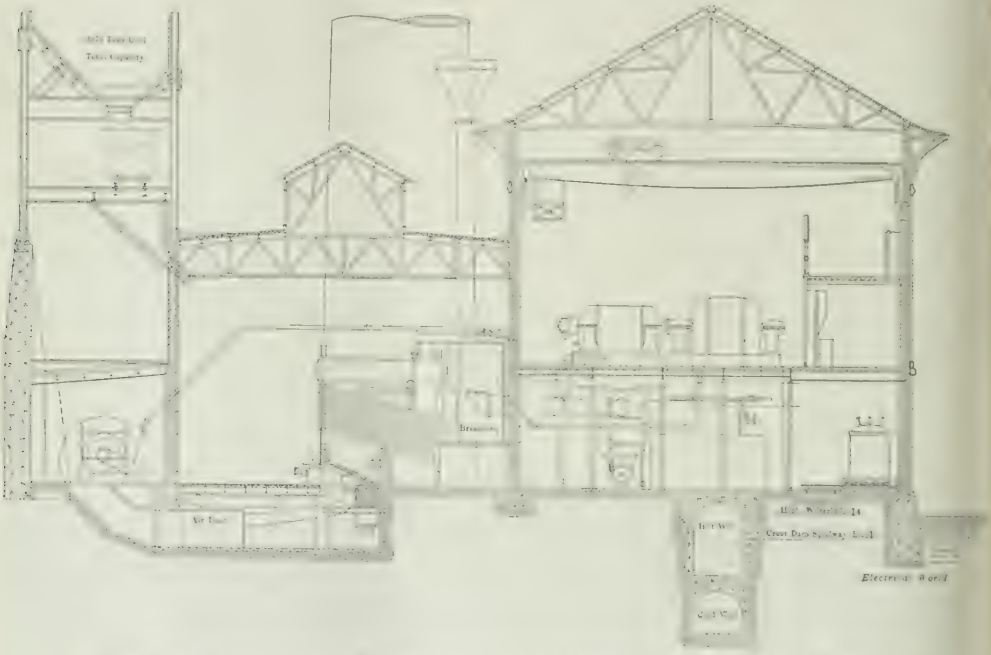


FIG. 2—SECTIONAL ELEVATION OF GORGE STATION OF NORTHERN OHIO TRACTION & LIGHT COMPANY

This article will be confined to a description of the structure and equipment of the Gorge power station, which is nearly completed and has taken on a portion of the load. The station is located in the valley of the Cuyahoga River, just below the Cuyahoga Falls, Ohio.

## Description of Gorge Station

As the low-water flow of the Cuyahoga River was not sufficient for condensing purposes, it was necessary to build a dam so that a suitable pond for cooling water would be provided, and as the fall of the Cuyahoga River is quite rapid at this point, it was found possible by utilizing the head from this dam in connection with a fall below the dam, to secure a head of about 100 ft. one-half mile below the dam.

Other reasons for adopting this site were the convenient and permanent location and the fact that the property was owned by the company. The natural scenery in this vicinity is very beautiful and the company's property has

pacity to care for future requirements of the system, and additional machinery will be installed from time to time as may be found necessary. The power station prope consists of the boiler room, 56 ft. wide by 330 ft. long, an the turbine room, 63 ft. wide by 227 ft. long, separated by a division wall, the turbine room being on the river side The turbine room was located on this side because thi decreased the length of the condensing water tunnels and also simplified the delivery of coal to the boiler room. In addition, there are two small wings in one of which are the blowers for the forced draft and in the other the lightning arresters. In case this station is enlarged a any future time it will be extended in a westerly direction but the probabilities are that when the load increases to that extent an entirely new station will be built in some other location.

The main floor of the boiler room, which is flush with the basement of the turbine room, is placed at elevation 918.5, which is about 40 ft. above the bed of the strea

d about 90 ft. below the top of the bluff, where coal is be delivered. The dam, which is about half a mile be- v this station, has its spillway at elevation 910, so that v water would only be 8 ft. 6 in. below the turbine-room sement. These elevations are referred to sea level. ring the recent floods in Ohio the water rose to eleva- n 918.2. Flash-boards may be provided on the spillway that the low-water elevation will be 912.

The foundations for the building are of concrete, on id rock, or of a compact shale which is found along the nks of the river and which is very durable when pro- ted from the weather. It was necessary to construct a ssive concrete wall about 24 ft. high on the river side obtain this solid rock foundation, but as the rock slope s very steep, the remaining foundation walls for the ilding were only 2 ft. 6 in. deep, except where they pped up at the ends of the turbine room.

The intake tunnel was built under this wall at the west d of the building, and a concrete wall was built adjoin- g this foundation wall directly over the intake, with an en space 1 ft. wide arranged for a shut-off gate in se at any time it should be necessary to clean the intake nnel. A trench for the intake and discharge tunnel for ndensing water was cut in this rock and the tunnels were ilt of concrete, the discharge tunnel being directly above intake.

A screen well was built in the end of the transformer om and duplicate sets of screens were provided, so ar- nged that they can be hoisted to the transformer-room or for cleaning.

The suction lines for the condensers reach the intake nnels through wells located at the side of the tunnels. channeling machine similar to those used in stone quar- s was used in cutting the sides of this trench, the rock ween the channels being blasted. This machine proved ty efficient on this work and fully paid for itself on this alone.

The general design of the exterior of this building is wn in the accompanying photographs. As this struc-

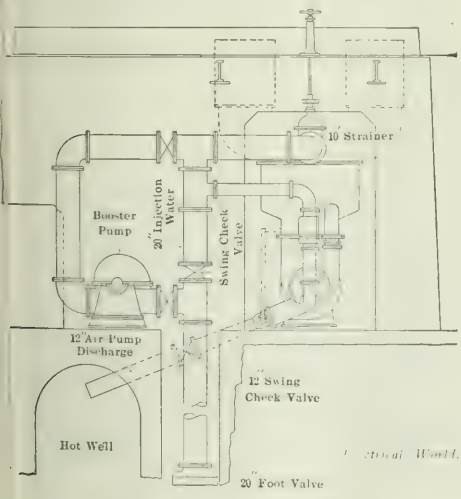



FIG. 3—CONDENSER CONNECTIONS

u is in a prominent location where thousands of the ople of the road pass each day, an attempt was made to re a pleasing exterior. The walls are built of paving ck, the exterior face being laid in Flemish bond of No. 1 cherry-red blocks with ½-in. raked joints and black ntar, backed with No. 2 blocks. All trimmings, moldings, indow architraves, copings, etc., were furnished in gray architectural terra cotta having a tooled surface. The window sashes are of solid steel sections throughout, furnished by the Detroit Steel Products Company. Those in the turbine room are glazed with polished plate glass, while all others are glazed with AA double-strength glass. The monitors over the boiler room are provided with continuous steel sash, glazed with ribbed wire glass. These

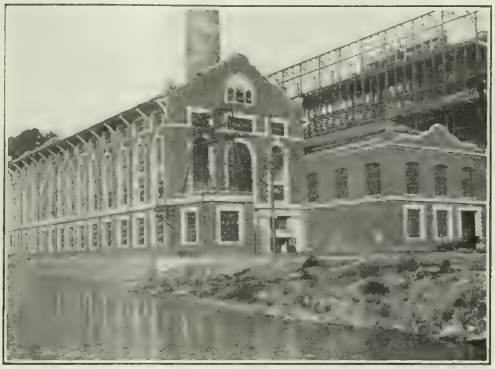


FIG. 4—EXTERIOR OF GORGE STATION

sashes swing from the top and are opened or closed in sections by devices operated from the boiler-room floor. A steel rolling door has been provided in the center of the turbine-room basement. This door is large enough to allow standard railway cars to enter, and the cars can be brought to a point under a main hatchway in the turbine-room floor, so that material can be unloaded by the traveling crane.

The main entrance to the building is just to the right of this track entrance. At one side is the timekeeper's office, and all the men are supposed to check in and out at this point, a door between the turbine-room basement and boiler room having been provided. On this basement floor are provided toilet and locker rooms for the firemen, together with shower baths, etc. The engineer's office is located in the corner of the turbine room, directly above this entrance, and a mezzanine floor is directly under this office, on which are the toilet and locker rooms for the operating forces in the turbine room.

All plumbing and fixtures throughout are of the best grade. Drinking fountains, to which is piped spring water from the bluff, are provided at various points throughout the station, as the general service water is taken directly from the river and is not fit for drinking purposes on account of the discharges from factories, etc., just above.

The roof of the engineer's office is made of 6-in. by 6-in. skylight glass, with sufficient strength to permit of its use as a visitors' gallery. To this end an ornamental railing around the edge of the roof and a stairway from the engineer's office is provided.

The entire surface of the turbine-room walls under the crane runway girders is finished with a marble-like material, known as "Vitrolite," and all interior ironwork is painted a light gray. All floors in the turbine room have a granulithic finish. Lamp circuits are carried in conduits back of the wall facing, except above the crane runways.

A switchboard gallery about 40 ft. long is located in the center of the turbine room on the river side. The structural steel framing is independent of the walls and was erected complete before the general building construction was started. I-shaped plate and angle columns were used throughout. Roof trusses of the "Fink" type were used over the turbine room and ordinary flat-top trusses over the boiler room. The crane runway girders

consist of built-up sections, reinforced in a lateral direction by 15-in. channels on the top flange. The traveling crane was operated for several weeks before the side walls and roof were built, and the rigidity of the steel construction was shown by the entire absence of vibration while the crane was in motion.

The roof of the turbine room is of Spanish tile laid on a reinforced-concrete slab, tile being used mainly for the architectural effect. The monitors on the boiler room are covered with the same tile, while the general surface of the boiler-room roof has a standard tar and gravel surface over concrete.

### Boiler-Room Equipment

The boiler room contains sixteen 604-hp Babcock & Wilcox boilers and superheaters, eight of which are in service at this time. These boilers are arranged in a single row, the stack being placed in the center of the boiler room, with eight boilers on one side and eight on the other. All boilers are equipped with Taylor stokers. Sturtevant fans, driven by Sturtevant engines, which are located in the blower room, just south of the boiler room, furnish the forced draft for these stokers.

may be kept. Richardson 200-lb automatic scales ha been ordered for each boiler. Each boiler will also be pro vided with a $CO_2$ recorder, draft gage and steam-flo meter. Recording thermometers will be used throughout s that an exact record of conditions may be kept. Auto matic feed-water regulators were installed on all boilers.

The stack was built by the Alphons Custodis Chimne Construction Company and is 275 ft. high and 16 ft. in diam eter inside at the top. The stack is unusually high becaus the station is about 90 ft. below the surrounding country Standard Custodis red brick were used in this construction and the stack is surrounded with a cast-iron cap. There are two openings for the breeching, each 20 ft. high an 7.5 ft. wide. This breeching was manufactured by th Babcock & Wilcox Company, and the novelty in its con struction was the use of ¼-in. American ingot iron plate throughout. The angle stiffeners, beam supports, etc., no being exposed to the corrosive action of the gases, are steel.

### Steam Piping

In designing the piping for this station an attempt wa made to secure material of the highest possible grade, an for this reason no provision was made for a duplicate sys

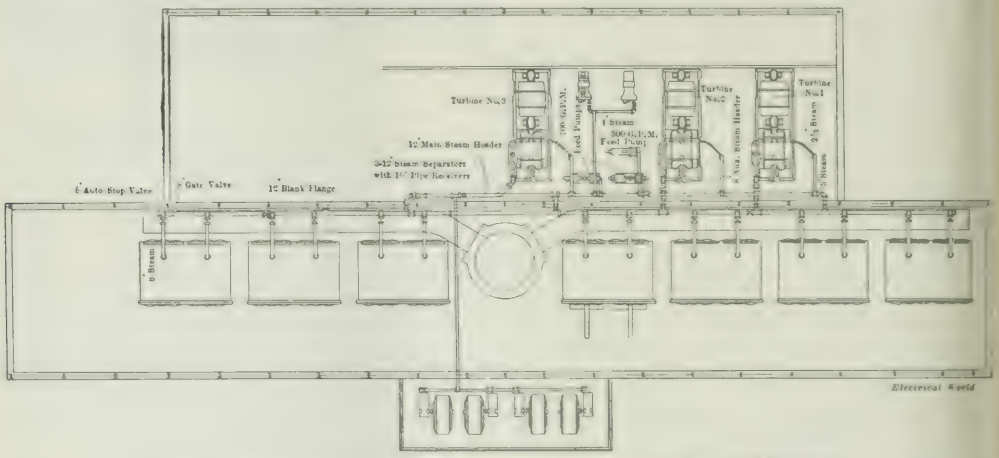



FIG. 5—PLAN OF GORGE STATION OF NORTHERN OHIO TRACTION & LIGHT COMPANY

Engines were chosen to drive the fans instead of motors so that it would be possible to regulate the speed of the fans directly from the steam pressure. The stoker contractors guarantee that the steam pressure will be held within 5 lb. of the desired working pressure when the boilers are normally operated at not over 200 per cent of rated capacity.

Ducts in the basement of the boiler room carry the air for the forced draft. The driving shafts for the stokers, which are driven by the same engines that drive the blowers, are also in the basement. The stokers are fed through chutes from small bunkers mentioned in a previous paragraph.

The ashes are dumped into ash pockets underneath the grates. The ash pockets are provided with dumping grates so that a carload can be dumped at one time. For the present the ashes are wheeled out by hand, but an elevator will soon be installed at the end of the boiler room so that the small cars can be lifted from the basement level to a trestle of sufficient height and thence be dumped into wagons or standard railroad cars for removal.

Steam at a pressure of 200 lb. will be used with a superheat from 75 deg. to 90 deg. Each boiler will be equipped with recording instruments in order that a complete comparative record of coal consumption and steam furnished

tem. However, the main steam header has been s arranged that the boilers may be divided into four groups one or more of which may be out of service at any time This main-station header was manufactured in lengths o about 36 ft. All nozzles, including the 12-in. leads to the turbine, were welded on by an electric arc. Van Ston flanges were used throughout on all high-pressure piping 4 in. and above in diameter.

Cast-steel fittings were used on all high-pressure super heated steam lines, and all high-pressure superheated steam valve bodies were made of cast steel, while the disks, seats and stems were of monel-metal. All high-pressure and low pressure steam piping is covered with 85 per cent magnesia covering.

The main steam piping consists of a 12-in. header in the boiler room, connected to each boiler by 8-in. compound bends. In each of these boiler connections there is an 8-in gate valve and an 8-in. "Foster" non-return valve. This 12-in. header is connected to the three turbines by 12-in leads, each of which is provided with a suitable separator at the lowest point and an angle valve adjacent to the throttle valve. This arrangement allows the separator to drain the header at all times, whether the turbine is in service or not. There is an 8-in. auxiliary header in the turbine-room basement, connected to this 12-in. header a

ree points, from which all connections are taken to auxil-ries, such as feed pumps, condenser pumps, blower en-nes, etc.

The blow-off main is taken outside the building at each d and the blow-off water conducted through a tile drain the pond. The exhausts from the main turbines are nnected to a 36-in. exhaust main which passes through the vision wall and vertically alongside the stack to a point ove the turbine-room roof and terminates in a standard haust head. The exhaust from all auxiliaries is con-ected through an 18-in. main to the feed-water heaters and e heating system, as well as a vertical exhaust line ex-nding above the roof. A relief valve is provided so that y steam not required for the heater may be wasted.

Service piping is provided throughout the building, water ing obtained from a 50,000-gal. steel tank which is set on e bluff just above the station with a head of about 100 ft. his tank supplies the general service water, the cooling ater for transformers, the water lines for cooling ashes d the fire lines. These fire lines are connected to the ed-water lines so that in case of fire one of the feed mps can be used as a fire pump.

Duplicate 6-in. feed-water mains are provided, filled by e three feed-water pumps, which take water from the hot-ell or discharge tunnel. Provision has also been made so at water can be taken from the cold-well or intake tunnel ien necessary. In one of these 6-in. lines a 6-in. Venturi ter has been provided. The results given by this meter ll be checked up by a General Electric flow meter.

A separate system of piping for condensing water is pro-led for each of the large turbines, and this piping is com-ratively simple, consisting merely of a suction line in wells, a discharge pipe through the condensers and the cessary connections to the booster pumps, together with discharge. This discharge pipe is sealed in the hot-well arranging the hot-well so that regardless of the elevation the surface of the pond the water in the hot-well will be least 6 ft. deep.

Air piping has been carried throughout the building, as mpressed air will be used in cleaning the generators, aries, etc., in the turbine room, and for operating turbine-e cleaners in the boiler room. Taps are located at con-ient locations throughout this system, so that the hose nnections will be comparatively short.

The oil piping for the transformers is so arranged that oil from any transformer may be removed through this

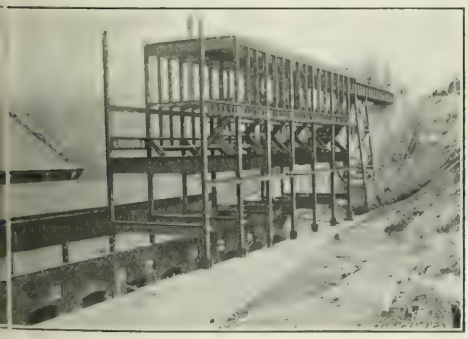


FIG. 6—COAL TRESTLE IN COURSE OF ERECTION

ou to barrels which are set in the pit at one end of the pit line; or, in case of fire, this oil can be run to a pit outsi of the building. A complete oiling system for the rbin units has been installed, so arranged that the oil may re cleaned and filtered at convenient intervals. The various ails of piping will be painted different colors so they can readily be identified.

### Turbine-Room Equipment

The turbine room is equipped with a 50-ton Morgan crane, fitted with one 50-ton hoist and an auxiliary 5-ton hoist, the four motors operating on a 500-volt direct-current circuit.

The present installation of generating equipment consists of three Westinghouse 6300-kw, 2300-volt, 60-cycle, three-



FIG. 7—BOILER ROOM, GORGE STATION

phase turbo-generators, 1800 r.p.m., directly connected to three Westinghouse horizontal double-flow steam turbines. The contractors have guaranteed a steam consumption not to exceed 14.8 lb. per kw-hr. at 100 per cent of rating and 15.4 lb. at 150 per cent.

The rating of approximately 6000 kw was determined on by the company, as it is not likely that the normal load during twenty-four hours will exceed that; nor is it probable that the high swings during the first year of operation will exceed 12,000 kw. Space has been provided in the open hatch previously mentioned for two additional similar or larger units in the future.

Two 150-kw steam-driven exciters have been installed and an additional motor-driven unit will soon be provided. As shown on the accompanying drawings, these exciters are placed on the turbine-room floor between main units and directly in front of the main switchboard. The exhaust steam from the turbines discharges into Westinghouse Le Blanc condensers, which are in the basement, immediately underneath the turbines. The circulating and air pumps for these condensers are on a single shaft and are driven by a 228-hp Westinghouse steam turbine. As there was a possibility that at some time the level of the pond would be drawn below the spillway of the dam, Alberger single-stage booster pumps were provided in the turbine-room basement, near the condensers, driven by 75-hp, 2300-volt, three-phase Westinghouse motors.

Three boiler-feed pumps driven by Kerr steam turbines have been provided in the basement of the turbine room. Two of these pumps are rated at 700 gal. per minute and were built by the Allis-Chalmers Company. The third pump is rated at 300 gal. per minute and was built by the Dayton Turbine Pump Company. The pipes are all interconnected and suitably valved so that any one or more may be connected to either of the boiler-feed mains. The pumps normally take their water from three Hoppes feed-water heaters which are placed on a platform midway between the turbine-room floor and the basement floor. However, the pumps have additional suction lines in both the hot-well and cold-well, so that water can be drawn from either of these

sources in case the feed-water heaters are disconnected or out of order. The feed-water heaters are filled from the hot-well or discharge tunnel by means of two 300-gal.-per-minute turbine pumps directly connected to Westinghouse motors. Two turbine service pumps directly connected to Westinghouse motors, each having a rating of 150 gal. per minute, are also located in the basement. These pumps are used filling the service tank on the bluff and also furnish the cooling water for the transformers.

### Electrical Equipment

The electrical operation of the station is controlled from a gallery about 40 ft. long on the river side of the turbine room between main units No. 2 and No. 3. A benchboard on this gallery contains fourteen panels. Three of these are used for the control of the main units, two for the exciters, three for outgoing high-tension lines, three for 2300-volt lines to substation No. 3, one for 2300-volt lines to the booster pump motors, and two are blank for future connections. Indicating and recording instruments are on vertical panels above the benchboard.

The structure for the busbars and oil switches is on the main floor under the front of this gallery. The ends of



FIG. 8—ROTARY CONVERTERS AND VISITORS' GALLERY

this structure are inclosed, forming a room in which the high-tension circuit-breakers are installed. The main cables from the generators are carried under the turbine-room floor to the 2300-volt busbar. From this bus cables lead to three 3000-kw transformers. Additional transformers will be installed soon. The transformers are located in the turbine-room basement directly beneath the switchboard gallery and step up to 22,000 volts for the outgoing high-tension lines which feed the substations mentioned before. The high-tension cables pass through ducts in the turbine-room floor to the lightning-arrester room. In this room are installed three sets of electrolytic lightning arresters. Directly above this room is an initial transmission tower which is the starting point for all lines.

Substation No. 3 is located in the northwest corner of the turbine room and consists of three 500-kw Westinghouse six-phase, 60-cycle rotaries and three step-down transformers which are fed directly from the 2300-volt main busbar. The switchboard for this substation contains the necessary panels for the rotaries and outgoing feeders. Sixty-cycle rotaries were finally selected for this service to avoid frequency changes in view of the fact that remarkable progress has been made during the past few years in their design. Additional panels for switches and circuit-breakers for lighting and auxiliary motors were placed on the turbine-room floor near the substation board.

### Station Operation

The station is now being operated by two shifts. The organization consists of one chief engineer and four assistant engineers. One engineer is expected to be on duty in the turbine basement and one on the main turbine-room floor at all times. In addition there is an operator on the main switchboard and one on the switchboard for Substation No. 3.

The boiler room is under one boiler-room foreman, and each shift consists of one water tender, one fireman and four coal handlers at the present time until the completion of the coal bunkers. Additional laborers are now employed removing ashes and wheeling coal into the boiler room, but when the ash-handling system is completed it will require very little attention and one or two ash handlers on each shift should be able to take care of all the ashes. When the coal bunkers are completed two men will be required to shift and unload coal and operate the coal crushers. In addition one clerk or timekeeper and one porter have been employed and from two to six boiler cleaners or laborers will be required.

The accompanying table gives the total cost of the various items entering into the structure and equipment and also their cost per boiler-horse-power.

COST DATA ON GORGE STEAM STATION

| Items | Total Cost | Cost per Boiler-hp |
|---|---|---|
| Foundations, excavation, etc., including condensing water tunnels | $170,000 | $17.60 |
| Portion of dam, construction, tracks, etc. | 50,000 | 5.20 |
| Superstructure | 109,000 | 11.30 |
| Structural steel | 43,000 | 4.45 |
| Coal bunkers, including structural steel, concrete, chutes, etc. | 112,000 | 11.60 |
| Electrical equipment of station, including turbines | 245,000 | 25.40 |
| Crane | 6,000 | .62 |
| Condensers | 41,000 | 4.25 |
| Pumps | 10,000 | 1.04 |
| Feed-water heaters | 6,000 | .62 |
| Piping, heating and covering | 40,000 | 4.15 |
| Stack | 13,000 | 1.35 |
| Boilers | 140,000 | 14.50 |
| Breeching | 11,000 | 1.14 |
| Stokers | 60,000 | 6.20 |
| Minor instruments | 10,000 | 1.04 |
| Engineering and superintendence | 50,000 | 5.20 |
| | $1,107,000 | $114.66 |

All foundation work and excavation for this structure was done by the company on a force-account basis. The contractor for the structural steel work was the McClintic-Marshall Construction Company, of Pittsburgh. The Carmichael Construction Company, of Akron, was the contractor for the superstructure. The M. W. Kellogg Company furnished and installed the piping, while the main units and the electrical apparatus, switchboards, etc., were furnished by the Westinghouse Electric & Manufacturing Company. Mr. J. T. Ross, of Cleveland, was consulting engineer on this work, while the writer had immediate charge of the civil and mechanical engineering features.

## Electricity Derived from Refuse

As a result of development in the incinerator method of disposing of mixed refuse, the older and less sanitary method will gradually give way to this more modern method, particularly as cities increase in size. Having produced a method of destroying refuse in a sanitary and inoffensive manner, the question of how best to utilize this heat is being answered by combining a steam boiler with the furnace and producing steam at any pressure that may be desired.

## Wireless and Weather

By A. H. Taylor

is a well-known fact that the night range of a long-ance wireless station is often several times as long as day range. It is also a matter of very common experi- that the day range and the night range are both sub- to wide variations from day to day or night to night.

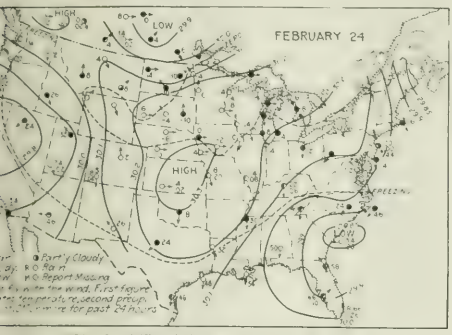



FIG. 1—WEATHER MAP FOR FEB. 24

erence is not here made to variations attributable to un-orable conditions at the sender or at the receiver, such xcessive atmospheric electricity, heavy rains with con-ent poor insulation, or interference with other stations, rather to variations that may be traced to general ab-tion over long stretches of land or sea.

here must be a vast quantity of data on hand bearing his problem, as every operator must have noticed some ection between transmissivity and weather conditions, he data are scattered and not very available. The writer ot aware that any serious attempt has been made to late the transmissivity over long distances with the her conditions prevailing in the region traversed by the s. There seems to be only one tenable theory as to the e of this absorption, and that is the sunlight theory ioned by Zenneck, Pierce and others. Ionization of up-ayers of the earth's atmosphere by the ultra-violet rays he sun is supposed to develop a slightly conducting um which would account for the absorption.

this be true, it might reasonably be expected that on a following a day which has been sunny over a long h of country between any two stations the transmis-

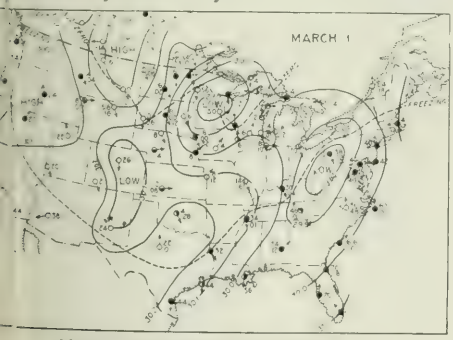



FIG. 2—WEATHER MAP FOR MARCH 1

it would be low, while if cloudy conditions prevail over e me area the transmissivity would be high. On the he hand, it may be argued that the ionization occurs in gics above the clouds, and that no connection between nissivity and cloudiness should be expected.

There are few stations in this country more favorably ated for the investigation of the problem of absorption over land areas than the radio-electric station of the University of North Dakota, situated, as it is, in Grand Forks, just 1,200 miles from each coast, and within easy reach of the lake district.

The aerial is of the inverted L type, 12 ft. wide, 130 ft. long and 80 ft. above the ground. An audion receiver, used with a loose-coupler and suitable tuning condensers, has been found to be the most sensitive for long-distance work. The audions used were operated at a fixed current value somewhat less than the value necessary for maximum efficiency. This heating current was in all cases not far from 0.32 amp. The sensitiveness of an audion receiver was tested frequently by means of a standard test buzzer circuit, adjustable to any desired wave-length and damping. The applied voltage on the telephone circuit was varied so as to keep the sensitiveness at nearly the same value through a series of tests.

It was not possible to obtain United States Weather Bureau maps on the day preceding the test, but through the courtesy of Prof. Simpson, director of the University of North Dakota weather station, it was possible to get the maps on the day following the tests. This had one advantage, namely, that the observer was unprejudiced by any preconceived notions as to the bearing of the weather on results.

On Feb. 24 the author listened between 7 p. m. and 11 p. m. and heard signals from the University of Michigan, at Ann

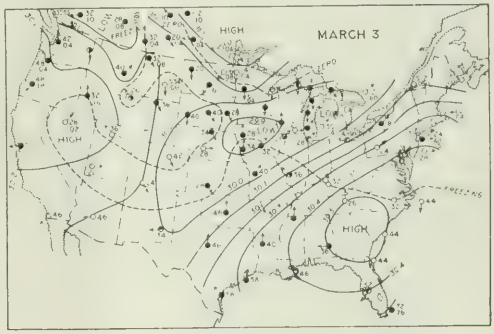



FIG. 3—WEATHER MAP FOR MARCH 3

Arbor, when 3.4 kw. was employed, as a subsequent letter from Mr. H. S. Sheppard, in charge of that station, indicated. Signals from some ten or twelve other stations along the Atlantic coast were also plainly heard.

It must be noticed that at this distance from the coast, and with a moderately high aerial (80 ft.), coastal stations and ocean vessels are heard only under rather favorable conditions for transmission.

A glance at the weather forecast for Monday morning, Feb. 24, shows two large cloudy areas moving over the northern part of the United States. This map also shows a clear area some 500 miles wide between the University of Michigan and the University of North Dakota. The test with the University of Michigan station was even more remarkable for the fact that the signals from the University of North Dakota station were heard faintly at Ann Arbor when calling with 1 kw. This test is the only one so far in which good transmission has been noticed to follow clear weather conditions, and even in this case it is seen that the whole Atlantic coast lay within a cloudy area, which extended to the westward beyond Michigan.

On Sunday, March 2, the author was not at the station, but Mr. E. C. Reinecke, an amateur at Fargo, N. D., reported a very good night. Mr. Reinecke thought he heard signals from Colon, Panama, on that evening. A map for Sunday is not sent out by the Weather Bureau, but the map for Saturday, March 1, shows a general cloudy condition all

along the Atlantic coast and from the Gulf to Winnipeg. The map for Monday shows very cloudy conditions prevailing throughout the Mississippi Valley, the lake district and the Northwest. The indications are, therefore, that Sunday was pretty generally cloudy, and both Saturday and Monday maps show general cloudiness in the area between Fargo and Key West. Whether this condition extended as far as Colon or not I am unable to say. It seems very likely.

On the evening of March 4 we were able to hear signals from the stations from both coasts, and Key West signals were received at the university and also at Fargo. The weather map for that date shows cloudiness all along the line between Grand Forks and Jacksonville, Fla., and the following day's map shows that this condition moved on down beyond Key West. The map for March 4 shows a cloudy belt to the northwest, toward Seattle and Vancouver, while the whole Atlantic coast is likewise cloudy.

The night of March 13 was one of the best as regards the number of stations from which signals were heard, but the excessive static electricity prevented any but a good operator from recognizing many calls. I have no hesitancy in saying, however, that more stations were heard from that night than on almost any other. The weather map for March 13 shows cloudiness everywhere except in the southwest.

The next test was made on March 17, and practically no signals were heard between 8 p. m. and 11 p. m. The map

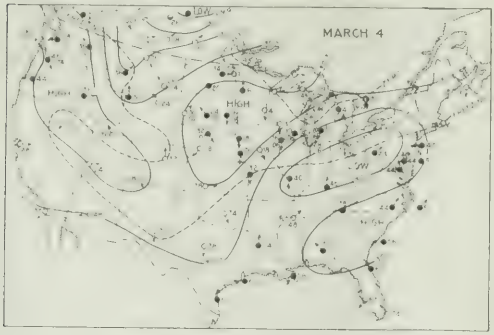



FIG. 4—WEATHER MAP FOR MARCH 4

for March 17 shows all the Eastern part of the country in a clear area. The connection seems to be obvious.

On the next evening the author thinks he identified three calls from the Pacific coast, near Vancouver and Seattle. It may have been a coincidence, but the map for the eighteenth shows a cloudy area between Grand Forks and Seattle, while the Eastern coast is clear. This seems to explain why signals from no Eastern stations were picked up that night.

The map for the eighteenth seemed to indicate that the cloudy condition would proceed eastward. Acting on this hypothesis, the author spent the evening of March 19 at the station, expecting to catch signals from many Eastern stations. Much to his surprise, not one was heard. Next morning when the map arrived it was seen that the cloudy condition had turned and swung down South through the valley of the Mississippi, and that the East had remained clear. This seems to be rather definite evidence that cloudiness and transmissivity are directly connected.

It should have been noted in connection with the test of March 17, when no signals were heard, that Michigan called us by pre-arrangement at definite intervals, using from 4 kw to 8 kw, but we were unable to hear anything.

On Monday, April 21, the University of Michigan called several times and was heard very distinctly at the University of North Dakota, although the static disturbances were very bad. No Eastern stations were heard, but signals from several in the lake district came in very strong. The weather map shows a cloudy area between Winnipeg and Chicag but a clear region along the Eastern coast. On the follo ing evening the author listened at the receiver between and 9:30 o'clock with no result. The Michigan station c not operate for our benefit that evening, but I should ha been able to hear signals from any lake stations if they h operated in that interval, if the cloudy area in that distr



FIG. 5—WEATHER MAP FOR MARCH 13

as shown by the April 22 map has any bearing. The Fa ern coast remained clear.

On Wednesday evening signals were heard from University of Michigan station, several stations in the l district and several on the northern Atlantic coast. T Wednesday map shows a cloudy area over all of this te tory. On Thursday, April 24, Mr. Reinecke, at Far reported hearing signals from a number of stations w great distinctness, an observation which was checked at University of North Dakota station. The map for this also shows a cloudy area in the lake region.

It would be possible to multiply greatly these instan of the connection between cloudiness and transmissivity. I have made many random observations after sunny d of the early winter when signals from very few stati were heard, and more often none at all. So far, of thirty observations, I have found only two which d clearly indicate that a general daytime cloudiness ove wide area is sure to be followed by an evening of h transmissivity. It still remains to be shown whether clou ness at transmission station or at receiving station is m fortuitous, although I am inclined to think that the transm

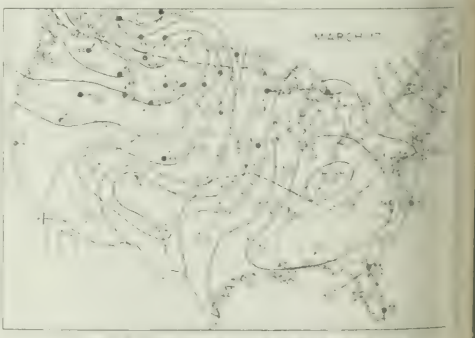


FIG. 6—WEATHER MAP FOR MARCH 17

sivity is better when the sunny area, if there is such, aff only the receiving station and its neighborhood. The tr missivity is even then not so good, of course, as it is w the cloudy area includes both the receiving and the s ing stations.

If the connection between cloudiness and transmissi be conceded, it will be apparent that the general at

neric absorption does not occur in the regions above the ouds to anything like the same extent that it does in the gions of lower level, which is contrary to previous spec- ations on this point.

It would also appear that far Northern stations operating summer when the period of sunshine is of long duration ould have a shorter range than in winter. It would be of terest to know if the operators of Alaskan and northern nadian stations have any data bearing on this point. With e collection and correlation of more data on radio-trans- ission and meteorological conditions, doubtless some of e vagaries of wireless experimentation will be accounted r, and might even be put to practical use by weather bu- aus.

## onvention of Southeastern Section, N. E. L. A.

The general news features of the convention of the outheastern Section, National Electric Light Association, ld at Macon, Ga., Aug. 14 to 16, were presented in our sue of Aug. 23, together with a detailed account of the apers, addresses and discussions of the first day's sessions. ere follows a report of the technical program for the emaining days of the convention, including abstracts of e papers and the discussions they provoked.

### Load Builders

"Load Builders" was the title of the paper by Mr. Milt aul, Georgia Railway & Power Company, Atlanta, Ga., ad in the author's absence by Mr. W. R. Collier, Atlanta, a. The author pointed out some of the opportunities en to the advertising department in building up the ntral-station load, a function which is of the greatest portance in successful utility operation. But no adver- ing campaign can ever be successful, declared Mr. Saul, thout contented and satisfied customers, and a staff of ployees which "makes good" in the largest sense the ims of the advertisement writer. Unless each depart- nt is performing its full duty, the advertising depart- nt's voice will soon strike falsely upon the public ear and s effectiveness will be lost. The work of the Atlanta mpany has included the preparation of booklets and ad- rtisements, citing large and successful companies already ntral-station customers. Use is also made of direct-by- il circular campaigns. The Atlanta company has a list 10,000 names divided into several classes. To each of se addresses there go each month several pieces of de- riptive literature. Some of the material is prepared by advertising department itself, in order to obtain local luence and character. Some is purchased from pub- hers, and the manufacturers of appliances furnish another ss of printed matter which is of great usefulness.

*Discussion*

Mr. G. K. Dustin, Columbia, S. C., recommended the use of illuminated billboards for central-station advertising. Newspaper advertising, he added, is valuable, although it should be employed on the modern principle of its com- rcial value rather than as a fee to the publisher.

Mr. M. H. Hendee, Augusta, Ga., testified that many purchasers of appliances had cited the moving-picture ad- rtising shows as first awakening their interest. Mr Hendee thought that such exhibitions are even more effec- ive than newspaper advertising.

Mr. T. J. McGill, Atlanta, Ga., also discussed the use of advertising matter and motion-picture films furnished by the electrical manufacturers.

Mr. W. R. Collier, Atlanta, Ga., testified against the practice of sending out advertising matter with bills. Many customers in opening such envelopes conclude the in- closures to be only advertising literature and throw the whole in the waste-basket. In this way a large number of bills have been destroyed with considerable annoyance to the company and loss of the discount to the customer.

Mr. G. K. Hutchins, Columbus, Ga., said that in one instance he had received only a dozen inquiries from 100,000 pieces of advertising matter sent out. Such advertising campaigns, he concluded, are of no value unless salesmen are detailed to follow them up.

Mr. A. L. Lindsay, Durham, N. C., outlined the plans contemplated for the Society for Electrical Development.

Mr. R. L. Rand, Anniston, Ala., favored the use of newspaper and moving-picture-show advertisements. He counselled, however, against promiscuous advertising, declaring that his own card index, which lists the apparatus in use by each customer, has been found most valuable at Anniston.

Mr. T. W. Peters, Columbus, Ga., suggested that the manufacturers might well do less advertising in the popular magazines and devote more to local campaigns. Direct solicitation from salesmen, he concluded, is of the greatest importance.

Mr. W. A. Belcher, Cordele, Ga., declared that newspaper advertising gets down to "the human touch." In one case which he cited the local central station was confronted with prospective customers using twenty-two languages. Salesmen, however, were hired who could speak various tongues, and with the aid of a card index much desirable business was obtained.

### Industrial Motor Service

"What Is a Horse-power?" was the title of a paper by Mr. Albert Milmow, Alabama Power Company, Birmingham, Ala., in which the author recommended departing from strictly technical terms in closing commercial motor-service contracts. Since the characteristics of electric drive are so different from those of the older forms of motive power, attempts to compare the two with the common unit are likely to lead to misapprehension and prejudice. For this reason, the definition suggested by the author is "a unit for the measurement of manufactured articles produced."

In comparing the cost of steam plants and motors all items must be included. Certain cotton mill engineers have cited $30 to $40 as the cost per hp of steam-engine capacity, compared with $18 to $30 per hp for equivalent motor installations. Another eminent designer placed the same figures at $33.90 for electric drive, against $79.04 for steam drive. In approaching the customer when a contract is to be closed care must be taken to present the proposition to him in its simplest possible terms. In the meantime, if it is necessary to use maximum demands, load-factors, etc., for equitable rate determinations, such terms should be made plain to the central-station's clients. It is the salesman's duty to see that the customer is contented, that he understands his rates knows he is getting a square deal and can read his kilowatt-hour consumption and use it as an index to his operating conditions.

The paper was discussed briefly by Messrs. J. S. Bleecker, Columbus, Ga.; W. R. Collier, Atlanta, Ga.; G. K. Hutchins, Columbus, Ga., and A. H. Sikes, Macon, Ga.

### The Hotel Load

Mr. C. A. Collier, Georgia Railway & Power Company, Atlanta, Ga., followed with his paper on "The Hotel Load." After pointing out the desirability of this class of business as a consumer of both electrical energy and steam heat, the author presented tabulations of data showing the installations in certain Atlanta hotels, together with curve sheets revealing the load characteristics of their lighting and motor service. One of the great talking points for the isolated plant is the claim that if engines are installed steam heating will cost nothing. As a matter of fact in the Atlanta district not more than 30 per cent of the steam needed for heating is available as exhaust, and of the total quantity of exhaust steam not over 30 per cent can be used for heating during the heating season.

Compared with exhaust-steam heating, the use of low-pressure boilers in one case was found to effect an addi-

outlay of only $750 per year, an amount offset several by the saving through the purchase of energy from entral station. In conclusion, said the author, the carefully the hotel load is analyzed the more attract- t will appear as central-station business. The com- al department of the central station can therefore use forts to no better advantage than in securing hotels stomers, to which end the many small reasons which mend this class of service are of no less importance the larger ones.

*Discussion*

W. L. Southwell, Macon, Ga., described the electrical ment of the Hotel Dempsey, Macon, Ga., where the ntion was being held. The Dempsey's connected load otors aggregates 185 hp, two motor-generator sets ying the elevator direct-current service. The building hted by 25-watt lamps and the consumption averages o kw-hr. per month.

E. S. Roberts, Savannah, Ga., reminded his audience they must not overlook the cosmopolitan and resort cter of the hotel load in certain Southern cities. In towns, however, the hotels are largely closed during mmer, while their large winter load makes undesirable nable business.

M. Webb Offutt, Birmingham, Ala., cited the govern- report on a 150-kw-hr. isolated plant at Fortress Mon- where it was shown that the cost of developing energy 4.32 cents per kw-hr.

H. C. Adams, Jacksonville, Fla., told of the condi- met by his company, which operates sixty small plants e principal business is ice-making. The Florida hotel n is short, lasting only three months during the winter, he hotel managers and proprietors can be convinced with difficulty that a comparatively high rate is just ich short-season service.

ernating-current elevator electric motors are now be- sed with success, declared Mr. W. R. Collier, Atlanta. One has operated in Atlanta during the past four and makes no trouble or noise.

M. H. Hendee, Augusta, Ga., questioned whether the under which the two large tourists' hotels in his city pplied can return much profit to the company.

E. C. Deal, Augusta, Ga., added that he would also prefer furnishing service to year-round hotels at a lower rate per kilowatt-hour than short-season serv- a high rate.

M. H. Rourk, Macon, Ga., manager of the Hotel sey, discussed central-station service from the hotel- viewpoint, recounting his experience with a $50,000 ed plant in the Hotel De Soto, New Orleans. When a occurred there the central-station throw-over service d of the greatest value to this plant. But hotel everywhere, explained Mr. Rourk, want a flat monthly for central-station service, and he declared that a amount of hotel business could be closed if the cen tations were willing to meet these conditions.

commenting on Mr. Rourk's remarks, Mr. E. H. Ginn, ta, Ga., inquired whether hotels would in turn be g to sell their service to guests at a flat rate. Others took part in the discussion were Messrs. C. D. Flani- Athens, Ga.; H. L. Wills, Atlanta, Ga., and T. J. ll, Atlanta, Ga.

### Controlled Flat-Rate Systems

A. T. Holbrook, Excess Indicator Company, Pitts- , Pa., closed Friday morning's program with a paper The Sale of Energy on a Flat Rate by Means of a nt-Limiting Device." Among the arguments cited e author to meet objections brought up, were: (1) existence of thousands of small customers now using gas for lighting, but who cannot be obtained as cen- tation customers by any other than the flat-rate od. (2) Present residence customers who have elec- tric irons or other appliances find difficulty in changing over from a meter to a flat rate, so that the effect on present meter customers need not be considered. (3) The inherent tendency of the public to buy service on the American plan causes many people to pay 25 to 50 per cent more for a flat-rate commodity than for the same commodity on a measured service. In other words, "knowing exactly the cost," is an even larger factor than the economy involved. (4) Records obtained with check meters show that the rate per kilowatt-hour secured under flat-rate systems, at 1 cent per month per watt connected, compares favorably with existing meter rates.

The recent campaign in Atlanta, Ga., resulted in 1200 contracts, of which 728 were houses actually signed up for wiring. Gas arcs to the number of 332 were also replaced. Other campaigns have been in progress in the towns of the Carolina Power & Light Company, where 930 new customers were obtained with an increased income of $14,784.

*Discussion*

Mr. J. E. Bingham, Tampa, Fla., declared that flat-rate campaigns open virgin fields for the solicitor, enabling classes of business to be taken on which were hitherto considered unprofitable. He questioned, however, the use of a force of outside solicitors and suggested that the various items of cost, including disconnections, customers' moving, etc., be included.

Mr. T. W. Peters, Columbus, Ga., described the large use of prepayment meters in his own city, where they are designed to secure the same class of business as is reached with the flat-rate controller. His 325 prepayment meters average 9.5 cents per kw-hr., with an approximate demand of 180 watts. The average use is 3.4 hours per day, and the meters return an average income of $21 per year. Loss of collection, he declared, is also smaller than that with the flat-rate system. The cost of obtaining a prepayment customer has averaged only 20 per cent of the yearly revenue

Mr. M. Webb Offutt recounted the experience of the Hartford (Conn.) company in adding to its lines flat-rate customers who hitherto could not afford metered electric service. Mr. Offutt also brought up the question of the attitude of public-service commissions toward flat-rate propositions as constituting special rates favoring certain classes of customers. He referred to the use of "blue meters" in crediting delinquent customers for past debts, and for certain classes of business he further suggested the use of the prepayment meter set at a higher rate, but without the minimum charge.

Mr. W. A. Belcher, Cordele, Ga., told of securing 201 contracts totaling 24.5 kw with a revenue of $3,215. The average income per customer was $16 per year at a maximum demand of 131 watts.

Mr. H. C. Adams, Jacksonville, Fla., pointed out that unless the flat-rate customer "sticks" his contract may have been secured at a loss to the company.

Mr. M. H. Hendee, Augusta, Ga., recounted a campaign in which three solicitors secured 1357 flat-rate customers, netting 945 permanent flat-rate users after 145 had quit the service and 135 others had changed to metered service. The monthly revenue obtained was $2,227, and incidentally 801 house-wiring contracts were closed. Check meters installed showed an average earning of 9 cents per kw-hr. (without lamp renewals), compared with 10.7 cents per kw-hr. under the regular meter rate (with lamp replacements).

Mr. J. S. Bleecker, Columbus, Ga., suggested the use of an inspection service to take the place of controlled circuits.

Mr. J. H. Robertson, Greensboro, N. C., reported earnings of 8.5 cents per kw-hr. as shown by check meters installed in connection with a flat-rate system whose charges ranged from 1 cent to 3 cents per connected watt per month. The equivalent meter rate was 12½ cents per kw-hr.

Mr. T. B. Culley, Augusta, Ga., reported that flat-rate

collections there have been good and that the flat-rate business obtained has been very desirable. Incidentally, bookkeeping is reduced to the minimum.

Mr. G. K. Dustin, Columbia, S. C., urged that central-station men do away with the usual uncertainty of customers' electric-light outlays by advising their customers to read their own meters and to control their consumption to fit their pocketbooks.

In conclusion, Mr. Holbrook, the author of the paper, declared that no objection has ever been raised by any commission to controlled flat-rate systems when offered as an optional rate. If, of course, a local ordinance specifies the rate, it is necessary to have a new ordinance drawn up. Hartford, Conn., has 4000 controlled flat-rate customers and 5000 metered customers, the income per kilowatt-hour being practically identical, averaging 6 to 4 cents. The income per capita at Hartford, said Mr. Holbrook, is $11 per year.

### Public Policy Session

At the public-policy session of Friday evening Mr. John S. Bleecker, Columbus Power Company, Columbus, Ga., presented a paper on some of the broader aspects of public relations, pointing the way to an attitude of better understanding on the part of both public-service corporations and public.

Public-utility monopolies, he said, must recognize that they are public utilities, the servants not the masters; they must remember that they are monopolies and not discriminate; they must give good service; they must not expect unreasonably high returns; they must encourage and assist the properly selected bodies which represent that average individual they wish to reach; they must not be over-sensitive nor overbearing; they must be frank, fair and efficient, and they must look for the bright side of that dark cloud. It is beginning to show. They can help turn its smiling countenance to the light by telling the public who they are, and what they are and why.

Following Mr. Bleecker, Mr. M. Webb Offutt gave a short address, taking as his text co-operation between central station, manufacturer, contractor and engineer. He also urged getting the support of the architect in the wiring of buildings and the arrangement of illumination. Central-station companies, he declared, should be close together in the discussion of vital questions and the interchange of policies. One great value of the State association has been in its attention to matters of State legislation, matters which demand most serious consideration. Not only is the customer entitled to a reasonable rate for his service, but the company as well should be allowed a reasonable return on its investment.

The treatment of labor, added Mr. Offutt, is one of the problems before the central station. It is important that the central-station manager gain the co-operation and interest of his employees. Profit-sharing and old-age pensions are two steps in the right directon.

Mr. T. H. Burch, Griscom-Russell Company, New York, followed with a brief discussion of the advantages secured by the use of evaporators in connection with electrified ice plants.

### Electric Truck Sales to Merchants

"The Sale of Electric Trucks to Merchants by Central-Stations" was discussed by Mr. H. W. Hillman, Electric Vehicle Company, Long Island City, N. Y., in a paper read in his absence by Mr. G. K. Dustin, Columbia, S. C. The author cited the experience of Hartford, Conn., Baltimore, Md., Vancouver, B. C. and other cities in the sale and promotion of electric trucks. He insisted that any community should support one electric truck for each 1000 of its population. Mr. Hillman urged that central stations extend to the local merchants the necessary leadership to promote electric truck sales, overlooking no opportunity to install battery-propelled vehicles for hotel-bus, commercial-truck and other purposes. He made a special point of the reliability and prestige added to the sale of electric trucks if handled by the local electric-lighting corporation, whose reputation is already well established in the community. In conclusion, the author presented comparative data on the cost of electric, gasoline and animal-drawn conveyances.

#### *Discussion*

Mr. E. D. Craig, Savannah, Ga., opened the discussion by pointing out that manufacturers of electric vehicles limit their agents to only one brand of car, although gasoline-car agents usually handle several cars. Until the time comes when one line will keep the agent busy, Mr. Craig recommended that the manufacturers remove their restrictions and allow agents to handle other cars.

Mr. J. S. Bleecker, Columbus, Ga., reported his own experience with an electric vehicle on consignment and criticized the attitude of the vehicle manufacturers as being narrow.

Mr. M. Webb Offutt, Birmingham, Ala., testified to the thoroughly satisfactory experience of his company with a 2-ton truck in operation four years and followed by the addition of other cars. He pointed out the advantages of sales offered by the central station, but also called attention to the lack of faith in the electric vehicle often seen on the central station's part. A feature of the electric-vehicle load is the aspect of controlling its off-peak characteristics. If the company will establish a storage service it can hold machines until after 10 p. m., then plunging in the cars for charging during the off-peak hours.

Mr. W. R. Collier, Atlanta, Ga., declared that the central station should go no further than to work up interest in electric vehicles and to pave the way for the manufacturer's salesman.

Mr. J. T. Hart, Cleveland, Ohio, said that central stations lack information concerning electric trucks. These cars can climb hills easily and have ample mileage for city haulage. He urged that the central station itself lead off in the use of electric trucks.

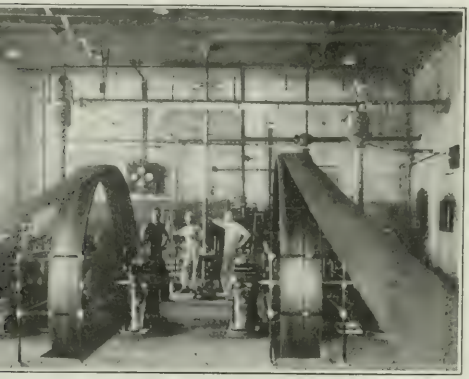
### Daily Meter Reading

The advantages of reading meters and billing continuously during the month were pointed out in a paper by Mr. F. B. Culley, Augusta, Ga., presented at the Saturday morning session. Under the older once-a-month plant the metermen were employed at other mechanical work during fully two-thirds of their time, while during the reading periods their number had to be swelled by recruits from other departments. With the daily-reading schedule, however, the readers are employed continuously and regularly, and readers and meter-repair men each have their definite functions in which they become very proficient and of great value to the company. One central station having 3043 meters scattered over 12 square miles of area accomplishes the full reading in twenty working days with only one meter reader. This reader is not at all rushed and has opportunity to make various investigations when necessary. He is required to make subtractions before leaving each meter and is thus assured that his work is correct. If there is a discrepancy, the reason is sought at once while still on the ground, and the fullest obtainable data are handed in to the accounting department at the beginning, thus avoiding delays. The effect of daily readings is also reflected in the even loading on the treasurer's office and cashier's window.

Among those taking part in the discussion were Messrs. A. A. Wilbur, Columbus, Ga.; W. L. Southwell, Macon, Ga.; J. E. Bingham, Tampa, Fla.; E. S. Roberts, Savannah, Ga.; J. H. Robertson, Greensboro, N. C.; R. L. Lindsay, Durham, N. C.; W. R. Collier, Atlanta, Ga.; E. C. Deal, Augusta, Ga; J. S. Gleecker, Columbus, Ga., and M. H. Hendee, Augusta, Ga. Of this number five reported that they are already using the daily-reading scheme, and three of the others are considering adopting it.

## Municipal Ice-Electric Plant in Oklahoma

Although certain large cities have agitated the question municipally controlled ice factories, the little town of eatherford, Okla., with a population of 2116, has inlled what is said to be the first plant of the kind in the intry. This installation is interesting not only because eatherford was foremost in trying out the economies of



1.—ENGINE ROOM, WITH ABSORPTION-TYPE ICE-MAKING EQUIPMENT IN REAR

mall plant but because of the possibilities shown here, elsewhere, for utilizing the exhaust steam from the genting station.

n response to questions contained in a letter received m the president of the borough of Manhattan, New rk City, the commissioner of public utilities at Weather-l, Mr. Hugh J. Cooper, made the following statement: ne practical operation of our plant has proved that the ory of connecting an ice plant with a power plant is a rect one."

The strongest opposition which was maintained against municipally operated ice plant was that the city would unable to obtain economical results with such a small ipment. The point made in this opposition, said Mr.

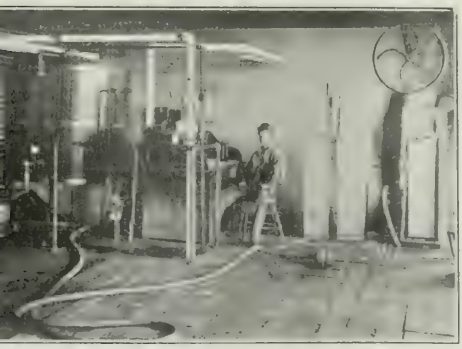


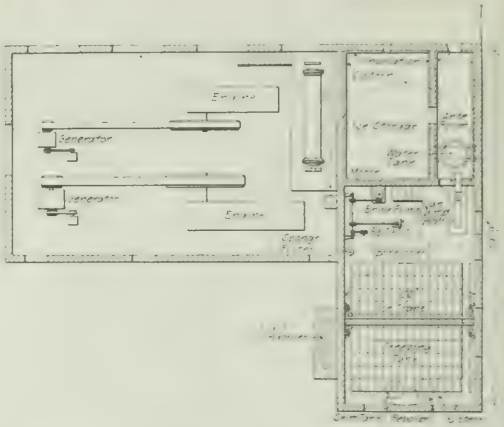
FIG. 2—INTERIOR OF TANK ROOM

oper, has been answered by trial, and the economy which racterizes the operation of this municipal plant now atts the loudest part of the praise accorded to it.

The plant has already been in operation three months has a normal output of 10 tons of ice a day, but can duce 15 tons by crowding. The cost of manufacturing o cents a ton, and consists of 40 cents for labor and 60 cents for fuel. The price delivered to the consumers for amounts less than 1000 lb. is 40 cents per 100 lb.; 1000 lb. or more, in full blocks in one delivery, 30 cents. Prices on the platform for 300 lb. or less are 40 cents per 100 lb.; for 300 lb. to 1000 lb. in full blocks, 25 cents, and for 1000 lb. or more, 20 cents. In car-load lots the price per hundred is 15 cents or $3 per ton f. o. b. from the plant's railroad siding. According to the data obtained, the cost of delivery is $2 per ton.

The installation cost the city $11,000, appropriation for which was obtained by utilizing a fund which was originally raised by the city for the erection of a city hall. Mr. Cooper decided, however, that an ice plant in connection with the generating station and water-works was more badly needed than a city hall, which would probably entail additional help and equal expenses. He convinced the city of its need and the ice plant was erected.

Figures quoted in the preceding paragraphs are quite comparable with the rates given by larger plants. The equipment used in manufacturing the ice is the absorption type, and was furnished and installed by the Carbondale Machine Company, Carbondale, Pa. Exhaust steam from the generating units is employed to evaporate the ammonia solution and compress the resulting ammonia gas. Water for cooling


Engine
Generator
Generator
Engine
Ice Generator
Water Tanks
Exhaust Pipe
Ice Tank
Ice Tank
Ice Tank

# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Reduced Monthly Minimum in St. Louis

Beginning Aug. 1, the Union Electric Light & Power Company reduced the monthly minimum bill for residence lighting from $1 to 50 cents. Prior to the establishment of the present residence schedule, the monthly minimum was charged at the rate of 3 cents per month per lamp connected, the charge in no case being less than $1. When the reduced residence schedule went into effect this monthly minimum was reduced to $1 flat for all residences. The present reduction brings the monthly minimum to 50 cents.

## Prizes for Students' Central-Station Essays

Early in the school year the Union Light & Power Company, of Franklin, Mass., offered to the graduating class of the local high school a cash prize for the best paper on the subject, "The Value of Electricity for Light and Motor Service, and the Part an Electric-Light Company Should Play in the Life of a Thriving, Progressive Community." Many interesting, well-written and logically thought-out papers, reviewing the principal central-station arguments, were received, two of which were considered worthy of prizes. The company was well pleased with the result and next spring will repeat the offer to the graduating closs of 1914.

## Selling Appliances in Combination

By selling electrical household appliances in groups combined at the choice of the purchaser, the Narragansett Electric Lighting Company, of Providence, R. I., has done much to stimulate popular interest in its service. The following energy-consuming devices are sold in sets of three each at a discount of 33⅓ per cent from the sum of the listed prices in each case: Percolator, $6.08; teapot, $6.48; toaster, $3.23; 6-in. stove, $4.05; egg boiler, $6.75; chafing dish, three sizes, $4.05 to $10.98; flatiron, $3.50. By this scheme a visitor to the company's showroom can secure, for example, a flatiron, a percolator and an electric toaster at a net cost of $8.54, compared with an individual total of $12.81. The plan of offering prospective users of heating devices a choice of such wide range has been particularly successful in comparison with that of offering low prices temporarily on a single piece of apparatus.

## Contractors Co-operate in Electrical "Movie" Matinee

With the co-operation of local electrical contractors, an electrical moving-picture matinee was recently given by the United Electric Light & Water Company, of Greenwich, Conn. The local theater was leased for the afternoon and the affair advertised in the newspapers and by the distribution of complimentary tickets. To add interest to the occasion it was announced that an electric toaster would be given to the lady holding the ticket bearing the lucky number. A number of excellent motion-picture reels and lantern slides were loaned by the manufacturing companies. As the performance was run with the aid of the local electrical contractors the expense was comparatively small. It stimulated, however, a great deal of interest in electrical devices, besides creating much favorable comment from both the public and the press. The performance was held under the direction of Mr. G. F. Atwater, superintendent, and Mr. E. F. Putnam, commercial manager of the Greenwich company.

## Electric Cooking at Hattiesburg (Miss.) Normal School

The Mississippi State Normal School at Hattiesburg, Miss., is now equipped with complete electric cooking apparatus for instruction in domestic science, the courses in which are in charge of Miss D. Campbell. As shown in the accompanying illustration, one of the schoolrooms is provided with twenty General Electric 1500-watt, three-circuit, 8-in. disk stoves installed on benches ranged along the two sides of the room. In the center there is also a full-sized electric range with a total connected load of 6.3 kw, which is used by the instructor in demonstrating culinary operations to the class. This electric-cooking equipment has proved such a success at the Hattiesburg school that it is now planned to double the installation, adding also a modern electric range of the latest type. Energy for the operation of these electric-cooking devices is furnished by the Hattiesburg Traction Company.



CLASS IN ELECTRIC COOKING, HATTIESBURG, MISS.

## Electric Truck for Long Ice Hauls

In a Southern city of 20,000 inhabitants the local combination ice-electric company has made successful use of a 3-ton battery-driven electric truck for hauling ice to outlying distribution points, from which the horse-drawn wagons deliver it to customers. In this way the one electric truck has replaced four single-horse wagons, with a great saving to the company. The truck loaded with ice is sent around fixed circuits, meeting the returning delivery wagons and

replenishing their exhausted stocks. Trips are made daily to both the east and west sides of the city. At a load the truck can carry fifteen 300-lb. cakes of ice. By motor delivery of the ice to the wagons the latter are saved the time and labor of the long haul back to the plant and return. A smaller number of wagons are thus enabled to get through with the delivery in much shorter time, while the working conditions of both animals and deliverymen are improved.

## Roller Skates for Storeroom Employees

Employees in the storerooms of central stations where the distances traversed are relatively large might find their work facilitated by the aid of roller skates, a novel departure which is actually in use with considerable success by the Union Street Railway Company, of New Bedford, Mass. This company's storeroom attendants are fitted with skates to accelerate their movements, and they thus save



USE OF ROLLER SKATES BY ATTENDANTS IN STOREROOM

considerable time in getting at stock. When one of the men receives a request for material at the delivery window he skates back to the section of the storeroom containing the required article and promptly returns with it to the delivery window. The use of the skates does not hamper the storeroom employees in mounting ladders for the purpose of reaching elevated bins in which material may be stored, as experience has shown that they are able to mount ladders to reach such places without removing their skates.

## Overtime Electric Drive for the Laggard Department

Motor-service salesmen often enlarge on the well-known point in favor of central-station drive to the effect that when power is not needed a switch can be thrown and all expense stops. While this is good argument, commented Mr. Albert Milmow, of the Alabama Power Company, Birmingham, Ala., in a paper before the convention of the Southeastern Section, N. E. L. A., at Macon, Ga., Aug. 15, he insisted that it is really of much greater importance to emphasize the fact that electric power is not intended to stop with but to run with, and if some department runs ahead it clearly is much more desirable that the others which are lagging should be operated overtime than that the advanced department should be curtailed. This view, he has found, always carries weight with a business man. The latter will probably say, "Oh, well, I run my engine overtime," and so he probably does, but if he does, it is not until the discrepancies between his departments are so great that loss has resulted. In a long experience with a large number of electrically driven cotton mills, the writer said he did not recall a single case where power is not run for extra time, although only a very small fraction of the total rating may be required, an amount usually altogether too small to warrant the running of a large steam plant.

## The Hotel as a Central-Station Customer

Probably no other type of customer offers the central station so large a revenue from the sale of energy or affords so advantageous a subject for advertising central-station service as the hotel, declared Mr. C. A. Collier, of the Georgia Railway & Power Company, Atlanta, Ga., in a paper presented before the recent Southeastern convention at Macon, Ga. To other prospective customers the fact

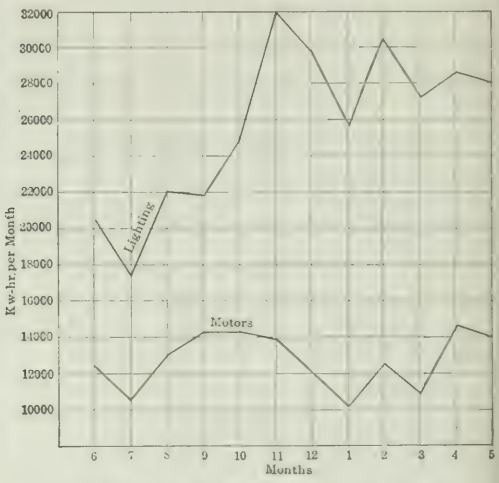



FIG. 1—YEARLY ELECTRICAL CONSUMPTION

that the hotel—usually the newest and largest building in the community, requiring the most reliable service at an economical figure—has decided upon the purchase of electric service, instead of manufacturing it, carries more weight than an all-day selling talk.

Again, looking at the hotel only as a consumer of energy, it is found that very few types of commercial business (some industrial plants excepted) consume as much energy per kilowatt connected as does the modern hotel. For instance, the combined average load-factor of two of the hotels mentioned herein is approximately 20 per cent, whereas the load-factors of other types of business are only as follows: Office buildings, 7 to 15 per cent; department stores, 8 to 10 per cent; newspaper publishers, 8 to 14 per cent. In other words, the ability of a hotel to use energy is almost double that of any other large commercial consumer.

Another factor certainly to be considered in connection with this comparison is the relatively small peak of the hotel load, and the absence, in comparison with other types of business, of the large "valleys," representing the hours of the day when little or no energy is used. In fact, the hotel, during every hour of the day, is a considerable user

of electricity, as shown by the accompanying curve. Especially is this true if the hostelry operates a machine for refrigeration and ice making, as the ice making is largely done during the night hours. The fluctuation due to the change in seasons is also less than for almost any other type of business.

There is nothing more important than reliable service

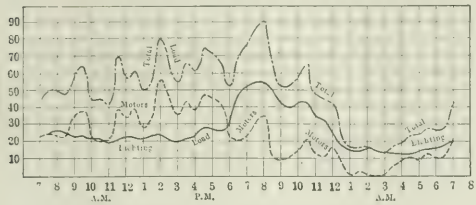



FIG. 2—HOURLY ELECTRICAL LOAD FOR JULY

in order to obtain and hold the hotel as a customer. To supply such service from an isolated plant means the installation of at least duplicate, and quite often triplicate, generating units at a very high initial cost. Such a plant must be kept in prime condition and guarded from shut-downs due to labor troubles and non-delivery of coal.

In Table I there are given detailed data for four typical hostelries, representing as many characteristic types of hotel service. Hotel "A" is a modern large building, thoroughly equipped with motors throughout, but having no ice machine. Hotel "B" has the same general characteristics as "A," with the addition of a 10-ton ice machine. Hotel "C" is a small hostelry, with no motors other than one elevator. Hotel "D" is equipped with individual-motor drive and is the most modern of the group.

TABLE I—ELECTRICAL AND STEAM-HEATING DATA FOR FOUR HOTELS

| | A | B | C | D |
|---|---|---|---|---|
| Lighting load in 50-watt equivalents | 3,200 | 2,600 | 154 | 1,250 |
| Connected motor load in hp. | 150 | 128 | 20 | 100 |
| Heating load, sq. ft. of radiation | 16,000 | 14,200 | 3,963 | 12,000 |
| Annual lighting consumption, kw-hr | 307,000 | 334,000 | 19,288 | 118,500 |
| Annual motor consumption, kw-hr | 153,000 | 177,000 | 3,056 | 183,000 |
| Building heating, lb. steam annually | 6,400,000 | 4,800,000 | 1,565,000 | 4,880,000 |
| Kw-hr. per 50-watt lighting equivalent per year | 96 | 128 | 43 | 95 |
| Kw-hr. per hp per year | 1,020 | 1,383 | 152 | 1,045 |
| Lb. condensation per sq. ft. radiation per season | 400 | | 508 | 400 |
| Load-factor of lighting, per cent | 22 | 29 | 9 | 21 |
| Load-factor of motors, per cent | 16 | 21 | 2.8 | 17 |

TABLE II—ENERGY CONSUMPTION FOR FOUR HOTELS

| | Maximum, Kw-hr. | Minimum, Kw-hr. | Ratio of Maximum to Minimum, per Cent |
|---|---|---|---|
| Hotel "A" | 45,000 | 27,700 | 60.5 |
| Hotel "B" | 51,300 | 36,200 | 71.0 |
| Hotel "C" | 2,840 | 1,240 | 43 |

For the sake of comparison, the minimum and maximum monthly consumptions for Hotels "A," "B" and "C" are also tabulated, in Table II.

Here is shown conclusively the advantage to the central station of the ice machine in increasing the commercial load.

### THE EXHAUST STEAM-HEATING FALLACY

The greatest talking point of the advocate of the isolated plant is the claim that if engines are installed, the steam heating will cost nothing. There is probably no greater error generally made, or one which, for the lack of specific information, goes so often unquestioned.

As a matter of fact, not over 30 per cent of the steam necessary for building heating in the vicinity of Atlanta is available as exhaust steam, and of the available 100 per cent of exhaust steam not over 30 per cent can actually be used for heating during the heating season.

As an illustration, Hotel "A" has installed 16,000 sq. ft. of radiation. This radiation condenses during the heating season approximately 5,600,000 lb. of steam, of which over 60 per cent is condensed during the months of January and February, leaving only 2,240,000 lb. of steam to be condensed in November, December, March and April.

The kilowatt-hour consumption during the four months November, December, March and April was 169,000. Taking the N. E. L. A. figure, 60 lb. of steam per kw-hr., the exhaust steam available during the above-mentioned four months is 10,140,000 lb., or practically five times the steam-heating demand. Despite even this large excess, actual running tests show that the steam-heating demand in the early morning hours is so great that it exceeds the output of exhaust steam available, resulting in live steam having to be supplied to the heating system.

In connection with the using of exhaust steam for heating, it must be remembered that there are few systems indeed that show no back pressure. This back pressure directly affects the operation and economy of the engine, owing to the fact that not only is the horse-power of the engine reduced but the steam consumption per kilowatt-hour output due to cylinder condensation is greatly increased. Therefore, the net results shows very little gain in the direction of economy. In fact, Hotel "A" can be heated from low-pressure boilers at a total over-all cost of $2,500 per annum. This $2,500 per annum would be reduced to a maximum of only 30 per cent of $2,500, or $750, by the use of exhaust steam from the engines. This $750 is offset several times by the saving in the purchase of energy from the central station.

The question also arises as to the supply of steam for hot water, cooking, etc. In Hotels "A," "B" and "D" this is handled by boilers of approximately 50 hp, two in each hotel, the only labor required being negro firemen at wages somewhat lower than if an isolated plant were operated. Except in the morning and at mealtimes there is no heavy demand for heating and cooking, so the necessity of close attention or heavy firing is avoided.

Assuming that individual plants of the proper size, type, etc., were installed to supply these hotel buildings, and crediting each plant with one engineer and two firemen, and the additional coal, etc., directly chargeable to steam heating, the

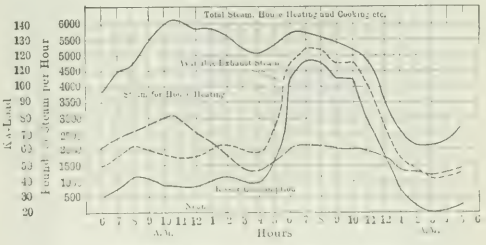



FIG. 3—DAILY LOAD CURVE FOR JANUARY

cost of manufacture per unit of energy will be very close to 4 cents per kw-hr., including all charges. The remaining credit for exhaust steam for heating being very small, it will hardly affect the cost per kilowatt-hour at all. The above figure will, of course, vary somewhat with the cost of fuel, labor, etc., but, generally speaking, it is about correct.

## Appealing to the Customer Through the Monthly Bill

The Greenfield (Mass.) Electric Light & Power Company makes effective use of the back of each customer's monthly bill in the line of publicity regarding rates and service matters, the management holding that as the bill is always scrutinized with much more interest than loose publicity matter and is in many cases retained for long periods as a receipt, it offers one of the most direct channels of appeal to the user of electric service. The monthly bills are rendered on forms 4¾ in. by 10½ in. in dimensions, and on the reverse side of each lighting bill are printed the rates for incandescent service, an explanation of the footing of the consumption charge and the service charge, the advantages of electric signs and a list of "Facts and Suggestions" outlining the company's policy regarding the loan of electric irons on fifteen days' free trial, interest on the consumer's deposit, free renewals, where to obtain instruction in meter reading and the benefits of reading lamps and other domestic appliances. The company points out that its service charge is very low, being 41 cents per month to all customers whose bills are less than $1.50 per month, and states that its purpose is to pay the interest, depreciation and maintenance charges on the investment necessary to serve the consumer. The reverse side of each bill for motor service bears the regular schedule of rates and a number of suggestions emphasizing the independence of the electric drive, the care of motors, selection of proper motor sizes, desirability of keeping duplicate bearings in hand and the saving in floor space by the use of electricity.

## Cost of Periodic Testing of Electric Meters

Periodic testing of electric meters does not necessarily insure a large increase in revenue due to the correction of slow meters, but the company adopting the practice gains the confidence of the public to which it is supplying service, as well as that of the public utility commissions. Especially is this true when the tests are conducted at frequent intervals. Mr. Weare Parsons, of the Springfield (Ohio) Light, Heat & Power Company, read a paper at the recent Ohio Electric Light Association convention, discussing the report of the meter committee of that association, in which he gave some interesting figures on the cost of periodic meter testing as compiled by the company which he represents.

Although periodic tests of meters have been carried on by this company for three years, the data compiled represented the average cost of conducting such experiments during the fiscal year ended Sept. 30, 1912. During that time 2623 meters were tested. This figure represents 71 per cent of the total number installed at the close of the year, or 92 per cent of those installed at the beginning of the year. The cost of testing amounted to $758.31, or 29 cents per meter. At this rate it would have cost $1,100 to test all of the meters, as there were 3829 installed. Of those tested 67 per cent were correct (between 98 and 102 per cent accuracy), 16 per cent were fast, and 17 per cent were slow. The average percentage of accuracy of the slow meters was 93, which means that 17 per cent lacked 7 per cent of being correct in registration. From this figure it was computed that the inaccuracy meant a loss of $3,000 to the company from all of its meters. The correction of fast meters meant a saving of $2,500 to the consumers, or a corresponding loss to the company. Lumping the cost of the test with the saving and loss in revenue due to the correction of the meters, it can be seen that the actual cost of testing was $610, or 16 cents per meter. After a careful investigation of the results shown by the compilation it was decided that a definite amount of time should elapse between tests. The oftener meter tests are conducted the more expensive it is.

A company that has done little or no testing will be able to pay the expenses of testing from the saving due to the correction of slow meters, as it has been found that meters, in general, register in favor of the consumer. Periodic testing reduces the number of complaints and does not cost nearly as much per test as do the individual tests. Such practice also prevents electric service companies from becoming outlawed where fast meters are found.

Periodic testing often discloses peculiar conditions which might not be found in any other way. Following are some of the instances which were encountered on a periodic testing trip. Jumpers on meters in a grocery store were removed during regular reading periods; one shunt-instrument coil burned out on a polyphase meter, the instrument recording only one-half the load; one shunt transformer burned out on primary installation, the meter recording only one-half the load; meter connected across 110-volt circuit when it should have been measuring 220 volts on the elevator circuit, meter recording only one-half; jumpers concealed in wall, meter recording only when plugs were screwed up; meters found in different degrees of accuracy on account of damaged jewels, etc.

The Public Service Commission of Ohio complimented the Springfield Light, Heat & Power Company on the accuracy of its meters after one investigation.

## A Portable Central-Station Exhibit Booth

In the accompanying illustration is shown the portable "knock-down" exhibition booth used by the New Orleans Railway & Light Company at various expositions and fairs where the company is represented. The entire structure is built of light wood with temporary fastenings so that the whole can be dismantled and transferred piece by piece to the next exhibition point. Massive beams of wood which overhang the cornice lend an attractive pergola effect to the booth. The four corners are marked by large frosted balls inclosing tungsten lamps, and the gold-lettered signs on the



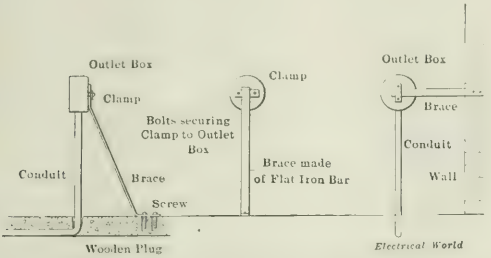

KNOCK-DOWN CENTRAL-STATION EXHIBIT BOOTH

white walls are illuminated by linolite fixtures extending the length of the four sides. Inside, the booth is attractively fitted up, outlets being provided for attaching electric irons, heaters, stoves, fans and other devices which make up the exhibition of the company's commercial department. Mr. W. E. Clement is contract agent for the New Orleans Railway & Light Company.

# Illumination and Wiring

## Support for Outlet Box During Construction

Considerable inconvenience is frequently experienced by electrical contractors from outlet boxes being accidentally knocked out of place during building construction. L. K. Comstock & Company, electrical contractors in Chicago, have reduced this trouble considerably by use of a very simple "made-on-the-spot" device. The device consists of




SUPPORT FOR OUTLET BOX DURING CONSTRUCTION

a brace which can be secured to the floor, wall or ceiling as desired and also to the outlet box. The brace is made out of a rectangular wrought-iron bar bent into the shape shown on the left of the illustration and secured to the outlet box by a clamp. Very little time is required to bend the braces into the desired shape if a form is used, and being simple to install, the device soon pays for itself as it can be used over and over again in different buildings.

## A Horse Down a 30-in. Manhole

An extraordinary manhole accident occurred at Rochester, N. Y., recently, when a horse hitched to a heavy truck caught his shoe in a manhole lid, pulling the cover up as he lifted his forefoot. His hind legs then sank through the opening, only 30 in. in diameter, and after many kicks and struggles the animal freed himself from his harness and gradually slipped into the opening until head and forefeet had completely disappeared below the surface of the street. A derrick was summoned, and after much difficulty the horse was hauled out by ropes looped around his neck and front feet. With the exception of a few scratches the animal apparently suffered little from his close contact with a number of 2500-volt cables in the manhole.

## Steel-Taped Cable for Series Circuits

A development of the past eighteen months of much importance in street lighting has been the rapidly increasing use of single-conductor lead-covered and steel-taped cable for series street-lighting circuits. Early in 1912 the amount of such cable in use was probably not over a few thousand feet. The reactance caused by the steel-taped covering over a single conductor was feared by many engineers, and it was thought by many that its reactance would be prohibitive for single-conductor cables. A few tests on short working circuits and at the factory, however, demonstrated that these fears were without foundation, and since that time many thousands of feet of such cable have been installed. Probably the largest quantity has been connected with street lighting in Chicago, where a large amount of this cable has been installed in residence districts for supplying energy to 80-cp series tungsten lamps spaced one to every 75 ft. of street on remodeled gas lamp-posts. It is also being used on a number of residence streets at Champaign, Ill.

The importance of this development in underground construction lies in the greatly reduced cost of running substantial series street-lighting circuits underground by this means as compared to lead-covered cable in any kind of conduit buried in concrete. This makes possible underground construction in many districts where before it would have been prohibitive in cost. In residence districts this cable is simply buried about 1 ft. under the surface of the ground in the parkway where digging is easy. Under narrow street intersections and sidewalks in clay it is easy to bury this cable through a hole previously drilled with an auger so that there is very little disturbance of pavements or sidewalks. This, of course, keeps construction costs low.

Another type of construction where this cable is used to advantage is that on Dearborn Street, in the heart of Chicago, where series flame-arc lamps are placed on special brackets at the top of each street railway pole. Conduit construction would have been extremely expensive on a downtown street like this. Exposed lead-covered cables hung in basement space under the sidewalks are liable to damage, as previous experiments with smaller construction in street-lighting work in Chicago has shown. In the recent Dearborn Street work single-conductor steel-taped cable was used, and this was run in the basement space under the sidewalk, with the assurance that the steel tape would afford mechanical protection against disturbance.

## Ornamental Tungsten Lighting at Tampa, Fla.

The first cost of installing the present 200 ornamental tungsten lighting standards on Franklin Street, Tampa Fla., was defrayed by the abutting property owners, who paid for the improvement on the basis of $1.12 per front foot. Extra posts for the street intersections were provided out of the city funds. For the first twelve months the abutting merchants also met the cost of operation of the lighting system, the agreement being that after the first year the city should take over the maintenance of the posts.

Each standard carries four 60-watt and one 100-watt




ORNAMENTAL TUNGSTEN LIGHTING AT TAMPA, FLA.

tungsten lamp. The installation is lighted from dusk to midnight, after which the regular city magnetite-arc lamps (also shown in the accompanying picture) are switched on. Under its five-year contract with the city, the Tampa Electric Company furnishes the service at an equivalent return of 8.25 cents per kw-hr. The cost of installing the present equipment was $6,200, each of the bare posts having cost $30. In addition to the seven city blocks already thus equipped, six more squares are now to be similarly lighted with ornamental standards. Mr. G. H. Wygant is commercial agent for the Tampa company.

### Electrolysis in Sockets and Electrical Fixtures

The suggestion that electrolysis due to the use of dissimilar metals in lamp sockets and other electrical fittings is a cause of the destruction and breaking of such parts is made by Mr. A. H. Kennedy, secretary and manager of the electric company at Rockport, Ind. Mr. Kennedy writes as follows:

"We have had more or less trouble with fixtures exposed to the weather, such as primary fuse-plug switches for transformers, sockets and rosettes for porch lamps, street-lamp sockets, etc. I have come to believe that this trouble arises from electrolysis. Usually such fixtures are made of two or more metals through which the current is conducted, the contacts being more or less perfect. Take, for example, the common series film cut-out socket now generally used with the series tungsten lamp. The binding posts are brass, the screws are iron, the two terminals of the socket which hold the film are brass, the two spring terminals of the circuit are copper, the socket is copper and the lamp base is brass. This means that the current has to change from brass to copper six times in passing through one lamp socket. We have also found that the brass parts of switches and other such fixtures exposed to the weather get brittle and go to pieces, which we now believe is also largely caused by electrolysis. This trouble could be completely prevented by making all such parts out of copper, but such sockets as that now before the writer seem to have been contrived actually to encourage electrolytic action."

### Recent Telephone Patents

#### Intercommunicating System

In the combined intercommunicating and exchange system which is now in quite general use there is no means of knowing for what station incoming calls from the exchange are intended. It is therefore necessary that such calls be transferred from the answering to the desired station and provision must be made to prevent the central office from interrupting connections during this transfer period. In systems of this type each station has a bank of keys so that it may be connected to any circuit. When a transfer is to be made, the answering station must not only hold the trunk from exchange, but it must in addition be free to call and converse with the desired station. The improvement described in a patent issued to Mr. L. D. Barrows, of New York City, and assigned to the American Telephone & Telegraph Company lies in this transfer feature, the holding of the trunk being accomplished by a relay. This relay is operated in response to the momentary depression of a holding key, after which actuation it is left in series with the trunk line and with its own contact. It will thus be seen that not only may it be released from the intercommunicating sets, but in case of failure at this end the abandoning of the call by the central office produces a similar result.

#### New Switchboard System

Two patents have been granted to Mr. F. G. Agrell, of Stockholm, Sweden, relating to a semi-automatic system. According to this system automatic devices connect the calling subscriber to an available connecting cord and set a signal before the operator when a call is originated. The operator responds in the usual way and extends the call manually either to a multiple circuit or to a trunk circuit. The line relays release a motor-driven contact arm. Lying in the path of the revolving contacts on this arm is a set of bars, and the first of these bars which is not in use engages the contacts. This set of bars is immediately drawn back out of the path of any following line contacts. One motor may drive a large number of line contacts and the sets of bars may be exposed to a very large number of lines, providing thereby economy of operation.

# Letters to the Editors

### Guaranteed Wiring by Contractors

*To the Editors of the Electrical World:*

Sirs:—As one who has been engaged for many years in the electrical contracting business, I was very much interested in the report of the last convention of the National Electrical Contractors' Association held in Chattanooga, Tenn., particularly in the fact that the association is giving some thought to the subject of guaranteeing the work of its members. Such a step cannot be too highly commended and if carried out will do much to restore confidence in the electrical contracting trade, which confidence has been much abused in the past by unreliable contractors. It has occurred to me that a further step might be taken to advantage, and that one of the large bonding companies might be found willing to furnish bonds for such work at little expense, under suitable arrangements with the National Electrical Contractors' Association. This bond could be made to cover the various local illuminating companies in whose fields the members of the association work. As a rule the electric-light companies in the large cities publish in their bulletins the names of contractors whom they recommend for electric wiring work, and under such a bonding arrangement these lighting companies could not only recommend but guarantee the work of the contractor. Nearly all of the users of electricity look upon the local lighting company as the authority in electrical matters, and if in addition to recommending certain contractors the lighting company could guarantee that the work performed by them would be satisfactory much good would result. I am convinced that this guaranty of the National Electrical Contractors' Association with the further advantage of bonding arrangement would protect the electric-light companies and would work to the advantage of the customer, the contractor and the central station.

I was also very much interested in the matter of uniform bookkeeping and a cost-keeping system. The most unreliable item with which an electrical contractor has to deal is the item of labor, and I would suggest that consideration be given to some arrangement with the trades unions whereby a fixed maximum cost on certain units of work could be determined and the item of labor kept from wide fluctuations. Thus, if the trades union could be induced to specify that the laying of a certain number of feet of conduit in certain types of buildings would constitute a day's work, the most uncertain element in the business will be eliminated.

*New York, N. Y.* Louis J. Auerbacher.

### Strength of Transmission Towers

*To the Editors of the Electrical World:*

Sirs:—In the article on the transmission-line span over the strait of Ondo Kaikyo, Japan, in your issue dated Aug 9, Mr. K. Nogami uses the term "safety factor" in reference to structural-steel towers. This term, as he uses it, is misleading and might cause trouble.

The tower, as shown by the photograph and described in his article, would probably collapse under the loads noted in the article, so that the structure as a whole has no safety factor for these loads. The safety factor of 3.4 as determined by Mr. Nogami is the ratio of the ultimate strength of one of the legs in tension to the applied stresses. This member would not fail in tension, but the corresponding leg, which must be in compression, would fail long before the load of 60,000 lb. per sq. in. was reached.

The tower as shown in the photograph has six panels of about equal length, or about 13 ft. A 4-in. by 4-in. angle of this length, without intermediate supports, will not support a load in compression causing as much as 17,000 lb. per sq. in. therein.

*Pittsburgh, Pa.* J. B. Leeper.

# Field of the Operating Engineer

**A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers**

## Burners for Oil Fuel—II

BY R. T. STROHM

The Hammel burner, shown in perspective and in section in Fig 1, belongs to the inside-mixing type. It consists of three main parts *a*, *b*, and *c*, held together by bolts *d* and *e*. The lower part *a* contains the passage *f* through which steam is admitted to the burner, and the upper section *b* has the oil connection *g* from which a duct *h* leads downward to a mixing chamber *i* formed by a recess in the under side of the section *c*. The steam flows up from the passage *f* into the chamber *j*, from which three slanting ducts *k*, *l* and *m* lead to the mixing chamber. These ducts are inclined in different directions, and their lower ends are grouped about the end of the oil duct *h* in such a way that the escaping steam will mingle thoroughly with the oil in the mixing chamber. From the mixing chamber a flaring opening *n* extends outward to the tip of the burner, and as the steam flows at high velocity and escapes from the wide orifice *o*, it spreads the oil and causes the burner to produce a fan-shaped flame.

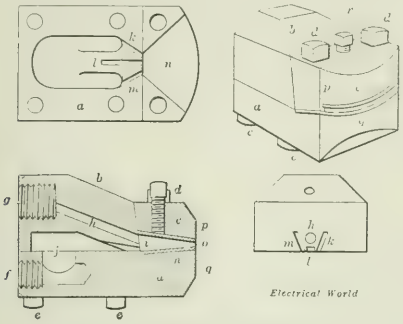



FIG. 1—HAMMEL OIL BURNER

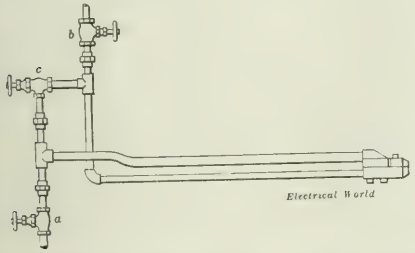



FIG. 2—STEAM AND OIL CONNECTIONS OF HAMMEL BURNER

Experience with steam turbines has shown that steam traveling at high speed has an erosive effect on pipe fittings, valves, vanes and other parts that deflect its motion. This cutting action is present likewise in oil burners that use steam as the atomizing agent, and in the Hammel burner the erosion is greatest in the divergent mouth *n*. The wear is due to the cutting action of wet steam and to the presence of particles of dirt and grit in the oil. As a consequence, the upper and lower faces of the opening *n* are lined with steel plates *p* and *q* that take all the wear and that may be renewed at small cost when they become greatly eroded. To insert new plates, the bolts *d* are unscrewed and the section *c* is removed, thus uncovering the plates. The set screw *r* serves to hold the upper plate *p* firmly in place when the burner is put together.

The Hammel burner is attached to the ends of the steam and oil pipes, as shown in Fig. 2, and these pipes are made of suitable lengths to allow the burner to project into the furnace through the front of the boiler setting. The valve *a* regulates the flow of oil and the valve *b* the flow of steam. The valve *c* acts as a by-pass for use in cleaning out the burner in case it becomes choked with grit or carbonized oil.

A perspective view of the Kirkwood burner is given in Fig 3, and in Fig. 4 is a longitudinal section of the burner, together with the arrangement of the piping. The same reference letter is used to designate corresponding parts that appear in both views. The main part of the burner is a hollow casting *a* into which the steam supply pipe *b* is screwed. A plug *c* is inserted at one end and at the other is a stuffing-box *d* through which the pipe *e* extends into the chamber *f*. At its outer end the pipe *e* is threaded and passes through a threaded collar *g* that may be rotated in the bracket *h* by means of the handle *i*. At the inner end

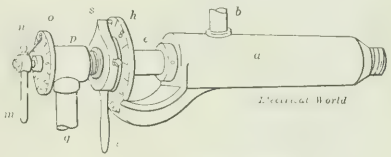



FIG. 3—KIRKWOOD BURNER

the pipe is closed by a plug *j* containing an orifice *k* that may be closed by screwing the long stem *l* inward until it seats against the plug. A handle *m* is fastened to the outer end of the stem and carries a pointer *n* that moves over the dial on the end of the flange *o* on the elbow *p*. The supply of oil is admitted from the pipe *q* through the elbow *p* to the pipe *e*, and it escapes past the regulating stem *l* through the orifice *k*, where it is picked up by the steam flowing into the chamber *f* and carried through the opening *r* into the furnace.

The handle *i* carries a pointer *s* that moves over a dial on the face of the bracket *h*. Movement of the handle *i* governs the position of the plug *k* with respect to the plug *c* and so determines the amount of steam used for atomizing the oil. The position of the stem *l* is regulated by the handle *m*, thus governing the rate of flow of oil. The two dials enable the fireman or the boiler attendant to adjust the flow of steam and oil very accurately after he has once determined the relative proportions that give the best results. By having the regulating valves very close to the point where the steam and oil mingle, as in this burner, the full pressure of each is maintained up to the moment of its escape. The valve *t* is a by-pass valve through which steam may be admitted to the oil pipe to clean it. A slip joint is sometimes inserted in the horizontal section *u* of the by-

pass pipe to allow easy sliding when the oil pipe *c* is moved in or out by the handle *i*. The setting or adjustment of the oil-regulating stem is not affected by the movement of the pipe *e* because the latter is fixed rigidly to the elbow *p* through which the stem passes, so that any movement of the pipe carries the stem along without changing its distance from the plug *k*.

The construction of the Koerting centrifugal spray nozzle

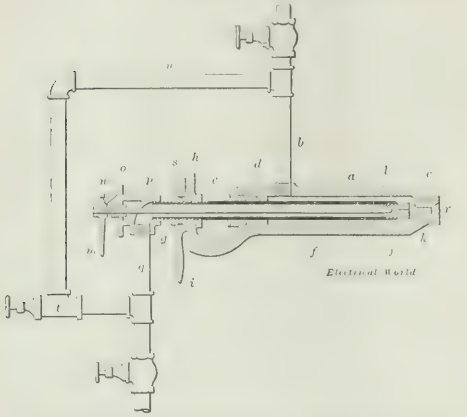



FIG. 4—ARRANGEMENTS OF PIPING FOR KIRKWOOD BURNER

is shown by the section in Fig. 5. The burner consists of a casting *a* that is inserted in a suitable opening in the boiler front and that in turn has an opening *b* through which the tips *c* of the spray nozzles may project. There are two of these nozzles held in the casting *d* that contains the oil passages and strainers. The tip *c* has at its end a small orifice that is expanded inward to form a chamber to contain the screw *e*, which is carried by a stem *f* that fits in the plug *g*, and is held in position by the pressure of the spring *h*. The oil enters through the pipe *i* and passes through the strainer *j* on its way to the spray nozzle, thus being cleaned. The cage *k* that carries the strainer is screwed into the casting *d* and may be taken out for cleaning by first removing the cap *l*. The oil is sprayed by the whirling set up by the screw in the tip of the nozzle, in combination with the pressure maintained in the oil system. The air required for combustion is admitted through registers around the outside of the casting *a*. The stems *f* are held by springs so that, when heated, they may expand freely. If they were held down by the direct pressure of the plugs *g*, any expansion due to heating would cause them

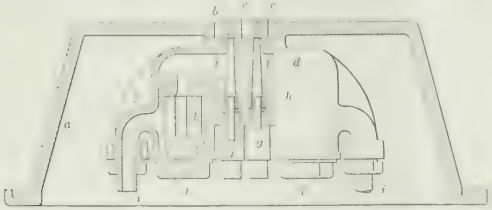


FIG. 5—KOERTING CENTRIFUGAL SPRAY NOZZLE

to buckle. The screws *e* may be removed for cleaning by taking out the plugs *g*.

In all of the types of burners heretofore described the relative proportions of the atomizing agent and the oil are under the control of the operator. The Kirkwood burner shown in section in Fig. 6 belongs to that class in which the relative sizes of the openings for oil and steam or air fixed during the construction or assembling of the burner. The oil and the steam enter through the pipes *a* and *b*, respectively, which are connected to opposite sides of the body casting *c*. The regulation of the flow of oil and steam is accomplished by turning the single handle *d*, which is threaded on the boss *e* and carries the stem *f*. This stem is hollow and is drilled with lateral holes *g* that connect with the oil supply. At its inner end it is tapered to fit a seat in the plug *h*. A tapered stem *i* is fixed centrally in this plug and projects into the hollow stem *f*. When the handle *d* is turned to the right as far as it will go, the stem *i* closes the duct *j* and at the same time the

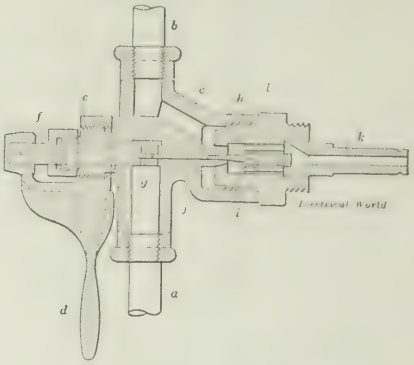



FIG. 6—SECTION OF KIRKWOOD BURNER

tapered end of the stem *f* comes against its seat in the plug *h* and shuts off the flow of steam to the tip *k* of the burner. In this way the burner is shut down. By turning the handle in the opposite direction, both steam and oil are admitted to the mixing chamber *l*, the relative proportions being governed by the taper of the stems *f* and *i*. The position of the stem is fixed by the manufacturer and cannot easily be changed by the operator. This removes the danger of having an unskilled operator affect the efficiency of the burner by changing the relative amounts of oil and steam.

## Composition of Non-Corrosive Metal

Will you kindly give the composition of monel metal and its characteristics.

E. C. I.

Monel metal is an alloy the composition of which varies. It contains from 67.55 to 69.54 per cent of nickel, 26.25 to 27.53 per cent of copper, 0.17 to 0.44 per cent of carbon and 2.07 to 3.33 per cent of iron, with traces of manganese and silicon. In forged or rolled metal the manganese varies from 1.26 to 1.82 per cent and the silicon from 0 to 0.37 per cent, while in cast metal the manganese varies from 0.00 to 0.49 per cent and the silicon from 1.08 to 1.41 per cent. The carbon appears to strengthen the alloy, but the silicon and manganese do not materially affect its physical properties. Iron hardens, whitens and increases the strength of the alloy, but has a tendency to reduce its elastic limit. The alloy resembles nickel in color; it machines well and takes a high polish which it retains indefinitely. Monel metal melts at 1360 deg. C., has a specific gravity of 8.87 and a hardness number of from 20 to 27 on the Shore scale. Its tensile strength varies from 85,000 lb. per sq. in. when cast to 110,000 lb. per sq. in. when annealed. It is magnetic and absorbs carbon, which can exist in it both free and combined. Monel metal resists corrosion by sea water, superheated steam and chemical solutions about as well as manganese bronze, phosphor bronze and Tobin bronze. It is used in pump cylinders for sea-water and in propellers, rudders, mining screens, valves and plumbing fixtures subject to corrosive influences. Sheets of monel metal are also used for roofing purposes.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*Direction of Rotation of Vectors in Alternating-Current Diagrams.*—A continuation of the discussion of the two different and opposite definitions of the direction of rotation of vectors in alternating-current diagrams. F. Emde compares the two definitions by discussing side by side the consequences following from both, as to phase displacement in diagrams, symbolic notation by complex numbers, definition of succession of phases and rotating fields. F. Richter discusses the different possible definitions of direction of rotation of vectors and succession of phases in polyphase diagrams.—*Elek. Zeit.*, Aug. 7, 1913.

*Theory of Commutation.*—C. L. R. F. Menges.—A theoretical article on the neutral commutation zone. The author endeavors to show that the usual theory of the magnetic commutation zone prevents a clear insight into the facts.—*Elek. u. Masch.* (Vienna), June 29, 1913.

### Lamps and Lighting

*Double-Filament Incandescent Lamps.*—A. Barth.—For outside lighting it is often desired to reduce the illumination to about one-half of the normal illumination at certain hours of the night. Extinguishing one-half the number of lamps is unsatisfactory, since it produces dark spots. The author has, therefore, developed a system of double-filament incandescent lamps in which one filament gives about double the candle-power of the other filament and the lamp can be easily switched over from each filament to the other or to both together.—*Elek. Zeit.*, July 31, 1913.

*High-Pressure Mercury-Vapor Lamps.*—A note on a recent British patent (No. 18,372, 1912) of the British Thomson-Houston Company and the General Electric Company of this country. The idle space in the envelope communicating with the arc chamber is filled with solid material so as to reduce the condensation of mercury and thereby increase the pressure of mercury vapor in the lamp.—London *Elec. Eng'ing*, Aug. 7, 1913.

### Generation, Transmission and Distribution

*Hydroelectric Development in Montana.*—Max Hebgen.—A long and fully illustrated paper giving a review of water-power development in Montana. Notes are given of the early developments at the Big Hole plant, the Canyon Ferry plant, the Madison plant No. 1 and the Black Eagle plants, and the later developments of the Madison River system, the Missouri River system, the Great Falls system, the Missoula River development and the Big Fork developments. The total generating capacity of the fourteen plants which are now operating on the combined systems of the Montana Power Company and the Great Falls Power Company is 72,100 kw. The principal transmission lines of the combined system operate at 46,200, 66,000 and 100,000 volts. Notes are given on the use of the electricity for lighting and small power purposes, street railways, mining, railroads and irrigation.—*Bulletin Am. Inst. of Mining Eng.*, August, 1913.

*Electricity in Mining.*—J. B. Fisken.—A paper on the application of electrical energy to mining in the Cœur d'Alene district. A map shows the development of the Washington Water Power Company's system in that district. In 1903 there were seven substations, with a total transformer capacity of 3350 kw. To-day there are eleven substations and a transformer capacity of 13,900 kw. The original plan followed was to step from 60,000 volts to 2300 volts in each substation and to have substations at frequent intervals; the practice now is to install fewer and larger substations and to have each substation serve a larger territory. The result is achieved by using a distribution circuit of 6900 volts from the substations and stepping down with open air-transformers to 2300 volts at the customer's plant.—*Bulletin Am. Inst. of Mining Eng.*, August, 1913.

### Traction

*Driving Submarines.*—In the course of a long paper on the development of submarines and submersibles and their propelling equipment, G. Berling deals with several matters of electrical interest. Usually, submarines are driven on the surface by oil engines, which also during such cruising periods drive dynamos charging a large storage battery. When the vessel runs submerged the dynamos are driven as motors from the battery and the oil engines are shut down.—From 1913 "Jahrbuch der Schiffbautechnischen Gesellschaft," abstracted in London *Elec. Review*, Aug. 8, 1913.

*British Tramways.*—A. J. Lawson.—The first part of a statistical article in which an analysis is given of the financial position of the tramways of the United Kingdom, the items examined being capital expenditure, cost of construction and equipment, traffic, revenue, appropriation, aid from rates, relief of rates and costs.—London *Electrician*, Aug. 8, 1913.

*Mountain Railway.*—A. Gradenwitz.—An illustrated description of the Villefranche-Bourg Madame electric railway in the French Pyrénées. Water-power is utilized, the direct-current system being employed with a third-rail at 850 volts.—London *Elec. Review*, Aug. 8, 1913.

*Electric Railways.*—E. E. Wachsmann.—An article on the electrification of main railways in the Northwest of the United States with special reference to the Puget Sound Railway and the Butte-Anaconda line.—*Elek. Zeit.*, July 31, 1913.

*Electric Automobiles.*—J. W. Bauchamp.—A general discussion of the electric vehicle, its limitations and selling points for the English market.—London *Elec. Review*, Aug. 8, 1913.

### Installations, Systems and Appliances

*Three-Wire Direct-Current Systems.*—A. Lauteren.—In many cases the necessary cross-section of the neutral wire in a three-wire system is not calculated with sufficient accuracy, so that with unequal load on both halves of the system there will be too high a current in the neutral wire and too great a difference between the voltages in the two halves. In order automatically to insure that the voltages in the two halves are equal it is proposed to insert a dynamo (neutral booster) in series in the neutral wire. This booster produces an emf which in every instant equals the current in the neutral wire multiplied by the sum of the resistance of the neutral wire plus one-half the resistance of the outer wires. Even under unfavorable conditions the dimensions of such a booster are small, so that it is an inexpensive means of insuring equality of voltage in the two halves of the network. The author finally discusses such networks in which two boosters are provided in the two outers in order to make up for the voltage drop in the two outers. In this case equality of the voltages in the

two halves is obtained if the two boosters are compounded in such a way that the current in the neutral wire excites the compound windings. The compound windings of the two boosters act in the opposite direction, the arrangement

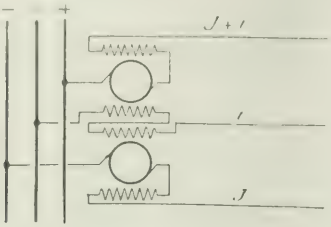



FIG. 1—ARRANGEMENT OF COMPOUND WINDINGS

being shown in Fig. 1.—*Elek. u. Masch.* (Vienna), July 20, 1913.

*Rates for Energy in the Austrian Central Stations.*—L. ROSENBAUM.—A statistical article on the different tariffs in use in Austrian central stations. The following table gives a review of the different systems of tariffs:

| | Number of Stations | |
|---|---|---|
| | Energy for Lamps | Energy for Motors |
| Meter tariff without discount | 179 (140) | 142 (118) |
| Meter tariff with discount | 167 (79) | 178 (80) |
| Double tariff | 8 (6) | 12 (6) |
| Flat rate | 240 (164) | 158 (98) |
| Mixed meter tariff and flat rate | 142 (102) | 110 (78) |
| Total | 736 (491) | 600 (380) |
| Data not available | 118 (81) | 254 (192) |
| Grand total | 854 (572) | 854 (572) |

The greater figures relate to Jan. 1, 1913, while the figures in parentheses relate to 1909. It is seen that the stations with meter tariff and discount and the plain flat-rate stations have shown the greatest increase since 1909. The stations using the flat rate employ water-power almost exclusively, while those with a meter tariff are mainly fuel-fired. The stations with mixed tariff are of about equal parts pure water-power stations, pure fuel-fired stations and water-power stations with a fuel-power plant reserve. Other tables give data on the rates charged for lighting and power, discounts allowed, etc.—*Elek. u. Masch.* (Vienna), July 6, 1913.

### Wires, Wiring and Conduits

*Electricity Supply Charges.*—An anonymous article giving a series of curves, the chief object of which is to give the engineer who is canvassing for a supply the means to lay before any prospective consumer an approximation of his expenditure for a supply of electricity per annum and his average price per unit on any estimated consumption (in the event of the scale of charges for supply not being based on a flat rate), and also a graphic illustration of the fact that "the more electricity the consumer uses, the cheaper it becomes to him, and therefore the more he can afford to increase the use of a supply when once installed."—London *Elec. Review*, Aug. 1, 1913.

*Capacity and Voltage Drop in Three-Phase Lines.*—G. P. MARKOVITCH.—A long mathematical article on the calculation of the capacity and the voltage drop in high-tension overhead three-phase lines whether balanced or unbalanced. In the calculation of the voltage drop the charging currents due to the capacity are taken into account.—*Elek. u. Masch.* (Vienna), June 22 and 29 and July 20, 1913.

*Transmission-Line Calculations.*—HANS GRUENHOLZ.—A mathematical article on the calculation of the poles for transmission lines with suspension insulators.—*Elek. u. Masch.* (Vienna), July 6, 1913.

### Electrophysics and Magnetism

*Magnetic Properties of Alloys.*—G. GOLDBERG.—The author emphasizes that Weiss' theory of the magnetic structure of molecules and atoms is on a sound basis and is well adapted to the study of the magnetic properties of alloys.—*Elek. Zeit.*, July 31, 1913.

### Units, Measurements and Instruments

*Ampere-Hour Meter for Alternating Current.*—J. BUSCH.—The curved form of the magnetization curve of iron has been a disadvantage for measuring instruments as it disturbs proportionality, but there are cases where this disturbance of proportionality can be made use of. Such a case is, for instance, an ampere-hour meter. The action of current and its field (without any auxiliary independent field) upon a moving body is under normal conditions proportional to the square of the current, and in order to obtain proportionality between speed of rotation and current consumption it would be necessary to use some system of air damping or liquid damping. But these methods have various disadvantages. However, damping by means of permanent magnets has proved very successful. The problem is now whether it is possible by employing high magnetic saturation to accomplish that when a permanent damping magnet is used the proportionality between current consumption and speed of rotation may be obtained within certain limits. The magnetization curve has a certain similarity to the curve $y = \sqrt{x}$, and this familiarity is used by the author for the design of an induction ampere-hour meter for alternating current by proper selection of the dimensions of iron. It is indeed possible to obtain satisfactory proportionality from one-tenth full load up to double full load. The author has built meters of this type for 1 amp, 200 to 250 volts, and for 2 amp, 100 to 130 volts.—*Elek. Zeit.*, July 31, 1913.

### Telegraphy, Telephony and Signals

*Time Signals in Wireless Telegraphy.*—H. THURN.—An illustrated account of the different wireless telegraph receivers which are permitted by the German government for receiving time signals from the Norddeich station. The signals have a wave-length of 1600 m. The government has a right to forbid the use of unsuitable receivers The

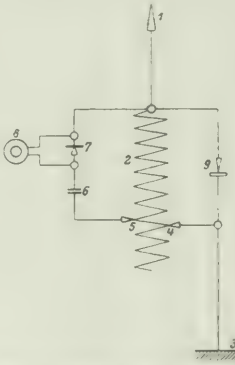
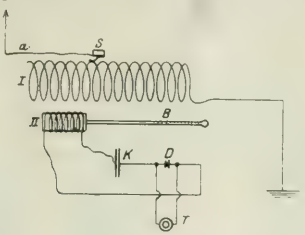



FIG. 2—SUITABLE WIRELESS RECEIVER FOR TIME SIGNALS

article describes four or five permitted receivers, of which two are reproduced in Figs. 2 and 3. Fig. 2 represents a receiver for time signals and weather telegrams for the special use of watchmakers, etc. 1 is the antenna, 2

s the receiving coil, 3 the earth, 6 a condenser, 7 the letector, 8 the telephone, while 9 is an auxiliary contact vhich is open while time signals are received and closed vhen the apparatus is not used, since it earths directly the




IG. 3—TIME-SIGNAL RECEIVER WITH PRIMARY INDUCTION COIL

ntenna and protects the apparatus from air-electric dis-harges. Fig. 3 shows another time-signal receiver, which ontains a primary induction coil *I*, one end of which is arthed, while the sliding contact *S* is connected to the ntenna. By means of the sliding contact the station is uned to the wave-length received. Within the primary oil *I* there is a secondary coil which can be pushed in nore or less by means of the rod *B*, so as to adjust the legree of coupling. The active windings are those be-ween the sliding contact and the earth connection. The econdary coil *II* is in series with a condenser *K* and the ontact detector *D*, which is in parallel with the telephone *T*.—*Elek. Zeit.*, July 24, 1913.

*Influence of Cable Inductance Upon Duplex Balances.*—GEORGE WALD.—The tendency toward higher speeds in ubmarine cable working has necessitated instruments vhose moving coils have smaller periods than formerly. The instrument thereby becomes enormously sensitive to apid disturbances, such as occur during the first few housandths of a second when a signal is sent into a luplexed cable. A great deal of this disturbance may be raced to the inductance of the cable and the absence of, or really comparatively negligible value of, the inductance of the artificial line, owing to its "zigzag" construction. The author discusses the influence of cable inductances rom a mathematical point of view and shows, first, that he current entering an artificial line on the direct appli-ation of a battery of negligible resistance is infinitely reat at the first instant and then falls in value inversely as the square root of the time. In the case of the cable he commencing current is limited to $e/(Lv)$, the cable behaving as though it had a commencing resistance $Lv$ ohms, where $v = 1/\sqrt{LS}$, $L$ the inductance and $S$ the capacity in farads per naut. If it were possible to have a differential duplex system with the limitations of no send-ng resistance or capacity, there would be an infinite dis-urbance at the first instant, though only of appreciable magnitude for the first few thousandths of a second. This s obvious, as the difference of the two currents is the disturbance in differential duplex. Later the disturbance reverses and gradually becomes zero. This effect is clearly shown in a series of diagrams. It is pointed out that a difference of the order of volts may exist across the re-ceiving instruments for a few thousandths of a second. If the assumption of negligible inductance in the artificial line is correct, a duplex balance is maintainable only by reason of the dissonance between the instrument and these rapid disturbances.—London *Electrician*, July 25, 1913.

*Dalmatia Incorporated Within the Austrian Telephone System.*—E. F. PETRISTCH.—In order to include the province of Dalmatia in the Austrian telephone system it was neces-sary to make connections by means of several submarine cable lines in series with overhead telephone lines. For the overhead line a bronze wire of 5 mm is used. For the submarine cable sections a continuously loaded cable of the Krarup system is employed. It was concluded that for this purpose continuous loading by the Krarup system was technically as efficient as discontinuously loading with Pupin coils, but the former system was found to be the cheaper one and was therefore adopted. Details of the line are given, and it is emphasized that the whole system has proved very satisfactory.—*Elek. u. Masch.* (Vienna), July 6 and 13, 1913.

*Wireless Telegraphy.*—E. NESPER.—An illustrated de-scription of some new developments of the Marconi system, especially the transmitting arrangements and the equip-ment of several new Marconi stations.—*Elek. Zeit.*, July 31, 1913.

### Miscellaneous

*German Association of Electrical Engineers.*—The first parts of a detailed account of the proceedings at the recent Breslau meeting and a verbatim account of the discussions (but no report of the papers themselves, which are printed elsewhere).—*Elek. Zeit.*, July 31 and Aug. 7, 1913.

## Book Review

PRACTICAL PHYSICS FOR SECONDARY SCHOOLS. Fundamental Principles and Applications to Daily Life. By N. Henry Black and Harvey N. Davis, Ph.D. New York: The Macmillan Company. 488 pages, 465 illus. Price, $1.25 net.

The student who acquires and assimilates the facts, prin-ciples and applications of physics, as presented in this book, will be exceptionally well equipped for taking up more ad-vanced courses in science or engineering, and even if he should not follow a career requiring exact scientific training and methods of thought, he will at least have a working knowledge—elementary perhaps, but not superficial—of the fundamental laws which underlie all happenings in the world of material things. Our modern civilization is such that the man without this knowledge is necessarily handi-capped and "behind the times." The extent of the ground covered by the authors in this book of 488 pages is enor-mous; the manner in which it has been done is almost won-derful, and they deserve nothing but praise for the meth-ods they have adopted and the consistent way in which they have carried out their purposes. From the simplest laws of mechanics the reader is led to an accurate presentation of velocities, accelerations, momentum and the principle of the conservation of energy. Then follow heat, magnetism, electricity, sound and light, the last chapter of all treating of electric waves and Roentgen rays. The language used throughout is simple, terse and accurate, and—owing partly to the method of presentation, but also to the frequent in-troduction of examples and illustrations from everyday life—the interest is aroused and kept from flagging. The numerous illustrations and cuts are excellently well adapted to their purpose; they are well drawn and clearly repro-duced, representing what the authors wish to represent—no more and no less. The book is undoubtedly original, and it represents much conscientious work. It is very far from being a compilation of cuttings from other textbooks—a most refreshing feature in a treatise of this class. At first sight it would seem that the boy of the secondary schools is expected to know a great deal, and in fact that the subject —notwithstanding the lucid manner of its presentation—is carried rather too far. This criticism might well be made were it not that the authors have taken pains to explain in their preface that the material they have selected—after careful exclusion of what they deem unnecessary—is prob-ably more than any class could undertake to study ade-quately in a single year. They suggest that the teacher adapt his instruction to the local needs of his class and the time available.

# New Apparatus and Appliances

**An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers**

## Toy Transformer

For the boy who is fond of experimenting with electricity the Thordarson Manufacturing Company, of 508 South Jefferson Street, Chicago, Ill., has developed for the market a toy transformer, in which the secondary is equipped with three taps, enabling 3, 6 or 9 volts to be taken off. Care has been taken to render this transformer



TOY TRANSFORMER

indestructible. It is inclosed in a steel case and immersed in an insulating compound that makes it impervious to moisture. Each transformer is equipped with a plug and a supply of flexible cord so that it may be attached to any alternating-current lamp socket.

## 66,000-Volt Substation Fuses

Among the recent developments in high-tension circuit-interrupting devices, the chemical fuse has shown successful operation under severe conditions. An installation for use on 66,000-volt systems is shown in the accompanying illustration. This particular installation is used to protect a three-phase substation taking energy at 66,000 volts and transforming it to lower commercial potentials. The illustration shows one phase of a three-phase service and also the method of handling the glass tube fuses by means of insulated tongs. It is said that 5-amp, 66,000-volt fuses have been blown under heavy short-circuit conditions on a feeder which had behind it a generating capacity of 27,000 kva.

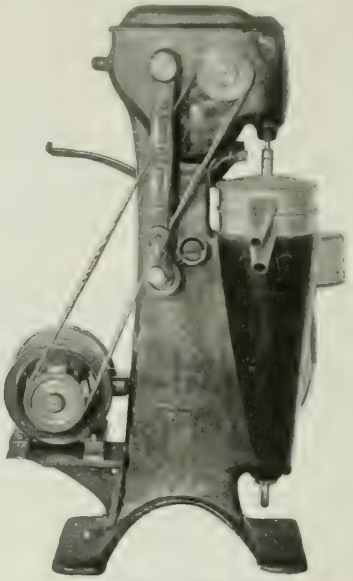



66,000-VOLT, 5-AMP CARBON-TETRACHLORIDE FUSE

This protective device is being manufactured by the Delta-Star Electric Company, Chicago. Its cost is said to be much less than that of oil circuit-breakers or switches.

## Motor-Driven Cream Separator

The illustration herewith shows the facility with which electric drive can be applied to a tubular separator, which will yield in different sizes of the same-type machine up to 950 lb. of butter per hour. Separation is accomplished by centrifugal force primarily exerted by a separator bowl or cylinder which revolves at a high rate of speed. A 0.25-hp, 1725-r.p.m. compound-wound open-type motor is used to drive the separator, but the motor may be readily disconnected and the handle thrown to mesh if hand operation is preferred.



DIEHL CREAM SEPARATOR

This motor-driven separator is manufactured and sold by the Sharples Separator Company, West Chester, Pa., the motor supplied being the product of the Diehl Manufacturing Company, Elizabeth, N. J.

## Electric Heater for Automobile Radiators

The use of an electric heating unit for heating an automobile radiator during the winter months when the engine is not in operation is a novel application as well as one of practical significance. Patents on such an application have been allowed Mr. William Gallaher, of the Laclede Gas Light Company, of St. Louis. One of the original units which was made for Mr. Gallaher is shown in the accompanying illustration. The device consists of an ordinary heating cartridge inclosed in a copper shell 0.375 in. in diameter and 2.25 in. long, which is sweated into the lower part of the radiator as shown in the cut. A flexible cord connects the heating unit with the dashboard, where a

lug receptacle can be installed which may be connected o an incandescent-lamp outlet when the automobile is tanding in the garage. If the car is provided with an lectric-starting apparatus, these plugs can be furnished vith two distinct heating coils—one for use on electric-

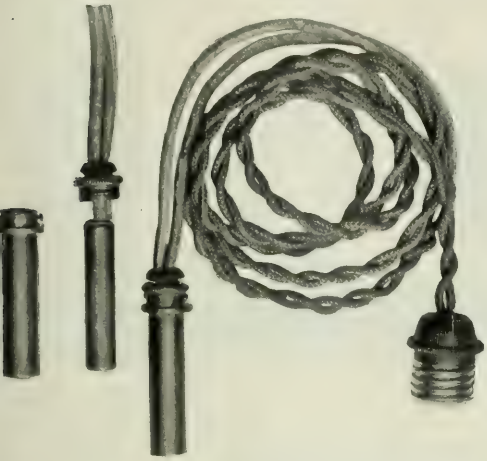


FIG. 1—FLEXIBLE CORD AND PLUG FOR ELECTRIC HEATER

amp circuits and the other for use on the storage-battery ircuit.

Experiments were conducted with one of these attach-ients, and it was decided that a 25-watt unit would gen-rate sufficient heat in the winter provided the radiator is overed with a blanket. The conclusion obtained above is n the assumption that the tank holds about 3 gal. of water nd that the owner of the automobile wishes to conserve as uch heat as possible. Attempts have been made by some wners of automobiles to keep their radiators from freez-

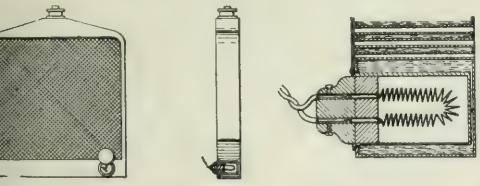


FIG. 2—ELECTRIC HEATER FOR AUTOMOBILE RADIATORS

ng in the winter by placing a luminous electric heater in ne garage near the car, but the method is uneconomical and ometimes ineffectual.

## Indirect-Lighting Units with Detachable Bowls

The new building of Butler Brothers, which fronts on andolph and Canal Streets, covers one city block, is fifteen ories high and is the largest warehouse in Chicago. Fig. shows the general offices on the main floor, which meas-re 150 ft. by 170 ft. The area of 25,500 sq. ft. is divided nto seventy-two bays, which are illuminated by means of 88 100-watt indirect units equipped with X-ray reflectors, ome idea as to the diffusion of the light and the general niformity of the resultant illumination may be obtained rom Fig. 3. A gross energy allowance of 1.5 watts per quare foot of area illuminated has been made in carrying ut the lighting scheme.

The type of unit used in this installation is shown in detail in Fig. 2. The outer brass spinning for supporting the silvered reflector is finished in what is known as "egg-shell" white (a matte-white washable enamel). The pend-ent socket and the canopy are finished in a similar manner,



FIG. 1—LIGHTING UNIT SHOWING HOW BOWL IS DETACHED



FIG. 2—LIGHTING UNIT EQUIPPED WITH X-RAY REFLECTOR

and the reinforced lamp cord is manufactured in the same color.

The construction of the lower brass spinning is such that for the cleaning of the reflector any of the supporting arms can be readily detached, as shown in Fig. 1. The reflector and lamp need not be removed from the fixture, and as these reflectors can readily be cleaned by merely wiping them with a damp cloth, cleaning labor is reduced to a minimum.

Altogether, 1600 units of the type here described, which

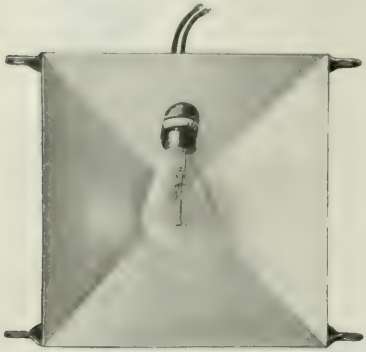


FIG. 3—MAIN FLOOR

were furnished by the National X-Ray Reflector Company, of Chicago, Ill., are installed in the various offices and sales-rooms of this building, and the illumination thus secured is said to be highly satisfactory.

## Wall Reflector for Bulletins and Signs

The Reynolds Electric Flasher Manufacturing Company, Chicago, Ill., is placing upon the market a specially designed reflector for painted walls, bulletins, billboards and signs. The reflectors are supported by wire cables, which in turn may be fastened to cross-arms at the top and bottom of a sign. The reflector contains a 100-watt tungsten lamp placed so that the light is evenly distributed over 15 sq. ft. of sign surface.



WALL REFLECTOR FOR BULLETINS AND SIGNS

The reflector, made of porcelain-enameled steel, has a glassy, white reflecting surface on the inside and is blue on the outside. This material is practically indestructible and requires no repainting.

## Switchboard Signaling in the World's Largest Power Station

In the world's largest power house, the Keokuk generating station of the Mississippi River Power Company (described in the *Electrical World*, May 31, 1913), it is more than 800 ft., or nearly one-sixth of a mile, from the switchboard to the most remote generator, and no part of the generator room is visible from the switchboard owing to the fact that the latter is installed in an upper story. For this reason no efforts were spared to make the signal system as dependable as possible, a novel principle of operation being employed.

The transmitter of the switchboard set is operated from a handle, pointer and dial, mounted on the front of the benchboard and concentric with the field-rheostat hand-

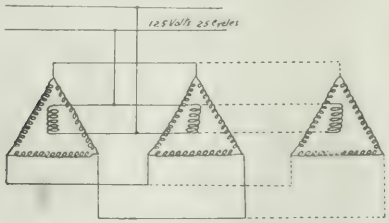



FIG. 1—DIAGRAM OF CONNECTIONS

wheel of the corresponding generator, the motion which sets the pointer of the transmitter being communicated by a cable. Synchronous movement of the pointers of the transmitter and receiver is accomplished by means of small induction motors, each provided with a three-phase delta-connected stator winding and a single-phase rotor winding of the shuttle type. Each pair of stator windings is connected in multiple, but these windings are not excited except by induction from the rotors, which are in turn excited from a 25-cycle, single-phase source. With two motors connected thus, any motion of the rotor of one is accompanied by a corresponding motion of the rotor of the other, so that both will always bear the same relative position to

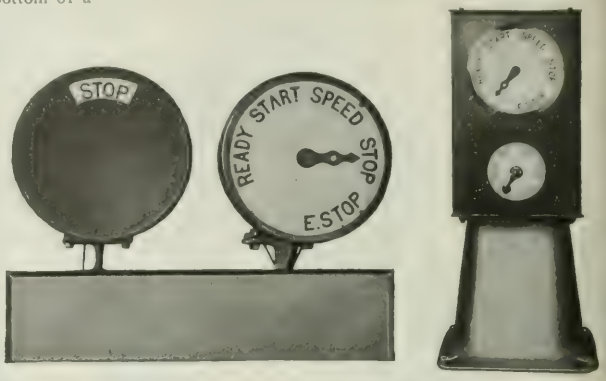



FIG. 2—CONTROL INSTRUMENTS

their stator windings. Provision is made for automatically throwing the rotors across an auxiliary supply circuit in case of failure of the main source.

To send a signal, the switchboard operator turns the handle to the proper position, this action moving both the pointer on the transmitter and that on the receiver, so that both point to the signal division. He then pushes a button, lighting a lamp at the generator whose operator is being signaled to and also blowing a whistle in order to attract attention.

As soon as the machine operator has read the signal, he turns the handle of his transmitter to the same position, transmitting the signal back as a check. Then he presses a button at the right, extinguishing the lamp and cutting out the whistle; after which he presses a button at the left to light a lamp in the switchboard room and ring a bell to attract the attention of the operator there. The latter, after checking the signal, presses the button at the left of his own handle, extinguishing the lamp and cutting out the bell, which in this way completes the sending and checking of a signal.

The apparatus which is outlined in this article was manufactured at the works of the General Electric Company, Schenectady, N. Y.

## The Horschitz Slip Meter

With the meter illustrated herewith, which has been developed for determining the slips of induction motors, measurement is made of the secondary frequency directly in terms of the primary frequency, from which the slip is ascertained at once.

This apparatus is constructed in the form of a revolution counter, and consists of a cylindrical aluminum body which contains a simple mechanism—a removable steel contact point and a handle. The cover has two openings, which bear the inscriptions "R" (revolutions) and "O" (oscillations) respectively, and ten round openings, or five pairs of openings, each pair being designated by its respective pole number. Special plugs with springs fit into these last-named openings. These plugs are attached to two conductors which have lugs on the other end for connection to the instrument transformer which is furnished with each outfit. This is a single-phase transformer having a secondary emf of 10 volts, so that the instrument receives only

is small voltage. The primary of the transformer is vided into twelve steps of 50 volts each, making a total nge of 600 volts. When using the slip-meter on voltages etween these steps, the next lower range is used, the strument not being affected by small voltage variations. he primary of the transformer is equipped with a switch nd fuses. For higher voltages any convenient transformer ay be used.

The method of making a measurement is as follows: he primary coil of the transformer is connected to two ires of the supply circuit. The secondary coil is then con- ected to the two conductors with the plugs, which are troduced into the respective sockets of the apparatus, at is, into the sockets the numbers of which correspond ith the number of poles of the motor under test. From fferences in the readings of "R" and "O" taken both be- ore and after pressing the slip-meter against the end of



FIG. 1—HORSCHITZ SLIP-METER, READY FOR USE

e induction motor shaft, the slip is determined by a simple tio formula.

The theory of the apparatus, briefly stated, is as follows: wo slip-rings and a commutator, having as many seg- ents as the motor has poles, are connected with the shaft the motor. The brushes of the two slip-rings are con- cted to the terminals of the motor, and the segments of e commutator are alternately connected with the two p-rings. The two brushes of the commutator are placed a distance of one segment apart and are connected with e windings of a double-T armature which swings be- een the poles of a permanent magnet.

If the motor should run in synchronism, the alternating rrent supplied to the commutator would be rectified dur- g each half-wave. This rectified current would have a nstant average value to which a certain deflection of the mature would correspond. This deflection would be de- ndent upon the momentary position of the rotating com- utator with respect to the brushes and the wave of the pply voltage at the time when the motor came into syn- ronism.

If, however, the motor does not run in synchronism, the ctification will occur later in each succeeding period, ve a different average value, and cause the double-T mature to assume a different position. The armature will owly swing from a positive indication, through zero, to negative indication and return. It therefore follows that e ratio of the number of swings or oscillations of the mature per second to the frequency will be equal to the p. The frequency is determined from the speed and the mber of poles, the mechanical arrangement being such

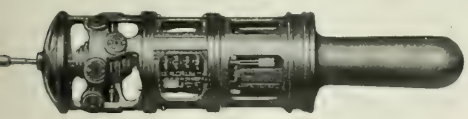


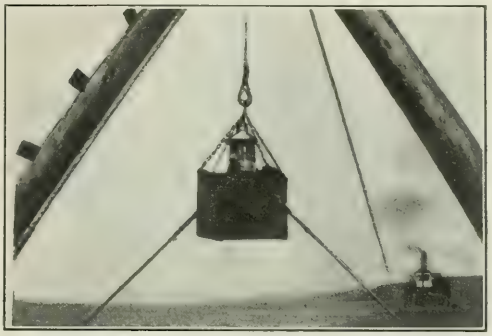
FIG. 2—HORSCHITZ SLIP-METER WITH CASING REMOVED

to correspond to a two-pole model. There are five com- utators with two, four, six, eight and ten segments, so at tests can be carried out upon motors with different mbers of poles.

This device has been placed on the German market by emens & Halske, Berlin, and on the American market by mes G. Biddle, 1211 Arch Street, Philadelphia, Pa.

## Storage-Battery Raft Lamps on the Columbia River

In accordance with government regulations on the Columbia River, the large log rafts can be towed down the river only at night on account of interference with navigation in the daytime. For the purpose of safety these rafts must be equipped with fore and aft lamps. The accompanying illustration shows an installation where lamps are placed directly over a case containing the batteries, doing away with practically all wiring. The outfit is equipped with two 4-cp lamps wired in parallel, and the battery consists of two 6-volt batteries having a capacity of 100 amp-hr.



ELECTRIC RAFT LAMP

This electric raft lamp was designed by the Astoria Hardware Company, of Astoria, Ore., and the batteries were furnished by the Electric Storage Battery Company, of Philadelphia. The arrangement keeps the batteries at a considerable height above the raft, where there is no danger of their being washed over by heavy seas. It is said that this scheme has been used for some time and has given satisfactory service.

## Special Attachment Plug for Heating Apparatus

The Hotpoint Electric Heating Company, Ontario, Cal., is manufacturing a plug especially designed to withstand the severe service imposed upon heating apparatus. The plug is extra long so that it may be easily screwed into a lamp socket when there is a reflector on the fixture. The hard-rubber grip is large and deeply knurled, affording a firm grip. The grip interlocks with the porcelain core, which in turn fits into a rectangular slot, with long parallel sides, in the screw-shell. The conductor ends are securely anchored, allowing little probability of short-circuits. There is plenty of knot room for the cord, and the hard-rubber grip has a wide bell, with easy curvature, where the cord enters.

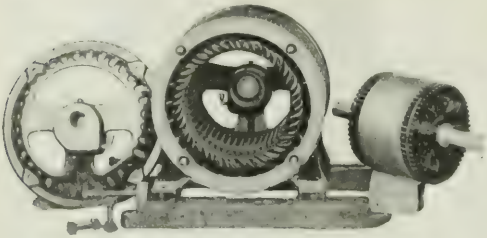


SPECIAL ATTACHMENT PLUG FOR HEATING APPARATUS

The screws that hold the three parts together fasten into nuts molded within the hard-rubber grip. These screws receive none of the strain incidental to turning the plug.

## Alternating-Current Motors

A new line of alternating-current motors has been put on the market by the Electric Machinery Company, of Minneapolis, Minn. The motors are made in three types, namely, squirrel-cage low-resistance rotor, squirrel-cage high-resistance rotor and slip-ring phase-wound motors. Special attention is given to particular applications such as



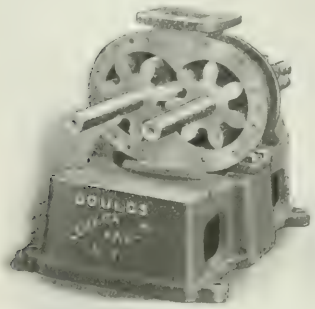
ALTERNATING-CURRENT MOTORS

to elevator and hoist duty where especially high torque starting characteristics are required. A great many conditions are met with the standard squirrel-cage type of motor with a special rotor giving it the same heavy starting characteristics as the slip-ring motor but eliminating the extra cost of slip-rings and also the attention they require. For variable-speed service, such as with cranes, ventilating fans, etc., where different degrees of speed are required for continuous operation, the standard form of slip-ring motor with phase-wound rotor is provided.

## Rotary Pump with Gear Impellers

A new type of rotary pump has been developed by the Goulds Manufacturing Company, Seneca Falls, N. Y. This pump differs from the ordinary rotary pump of the same capacity in that gear-style cams have been substituted for the three-toed cams and the gears on the end of the cam shafts have been eliminated.

The pumps are built in two sizes, one of which has a rating of 25 gal. to 50 gal. of water per minute at 225 to




ROTARY PUMP WITH GEAR IMPELLERS

450 r.p.m., and the other has a rating of 50 gal. to 100 gal. per minute at 225 to 450 r.p.m.

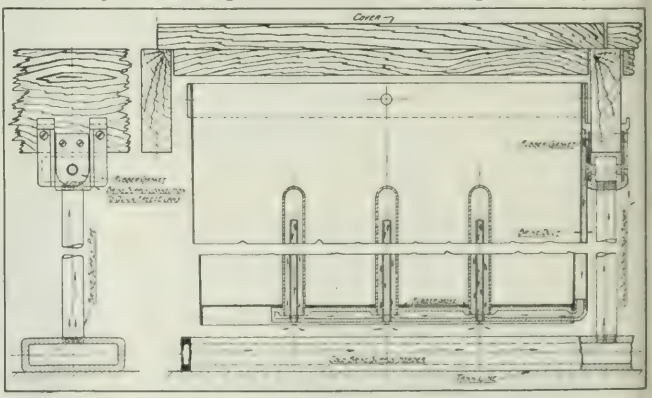
Both types of pump are mounted on cast-iron bedplates, fitted with outboard bearings and tight and loose pulleys for belt drive. One type of pump has two discharge openings and the other has three discharge openings. The pumps are provided with 3-in. and 4-in. suctions and 1.5-in. and 2-in. discharges respectively in the two styles.

## Twelve-Hour Ice-Making Process for Central Stations

With the improved freezing-can construction illustrated in the accompanying sketch it is declared that 300-lb. cakes of ice can be made in twelve hours, using brine at 10 deg. Fahr.—features which are of special interest to the central-station contemplating the installation of off-peak ice-making equipment. This saving of time is made possible with brine at ordinary temperatures since in the cans illustrated freezing of the distilled water proceeds both from the outside walls of the can and from the brine-circulating pipes within the can. These latter double pipes are connected in multiple to a manifold on the bottom of the can, the cold brine passing first upward through the annular space between the pipe walls and then downward through the smaller interior pipe which discharges out into the brine tank in which the cans are immersed. The brine thus first chills the central pipes and then passes on to the tank contents to produce freezing from the outside walls of the can. Freezing takes place in both directions within the can, thus greatly accelerating production of the finished cake of ice.

The construction diagrammed in the illustration is that used for plants in which the ammonia-expansion coils are immersed in the freezing tank. The standard construction recommended by the designers, however, utilizes expansion coils or shells at a point remote from the freezing tank. The freezing tank is divided into a number of compartments, insulated from each other. In this way, while freezing is proceeding in several of these sections, the brine in the one where freezing has been completed is being warmed in the forecooler or exchanger operated with the remainder of the plant, so that ice in the finished section is meanwhile being thawed free of the cans without loss of refrigeration. The freed cakes of ice are then ready to be lifted from the cans, which remain fixed in the brine tank.

To demonstrate the practical operation of this "quick-freeze" system in producing twelve-hour ice with 10-deg. brine a test was recently run at the Hotel Empire, New York City, where a 10-ton plant with thirty-five 250-lb. Parsons "quick-freeze" cans is installed. Filling a can with 74-deg. (Fahr.) raw unfiltered water at 9:30 a. m. Aug. 21, the 250-lb. cake of ice was solidly frozen by 9:30 p. m. of the same day, according to Mr. John Fitzsimmons, chief engineer of the hotel, the average brine temperature



SECTION THROUGH QUICK-FREEZING ICE CAN

having meanwhile been 8.5 deg. Fahr. and being held steadily at 10 deg. during the last seven hours.

The ice produced in this way is practically without core, and the can equipment is reduced to half that required for twenty-four-hour freezing.

The Parsons Quick-Freezing System is marketed by the United Ice Improvement Company, Marbridge Building, New York City.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Good Fan Season Reported.**—The Hunter Fan & Motor Company, of 114 Liberty Street, New York, made an increase of about 16 per cent during the first six months of this year over the sales for the corresponding period of 1912. This company makes a specialty of ceiling fans, but it handles also a line of portable fans.

**Lamp Factory Located at Ampere, N. J.**—The Howard Miniature Lamp Company, formerly located at Academy Street, Newark, N. J., has moved into its new factory at Ampere, N. J. The building occupies a ground area of 172 ft. by 75 ft. and is two stories in height, of slow-burning mill construction. It is light and airy and has provision for a lunch room for the accommodation of employees. The capacity of this new plant is 20,000 lamps a day.

**Indiana Manufacturer Equipping New Factory.**—The new factory of the Duncan Electric Manufacturing Company at Lafayette, Ind., is completed and the new machinery is being installed. This addition to the present works will permit of an increase of 100 or more in the working force. The company is experiencing a heavy sale in its various lines of house-type, switchboard-type and portable-type direct-current and alternating-current watt-hour meters and transformers.

**Generating Station Equipment Ordered.**—Orders for generating equipment, converters, transformers and switchboards have been received lately in large volume by the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa. The purchasers of such apparatus mentioned in that company's latest report are the Centralia (Ill.) Gas & Electric Company, the city of Cleveland, Ohio; the Maryland Electric Railway Company, of Annapolis, Md.; the Hartford (Conn.) Electric Light Company, and Sears, Roebuck & Company, of Chicago, Ill.

**Electrical Domestic Appliances Have Italian Market.**—The Bureau of Foreign and Domestic Commerce at Washington, D. C., has received from Vice-Consul Leon Böhm de Sauvanne, of Leghorn, Italy, a list of the electric-lighting companies, the voltages in use in the different cities and the principal wholesalers and dealers in heating and cooking appliances in that consular district. This list was accompanied by the statement that such appliances are regarded there as luxuries, but that their sale is increasing and that most of the dealers make their purchases from the important commercial centers, principally from Milan.

**Transmission-Line Specialty Sales.**—The Clark Electric & Manufacturing Company, of 149 Broadway, New York, has received through the Electric Bond & Share Company, of New York, an order for suspension choke coils, contact grounding devices and other power-house equipment for the Utah Power & Light Company, and another order for suspension-type line disconnecting switches for the Carolina Power & Light Company. The Clark protective clamping set, for use at railroad right-of-way or where lighting circuits cross over or under telephone lines, has recently been approved by the Chicago Telephone Company. Several of these sets have been ordered for shipment to Japan.

**Equipment of R. A. Waller Substation, Chicago.**—The board of trustees of the Sanitary District of Chicago has awarded the contract for alterations and additions, including the furnishing of electrical equipment, in the R. A. Waller substation, Chicago, to the W. A. Jackson Company for $27,850. This is one of the city substations for electric street lighting and is operated by the Sanitary District. The contractor agrees to furnish oil switches, potential transformers, ammeters, voltmeters, a 100-amp-hr. storage battery and a 3-kw motor-generator to charge it. All of this apparatus will be of General Electric make except the battery, which will be obtained from the Electric Storage Battery Company. The District will furnish six 250-kva step-down transformers and the constant-current arc regulators. During the rehabilitation the station will be kept in service.

**Kansas City Manufacturer Has Optimistic Outlook.**—Weather conditions in some parts of Kansas recently have left a good deal to be desired, and it is therefore refreshing to note the optimistic strain in the following letter received from the Barber-Dwinnell Company, Kansas City, manufacturer of storage-battery lighting plants, electrical machinery and supplies: "In spite of the adverse crop conditions in our territory, we are able to say that our business so far this year has shown a healthy increase over that of last year. In Century fans the business is almost double that of last season."

**Spain to Have a National Commercial Museum.**—According to recent reports from Consul F. T. F. Dumont at Madrid, Spain, steps are being taken toward the establishment of a national commercial museum of large size and scope for that country. The service will be divided into five administrative bureaus, as follows: Permanent exhibition of samples, internal commerce and transportation, external commerce and transportation, contract laws in Spain and foreign countries, publications and references. The whole movement is designed as a sort of adjunct to the Spanish consular service, a headquarters for trade information.

**Fixture Salesmen Convene.**—Celebrating the removal of the factory and the general sales office to their new quarters at Cleveland, the United States and Canadian sales forces of the Tungstolier Works of the General Electric Company held their annual conference at Cleveland, Ohio, during the week ended Aug. 16. Eighteen salesmen and branch managers met to visit the new plant just opened and to discuss plans for a very active sales campaign to be conducted during the coming year. Glenn C. Webster, general manager of the works, F. C. Maxheimer, sales mananger, and W. H. Fisher, superintendent of the factory, predicted the biggest fixture year in history.

**Telephones to Be Sold in Standard Packages.**—Following in the footsteps of the famous "Inner Seal," the Western Electric Company has decided to introduce a novelty into its selling system by putting out its two-station, interphone sets in standard packages. There will be two styles of these packages, according to present plans, one for the familiar wooden-wall type of intercommunicating telephones, and the other for the more convenient hand set, having transmitter, receiver and ringing button all on one handle. Two kinds of wiring outfits will be supplied in these standard packages, one for interior and the other for exterior connecting lines.

**Cheap Electrical Evaporation Process Claimed.**—The firm of Halbert P. Hill, Inc., of 30 Church Street, New York, is taking over the exclusive manufacturing, sales and licensing rights on the General Reduction Company's process of taking solids from containing liquids. The process is said to be a mechanical and electrical one and is claimed to make it possible to reduce skimmed milk to a powder at a cost of less than $1 per ton of liquid. It is stated to be adaptable to the making of solid glue, recovering of packing house by-products, production of sugar direct from the cane juice, and the manufacture of various other chemical and industrial products. The apparatus is built in several sizes, the smaller ones being operated wholly by electricity. The above-mentioned agents are ready to send printed

matter describing the apparatus and to demonstrate the same at their laboratories to central stations or other interested parties.

**New Equipment for Jamestown (N. Y.) Municipal Plant.**—Supplementing a note in the July 19 issue of the *Electrical World* it is learned that at a recent taxpayers' election in the city of Jamestown, N. Y., the proposition to bond the city for $40,000 to provide for improvements and extensions to the municipal electric-lighting plant was approved by a vote of 430 to 184. On Aug. 15 the board of municipal electric lighting commissioners held a special meeting to consider bids for two seventy-five-light street-lighting sets. The commissioners awarded the contract for one set to the Westinghouse Electric & Manufacturing Company for $3,214.56. This amount was lower than the bid of the General Electric Company, which was the only other concern making a tender.

**New Jersey Motor Manufacturer Enlarges Plant.**—Additions are being made to the plant of the Bell Electric Motor Company, of Garwood, N. J. The new buildings are well under way and will be completed shortly, when the company will be able to double its output. It has recently received many orders for motor-generator sets, for storage-battery charging and similar service, and at present this is becoming a large part of its business. An order has just been placed by the Central Railroad of New Jersey for this class of apparatus, to be used for charging batteries on the baggage trucks in its new passenger station at Jersey City. Nine motor-generator sets, each consisting of a 40-cycle, single-phase motor directly connected to a direct-current generator, were shipped a short time ago to the Postal Telegraph Company at Albany, N. Y.

**Scientific Management in Hotel Lighting.**—An unnecessary expense, which in the aggregate is heavy, is incurred in an electrically illuminated hotel every time that a guest leaves his room and forgets to turn out the lights. At the same time it gives an air of "smallness" to the house to install any form of switch that will automatically extinguish the lights, unless at the same time it is arranged to turn them on again automatically at the guest's return. Working to this end, the Hart Manufacturing Company, of Hartford, Conn., maker of the Diamond H line of switches, perfected not long ago a door-bolt solenoid switch that is arranged to accomplish both desired results. The company has had large success in introducing this switch into big hotels in Chicago and other Western cities, although the Eastern hotels are a little backward in adopting it.

**Robbins & Myers Welfare Work.**—Following a very busy season in its factory at Springfield, Ohio, the Robbins & Myers Company instituted a big "get-together" day for its factory and office force during the second week of August. The occasion was one in which the entire corps of employees, from the officers and owners to the least important workers, participated, and it afforded each class an opportunity to benefit by getting better acquainted with the aims and personalities of the other. The question of whether an individual is at the head or at the tail end of a business is not only one of latent mentality but also, in most cases, of early opportunity and environment. This company seems to be aiming at closer co-operation between the various parts of its organization by bringing them together in other relations besides those of master and servant.

**Troubleman's Searchlamp Popular.**—The portable troubleman's searchlamp, manufactured by the Electric City Sales Company, of Marion, Ind., is finding wide distribution among the central stations of the country which have transmission lines to maintain. The following companies have recently added this type of lineman's lamp to their equipment: Pacific Light & Power Company, Manchester Traction, Light & Power Company, Edison Electric Illuminating Company of Brooklyn, Butte Electric & Power Company, Evansville Public Service Company, Sao Paulo Tramway, Light & Power Company and Central Hudson Gas & Electric Company, and in addition lamps have been sold to the cities of Galveston, Tex., and Winnipeg, Canada. The lamp gas container and accompanying apparatus were described and illustrated in the *Electrical World* of May 18, 1912.

**Advocating Interstate Trackless Trolley Line.**—There is some agitation on foot in favor of the installation of a trackless trolley service from West Pawlet, Vt., to West Granville, N. Y., passing through the towns of Wells, Vt., and Granville, Middle Granville and North Granville, N. Y. The length of the proposed line would be about 15 miles and a present population of about 7000 would be affected. Thomas F. Healey, of Middle Granville, is interested in the project and, if it is finally installed, the system may draw its electrical energy supply for operation from the Western Vermont Power & Light Company, of Fairhaven, Vt. A franchise has been granted for the construction of a regular trolley line over part or all of the above route, and it is thought that this will cover the proposed trackless trolley installation. The advantages of the latter are a reduction in the cost of construction, because of the elimination of all grading work and laying of tracks, and also a greater flexibility of operation than is afforded by the ordinary trolley system. The coach proposed for this line is of the semi-convertible, one-man, prepayment type, equipped front and rear with dual rubber tires, and having an individual motor drive on each wheel. This four-motor, four-wheel drive, combined with rubber tires, gives maximum traction and, with a reasonably hard road surface, makes the vehicle adaptable for use under all conditions of weather.

**German Electrical Exports Show an Increase During 1912.**—In the following table is shown a comparison between the figures for the first six months of 1912 and those for the same period this year on German electrical exports. It is worthy of note that out of the seventeen items covered, embracing all the important classifications, decreases occurred in only four. Of interest also is the fact that during the first half of this year the imports of electrical goods amounted to about $1,527,000, while for the same time last year these imports were valued at approximately $1,235,000.

GERMAN ELECTRICAL EXPORTS

| Classification | Value, January to June Inclusive 1913 | 1912 |
|---|---|---|
| Dynamos, motors, transformers, etc. | $6,430,000 | $5,575,000 |
| Armatures and commutators | 920,000 | 720,000 |
| Secondary batteries and electrodes | 596,500 | 756,000 |
| Cables | 4,435,000 | 2,735,000 |
| Arc lamps, mercury-vapor lamps, etc. | 341,500 | 316,500 |
| Searchlamps, etc. | 282,300 | 112,700 |
| Metal-filament lamps | 4,765,000 | 5,415,000 |
| Carbon-filament lamps | 463,000 | 390,000 |
| Telegraph apparatus | 133,700 | 173,500 |
| Telephone apparatus | 881,000 | 623,000 |
| Safety and signaling apparatus | 452,000 | 447,000 |
| Wireless telegraph and telephone apparatus | 170,000 | 179,700 |
| Apparatus for lighting, power transmission, etc. | 6,140,000 | 4,230,000 |
| Medical apparatus | 481,000 | 476,500 |
| Measuring apparatus | 2,697,000 | 1,964,000 |
| Primary batteries | 282,000 | 184,700 |
| Insulating tubes | 350,000 | 291,500 |

**Hartford Telephone Manufacturer Installs Motor Drive.**—The new plant of the Gray Pay Telephone Company at Hartford, Conn., has recently been completed. Ten small two-phase 220-volt Western Electric induction motors, with a total capacity of 115 hp, have been installed, together with seven ovens of 50-kw capacity each and a 10-kw welding machine. The ovens are used for baking enamel on the telephone cases and are controlled through circuit-breakers operated by time switches mounted on a separate switchboard. There are 650 lighting outlets, those on benches and machines being provided with White adjustable fixtures, and those for general lighting being supplied with Benjamin single-light fixtures. A power panel on each floor controls the motors and the feed wires run from these panelboards to a four-panel switchboard. All feeders both for power and lighting are in conduits and all branch lines are placed in National Meta molding. Trumbull panelboards and switchboards are used throughout, and the contracting work was done by the L. K. Comstock Company, of 30 Church Street, New York. G. W. Perry, wire inspector of the Hartford Board of Fire Commissioners, from whom the above item is received, states in addition that prospects are bright for a good growth of business during the coming autumn. Several large buildings are now under construction, among them the new office building of the Hartford Electric Light Company.

**Bids Sought for Alternating-Current Synchronous Condensing Apparatus.**—The clerk of the Sanitary District of Chicago will receive sealed proposals for furnishing alternating-current synchronous condensing apparatus and also for furnishing round manhole frames and covers, at the office of the District, 900 South Michigan Avenue, Chicago, until noon on Aug. 28. Specifications, plans and form of proposal may be obtained upon application at the office of the Sanitary District, of which John McGillen is clerk.

**Brookfield Insulators Used in a Difficult Climate.**—Following difficulty in obtaining an adequate insulator for low-tension service in the salt swamp district of Utah, the Brookfield Glass Company, of 2 Rector Street, New York, has perfected a new type of insulator which has been adopted by the Postal Telegraph-Cable Company for the lines which it operates in this locality. It was found that with the earlier type of insulator the salt dust would settle on the surface of the glass, and when a slight rain or snowfall came the salt solution formed would serve to short-circuit the line. The new type of insulator is improved by having a large and comparatively flat exposed surface which can be cleaned conveniently, two large protected inner areas and, finally, a deep inner petticoat which makes the leakage path extremely long. While this type of insulation was developed primarily for the peculiar conditions above mentioned, it is suitable for use on any low-voltage line.

**Tungstolier Works Move to Cleveland.**—The Tungstolier Works of the General Electric Company, formerly located at Conneaut, Ohio, are now located at Cleveland, Ohio, the factory and office having been transferred on Aug. 1. The plant now occupied by the fixture works is known as the Ivanhoe Metal Works of the General Electric Company and is situated on Ivanhoe Road in East Cleveland. This new plant is a magnificent structure of brick and stone, equipped with the most modern apparatus for producing formed and cast-metal products. Speed machines, spinners, presses and automatic devices of many kinds have been installed. The conveniences provided for employees include a cafeteria, library, rest and recreation rooms and shower baths. Under the direction of Glenn C. Webster, general manager of the Tungstolier Works, the plant has been organized and systematized to operate at highest efficiency. From the designing room to the shipping room the effort of the organization is to turn out the products in the best possible manner and in the quickest possible time. The headquarters of the Tungstolier sales organization are located in the downtown district, at Euclid Avenue and Ninth Street. Showrooms have been equipped at this address and everything which leads to complete and comprehensive service to the trade has been installed.

**Steel Works Drew Energy Supply from Large Central-Station System.**—Several of the independent steel companies in the coal and iron region of Pennsylvania and West Virginia, among them the Apollo (Pa.) Steel Company, Weirton (W. Va.) Steel Company, West Leechburg (Pa.) Steel Company, Blaw Steel Construction Company, of Hoboken, Pa., and the Vanadium Alloys Company, of Pittsburgh, Pa., are large users of electric drive and draw their energy supply from the lines of the West Penn Traction Company. In the cold-rolling department of the West Leechburg company's plant electricity is extensively used for driving the rolls, machine tools, cranes and lifting magnets. The energy is brought in on lines from the Connellsville (Pa.) generating station, although there is connection to the lines of the Allegheny Valley station for use in emergency. This three-phase, 60-cycle current, at 2200 volts pressure, is converted to direct current by means of a synchronous motor-generator set, as the service demands a wider range of speed variation than can easily be obtained with the present standard alternating-current apparatus. The Weirton company has just completed the construction of a group of mill buildings (the largest of which occupies a ground area measuring 300 ft. by 200 ft.), in which all rolling-mill drive and auxiliary mechanical operations will be done electrically. Energy for this electrification is to be drawn from the substation at McDonald, Pa., the tension on the incoming wires being 25,000 volts. Here again the direct-current drive is preferred, and for the same reason as in the case of the above-mentioned plant, and, in order to obtain this from the alternating-current supply, two motor-generator sets of 1500-hp rating have been installed by the steel company.

**Electrical Properties Company Readjustment.**—Stockholders of the Electrical Properties Company have approved the plan for reduction and readjustment of its capital stock, proposed by J. F. Wallace, H. R. Hayes and A. M. Chambers. The concern's assets will be sold to a new company to be known as the Electrical Properties Corporation, which will own all the capital stock of Westinghouse, Church, Kerr & Company.

**Public Service Company of Northern Illinois.**—The Chicago newspapers publish a rumor to the effect that the dividend rate on the common stock of the Public Service Company of Northern Illinois is to be increased from 4 per cent to 5 per cent before the end of the year. This company, which is one of the Insull properties, has an aggregate funded debt, including that of the underlying properties, of $26,699,100, besides $2,500,000 in three-year 6 per cent notes. It has issued $7,588,000 in 6 per cent preferred stock and $9,062,000 in common stock. It serves a large and prosperous area surrounding Chicago in northeastern Illinois.

**Sale of Toronto Hydro-Electric Bonds.**—General debentures of the Toronto Hydro-Electric Commission, amounting to $4,220,000, were disposed of to N. W. Harris & Company, of New York and Chicago, the bonds, which bear interest at 4 per cent, being at 83, making the effective interest about 5 per cent. This is the first sale of the commission's bonds, which have heretofore been refused by the London market, the reason commonly given being that Toronto interests have carried on an active campaign in London to discourage the purchase of public utility securities. The importance of this sale to the city will be understood when it is stated that through inability to dispose of them before the city has held these bonds in its own sinking fund, utilizing the money they represent for construction work on the municipal electric system.

## Industrial Securities

| Security | Capital Stock Listed | DIVIDEND Per Cent | DIVIDEND Period | QUOTATION Aug. 20 | QUOTATION Aug. 26 |
|---|---|---|---|---|---|
| Allis-Chalmers, t.r., 5th pd | $19,800,000 | | | 9¼ | 7½* |
| Allis-Chal., pf., t.r., 5th pd | 16,050,000 | | | 20 | 19* |
| Amalgamated Copper | 153,887,900 | 1½ | Q | 74 | 73½ |
| American Tel. & Tel. | 344,471,400 | 2 | Q | 130½ | 130½ |
| Electric Storage Battery,c | 16,074,425 | 1 | Q | 47⅞ | 48 |
| General Electric | 101,363,600 | 2 | Q | 145½ | 145 |
| Mackay Cos., c. | 41,380,400 | 1½ | Q | 86 | 86* |
| Mackay Cos., pf. | 50,000,000 | 1 | Q | 67 | 67* |
| Western Union Tel. | 99,747,600 | ¼ | Q | 67½ | 68* |
| Westinghouse, E. & M., c. | 34,496,400 | 1 | Q | 72 | 71¾ |
| Westinghouse, E. & M., pf. | 3,998,700 | 1¼ | Q | 119½ | 119* |

*Last price quoted.

### NEW YORK METAL MARKET PRICES

| | Aug. 18 Bid. | Aug. 18 Asked. | Aug. 25 Bid. | Aug. 25 Asked. |
|---|---|---|---|---|
| Copper: | | | | |
| Standard, spot* | | | | 16.00 |
| | Selling Prices | | Selling Prices | |
| | £ s d | | £ s d | |
| London, standard, spot* | 69 18 0 | | 69 10 0 | |
| Prime Lake | | 16.00 | 15.85 | to 15.95 |
| Electrolytic | 15.85 | to 15.95 | 15.70 | to 15.80 |
| Casting | 15.70 | to 15.80 | 15.60 | to 15.70 |
| Copper wire base | 16.75 | to 17.00 | 16.75 | to 17.00 |
| Lead | | 4.75 | | 4.75 |
| Nickel | 40.00 | to 45.00 | 40.00 | to 45.00 |
| Sheet zinc, f. o. b. smelter | | 7.75 | | 7.75 |
| Spelter, spot | | 5.87½ | | 5.87½ |
| Tin, spot* | 41.40 | to 41.65 | 41.15 | to 41.50 |
| Aluminum: | | | | |
| Prompt delivery | 22.50 | to 23.00 | 22.25 | to 22.75 |
| Future | 20.00 | to 21.00 | 20.00 | to 21.00 |

### *OLD METALS

| | | |
|---|---|---|
| Heavy copper and wire | 14.50 | 14.50 |
| Brass, heavy | 9.25 | 9.25 |
| Brass, light | 8.25 | 8.25 |
| Lead, heavy | 4.40 | 4.65 |
| Zinc, scrap | 4.62½ | 4.62½ |

### *COPPER EXPORTS

Total tons to Aug. 25 ..... 27,597

*From daily transactions on the New York Metal Exchange

## Business Notes

The Wagner Electric Manufacturing Company of St. Louis has opened a sales and service department for the maintenance of its automobile starters at 1911 Woodward Avenue, Detroit, and is conducting this work in connection with its manufacturing plant and general offices.

Frederick Ball, 30 to 32 York Place, New York, has the exclusive agency in connection with the Trumbull Electric Manufacturing Company, of Plainville, Conn., for handling that company's line of bells, chimes, buzzers, and transformers for electrical connection to Century New York and Utility.

The Hurley Machine Company of Chicago, Ill., has been formed to take over the business heretofore conducted by the same firm in order to bring it into line with the growth of its business in Chicago and the suburbs. J. M. Hurley, vice-president and general manager of the company's Chicago operations, will be responsible for the business in Chicago and vicinity, while the executive offices will remain in Binghamton, New York.

M. W. Dunton Company.—Mr. F. L. Thayer, of the Stock Quotation System, Chicago, has been appointed district manager for the M. W. Dunton Company, of Passaic, N. J., which manufactures "Triplex" insulating paper. This paper is composed of the chemical wood pulp and a core of the phosphate paper principle.

The Blaw Steel Construction Company recently completed a new office building of its own in Milwaukee, Wis., and moved its general offices to that city. It has also established a district sales office in charge of H. H. Flaherty, Stock Building, Cincinnati, O. The company has appointed the partnership of Ingalls, Hart & Lee, engineers and sales managers of the Pittsburgh Steel Company of Pittsburgh, Pa., who will have the headquarters of this organization in New York, and will handle the sales of steel for bridges, public and other piers, and the general structural business of the company in the East.

## New Industrial Companies

The Electric Traffic Signal Company, of Seattle, Wash., has been incorporated with a capital stock of $25,000 by A. A. Boardman, P. E. Parker and others.

The Indianapolis House-Lighting Company, of Indianapolis, Ind., has been incorporated by Carl L. Rost, O. F. Moore and H. C. Bonnet. The company is capitalized at $10,000 and proposes to conduct a lighting business.

The California Mechanical & Electrical Engineering Company, of Sacramento, Cal., has been incorporated with a capital stock of $10,000 to carry on a mechanical and electrical engineering business. The incorporators are J. F. Bradley, S. J. Harding and H. J. Schmelling.

The Tyre Service, Inc., of New York, N. Y., has filed a certificate of incorporation with a capital stock of $10,000. The incorporators are Charles L. Dixon, W. M. Rossi and Lee C. Tyrrell, 1 Madison Street, New York, N. Y. The company proposes to manufacture motor vehicles, etc.

The Maxwell Non-Leak Manufacturing Company, of Los Angeles, Cal., has been incorporated with a capital stock of $25,000 for the purpose of taking a mechanical and electrical engineering business. The incorporators are T. Edwards, W. B. Maxwell, J. Kline, H. C. B. Knudsen, all of New York City, and W. Lacey, of Jersey City, N. J.

## Trade Publications

Lamp Bulletin.—A leaflet has been issued by the H. M. Byllesby Engineering Company, New York, in which the advantages of the Shallcross lamp, manufactured and sold by the company, are set forth. A few words of explanation are also given in regard to the H. M. Byllesby Engineering and Management Corporation, which is a subsidiary company.

Report Covering Fire.—Correspondence with many customers has enabled the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., to issue a report covering the fire which occurred in the Westinghouse Electric & Manufacturing Company's plant at East Pittsburgh, Pa., on Dec. 19, 1913. This report is a very complete one and gives the views of manufacturers of fire-protective devices.

Bushings.—A pamphlet on the No. A1 bushing, between the two parts of which is inserted a facsimile of the New York Edison Company's letter of May 2, 1913, in which the Edison Company states that the bushing has been in service for more than a year and has given satisfaction, is being distributed by the Federal Sign System Electric Company, Chicago. These bushings are formed with small recesses on the inside to avoid creeping discharges.

Power Plant Supplies.—The Schutte & Koerting Company, Philadelphia, has issued a twenty-two-page catalog in which the steam-flowing equipment manufactured and marketed by the company is illustrated and described. Engineering specialties, valves for various purposes, damper regulators, exhaust heaters and other devices are included.

Generators.—A leaflet, No. 4001, of the Westinghouse Electric & Manufacturing Company, says that Westinghouse commutating-pole generators, from 15 kw. to 200 kw. capacity, are described and illustrated. These generators have ventilated steel frames, interchangeable parts, low operating temperature and other essential qualities.

Laundry Machinery.—The Hurley Machine Company, Chicago, has recently distributed a folder in which are illustrated drawings that call attention to a Texas laundry outfitting equipment for the oil workers of Brazoria, which the company purchased in new forms and brought added equipment to the township, as well as increased freedom for the workers.

Storage-Battery Lighting Plants.—In an eight-page pamphlet bearing the imprint of the Exide Battery Department of the Electric Storage Battery Company, the manufacturers of Exide storage batteries, are exemplified different storage-battery lighting plants for towns and country residences, public buildings, business houses and small stores are fully described. Some interesting personal testimonials to the merits of Exide batteries are given.

Conduit.—The D. Austin & Company Manufacturing Company has issued sheets, designated as Austin No. 13 and known for use as "Reinforced" and "S. K. C. Co. Special" conduit, and another sheet referring to "Standard" conduit and containing revised prices on these products. The latter sheets supersede No. 12 and Bulletin No. 30. These sheets carry with the prices of ordinary use the same advisory notes as have appeared in the past.

Railroad Electrification.—Mr. Leffler, Wm. Jay, and John Reed, of the Westinghouse Electric & Manufacturing Company, are named as valued users of the electrification of the New York extension of the Pennsylvania Railroad and the Long Island New Haven & Hartford Railroad. In describing a few of the many important parts of the equipment, the bulletin, No. 4002, "Westinghouse Railway Motors," also contains many interesting pictures of the electrified system.

Motors.—Bulletin 4 recently issued by the United States Electrical Manufacturing Company, Los Angeles, Cal., relates to an engine type "UE" constant-speed alternating-current synchronous induction motors. Owing to their mechanical and commutator with reference to the speed and current, as well as many other points of interest, are set forth in the bulletin. A comprehensive treatise covering the different elements of the bulletin, the general arrangement and the exact drawing, the installation and construction of these motors.

Electric Welding.—The industrial and power department of the Westinghouse Electric & Manufacturing Company has issued a pamphlet form a reprint of an article on "Electric Arc Welding Processes" recently published in the technical press by Mr. C. J. Reed, chief of processes, materials and methods of the Westinghouse Company. The paper refers to well-illustrated explanations to explain the different processes employed in arc welding, with comparisons and conclusions, and gives some figures of comparison of arc and thermite welding.

Transformers.—Bulletin No. 301 of the American Transformer Company, Newark, N. J., refers to the high-voltage testing transformers and complete testing sets. It calls attention to the following points of material which have proved their fundamental strength, the compact and economical arrangements of the unit all of the testing sets which is made from the materials and details. Two standard equipments have been designed, type "TS-1" for power only, and type "TS-2" for power with "The new processes by which assembled and clamped

# Personal Mention

Mr. J. H. Lawton, formerly of Evansville, Ind., has become manager of the New Haven (Ct.) electric properties controlled by the same interests.

Mr. C. A. Dow has been appointed superintendent of the Arlington (Mass.) Water and Light Department, as successor to Mr. C. J. Brown.

Mr. L. W. Crenshaw has been appointed city engineer, with supervision over the water, light, sewer and paving of Dallas, Tex.

Mr. H. M. Ferguson has been appointed manager of the electrical department of the Monongahela (Penn.) Light & Power Company, as successor to Mr. C. D. Gregg.

Mr. Oliver B. Miller has been appointed manager of the municipal electric light plant at Colfax, Wash., as successor to Mr. O. A. Clark, who resigned on April 1.

Mr. W. B. Powell has been elected general manager, secretary and treasurer of the Villa Rica (Ga.) Electric Light & Power Company, in place of Mr. C. B. Mallard.

Mr. B. F. Tucker has become superintendent of the Taylorville (Ill.) district of the Central Illinois Public Service Company. Mr. Tucker was formerly at Virden, Ill.

Mr. I. P. Ellison, of Chicago, has been engaged as superintendent of the municipal electric light plant at Eden Prairie, Minn., as successor to the late W. H. Winchenbach.

Mr. J. A. Porter, formerly manager of the Perry (Ok.) Light & Power Company, has been made assistant to the president of the Light & Development Company, at Joplin, Mo.

Mr. F. D. Mahoney, formerly with the Laurel Light, Heat & Power Company, at Ridgeway, Pa., has become associated with the Keystone Light & Power Company, as commercial engineer.

Mr. Henry Floy has been appointed an arbitrator in the awards of the Public Service Commission, Commission of New York, which has instituted the system of rates for New York's new subways. The company must eventually be placed in the hands of a receiver.

Mr. R. C. Jones, secretary and treasurer of the San Antonio (Tex.) Gas & Electric Company, has been elected secretary of the San Antonio Traction Company, of which he is treasurer and assistant general manager. Mr. Jones succeeds Mr. L. D. Wheelwright, resigned.

Prof. H. H. Higbie has resigned as head of the electrical department of the Massachusetts Institute of Technology to become professor of engineering at the University of Michigan, his alma mater. Mr. and Mrs. Higbie have the warmest sympathy of their many friends in the loss they are meeting with in his death at the University of Illinois.

Mr. C. E. White, manager of the Montgomery (Ala.) Light & Water Power Company, and a vice-president of the Southern Gas Association, has been appointed the delegate of the association to represent it at the next international Gas Congress to be held on the Riviera in October next.

Mr. George H. Lawrence, of Boston, Mass., has resigned his position as a member of the Massachusetts Public Service Commission, in Massachusetts, owing to the state of his health. Mr. Lawrence was succeeded by Mr. Bancroft, who assumed his duties on April 1. Mr. Bancroft was formerly with the engineering department of the Westinghouse Electric Company, of Chicago. It is here that he was associated with Mr. Lawrence. The latter is a Manufacturing Company in Pittsburgh.

Mr. Carl O. Y. Monnelius, previously chief engineer, and Mr. Hugo M. Bjärnum, electrical engineer, of the electrical department Stockholm (Sweden) Tramways, arrived in New York May 31 on board the Swedish steamship Oscar II, having completed high-tension transmission systems and installations of heavy electric traction. After visiting points in New York and in the vicinity of New York, Messrs. Monnelius and Bjärnum will proceed to Chicago, Milwaukee, Duluth, Minneapolis and San Francisco, visiting the principal electrical plants in those cities. They will then return to Sweden.

Mr. Arthur L. Provines, [illegible] of superintendent of the distribution department of the Pittsburgh Power Company, has resigned to become assistant engineer of the Pittsburgh Railways Company. Mr. Provines was formerly with the Pittsburgh Railways Company, but left it to become connected with the Pittsburgh Power Company.

Mr. George H. Duffield, for many years general engineer of the Illinois Steel Company, Chicago, Ill., and who, during the Spanish-American War, was commissioned a major in the United States Army, has been appointed consulting engineer to the Commissioners of the District of Columbia, to succeed Mr. Alexander Hamilton, who has recently accepted a position as consulting engineer to the Pennsylvania Railroad.



Mr. George H. Duffield

Mr. T. Warren Allen, formerly connected with the Edison Electric Illuminating Company, of Boston, Mass., and for the past two years engineer in charge of the Boston office of the Stone & Webster Engineering Corporation, has been appointed manager of the Boston office of the Westinghouse Electric & Manufacturing Company, succeeding Mr. Charles F. Scott, who has been appointed manager of the Pittsburgh district of the Westinghouse Company.

Mr. Arthur L. Provines, [illegible] of superintendent of the distribution department of the Pittsburgh Power Company, has resigned to become assistant engineer of the Pittsburgh Railways Company. Mr. Provines was formerly with the Pittsburgh Railways Company, but left it to become connected with the Pittsburgh Power Company. He will be in charge of the construction of a station, substations and entire high-tension system for the Pittsburgh Railways Company, which is now being built by the Stone & Webster Engineering Corporation. Mr. Provines will have charge of the construction of the Pittsburgh Railways Company's new power station on the Monongahela River front at Rock Point, Pittsburgh. While in the employ of the Pittsburgh Power Company, Mr. Provines was in charge of the construction of a station, substations, transmission and entire high-tension system. He was also the engineer assigned to become associated with Mr. [illegible] T. Warren, electrical engineer and superintendent of the Public Service Commission, in making an investigation and report of the electrical equipment of the Twin Screw Steel Steamship Company. Mr. Duffield will continue to act as consulting engineer for the Pittsburgh Railways Company, and will have charge of the construction of the Railways Company's new power station on the Monongahela River front at Rock Point, Pittsburgh, and will also have charge of the construction of the Railways Company's new high-tension transmission system, which will run from Rock Point to Pittsburgh, a distance of about 12 miles. The new power station will be one of the largest in the country, and will have a capacity of 100,000 kw. It will be equipped with Westinghouse machinery, and will be operated by the Westinghouse Electric & Manufacturing Company. Mr. Duffield will also have charge of the construction of the Railways Company's new power station at Aliquippa, Pa., on the Ohio River, which will be equipped with Westinghouse machinery, and will be operated by the Westinghouse Electric & Manufacturing Company. Mr. Duffield will also have charge of the construction of the Railways Company's new power station at Aliquippa, Pa., on the Ohio River, which will be equipped with Westinghouse machinery, and will be operated by the Westinghouse Electric & Manufacturing Company.

# Obituary

Mr. James Stevenson, [illegible] & Stevenson, Pittsburgh, Penn., and a prominent engineer and manufacturer of Pittsburgh, died on April 20, 1904, at the age of 74 years. He was born in Ireland, and came to this country when a young man. He was engaged in the manufacture of [illegible] and was one of the pioneers in the electric railway business. He was a member of the Engineers' Club of Pittsburgh, and was well known in engineering circles throughout the country. He was a member of the Engineers' Club of Pittsburgh, and was well known in engineering circles throughout the country.

# Construction

## New England

SKOWHEGAN, ME.—The Somerset Trac. Co., of Skowhegan, will award a contract for the construction of a substation within the next 30 days.

CHELMSFORD, MASS.—The Lowell El. Lt. Corpn., of Lowell, has submitted a proposition to the Water Commissioners for furnishing energy at the pumping station.

MALDEN, MASS.—The Street and Water Commission is considering plans for the installation of an ornamental street-lighting system on the business streets of Central Square and has asked the City Council for an appropriation of $42,000 for street-lighting next year, which will provide for ornamental lamps.

NEW BEDFORD, MASS.—The stockholders of the New Bedford Gas & Edison Lt. Co. have voted to increase the capital stock by 2650 shares to be sold at $200 per share. The proceeds will be used for extensions and improvements in the power plant and for extensions to business.

READING, MASS.—Preparations are being made by the Reading municipal electric light board for improvements and extensions to the municipal electric plant, involving an expenditure of about $25,000.

TAUNTON, MASS.—Mayor Fish has signed the order appropriating $50,000 for a new generating unit for the municipal electric-light plant.

NARRAGANSETT PIER, R. I.—The Narragansett Pier El. Lt. & Pwr. Co. has recently completed a 6-mile extension to its system to Matunuc Beach. R. I. W. C. Clarke is general manager.

PASCOAG, R. I.—The Pascoag Fire District has decided to continue to operate its municipal electric-light plant, instead of purchasing electricity from the Blackstone Valley Gas & El. Co. to operate the system. Improvements will be made to the plant, to cost about $4,000.

## Middle Atlantic

AURORA, N. Y.—The Aurora El. Lt. Co. expects to purchase within the next six months about 1000 incandescent lamps. N. L. Zabriska is manager.

LONG ISLAND CITY, N. Y.—Contracts have been closed between the New York & Queens El. Lt. & Pwr. Co., of Long Island City, and the General Vehicle Co., of New York, whereby the former will furnish energy to operate the manufacturing plant of the latter, now being erected on Borden Avenue, Long Island City. The New York & Queens El. Lt. & Pwr. Co. has also signed a contract to furnish energy to operate the factory of Joseph Haberman & Co., on Borden Avenue.

MARION, N. Y.—The Marion Pwr. Co. has just completed the erection of a distribution line, including transformers, costing about $6,000 for the Wayne Cold Storage Co., of Marion. The line from Williamson to Marion has recently been rebuilt.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, until Sept. 2, for additions and repairs to the electric equipment at De Witt Clinton High School, High School of Commerce and Wadleigh High School, borough of Manhattan; for additions to and alterations in the electric equipment of Public School 18, Broadway, West New Brighton, borough of Richmond. Also for fire protection work at Public School 3, Church Street, Pleasant Plains; Public School 4, Shore Road, Kreischerville, and Public School 29, Manor Road, West New Brighton, borough of Richmond. Blank forms, plans and specifications may be obtained at the office of the superintendent of school buildings, corner of Park Avenue and Fifty-ninth Street, borough of Manhattan.

PHOENIX, N. Y.—The Seneca River Pwr. Co., of Phoenix, is changing the present arc-lamp street-lighting system to 250-watt tungsten lamps. E. M. White, of Phoenix, is vice-president.

RANDOLPH, N. Y.—The Randolph El. Lt. & Pwr. Co. expects to purchase within the next six months one 100-kw to 150-kw, three-phase, 60-cycle, 2300-volt generator and engine suitable for same. J. W. Grace is manager.

ALBURTIS, PA.—Preparations are being made for the installation of an electric-lighting system in Alburtis.

ALLENTOWN, PA.—The Lehigh Valley Transit Co., of Allentown, has closed a contract whereby it will supply electricity to the Philadelphia Suburban Gas & El. Co., which furnishes electrical service in North Wales, Lansdale and suburban districts.

EPHRATA, PA.—The Borough Council has accepted the bid of the Westinghouse El. & Mfg. Co., of Pittsburgh, for furnishing the new 350-kw turbo-generator set, exciter and switchboard and condenser for the municipal electric-light plant, at $11,600.

LANSFORD, PA.—The Lehigh Coal & Navigation Co., of Lansford, expects to purchase within the next two months an electric shaft hoist (700-hp), including transformers and instruments, circuit-breaker, etc. Albert Leonarz is superintendent.

MEDIA, PA.—The municipal light committee expects to purchase in the near future engine, generator and pumps of 1,000,000-gal. capacity. The Council as yet has taken no definite action on this matter. The committee also expects to purchase within the next two months some 30-ft. and 35-ft. poles. P. E. Ahearn is superintendent.

PATTON, PA.—The Penn Central Lt. & Pwr. Co., of Altoona, has taken over the plant and holdings of the George S. Good El. Co., of Patton. It is understood that improvements will be made to the electric service.

PITTSBURGH, PA.—The Pittsburgh, Harmony, Butler & New Castle Ry. Co., it is reported, has secured an option on the organ works in Morado, where it proposes to build a new power plant.

JERSEY CITY, N. J.—Plans are being considered for the installation of a new street-lighting system on Newark Avenue. The service will be furnished by the Public Service El. Co.

WOODSTOWN, N. J.—The Woodstown Ice & Cold Storage Co. expects to erect within the next six months 3 miles of distribution lines C. F. Moore is manager and treasurer.

CRISFIELD, MD.—The Crisfield Lt. & Pwr. Co. has applied to the Public Service Commission for permission to issue $10,000 in additional capital stock, the proceeds to be used for improvements.

LONACONING, MD.—The Home El. Lt. Co., of Lonaconing, has purchased the controlling interest in the Lonaconing El. Lt. & Pwr. Co.

MANASSAS, VA.—Bonds to the amount of $75,000 have been voted for the installation of a municipal electric light plant, water-works and sewer systems. Harry Stevens, Union Trust Building, Washington, D. C., is engineer.

ROANOKE, VA.—The Norfolk & Western Ry. Co. has awarded the contract for electrical equipment for its Bluefield-Vivian section (85 miles in length) to the Westinghouse El. & Mfg. Co., of Pittsburgh. The contract calls for all electrical equipment required, including 26 120-ton electric locomotives of the single-phase and two-phase type, with all power house generating machinery and transmission apparatus. Energy for operating the entire section will be generated by a central power plant located at Bluestone, W. Va., having an output of 27,000 kw.

ROCKY MOUNT, VA.—The capital stock of the Lt. & Pwr. Co., of Rocky Mount, has been increased from $5,000 to $15,000, the proceeds to be used to purchase the water rights at Pelter's Ford on Pigg River, about 2 miles from the town, and the construction of a concrete and wooden dam. About 200 hp will be developed, enabling the company to furnish a continous service for lamps and motors.

WASHINGTON, D. C.—Bids will be received at the Engineer Depot, United States Army, Washington Barracks, Washington, D. C., until Sept. 8, for furnishing four motor-driven vertical centrifugal pumping sets. Further information may be secured upon application to above office.

WASHINGTON, D. C.—A report from an American consul states that the Director of General Telegraphs and Telephones in a Latin-American country is contemplating the purchase of telephone supplies. For further information address No. 11,534, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C.

WASHINGTON, D. C.—Supplementing a previous report, an American consular officer advises that an award which was made recently for two electrically operated cranes for local dry dock has been annulled and new proposals will be received. A diagram, with blueprints, showing dimensions of the two cranes, accompanied by report, may be obtained from the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., referring to No. 11,535.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 16 for furnishing at the various navy yards supplies as follows: Brooklyn, N. Y., Schedule 5802—1000 ft. lead-covered, paper-insulated single conductor, Washington, D. C., Schedule 5804—two 3-ton electrically operated hoists. Eastern yards, schedule 5795—miscellaneous lamp sockets. Bids will also be received at the same place until Sept. 23 as follows: Washington, D. C., Schedule 5812—for furnishing and installing seven soot cleaners on boilers. Applications for proposal should designate the schedule desired by number. T. J. Cowie is paymaster general, U. S. N.

## North Central

GRAND RAPIDS, MICH.—The Roseberry-Henry Co., of Grand Rapids, has secured the contract for installing an electric-light system at the West Michigan State Fair Grounds. The contract provides for 1000 lamps, of which 500 will be erected throughout the grounds and the remainder in the buildings.

GRAND RAPIDS, MICH.—The Stowe-Davis Furniture Co. has awarded a contract to the Wernette-Bradford-Meade Co., electrical contractor, for remodeling its power plant, to cost about $5,000. The plans provide for the construction of a new engine room, the installation of a new engine and rope drive.

HANCOCK, MICH.—The Houghton County El. Co., of Houghton, has submitted a proposition to the Council for the installation of a street-lighting system on Front Street. The contract provides for the erection of 13 poles carrying one or two arc lamps as the Council directs.

MUSKEGON, MICH.—Arrangements are being made by the Brunswick-Balke-Collender Co. for building an addition to its boiler room before

the winter. The plans provide for a brick building 60 ft. by 80 ft. and 25 ft. high, and the installation of 1200 hp boilers. The present iron smokestack will be replaced with a concrete stack 175 ft. high with an interior diameter of 9 ft. Contracts have been placed for the stack. The company recently replaced some of its large motors with smaller motors.

NILES, MICH.—The Electric Appliance Co., of Chicago, Ill., has been awarded the contract for installing the new street-lighting system, consisting of 500-watt tungsten lamps, to replace the present arc lamps.

NILES, MICH.—The substation of the Southern Michigan Ry. Co., located in Niles, was badly damaged by an electrical storm recently, causing a loss of about $5,000. Two large rotary converters were injured.

SAULT STE. MARIE, MICH.—The Michigan Northern Pwr. Co., of Sault Ste. Marie, has applied to the State Railroad Commission for permission to issue $2,995,000 in capital stock and $2,000,000 in mortgage bonds to provide funds to make improvements made necessary to maintain the level of Lake Superior as ordered by the federal government.

TECUMSEH, MICH.—Special elections will be held in Tecumseh, Macon and Ridgeway for the purpose of voting on the proposition of granting the Tecumseh El. Co. a franchise to erect transmission lines through these townships to furnish electrical service. The company also proposes to furnish energy for lamps and motors in the villages of Ridgeway and Britton.

COSHOCTON, OHIO.—The Coshocton Lt. & Htg. Co. expects to install within the next three months a 5000-kva, 2300-volt General Electric turbine with condensing apparatus and 1000-hp boilers; also to erect 15 miles of three-phase, 33,000-volt transmission line and two substations, one at New Comerstown and the other at West Lafayette. All material for above improvements has been purchased. C. H. Howell is manager.

FINDLAY, OHIO.—The lighting committee has submitted a proposition to the Toledo, Bowling Green & Southern Trac. Co. giving the terms under which the City Council would renew the contract for street-lighting. The proposition submitted would necessitate the installation of new arc lamps (at least 200) throughout the city, the price not to exceed $55 per year for all-night and every-night service.

FRANKLIN, OHIO.—The Franklin El. Lt. Co. expects to purchase electricity from the Middletown Gas & El. Co., of Middletown. A transmission line is being erected from Middletown to Franklin to furnish energy here.

MINSTER, OHIO.—The Board of Public Affairs expects to purchase within the next six months a gas engine and generator for the municipal electric-light plant. H. B. Ruemann is secretary of board.

PAINESVILLE, OHIO—Within the next three months the managers of the municipal electric light plant expect to purchase one 200-hp boiler. O. W. Kile is secretary.

BLUFFTON, IND.—The Fort Wayne & Northern Indiana Trac. Co. has closed a contract with the Erie Stone Co., of Villa North, a suburb of Bluffton, to install electrical equipment at its plant there. The contract calls for a 500-hp motor to be in operation by Sept. 15.

INDIANAPOLIS, IND.—Preparations are being made by the Stenotype Co. for the construction of a new plant at Mars Hill, to cost about $500,000, including equipment. The plans provide for a power house, 45 ft. by 130 ft., equipped with two 250-hp boilers. The smokestack will be 150 ft. high. All machinery will be equipped for electrical operation and the company will generate its own power. Contract for construction of main building has been awarded to Henry Dellman, of Indianapolis. R. M. Bowen is general manager of the Stenotype Co.

LINTON, IND.—Plans and specifications have been prepared by S. W. Fries, superintendent of the municipal electric-light plant, for the installation of additional cluster lamps in the business district. The business men have offered to pay for the ornamental standards provided the city will take over and maintain the same.

CHICAGO, ILL.—Arrangements are being made by the North Clark Street Progressive Business Men's Association for the erection of cluster lamps along Clark Street from the river to North Avenue.

CHICAGO, ILL.—Bids will be received by the city of Chicago, Room 406, City Hall, Chicago, until Sept. 5 for furnishing nine direct-current electric motors, varying in size from 2 hp to 15 hp, at the water-works shops, 2304 South Ashland Avenue, Chicago, according to plans and specifications on file in the office of the Department of Public Works, Room 406, City Hall. L. E. McGann is commissioner of public works.

CHICAGO, ILL.—Bids will be received by the city of Chicago, Room 406, City Hall, Chicago, until Sept. 5 for furnishing and erecting two two-panel switchboards, one at the water-works shops, 2304 South Ashland Avenue, Chicago, and the other at Twenty-second Street pumping station, 2260 Ashland Avenue, Chicago, according to plans and specifications on file in the office of the Department of Public Works, Room 406, City Hall. L. E. McGann is commissioner of public works.

SHEBOYGAN FALLS, WIS.—The village of Sheboygan Falls has appointed a committee to negotiate with the Falls Lt. & Pwr. Co. for the purchase of its electric plant to be owned and operated by the municipality.

WARRENS, WIS.—The George Warren Co., of Warrens, expects to purchase within the next 12 months an engine (oil or gas) to replace the present steam equipment. F. R. Barber is manager.

AURORA, MINN.—The Northern Minnesota Pwr. Co., it is reported, will soon begin work on its water-power development south of Aurora. The proposed dam will be 16 ft. high and will generate sufficient energy to supply several villages in this vicinity. James H. Simons, of Aurora, is president.

BIG FALLS, MINN.—The installation of an electric-light plant in Big Falls is under consideration. A. M. Jenson, J. A. Richardson and others are members of a committee appointed to look into the matter.

BIRD ISLAND, MINN.—H. B. Rutledge, representing the Central Minnesota Lt. & Pwr. Co., of Glencoe, has been granted a franchise to install and operate an electric light system in Bird Island.

BREWSTER, MINN.—The Board of Water and Light Commissioners of the town of Worthington has submitted a proposition to the Village Council of Brewster offering to furnish energy for an electric-light system here from the municipal plant in Worthington.

CROOKSTOWN, MINN.—Bids will be received at the office of the State Board of Control, State Capitol Building, St. Paul, until Sept. 5 for erection and completion of the Boys' Dormitory Building at Northwestern Experiment Station, Crookston, including heating, ventilating, plumbing and electrical work and fixtures, in accordance with plans and specifications furnished by C. H. Johnston, architect, 715 Capitol Bank Building, St. Paul. Bids will be received collectively or separately. Copies of plans and specifications may be seen at the Builders' Exchanges at St. Paul and Minneapolis; at the superintendent's office of the Northwestern Experiment Station, Crookston, and at the office of the State Board of Control, Capitol Building, St. Paul.

ELY, MINN.—The town of Ely is installing an ornamental street-lighting system, consisting of 83 ornamental lamp standards carrying three-lamp clusters and 73 standards carrying five-lamp clusters. All material has been purchased. T. W. Tool is superintendent of the Light and Water Department.

ROCHESTER, MINN.—Bids will be received by the State Board of Control, State Capitol Building, St. Paul, until Sept. 2 for the erection and completion of power plant at the Rochester State Hospital, Rochester, including heating, ventilating, plumbing and electrical work and fixtures, in accordance with plans and specifications furnished by C. H. Johnston, architect, 715 Capitol Bank Building, St. Paul. Bids will be received separately and collectively. Copies of plans and specifications may be seen at the Builders' Exchanges at St. Paul and Minneapolis and at the superintendent's office at Rochester and at the office of the State Board of Control, State Capitol Building, St. Paul.

WOODLAKE, MINN.—Earl Jackson, of St. Paul, has been engaged to prepare plans and supervise the construction of the proposed municipal electric-light system. Energy for operating the system will be secured from Granite Falls, 12 miles distant. H. F. Payne is recorder.

AMES, IA.—Orders have been placed by the City Council for machinery to double the present output of the municipal electric-light plant, thus removing all possibility of the erection of a new plant. At a special election permission was given the Council to dispose of the present site and erect a new plant.

BAYARD, IA.—Bids will be received by the town of Bayard until Sept. 9 for the construction of a complete electric-lighting system, plans and specifications for which are on file at the office of F. E. Munger, town clerk.

BELLE PLAINE, IA.—The Belle Plaine El. Co. is installing a new 75-kw directly connected outfit and a 100-hp boiler. W. A. Mall is manager.

MARBLE ROCK, IA.—The City Council has passed an ordinance authorizing an issue of $24,000 in bonds for the construction of a dam across the Shell Rock River to furnish power to operate a lighting plant. The Power Engineering Co., of Minneapolis, Minn., has charge of construction of the dam.

MONTEZUMA, IA.—The Montezuma El. Lt., Pwr. & Htg. Co. expects to erect within the next six months a substation and to purchase material for distribution and lighting systems. George H. Husman is local superintendent.

AVA, MO.—Application has been made to the City Council by J. W. Pettit for a franchise to install and operate an electric-light system in Ava.

CARTHAGE, MO.—The Board of Public Works expects to purchase within the next two or three months boiler-room coal weighing apparatus and car and possibly stokers. A. P. Knowles is superintendent.

COLUMBIA, MO.—The managers of the municipal electric-light plant expect to purchase within the next six months one 750-kw turbo-generator unit complete with condenser and switchboard. Marion E. Fawks is chief engineer.

FAYETTE, MO.—The Fayette Lt., Ice & Coal Co. expects to install within the next 12 months a 300-hp Corliss engine directly connected to a 200-kw generator and to purchase within the next six months a tungsten street-lighting system to replace the present direct-current arc-lamp system. The company expects to build a 2000-ton storage room and operate ice plant all winter, using exhaust steam from electric plant. J. B. Bell is president.

KEARNEY, MO.—Arrangements are being made for the installation of an electric-lighting system in Kearney. Energy for operating the system will be supplied from the plant in Excelsior Springs.

ORRICK, MO.—The Orrick El. Co. expects to erect within the next

six or eight months [illegible] to purchase within the next six months one [illegible] and generator. Within the next 30 days the company expects to purchase lightning arresters, wire and meters and about 50 poles; also within the next two months some household labor-saving devices, including vacuum cleaners, washing machines and wiring devices, etc. C. T. Harding and E. W. Harding are owners.

ST. LOUIS, MO.—The Lt. & Devel. Co., of St. Louis, expects to erect within the next three months a transmission line from Sikeston to Morehouse, and from Illmo to Chaffee, all in Missouri. The company is now installing a 225-hp Diesel engine and a 160-kw, three-phase generator at its power plant in Mitchell, S. D. The main office of the company is in the Wright Building, St. Louis, Mo.

EDGELEY, N. D.—The board of managers of the municipal electric light plant expects to purchase within the next six months one 60-kw, single-phase, 1150-volt generator. C. S. Rygh is electrician.

FINLEY, N. D.—The Finley Lt. & Pwr. Co. expects to erect an addition to its power house (18 ft. by 22 ft.) within the next two months and also to purchase an internal-combustion engine (15 hp to 20 hp), an 8-kw, 110-volt direct-current generator and a 3-amp to 5-amp booster and centrifugal pump. Frank E. Curry is superintendent.

MANDAN, N. D.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 19 for construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches, of the United States post office at Mandan, N. D. Drawings and specifications may be obtained from the above office or from the custodian of site at Mandan, N. D.

HURLEY, S. D.—Local business men are interested in a project to form a company for the purpose of taking over the Hurley electric-light plant. It is expected that improvements will be made to the plant and service.

ALLIANCE, NEB.—The Alliance Water and Light Department expects to purchase within the next six months one feed-water heater (300-hp capacity), one synchronism indicator, a few transformers and a small amount of weather-proof wire. The purchase of material for a series street-lighting system is also contemplated. Clare Dow is superintendent.

GENOA, NEB.—The managers of the municipal electric light plant expect to purchase in the near future one 10-kva or 12-kva tub transformer for series incandescent lamp-lighting system.

LOUISVILLE, NEB.—The City Council has granted two electric franchises to extend 50 years, one to the Lincoln-Omaha Interurban St. Ry. Co. and the other to the Continental Gas & El. Co., of Cleveland, Ohio, which operates electric plants in Beatrice, Plattsmouth and York. W. H. Abbott, of Cleveland, Ohio, is vice-president of the Continental company.

OMAHA, NEB.—The installation of a municipal electric-light plant in Omaha is under consideration. The city has lost a suit against the Omaha El. Lt. & Pwr. Co. to prevent it from selling power. The court decided that the company's franchise was perpetual although its charter expired in 1894. This decision did not make the franchise exclusive.

DODGE CITY, KAN.—The Midland Wtr., Lt. & Ice Co., of Dodge City, it is reported, is contemplating the installation of a new electric-light plant to furnish energy to farmers within a distance of 5 miles each way from the city to operate irrigation pumps. George Theis, Jr., is president and manager of the company.

HOLTON, KAN.—The Mayor and city commissioners have awarded the contract for furnishing engine and generator for the municipal electric-light plant to the Murray Corliss Engine Co., of Burlington, Ia. (390-hp engine connected to a 250-kw Fort Wayne generator), for $7,518.

HUTCHINSON, KAN.—The United Wtr., Gas & El Co., of Hutchinson, has under way the installation of an ornamental street-lighting system, covering 18 blocks. Each standard, of which there are to be 10 to each block, will carry four 100-watt lamps, maintained by underground wires. The company will do the work and the installation will cost approximately $15,000. J. F. Springfield is general manager.

TOPEKA, KAN.—The Atchison, Topeka & Santa Fé Ry. Co. is reported to be contemplating the construction of a new power plant in connection with its local shops, to cost about $100,000.

## Southern States

MONROE, N. C.—The electric light commission expects to purchase within the next three months one centrifugal pump, 3-in. suction, 2½-in. discharge, directly connected to induction motor, to carry 60-lb. pressure, one car load of juniper poles, 10 lightning arresters, 500 glass insulators and 300 lb. weather-proof wire. W. H. Crow is superintendent.

MORGANTOWN, N. C.—The Board of Public Works expects to purchase within the next three months one second-hand 50-kw, 60-cycle, 2300 volt direct-connected unit. The board is now installing 150 Westinghouse wattmeters (type 00). R. W. Pepken is manager and F. J. Wortman superintendent.

WHITEVILLE, N. C.—A committee has been appointed by the city commissioners to make investigations relative to the installation of an electric-light plant, to be located in the central part of the town. The present plant, owned and operated in conjunction with a mill and gin, has been closed down.

BENNETSVILLE, S. C.—The managers of the municipal electric-light plant are installing an ornamental street-lighting system in the business district. Only part of the material needed has been purchased. E. C. Morrison is manager.

HAZLEHURST, GA.—The municipal electric-light committee expects to purchase within the next few months meters for water and light customers. At present the service is furnished at a flat rate. J. L. Brown is electrician.

NEWNAN, GA.—The generating plant of the municipal electric-light plant has been closed down and energy for operating the electric-light system is purchased from the Columbus Pwr. Co., of Columbus. W. B. Pringle is secretary of the Water and Light Commission.

LABELLE, FLA.—A 150-hp boiler is now being installed in the local electric-light plant, owned by E. E. Goodno.

LAKE BUTLER, FLA.—C. M. Richard, of Lake Butler, and John H. H. James, of Waycross, Ga., it is reported, will apply to the City Council for a franchise to construct and operate an electric-light system here.

NASHVILLE, TENN.—Bids will be received at the United States Engineer Office, Nashville, Tenn., until Dec. 11, 1913, for franchise for water-power development at Muscle Shoals, Ala., on the Tennessee River. For details see issue of March 29, 1913. Further information may be secured on application to Major H. Burgess, U. S. Engineer Office, Nashville, Tenn.

CULLMAN, ALA.—The city of Cullman expects to purchase within the next 60 days three motor-driven centrifugal pumps. B. Kiel is superintendent.

BELZONA, MISS.—The Water and Light Department expects to purchase within the next six months 300 25-ft. poles. J. J. Sisloff is superintendent.

ARKADELPHIA, ARK.—The Arkadelphia El. Lt. Co. has recently rebuilt its pole-line system. W. C. Maguire is superintendent.

BOONEVILLE, ARK.—Improvements are being made to the local electric-light plant, owned by Greenway & Harvey, including the installation of a 260-hp C. & T. engine and a 150-kw General Electric generator. R. M. Harvey is president.

MAMMOTH SPRING, ARK.—The East St. Louis Cotton Oil Co., National Stock Yards, Ill., is erecting a new cotton gin in Mammoth Spring, to be equipped for electrical operation, using 70-hp motors. Energy for operating the gin will be furnished by the Mammoth Spring El. Lt. & Pwr. Co.

MENA, ARK.—The Mena El. Lt. & Pwr. Co. expects to purchase within the next two months a tungsten street-lighting system consisting of 150 lamps.

NEWARK, ARK.—A franchise has been granted by the town of Newark, to L. P. and W. J. Caldwell to construct and operate an electric light plant here.

BATON ROUGE, LA.—The city of Baton Rouge is contemplating the installation of a municipal electric light plant and garbage incinerator.

MELVILLE, LA.—At an election held recently the proposition to issue bonds for the installation of a municipal electric-light plant and water-works system was carried.

DURANT, OKLA.—The Durant Ice & Lt. Co. expects to install a complete new plant within the next six months and to purchase two 300-hp boilers, two 312-kva generators and two engines to drive same and necessary exciters, pumps and accessories. W. J. O'Brien is manager.

DURANT, OKLA.—The managers of the municipal electric light plant expect to purchase within the next two months 4 miles of three-wire, three-phase transmission line to No. 6 electric pumping plant, and to purchase within the next 30 days one 100-kw polyphase intergrating wattmeter (switchboard type). E. S. Bennett is superintendent.

HENNESSEY, OKLA.—The Hennessey El Lt., Pwr. & Ice Co. expects to purchase within the next six months one 30-hp to 40-hp oil engine and generator and equipment for a 10-ton ice plant.

HOLDENVILLE, OKLA.—The Holdenville Ice & El. Co. expects to purchase within the next few months transformers for series street-lighting system and to install tungsten lamps. The company has recently installed a new 150-kw, three-phase, 2300-volt General Electric generator, and would like to dispose of a 90-kw, single-phase, 1100-2200-volt generator. W. M. Dunn is president and manager.

LINDSAY, OKLA.—The managers of the municipal electric light plant expect to purchase within the next 30 days a stock of inside material, including heating and cooking apparatus and labor-saving devices, etc. A. W. Simpson is superintendent.

BURNET, TEX.—The installation of an electric light plant in Burnet is under consideration. W. C. McDonald is reported to be interested in the project.

KERENS, TEX.—The Council has contracted with the Corsicana Gas & El. Co. for electrical service in Kerens. Work will begin at once on the erection of the transmission line between Corsicana and Kerens. J. W. Carpenter is president and manager of the company.

MARSHALL, TEX.—The city commissioners have granted the Marall Trac. Co. a new franchise for its street railway in Marshall. Prepaions are being made, it is reported, by interests connected with the lway to enlarge the local electric-light and power plant.

MEXIA, TEX.—Preparations are being made by the Mexia Lt., Wtr. Sewerage Co. to equip its pumping plant, located 6 miles from Mexia, electrical operation.

## Pacific States

MORTON, WASH.—The Morton El. Co. is planning to construct a 0-hp hydroelectric power plant on the Tilton River, to cost about $10,000.

SEATTLE, WASH.—The Cascade Mining Company has offered its ter rights on Miller River in the town of Benton, 2 miles from Skymish, to the city of Seattle for $90,000. The power site is within 40 les of Seattle by the shortest route and 90 miles by railroad.

VANCOUVER, WASH.—The Lewis County Commissioners have anted the Independent Lt. & Pwr. Co. a franchise to erect transmisn lines from the north line of the county at the Woodland Bridge the north line of the city of La Centre, and from the south line of Centre to the north line of Vancouver.

YACOLT, WASH.—The Northern Clarke County Lt. & Pwr. Co., of ncolt, has recently established a day service. The company is now ecting a line to connect up a 20-hp motor to operate a rock crusher. R. Miller is engineer.

BAKER, ORE.—The City Council has accepted the plans of Stannard Richardson, of Portland, for the construction of a municipal lighting nt, bids for which will soon be asked.

EUGENE, ORE.—Contracts have been closed whereby the Oregon wr. Co., of Albany, will furnish energy to the Portland, Eugene & stern Ry. Co. for all its railway lines now in operation and all oposed railways as far north as Salem. The service will be furshed from the Springeld plant. In addition to the present line, rrying 11,000 volts, a 33,000-volt transmission line will be erected Albany, which will be looped back by the way of Corvallis to Monroe.

PORTLAND, ORE.—A plan for the construction of a municipal ectric-light plant for the city of Portland is being prepared by Comssioner Daly of the Public Utilities Department. Water rights on e Zigzag River, in the Mount Hood district, 40 miles from Portland, ve recently been secured by the city, and it is estimated that 7000 can be obtained with practically no development. By constructing servoirs a much larger amount of power may be obtained.

WARRENTON, ORE.—The Pacific Pwr. & Lt. Co., of Portland, has plied to the City Council for a franchise to furnish electrical service Warrenton.

ELSINORE, CAL.—The Southern Sierras Pwr. Co., of San Berrdino, is planning to extend its transmission along Grand Avenue to e Lakeland Ranch, a distance of 5 miles. The proposed line will st about $8,000 and will furnish energy for lamps and to operate mps for irrigating purposes.

EUREKA, CAL.—The Secretary of the Interior has granted the petin of Frank and Carl Langsford, of Eureka, for a right-of-way for eir water canals through the national forest at the Big Bend of the amath River. They hold water rights to the amount of 500 in. in the amath River, and it is understood that work will begin immediately on e construction of an electric plant at Ishi Pishi Falls.

FRESNO, CAL.—The San Joaquin Lt. & Pwr. Co., of Fresno, excts to install within the next few months additional hydraulic capacity Kern Canyon and at No. 2 North Fork, aggregating about 11,000 , and to increase the output of the steam plant at Bakersfield by 6250 . All equipment has already been purchased. A. G. Wishon is neral manager.

GRANITEVILLE, CAL.—Arrangements are being made to erect a ge power plant on Weaver Lake, 10 miles from Birchville, to furnish ectrical energy to the Birchville mine near Graniteville John A. Bunt- is president of the Birchville Mining Co.

PASADENA, CAL.—The city of Pasadena is installing a 400-hp Stirling iler with superheater and one 25-kw exciter in the municipal electric ht plant, also several miles of pole lines in new addition to city, and erecting ornamental street lamps on 6 miles of streets, maintained underground conduits. C. W. Koiner is general manager of the unicipal electric light plant.

RIVERSIDE, CAL.—The city of Riverside has acquired the domestic ater system owned by private companies and has consolidated it with e municipal electric-light and water department under one manageent. No immediate improvement is contemplated to the lighting deartment, but the water system will be almost entirely rebuilt. Plans e now being prepared. Joseph H. Cox is general manager of public ilities.

SAN FRANCISCO, CAL.—At an election held Aug. 26 the proposiin to issue $3,500,000 in bonds for municipal traction lines was carried.

SANTA ANA, CAL.—The Pacific El. Co. has abandoned its plans to tablish a power plant and railroad yards on the site at Fourth, D, fth and Lacey Streets. The power plant located at the corner of fth and Lacey Streets will be moved to North Main Street and will located on or near Santiago Creek.

SANTA BARBARA, CAL.—The Santa Barbara Gas & El. Co. has recently purchased one 1000-kw, 2200-volt General Electric Co. turbogenerator set, one 4000-sq. ft. Wheeler Condenser & Engineering Co. condenser, with two vertical hot-well pumps and rotary dry-vacuum pump and two 25-kw exciters, one turbine-driven and one motor-driven. H. W. Dennis is construction engineer.

HAILEY, IDAHO.—The Beaver River Pwr. Co., of Beaver, Utah, has filed formal acceptance of its franchise with the city clerk. Under the terms of the franchise the company is to furnish electrical energy in Hailey before May, 1914.

IDAHO FALLS, IDAHO.—The City Council is contemplating the installation of two additional 750-hp units in the municipal electric-light plant.

MALAD CITY, IDAHO.—The Evans Lt. Co., of Malad City, expects to purchase within the next 30 days 10 or 12 flaming-arc lamps as an addition to street-lighting contract. Preparations are being made by the company for changing its present single-phase system for three-phase distribution. J. H. Campbell is manager.

OGDEN, UTAH.—Preparations are being made by the Utah Pwr. & Lt. Co. for the erection of two transmission lines in this section of the State. The principal line (steel towers) will extend from North Ogden, where it will connect with the company's present line north to Grace. The other line, on which the engineers are now working, a wooden-pole transmission system between Ogden and Devil's Slide, in Weber Canyon, will furnish energy to operate the plant of the Union Portland Cement Co. Energy will be transmitted at 45,000 volts from the company's main line at the Uintah station.

DILLON, MONT.—The Union El. Co., of Dillon, has recently placed orders for one 360-hp Leffell turbine, to be delivered in October.

FORT BENTON, MONT.—The Benton El. Lt. Co., of Fort Benton, expects to purchase within the next 30 days 40 30-ft. (6-in. top) poles and about 1000 lb. No. 10 weather-proof wire. George L. Overfield is secretary and manager.

KALISPELL, MONT.—The Northern Idaho & Montana Pwr. Co., of Kalispell, it is reported, has sold its plant to the Chicago, Milwaukee & St. Paul R. R. Co. The railway company is equipping its railroad for electrical operation in this section.

THOMPSON FALLS, MONT.—The Town Council has signed a contract with the Thompson Falls Pwr. Co. providing for the installation of a street-lighting system for the town. W. E. Hadley is manager of the Prospect Creek plant.

TOWNSEND, MONT.—The Montana Power Co., of Butte (which has purchased the municipal electric-light plant), expects to change the local system from 2200 volts to 60,000 volts within the next three months and to install within the next two months a series tungsten street-lighting system. A. E. Davidson is local manager.

LAS CRUCES, N. M.—The Las Cruces El. Lt. & Ice Co. has recently completed an ice plant, using exhaust steam.

TUCUMCARI, N. M.—The Tucumcari Lt. & Pwr. Co. expects to erect within the next 18 months a one-story fireproof power house, 60 ft. by 100 ft., and to purchase one 200-hp water-tube boiler, one 150-kw generator and a four-valve engine (directly connected), one generator panel and one two-circuit feeder panel; also within the next 12 months shaking grates and belt-driven boiler-feed pump. S. B. Richey is resident manager.

## Canada

CALGARY, ALTA.—Tenders will be received by the city of Calgary until Sept. 3 for furnishing lamp standards for luminous-arc lamps. Plans and specifications may be obtained at the office of the city electrician. J. M. Miller is city clerk.

ROSSLAND, B. C.—Preparations are being made for equipping the Canadian Pacific Railway branch between Rossland and Castlegar, a distance of 30 miles, for electrical operation. Direct current from the power plant at Bonnington Falls will be used and the trains will be operated by large electric locomotives. Overhead wires will be used.

WARDNER, B. C.—The planer and electric plant of the Crows Nest Lumber Co., of Wardner, was recently destroyed by fire, causing a loss of about $40,000.

NEW TORONTO, ONT.—The Village Council has passed a resolution asking the Hydro-Electric Power Commission of Ontario to begin work on the installation of the system at once instead of waiting until autumn. The Council has recently passed the by-law appropriating funds for the installation of the system.

PARRY SOUND, ONT.—Three 22-kva constant-current transformers are now being installed in the municipal electric-light plant to supply energy for the new street-lighting system (tungsten 6.6-amp lamps), consisting of 50 four-lamp clusters (80-cp. lamps) and 50 single lamps of 60 cp on pole fixtures (Westinghouse apparatus). The work is being done under the supervision of G. Groves, superintendent of the municipal plant.

TORONTO, ONT.—The city of Toronto has decided to erect cluster lamps of 500 cp over the center of the roadways at important corners in the city and to install cluster lamps of 300 cp at the less important intersections.

TORONTO, ONT.—The Toronto Hydro-Electric system has received permission to erect a temporary substation in the northeast corner of

Withrow Park, as the permanent station at Coxwell and Gerrard Streets will not be ready for about six months.

HULL, QUE.—The E. B. Eddy Co., Ltd., is building a new hydro-electric power plant and pulp mill in Hull at a cost of about $750,000 The output of the power plant will be increased from 8500 hp to between 16,000 hp and 18,000 hp. The company is also deepening and enlarging the forebays and intakes of its plant and increasing the draft tubes.

REGINA, SASK.—Tenders will be received by the city commissioners of Regina, Sask., until Oct. 1, for furnishing coal bunkers, ash hoppers, coal and ash conveyors and crushers. Specifications may be obtained from E. W. Bull, superintendent of Light and Power Department.

## New Incorporations

TARPON SPRINGS, FLA.—The Citizens' Ice & Lt. Co. has been organized with a capital stock of $25,000 by I. B. Read, J. K. Cheyney, L. S. Fernald, N. A. Van Winkle and others.

PORTLAND, ME.—The Dominion Trac. & Ltg. Co. has filed articles of incorporation under the laws of the State of Maine with a capital stock of $5,000,000. The company proposes to construct, acquire and operate railways, etc.

LEBANON, PA.—Charters have been granted by the State Department to the North Londonderry and Stauffer Electric Companies. Each company is capitalized at $5,000 and the incorporators are: Abraham G. Stauffer and Oscar Stauffer, of North Londonderry, and George Woodward, of Philadelphia.

BERRYVILLE, TEX.—The Berryville Tel. Co. has been chartered with a capital stock of $10,000 by W. G. Hanbury, R. E. Norris, Thomas Morris and others.

PARK PLACE, TEX.—The Park Place Wtr., Lt. & Pwr. Co. has been incorporated with a capital stock of $10,500 by G. J. McCarty, F. A. Tucker and Lewis Fogle. Post office address, Houston, Tex.

RAYMOND, WASH.—The Willapa El. Co. has been incorporated with a capital stock of $400,000 by J. S. Thornton, R. L. Fisher and M. M. Fisher.

SPOKANE, WASH.—The Spokane Valley Pwr. Co. has been incorporated with a capital stock of $200,000 by J. W. McBride, Fred A. Kragelund, L. Timberman, V. E. Bayless and T. J. Meenach. The company proposes to produce and distribute water-power.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED AUG. 19, 1913.

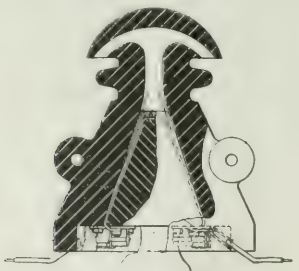
[Prepared by Robert Starr Allyn, 16 Exchange Place, New York]

1,070,387. PUSH-BUTTON; J. D. Baldwin and J. J. Schlegelmilch, Cleveland, Ohio. App. filed Aug. 5, 1912. Indicator for door signal.

1,070,398. APPARATUS FOR AND METHOD OF CLEANING GASES; H. A. Brassert and R. W. Cousins, Chicago, Ill. App. filed April 7, 1908. Condensation of moisture and magnetic separation of magnetic material.

1,070,407. TELEGRAPH TYPEWRITER; A. D. Cardwell, New York, N. Y. App. filed Dec. 2, 1910. Successive selection of groups of working magnets.

1,070,426. INCANDESCENT-LAMP LOCK AND SEAL; H. Davies and J. Cooke, West New York, N. J. App. filed Nov. 20, 1912. Riveted split shell with locking flange.



1,070,452.—Fusible Cut-out.

1,070,432. BOW CONTACT FOR TROLLEYS; M. Ergenzinger, Atlanta, Ga., and H. S. Day, Brooklyn, N. Y. App. filed June 25, 1910. Pantograph support for a plurality of independent resilient contact strips.

1,070,437. DYNAMO-ELECTRIC MACHINE; T. Ferguson, Altringham, England. App. filed May 15, 1909. Automatic regulation of variable speed for train lighting, ventilating, etc.

1,070,452. FUSIBLE CUT-OUT; G. B. Griffin, Edgewood, Pa. App. filed Oct. 31, 1910. Line insulator with plug.

1,070,454. ELECTROLYTIC CELL; T. Griswold, Jr., Midland, Mich. App. filed June 15, 1911. Bi-polar electrode. (Improvement on patent No. 987,717.)

1,070,456. MEANS FOR CONTROLLING ELECTRIC CIRCUITS; J. H. Gugler, Milwaukee, Wis. App. filed Sept. 22, 1910. Automatic unidirectional switch for use in charging storage batteries, etc.

1,070,492. WINDING FOR DYNAMO-ELECTRIC MACHINES; B. G. Lamme, Pittsburgh, Pa. App. filed Jan. 26, 1910. Armature winding for commutator of high-speed direct-current machine and single phase alternating-current machine.

1,070,505. SIGNAL SYSTEM; J. H. Mattice, Clyde, Kan. App. filed May 26, 1911. Electromagnetically operated selective control.

1,070,542. HIGH-TENSION RECTIFIER FOR ALTERNATING CURRENTS; L. Schmidt, Hanover, Germany. App. filed March 26, 1912. Mechanical details of rotary type.

1,070,546. AMUSEMENT DEVICE; J. F. Sherlock and H. Spengler, New York, N. Y. App. filed Sept. 10, 1909. Device magnetically operated on a globe.

1,070,564. LOCOMOTIVE DRIVING CONNECTION; J. E. Webster, Pittsburgh, Pa. App. filed Jan. 10, 1912. Yielding to avoid shocks.

1,070,568. METHOD OF MELTING METALS AND ALLOYS; R. S. Wile, Pittsburgh, Pa. App. filed Nov. 22, 1911. Electrically heated inert bath.

1,070,577. ELECTROMAGNETIC DRIVE FOR SECONDARY CLOCKS OR THE LIKE; A. O. Benecke, Foxboro, Mass. App. filed June 7, 1911. Escapement and ratchet.

1,070,597. CONTROLLING DEVICE; W. H. Gaulke, Milwaukee, Wis. App. filed Aug. 12, 1912. Alternating-current rheostat-starting device. (Improvement on patent No. 1,009,661.)

1,070,614. INSULATING JOINT; C. A. Kraus, Newton Highlands, Mass. App. filed Aug. 27, 1909. Gas-tight pipe joint.

1,070,615. ELECTRIC LEAD FOR VAPOR-ELECTRIC APPARATUS; C. A. Kraus and R. D. Mailey, Newton Highlands, Mass. App. filed June 30, 1910. Cathode lead with a hollow foot.

1,070,629. ADJUSTABLE FIELD RHEOSTAT; P. J. Ray, Lakewood, Ohio. App. filed Sept. 3, 1912. Automatically cuts out resistance.

1,070,638. CONTROL SYSTEM FOR ELECTRIC MOTORS; L. H. Thullen, Cincinnati, Ohio. App. filed Dec. 11, 1912. Feed carriage for friction saw.

1,070,647. REVERSIBLE ELECTRIC MOTOR; G. H. Whittingham, Pikesville, Md. App. filed March 19, 1912. Pilot controlling motor.

1,070,648. CONTROL SYSTEM FOR INDUCTION MOTORS; G. H. Whittingham, Baltimore, Md. App. filed Dec. 12, 1912. Starting and running control with variable resistance.

1,070,651. ALTERNATING-CURRENT REGULATOR; J. J. Wood, Fort Wayne, Ind. App. filed Feb. 24, 1910. Series connection. (Improvement on patents No. 720,305 and No. 765,948.)

1,070,657. CONTROLLER SWITCH; V. G. Apple, Dayton, Ohio. App. filed Aug. 8, 1912. Direct-current machine with storage battery for starting gas engines, etc.

1,070,658. TROLLEY-WHEEL CONSTRUCTION; W. H. Arnold, Stockton, Cal. App. filed Dec. 26, 1912. Simplified form of bearing.

1,070,673. ELECTRICAL HEATER; A. Eimer, New York, N. Y. App. filed March 26, 1912. Expansible tube.

1,070,674. ELECTRIC SWITCH; R. H. Fenkhausen, San Francisco, Cal. App. filed Sept. 4, 1912. Normally locked knife switch.

1,070,726. HARMONIC SELECTIVE TELEPHONE SYSTEM; A. F. Poole, Wheeler, W. Va. App. filed Feb. 4, 1907. Combination of selective currents.

1,070,734. ELECTRIC HEAT ACCUMULATOR; A. Rittershaussen, Cassel, Germany. App. filed Jan. 4, 1912. Water circulation.

1,070,743. DEVICE FOR PROTECTING ELECTRIC LINES AND APPARATUS AGAINST OVERTENSION; S. De Stefani, Verona, Italy. App. filed Oct. 16, 1912. Lightning arrester with improved ground.

1,070,769. ARC LIGHT; W. E. Brown and L. C. Granger, Milwaukee, Wis. App. filed Sept. 15, 1911. Carbons at 90 deg. for moving-picture machines, etc.

1,070,777. ELECTRIC SWITCH; R. V. Collins, New York, N. Y. App. filed July 14, 1909. Magnetically operated railway switch with sealing cup.

1,070,793. BRUSH-HOLDER ATTACHMENT FOR MAGNETOS; O. Fischer, Stuttgart, Germany. App. filed April 24, 1913. Invertible brush holder.

1,070,899. CABLE CONNECTOR; F. Kratz, Stuttgart, Germany. App. filed June 1, 1910. Conducting sleeve for ignition apparatus, etc.

1,070,904. SAFETY LOCK; G. C. Maxwell, New York, N. Y. App. filed Jan. 12, 1911. Signal cord lock for railroad cars.

1,070,935. ELECTRICAL SWITCH; C. Aalborg, Wilkinsburg, Pa. App. filed Dec. 6, 1907. Solid-contact member with resilient pressure.

1,070,936. INTERLOCKING DEVICE; C. Aalborg, Wilkinsburg, Pa. App. filed July 13, 1910. For hand-controlled switches.

1,070,945. CONTROLLING SYSTEMS FOR RECEIVING APPARATUS; A. D. Cardwell, New York, N. Y. App. filed Nov. 14, 1911. Telegraph-typewriter recorder.

1,070,948. CABLE AND TUBE COUPLING; T. W. Dodd, Des Moines, Ia. App. filed May 6, 1912. Shaped out of sheet metal.

1,070,966. ELECTRIC WELDING; C. H. Kicklighter, Pasadena, Cal. App. filed Dec. 18, 1911. For welding long pipe joints.

1,070,970. BUFFING DEVICE; L. V. Lewis, Edgewood Park, Pa. App. filed Jan. 11, 1912. For absorbing momentum in the vane type of relay.

# Electrical World

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**Arc-Lamp Improvements**

Although the flame-electrode long-burning arc lamp has been used for half a dozen years, great improvements have been made in it recently, not only in the production of long-burning electrodes of fairly high efficiency but in the mechanical and electrical design of the lamps themselves. The long-burning flame lamp, desirable as it is, has presented a formidable series of problems not easy of solution. In the first place, the electrodes themselves require great attention. Long-burning and high luminous efficiency are in a manner opposing characteristics, and it is only as a result of tedious experiment that a really good compromise has been reached. In this more than anything else perhaps has the long-burning flame-arc lamp been improved. Carbon among all substances used for arc electrodes has the unique advantage of producing oxides that are gaseous, odorless and non-corrosive. All flame lamps yield a smudge of products of combustion which are much in evidence and often possess unpleasant characteristics. It has taken no small ingenuity to provide condensing chambers and suitable draft so as to carry the débris to a point where it will not interfere seriously with the light and with the mechanism of the lamp. The arcs produced are none too stable, and extremely good regulating mechanism is required to hold them to the point of efficient operation. This type of lamp, in short, is harder to regulate than the older arc lamps and consequently requires mechanism improved in delicacy to secure steadier operation of the arc, and in power to maintain this condition in spite of a somewhat troublesome tendency toward clogging.

**Utility of the Porch Lamp**

Consumers of electric energy in residences need to be taught the benefits of the porch lamp in countless cases where a few evenings' trial would be sufficient to establish this useful application beyond recall. The improved tungsten lamp has entirely changed the porch-lighting situation as regards cost and quality of service, and now that the 10-watt incandescent unit is on the market, there is little excuse for any well-equipped homes being without one. The porch lamp symbolizes in twentieth-century hospitality the old saying that "the latch string is out"; it saves time and temper on dimly illuminated suburban streets in a way that only the initiated appreciate, and it adds so little to the individual bill that it is within the means of everyone who entertains on even a modest scale. At a rate of 10 cents per kw-hr. such a lamp can be run practically all night for 1 cent. On screened-in sleeping or second-story porches where reading is a feature of the household life the cost is also low where higher-powered lamps are used for several hours an evening. The expense of wiring for a porch lamp is usually trifling, and while the revenue from each lamp is small for the central station, few devices better advertise the service. Even the small monthly energy consumption of the individual installation means business for the central station worth striving for when multiplied through whole neighborhoods. The supplementary effect on street lighting where lamps are few and far between or where foliage is dense is admirable. It ought not to be difficult to secure an income of from $1 to $3 per year from a porch lamp of moderate size, and it will pay to spend a little time and thought upon the solicitation of this kind of business in the right sort of neighborhoods.

**The Tungsten Lamp Outlook**

When, in 1909, the tungsten lamp was first seriously considered as a commercial product the electric-lighting industry little dreamed that in four years it would supplant the carbon-filament lamp, much less become an active competitor of the arc lamp. Representing as great an advance in the electric-lighting art as the Welsbach mantle did in the gas-lighting industry, it has outstripped the latter in the rapidity of its introduction and in its domination of the lighting field. This is merely indicative of the enterprise and progressiveness of one industry as compared with the other. However, the tungsten lamp was not then welcomed with open arms, nor was the drop in revenue which its introduction brought about pleasant to contemplate. Nevertheless, it acted as the incentive to spur managers to seek for more business to nullify its effect on earnings, and incidentally also it brought out the fact that there was a lot of business to be had merely for the asking, for up to that time only the surface had been skimmed. That the use of tungsten lamps has permanently affected the revenues of small companies has been proved by the fact that many have applied to commissions for permission to advance rates on that account. Meanwhile the manufacturers have been busy. Their best engineers and chemists have been at work on the evolution of an improved lamp, and success is in sight, if it has not already been attained. The lighting industry will, therefore, have to face the early probability of a greatly improved tungsten lamp whose introduction, though now seemingly remote, is nevertheless inevitable. Everything points to a shrinkage in revenue per lamp and to the necessity of earnest consideration of existing rate schedules in order that the revenue from lighting shall be commensurate with the service rendered. Far-sighted managers will appreciate the fact that any improvement which will cause the incandescent electric lamp to surpass all its competitors in the lighting field will ulti-

mately be advantageous to the industry even though it seem to demoralize it for the time being. It will lead to the universal use of electricity as an illuminant and will compel cheaper installations. It will also result in a more diversified application of electrical energy for heating, cooking and other purposes in the household. It will lop off the peaks of load curves and make isolated-plant loads more easy of attainment. In fact, the opportunities are immense; but so are the problems which the advent of the greatly improved lamp will present. Who knows whether the half-watt lamp of to-morrow may not become the quarter-watt lamp of the day after? It is not beyond peradventure. Anticipation of probabilities under such circumstances is entirely commendable.

## The Control of Central Stations

Central-station plants are divisible into three classes: first, those controlled through some form of holding company, syndicate or other dominant financial factor; second, those that are held free from any connection with similar properties through the medium of a holding company or otherwise, and, third, the municipal plants. We have made a compilation showing the division of plants into these three classes by states in towns and cities of the United States of more than 1000 population. The results, published elsewhere in this issue, are full of significance to the electrical industry. The facts of leading importance shown by the statistics are that 48 per cent of the total number of central stations in these communities are independent of financial connections, close or remote, with other properties; that 29 per cent of the total number of plants are held under some form of syndicate or generally admitted financial control by well-known interests, and that 23 per cent of the total number of plants are municipal. The compilation deals only with the number of plants; in importance and output the plants held in some form of syndicate control rank first. The importance and output of the municipal plants place them in third or last rank. If the analysis had been extended so as to include communities of less than 1000 population, undoubtedly the number and the proportion of both independently owned plants and municipal plants would be larger. However, the compilation is based on the reports from a total of 4774 plants, and, therefore, it may be taken as fairly indicative of the present status of the industry in these respects.

The form of control of operating plants generally discussed as the holding-company movement or the syndicate movement is interwoven closely with the progress of the industry, and its extension in the future will follow substantially the same lines that it has in the past; that is to say, many different and widely scattered dominant financial interests, operating separately, will either acquire an actual majority of stock of operating companies and will vest the ownership of this stock in holding companies or they will acquire enough stock to enable them to determine financial and operating policies. While the general lines of development in this direction, therefore, are perfectly simple and plain, it is clear that, to a greater degree than in the past, the operations of many of the large factors in the industry are being extended to the plants of medium and even small size. Ordinarily the plants in the larger cities are held by interests which have been identified with their control for many years, and naturally they do not propose to divest themselves of their ownership unless they are tempted to do so by offers of a large price for their holdings. We find that in the cities of over 100,000 population 87 per cent of the plants are controlled by some form of syndicate, holding company or strong financial interest. The proportion is slightly smaller in the cities of between 50,000 and 100,000, being 84 per cent. In the cities of still smaller size the proportion of plants owned or controlled by syndicates becomes less. In the cities of between 10,000 and 50,000 population 63 per cent of the plants are held by syndicates. In the cities of the next smaller group, 5000 to 10,000 population, 44 per cent of the plants are held by syndicates. The proportion is reduced to 20 per cent in the cities of between 1000 and 5000 population.

The opportunities for the further extension of the advantages of consolidated ownership and operation therefore lie mainly in the smaller communities and increase in proportion as the sizes of the communities decrease. In closely settled districts of the country, where there are many towns or villages and a substantial rural population within a small area, the development in this direction within the last year or two has been epochal in nature. In such cases the object of the dominant financial factor has been virtually to preempt the district in which the operations were to be conducted. In other words, it was just as important to effect a monopoly in public-utility service in a large area containing many communities as it is admitted by public service commissions and electrical authorities to be in a large area containing a single community. The advantages in each case lie in centralized production on a large scale, in modern economical methods of transmission and distribution, and in the application of advanced commercial methods of sale of the service.

As we have shown, the proportion of syndicate-controlled plants is largest in the larger cities and smallest in the smaller communities; conversely, the proportion of independent plants is smaller in the large cities and large in the small cities. In the smaller communities, those which have between 1000 and 5000 population, the number of independent plants is 55 per cent of the total. The proportion of municipal plants is but 3 per cent in the larger cities. It increases as the size of cities in each group taken in the compilation decreases. In the communities of between 1000 and 5000 population the proportion of municipal plants is 25 per cent, and as the communities in this group furnish 3492, or 73 per cent, of the 4774 in the entire compilation, it is virtually this percentage which determines the conclusion that 23 per cent of all the plants in the compilation are municipal. Many small communities started and carried the burden of municipal plants when they did not have enough population to support private plants.

The statstics therefore show that through the purchase of small independent and municipal plants many opportunities may be grasped for the introduction and extension of the benefits of centralized production and economical distribution over a large area.

## The Advance of Illuminating Engineering

The well-arranged combined meetings of the Illuminating Engineering Society and the International Congress on School Hygiene at Buffalo on Aug. 29 and 30, the forthcoming annual convention of the Illuminating Engineering Society at Pittsburgh Sept. 22 to 26, and the approaching seasonal increase in the lighting load on central stations, give emphasis to the advance in illuminating engineering practice noticeable increasingly during the past few years.

Although many examples of wretched lighting can be found in cities and towns of all sizes close beside installations of excellent design, the latter are coming more and more to the front. The advance of the art is being directed into many fields which are open for fresh and skilful applications of the latest equipment for effective service. Thus, an unusual amount of study is being given at present to the illumination of libraries, restaurants, theaters, hotel and art galleries; large and expensive railroad stations are being efficiently lighted along lines utterly unknown in the past decade of transportation, and in the street-railway field investigations are under way in respect to the fitness of tungsten lamps for car service which would have been practically out of the question before the advent of drawn-wire tungsten filament in commercial form. The production of small candle-power lamps of this style for use on 110-volt circuits has made great strides within the past two years, indicating the possibilities of better residential lighting. The beauty and utility of some of the latest art-glass fixtures represent a wide departure from former ideas regarding high quality lighting, and when used with discrimination and full recognition of the engineering elements involved, this sort of equipment literally furnishes the building designer with a new system of practical ornamentation capable of extraordinary usefulness.

With all that has been accomplished, however, much that is elementary remains to be learned before general lighting practice rises to a level of scientific efficiency corresponding to that now enjoyed in the field of electric-motor applications. More accurate surveys of installations existing and proposed are necessary and greater care should be exercised in checking data for subsequent reference. Too often designers called upon to submit estimates based upon former work are possessed of inaccurate figures regarding the number of lighting units placed in service subsequent to the initial installation, the wattage requirements and locations of lamps, and the permanent types of shades and dimensions settled upon by the plant owners as standard for their particular needs. The grosser errors of installing lamps and fixtures without due regard to glare, of forcing excessive and painful luminous fluxes upon inexperienced purchasers of light in the interests of publicity illuminations, and the omission of careful calculations as to fixed and operating costs, including renewals, taxes, insurance and depreciation under the former head, need to have more consideration, as do also the use of mixed equipments in conflict with one another and the economical mistreatment of otherwise excellent installations through insufficient outlays for circuit subdivisions. Taken in the rough, the progress of illuminating engineering is at present in an extremely healthy condition, and if the well-established principles of good practice are spread through the ranks of engineers at the rate indicated as one looks backward over recent work, the realization of still greater achievements will not be long delayed.

## Efficiency and Effectiveness of Reflectors

Much valuable information concerning the efficiency and effectiveness of various types of incandescent-lamp reflectors is contained in an article by Messrs. G. H. Stickney and A. L. Powell, on page 477 of this issue. The authors report the result of a series of tests relating to the total luminous flux and space distribution thereof from clear and bowl-frosted tungsten lamps with and without standard forms of opaque, opalescent and clear-glass reflectors. As one would expect, the opalescent and clear-glass reflectors are most efficient, the loss by absorption being as low as 8 per cent in the case of the former and 9 per cent with the latter, as compared with from 14 to 43 per cent in opaque reflectors. It may prove surprising to some to learn that, although the metal type of reflector is the least efficient of all, yet it is the most effective from the point of view of re-direction of the light to the lower hemisphere. Results of the test indicate for the flat-dome reflector with porcelain enamel finish a total of 785 downward lumens as compared with only 626 for the most efficient opalescent-glass reflector and 717 for the best grade of prismatic-glass reflectors tested. This result is attributable to the higher reflective coefficient of the porcelain enamel as compared with the glass prisms. In this connection sight should not be lost of the important fact that when use is made of glass reflectors much of the light not reaching the lower hemisphere is useful for illumination throughout the upper hemisphere. For this purpose credit must be given to the prismatic reflector for 91 lumens, while only 35 lumens are to be credited to the flat-dome porcelain-enamel reflector.

Not the least important feature of the tests discussed by the authors is the necessity for correctly locating the lamps within the reflector and proportioning the reflector for the lamps. Marked changes in the space distribution of the light flux are produced by simply varying the position of the lamps with reference to the reflector. In designing a prismatic reflector full account must be taken of the fact that the light source is not concentrated at a point. To neglect of these considerations doubtless may be attributed much of the decrease in efficiency and effectiveness of certain prismatic reflectors tested by the authors. Even with the downward lumens at as low a value as 590 compared with 717 lumens for other types of prismatic reflectors, the efficiency is as high as 86 per cent as compared with 91 per cent for the more carefully made reflector. Thus the loss in effectiveness is attributable more largely to improper re-direction than to absorption of light. A factor in service not touched upon by the authors is the added light absorption with accumulation of dust. Pronounced differences in this respect are found in different types of reflectors. Doubtless reflectors depending for increased efficiency upon the light passing into the upper hemisphere suffer from dust accumulation more than do those of the opaque type.

# The News of the Week

**Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.**

## Growth of Public-Control Sentiment

In his address before the Governors' conference at Colorado Springs on Aug. 29 Governor Dunne of Illinois spoke on "The Growth of Public Control of Utilities." He traced the history of the movement from 1905 (when Massachusetts was the only state having state control of utilities) to 1913. Now there are twenty-two states having state utility commissions. The Governor praised the Wisconsin law, but said that it fails to cover situations arising in other states, like New York, Pennsylvania and Illinois, where there are large cities. He said that he was in sympathy with the home-rule sentiment in Chicago, but was confronted with the alternative of approving or vetoing the Illinois act, without the home-rule section, as passed by the Legislature. He finally determined that it was his duty to sign the bill. The Illinois law is framed on the lines of the Wisconsin law, with two material changes—publicly owned utilities are excluded from the jurisdiction of the commission and there are no indeterminate franchises. Only three states, Ohio, California and Kansas, provide for home rule of utilities where there are state commissions. Governor Dunne is satisfied that the Illinois law gives adequate and complete control to the state commission and that it "will do much to correct the scandalous abuses which have afflicted the public in the past, owing to the absence of any control over these utilities." Probably every state will have a public-utility commission within a few years. If public control should fail, then the only alternative left is public ownership and operation.

## H. M. Byllesby on Regulation

In a letter referring to the payment of the next dividend on the preferred stock of the Standard Gas & Electric Company in scrip instead of in cash, Mr. H. M. Byllesby, the president, refers to regulation by public service commissions as follows:

"During the past several years, and particularly in the eighteen months just closed, the subsidiary companies of the Standard Gas & Electric Company have been under the necessity of appearing before various regulatory bodies, in some cases for the purpose of resisting unfair increases in taxation, in other cases for arguing the question of rates and of necessity for extensions to their properties, in other cases dealing with threatened competition and appeals to such regulatory bodies for the proper degree of protection. All this has caused large expense to Standard and its subsidiary companies for legal advice, traveling expenses and the cost of expert and technical witnesses, which has had its effect upon the earnings of the subsidiary companies. So far these companies have emerged from these controversies with credit to themselves, and, aside from the marked increase in taxes, with a more satisfactory working condition than had heretofore existed.

"The attitude of your officers and of the officers of Standard's subsidiary companies has uniformly been to deal in a spirit of candor with the various commissions and regulatory bodies before which it is increasingly necessary for public utility officers to appear, and, so far as our experience goes, the attitude of these commissions and regulatory bodies ameliorates and improves as these bodies become better acquainted with the problems which concern the utility companies and as they become personally acquainted with the organizations of those companies and with the sincerity and frankness of their procedures."

## Old Time and Military Telegraphers

The annual joint reunion of the Old Time Telegraphers and Historical Association and the Society of the United States Military Telegraph Corps was held in Detroit on Aug. 26 to 28, with headquarters at the Hotel Cadillac. About 250 ladies and gentlemen were present. These annual gatherings of the veterans of the key are mainly social in character, but at short business meetings Mr. George M. Meyers, of Kansas City, was elected president of the Old Timers, and Colonel William Bruder Wilson, of Holmesburg, Pa., was re-elected president of the Military Telegraphers. The entertainment features consisted of an automobile ride through Detroit and suburbs, a steamboat excursion on the Detroit River and an electric-railway trip to Mount Clemens, where the local Chamber of Commerce gave a reception to the visitors. At the banquet of Aug. 28 Mr. W. A. Jackson, of Detroit, was toastmaster, and the principal address was made by Governor W. N. Ferris of Michigan.

## Membership Campaign of the Society for Electrical Development

According to Mr. J. M. Wakeman, general manager of the Society for Electrical Development, responses in the campaign for members have been numerous and very gratifying. Quite a number of responses, however, indicate that some men are willing to trail along and join the society at the last moment, rather than be pioneers in the greatest co-operative movement of this time.

This attitude will not prevent the society from becoming a practical reality, both because its work is recognized as a real necessity in the electrical field and because the leading electrical concerns are members of it and will inevitably put it into action. It simply postpones the time when the electrical industry will get the benefit of the immense amount of time and thought already devoted to the work of the society.

Some men have said that the electrical industry develops itself automatically, yet, according to Mr. Wakeman, 80 per cent of the houses within serviceable reach of the central stations are not even wired, and not 1 per cent of those which are wired are equipped for complete electric service.

The work which the society will do is a kind which needs doing and which no individual or corporation can afford to do singly. It will directly stimulate the public demand for electric service, which means the development of the industry as a whole, which in turn means increased prosperity to every individual engaged in it.

The educational campaign will be nation-wide. It will remove the mistaken opinion regarding the extravagance of electricity. It will show that electricity is the only commodity of daily use which has constantly been reduced in price at a time when the cost of every other necessity in life has increased. It will not be merely an advertising

campaign. The society has a great work to perform in harmonizing, wherever possible, conflicting local interests.

All the movement needs to set it at work at once is a full appreciation upon the part of the men in the electrical industry of the progressive spirit in which it has been conceived, and it is evident from the number of applications coming in that this spirit is rapidly becoming recognized.

The Society for Electrical Development proposes at small individual expense to bring big returns in increased business, better prices and larger profits to those who participate. It is collecting funds to enable the men engaged in the electrical industry to put some of their dollars to work co-operatively to develop in a big, broad spirit the latent market.

## Convention Program of the Association of Edison Illuminating Companies

The thirty-fourth convention of the Association of Edison Illuminating Companies will be held at the Hotel Otesaga, Cooperstown, N. Y., Sept. 8, 9, 10, 11 and 12. The program is as follows:

Address of the president.

Report of the executive committee.

Report of the treasurer.

Report of the meter committee; Mr. S. G. Rhodes, chairman, New York.

Report of the committee on heating; Mr. E. W. Lloyd, chairman, Chicago, Ill.

"The Central Station and Industrial Electric Heating," by Mr. Thomsen King, Baltimore, Md.

"One Year's Activity by the Boston Edison Company in Promoting the Use of Energy-Consuming Devices and the Results," by Mr. L. L. Edgar, Boston, Mass.

"Possible Fire Hazards in Service Connections," by Mr. J. B. Murray, Brooklyn, N. Y.

"Some Notes on Welfare Work," by Mr. H. W. Moses, Boston, Mass.

"Welfare Work at the Works of the General Electric Company," by Mr. G. E. Emmons.

"Corporation Schools," by Mr. F. C. Henderschott, New York, N. Y.

"Private Conservation for Public Benefit," by Mr. George C. Holberton, San Francisco, Cal.

Report of the lamp committee; Mr. John W. Lieb, Jr., chairman, New York. Prepared discussions by Messrs. R. S. Hale, J. W. Howell and others.

"Latest Developments in Incandescent Lamps," Mr. John W. Howell, Harrison, N. J.

Report of the vehicle committee; Mr. G. H. Jones, chairman, Chicago, Ill.

Report of the storage-battery committee; Mr. S. C. Harris, chairman, New York.

"Modern Electric Drive and What It Accomplishes in the Ice-Cream, Glass-Bottle and Fertilizer Industries," by Mr. R. H. Tillman, Baltimore, Md.

Report of the code committee; Mr. R. S. Stewart, chairman, Detroit, Mich.

"Load-Factor," by Mr. A. S. Loizeaux, Baltimore, Md.

"Sixty-Cycle Rotary Converters," by Mr. B. G. Lamme, East Pittsburgh, Pa.

"A New Apparatus for Catching Cinders," by Messrs. C. B. Grady and E. B. Ricketts, New York.

"Notes on the Further Operation of Large Boilers of the Detroit Edison Company," by Mr. J. W. Parker, Detroit, Mich.

Report of the committee on steam turbines; Mr. J. P. Sparrow, chairman, New York.

Report of the committee on high potentials; Mr. L. L. Elden, chairman, Boston, Mass.

"Circuit Protection," by Mr. Paul M. Lincoln, East Pittsburgh, Pa.

"Recent Improvements in the Protection of High-Voltage Transmission Circuits," by Mr. F. E. Ricketts, Baltimore, Md.

Address on the model public utility bill by Mr. E. W. Burdett, Boston, Mass.

"The Proper Basis of Valuation of Property in Rate Cases," by Prof. D. C. Jackson, Boston, Mass.

It is expected that an address will be made by Mr. S. E. Doane, of the National Electric Lamp Association, who will outline his observations upon the more recent electric developments in Europe made during a very extensive trip. An exhibition of some of Mr. Edison's latest developments in educational and industrial films, his new phonographic records, and possibly other important features of his work, is also an anticipated feature. Abundant entertainment features are provided for every day the convention is in session. It is expected that Mr. and Mrs. Edison will be present at the reception on the evening of Sept. 8.

## Convention of the Pennsylvania Electric Association

The sixth annual convention of the Pennsylvania Electric Association will be held on Sept. 16, 17 and 18 at the Water Gap House, Delaware Water Gap, Pa. As heretofore, a number of entertainment features have been arranged to provide diversion during the time not devoted to the convention sessions. The following is the tentative program: Report of the lamp committee; report of the committee on welfare work; report of the public utility interconstruction committee; "Rates," by Mr. L. H. Conklin; "Rules and Regulations for Outside Employees," by Messrs. S. W. Brown and J. A. Metz; "Rules and Regulations for Station Operation," by Mr. I. G. Walborn; "Boiler-House Practice," by Mr. S. G. Coghlan; "Feeder Regulators," by Mr. A. D. Fishel; "Street Lighting," by Mr. Preston S. Millar, and an address on the recently enacted public service company law by Mr. Frederic W. Fleitz, a well-known corporation lawyer of Pennsylvania. Mr. Walter E. Long, 1000 Chestnut Street, Philadelphia, Pa., is the secretary of the Pennsylvania Electric Association.

## Fourth Annual Meeting of California Contractors

The fourth annual meeting of the California State Association of Electrical Contractors began at Santa Barbara on Aug. 13, the registered attendance being 120. President Rendler in his annual address stated that he expected the association to make great strides during the coming year. The following committees' reports were presented: segregation, jobbers', liability insurance, state license, price book, and director to the national convention.

During the meeting of Thursday morning the report of the auditing committee was received and a special committee on liability insurance was appointed. Clippings from the *Electrical World* with reference to guaranteeing the work of members of the association were read. The secretary reported that this matter was being handled by the executive board of the National association, and also that a plan was being tried by the Faraday Club of Chicago. The subject was referred to the executive board. The election of officers resulted as follows: President, Mr. C. V. Schneider, of Sacramento; first vice-president, Mr. Claude Loveday, Santa Barabara; second vice-president, Mr. George Sitman, San Francisco; secretary nad treasurer, Mr. W. S. Hanbridge, San Francisco; sergeant at arms, Mr. Frank Somers, San José.

The meeting of Aug. 15 was devoted to the reading of papers. Mr. A. H. Halloran gave a talk on the work that was being done by the Society for Electrical Development, and Mr. Huntington, manager of the Santa Barbara Light

& Power Company, spoke on "Mutuality of the Central Station and the Contractor." Mr. C.A. Austin, chairman of the Los Angeles Chapter of Architects, also read a paper, and Mr. Ralph Clapp, statesman from Southern California, spoke on Jovianism. Mr. P. B. Hyde, of the Edison Primary Battery Company, gave a short talk on the necessity of installing fire-alarm systems in hotels and office buildings. The final paper of the day, on "Liability and Compensation Insurance," was presented by Mr. J. R. Malony, the Western manager of the Ætna Insurance Company. This subject was very well timed, as on Jan. 1, 1914, a very drastic compulsory insurance law will become effective in California.

A short session of the contractors was held after the reading of the papers, at which time Sacramento and San Francisco were chosen as the places for the 1914 and 1915 conventions respectively. It was also voted to establish a committee of experts to be at the disposal of architects when disputes arise. The directors were instructed to establish a sample room in their respective cities, at which the architects could visit and see the different appliances that go to make up good construction. Much attention was attracted at this convention to the bookkeeping set recently brought out by the National Electrical Contractors' Association. A Spanish barbecue, a ball game, rides for the ladies and Jovian activities helped to take up the time not spent in the convention sessions.

## Commonwealth Edison Company Protests Against City's Valuations

The Commonwealth Edison Company of Chicago has protested against the valuations placed on its property in the report made by Mr. Ray Palmer, city electrician, for the purpose of regulating electric rates. The company's counsel declares certain investments were excluded, among others an investment of about $400,000 in coal property, while the important questions of going value, good will and municipal franchises were slighted. Inasmuch as the company has reduced its rates voluntarily when it was possible, it contends that there is no occasion for the city taking legal means to reduce the rates. Copies of the statement were sent to the members of the City Council committee on gas, oil and electric light. The Commonwealth Edison Company's discussion of the Palmer report will be considered when the Council committee meets again in October.

## Plans for Convention of New England N. E. L. A. Section

The fifth annual convention of the New England Section of the National Electric Light Association will be held at the Hotel Vermont, Burlington, Vt., from Sept. 17 to 19, inclusive. A large attendance is anticipated in view of the attractions of the business and social program and of the Lake Champlain district at this season, when the foliage of the Green Mountains is at its height in autumnal coloring. The largest delegation will probably leave Boston on special cars attached to the 11 a. m. train on Sept. 17, via the Rutland Railroad, and this party will be in charge of Mr. Leavitt L. Edgar, master of transportation, 39 Boylston Street, Boston, Mass.

The business sessions will begin at 10 a. m. Sept. 18 and will be four in number. The papers to be presented are as follows: "Problems of Central-Station Managers in Cities of Less Than 5000 Inhabitants," by Mr. A. B. Marsden, Manchester, Vt.; "Principles Governing Central Stations in Line Extensions and Various Commission Rulings Thereon," by Mr. Alexander Macomber, C. H. Tenney & Company, Boston; "Some Phases of the Merchandising of Electric Appliances," by Mr. W. G. Stetson, Boston Edison company; "The Value of the Electric Vehicle to the Central Station," by Messrs. W. H. Snow and David W. Beaman, New Bedford (Mass.) Gas & Edison Light Company; "Co-operation of Allied Electrical Industries," by Messrs. S. St. John Morgan, Westinghouse Electric & Manufacturing Company, Boston, W. J. Keenan, Pettingell-Andrews Company, Boston, J. G. Gilliland, New England Engineering Company, Waterbury, Conn., and Francis A. Gallagher, Jr., Narragansett Electric Lighting Company, Providence, R. I.; "The Relation of the Central Station to Its Customers," by Mr. J. T. Shannon, United Electric Light & Water Company, Waterbury, Conn.; "Lamp Voltage and Socket Voltage," by Mr. Henry Schroeder, General Electric Company, Harrison, N. J. Abundant entertainment features have been provided.

## Jovian Co-operation in Electrical Development Society's Membership Campaign

The 12,000 Jovians in the United States and Canada are at present actively engaged in a co-operative campaign to increase the membership of the Society for Electrical Development, Inc. As an incentive to those who are lending their assistance in this movement the board of directors of the Society for Electrical Development has authorized the payment of the following cash prizes for memberships secured between Aug. 15 and Sept. 30: $500 to the Jovian league securing the largest number of members, $250 to the individual Jovian securing the largest number of members, $150 to the individual Jovian securing the second largest number of members, and $100 to the individual Jovian securing the third largest number of members.

## Historical Review of the Keokuk Hydroelectric Development

An interesting feature of the celebration which opened the great hydroelectric plant of the Mississippi River Power Company at Keokuk, Ia., Aug. 26, was the history of the efforts made to develop this water-power, read by Mr. William Logan, of Keokuk.

Mr. Logan said that as far back as 1848 a company was formed to utilize the water-power of the Des Moines Rapids, estimated at 200,000 hp. No success attended the effort, which was ultimately abandoned. In 1868 the United States government began the construction of a navigation canal around the rapids, the canal being completed in 1876. In the following years several organizations were formed to build a power canal or wing dam on the Illinois side of the river, but all grants or permits lapsed prior to 1899.

On July 7, 1899, a number of the citizens of Keokuk, Ia., and Hamilton, Ill., Mr. Logan being one of the number, organized the Keokuk & Hamilton Water Power Company with a capital stock of $2,500. In 1901 this company procured from Congress a franchise to build a wing dam, or power canal, on the east side of the rapids not over 500 ft. wide. The company then secured the services of Mr. L. E. Cooley, the well-known hydraulic engineer of Chicago, who reported that the cost of the wing-dam project, considering the amount of energy to be utilized, was prohibitive. Mr. Cooley concurred with Major Montgomery Meigs, civil engineer in the United States government service, who had suggested a dam across the river.

Another year passed and the funds of the company were exhausted. It was, however, determined to go ahead on the new plan of building a dam from shore to shore. Senator Allison, of Iowa, was appealed to for advice, and finally Congress passed a resolution directing the Secretary

of War to appoint a board of engineers to investigate the project. This board consisted of Col. Alexander McKinzie, Lieut.-Col. H. E. Hodges, Capt. Edward Burr, Capt. Charles McKinstry and Capt. William B. Judson. Col. Hodges was chairman. In its report the board of engineers held that the project was feasible and practicable, and that as proposed it would be an aid to navigation. The point was



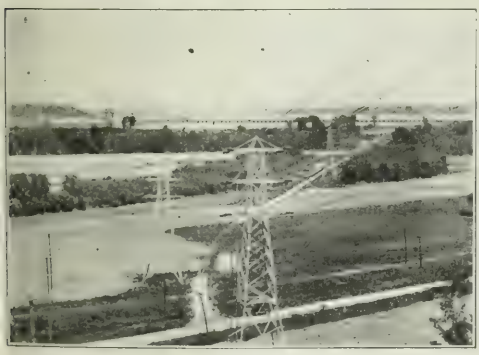
IG. 1—POWER HOUSE, KEOKUK HYDROELECTRIC DEVELOPMENT

made that if private capital were disposed to aid in the improvement of navigation without expense to the government, no objections should be made by the government. The engineers' report was made public in 1903. Mr. C. P. Birge, of Keokuk, the president of the company, died in that year. Mr. Logan spoke of him as the father of the enterprise.

Mr. Logan gave in some detail the history of the unanimous passage of the bill by Congress early in 1905, giving the Keokuk & Hamilton Water Power Company the right to build a dam across the river.

Early in September, 1905, the stockholders received a telegram from New York signed by Hugh L. Cooper, asking for an appointment. This was arranged, and the committee accompanied Mr. Cooper to Niagara Falls, where he was then building a water-power plant. In Toronto on Sept. 15, 1905, the committee entered into a contract with Mr. Cooper, as the agent of a syndicate of capitalists, giving them a two-year option on the stock and franchise. Nothing was done during the ensuing fall and winter except that Mr. Cooper prepared plans and specifications for the tentative approval of the Secretary of War.

Mr. Cooper came to Keokuk in the spring of 1906 and



IG. 2—POWER HOUSE, DAM AND TRANSMISSION LINE, KEOKUK

brought with him a corps of engineers who made the necessary surveys and contour lines showing areas to be flooded. The year 1907 was a year of financial disturbance and nothing was done. The hearts of Messrs. Johnstone, Logan and Dadant, the Keokuk promoters, grew sick with hopes long deferred. In June, 1907, the Toronto syndicate abandoned the enterprise under the terms of the option.

On July 8, 1907, the Keokuk men entered into a new option with Mr. Hugh L. Cooper personally, which was to expire Dec. 31, 1908, but was extended to expire Feb. 1, 1910. Mr. Cooper did a prodigious amount of work during the years 1907 and 1908 to induce capitalists to join him in the undertaking. Mr. W. V. N. Powelson, then president of the Union Electric Light & Power Company of St.



FIG. 3—NIGHT VIEW OF POWER HOUSE, KEOKUK

Louis, resigned that position in 1908 and became a partner of Mr. Cooper, the firm being Cooper & Powelson. In October, 1908, Mr. Cooper and the Keokuk & Hamilton Water Power Company made a contract with the Mississippi River Power Distributing Company, the Union Electric Light & Power Company, the United Railways Company and the Laclede Gas Light Company, all of St. Louis, for the sale and purchase of 60,000 electrical horse-power to be delivered in St. Louis. This appears to have been the turning point of the enterprise.

The stock, franchise and property of the old company were turned over to Mr. Cooper and the company was reorganized by the election of a new board of directors consisting of Messrs. Hugh L. Cooper, W. V. N. Powelson, W. J. Curtis and J. P. Allen, of New York; John Hunter and J. H. Drabelle, of St. Louis, and William Logan, of Keokuk. Mr. Cooper continued indefatigable in the difficult task of interesting capitalists. Under the terms of the franchise actual construction was to begin on or before Feb. 9, 1910, or the grant would lapse.

In the latter part of 1909 Mr. Cooper took the matter up with Stone & Webster, of Boston. Representatives of that firm came to Keokuk to look the situation over and re-

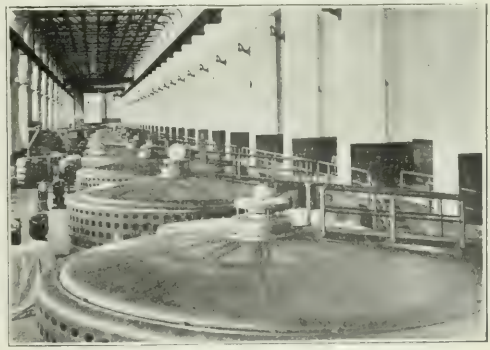


FIG. 4—GENERATOR ROOM IN POWER HOUSE, KEOKUK

ported favorably. On Jan. 8, 1910, Mr. Cooper received a telegram from Stone & Webster, saying that they would put up the money to start the work and would organize a company to carry it through to completion. On Jan. 10, 1910, just thirty days before the franchise expired, work was commenced, and it continued uninterruptedly until the last shovel of concrete was put in place May 31, 1913.

In the spring of 1911 the Mississippi River Power Company succeeded the Keokuk & Hamilton Water Power Company, and it is now the owner of the entire plant and equipment. The dam, power house, lock, dry dock and appurtenances combined constitute the largest water-power plant in the world, the concrete construction being exceeded only by that in the Panama Canal. The total cost when fully equipped will be about $30,000,000.

Mr. Logan gave some interesting statistics. The total length of the dam, power house, lock, dry dock and sea wall, forming the dam complete, is about 9000 ft. The dam itself is 4278 ft. long. The power house is 123 ft. wide and 133 ft. high. When ultimately completed it will be 1718 ft. long. It is now about 900 ft. long. There will be thirty generators with vertical shafts, each driven by a turbine waterwheel and rated at about 10,000 hp. Fifteen of these units are now in place, although two of them are not yet in operation.

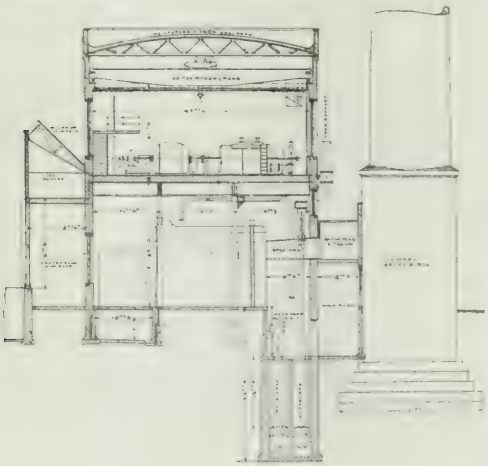
During the construction work and up to Aug. 26, 1913, there were used 232,706 cu. yd. of sand, 554,785 cu. yd. of crushed stone, 565,000 cu. yd. of concrete, 2,832,096 sacks of cement, 21,997 tons of steel, 289 tons of dynamite and 8,000,000 ft. of lumber. The excavation consisted of 586,869 cu. yd. of rock and 700,947 cu. yd. of earth.

A transmission line extends to St. Louis and is 137 miles long, the initial voltage being 110,000 volts. A transmission line to Burlington, Ia., has been built but is not yet in service.

A number of articles have appeared in the *Electrical World* descriptive of the Keokuk plant. The latest and most comprehensive appeared in the issue of May 31 last. Herewith are given some reproductions of photographs taken since then.

## Passing of the "Double-Deck" Station at Fort Wayne, Ind.

The electrical energy for the operation of the interurban and trolley cars, lamps and motors on the circuit of the Fort Wayne & Northern Indiana Traction Company has in the past been generated in what is commonly known as a "double-deck" station at Fort Wayne, Ind. In the past the



SECTION THROUGH DOUBLE-DECK STATION

opinion has been held by some engineers that from the standpoint of steam economy the double-deck arrangement with the turbine directly over the boilers gave a type of design which was as nearly as possible theoretically correct, but in the course of work of rehabilitation at Fort Wayne this double-deck feature will be entirely done away with.

The excavation and the concrete work for the 40-ft. by 100-ft. addition which is to be made to the front of the building are now under way. In the completed plant all turbines will be set on the ground floor, the two 25-cycle machines which are now over the boiler being moved down and placed beside two new 6250-kva, 4000-volt, three-phase, four-wire General Electric turbo-generator sets which have recently been purchased. The new machines will be fitted with directly connected exciters, and in addition a turbine-driven exciter will be installed for break-down service. All turbines, feeder circuits and oil switches will be remotely controlled from a benchboard. The present jet condensing equipment will be taken out and the entire plant operated on Worthington surface condensers. Two 500-kw rotary converters now in the plant will be taken out and shipped to substations, and in their stead will be installed two 1000-kva synchronous motor-generator sets. The switchboard will be entirely new and all switching apparatus on the board will be installed in duplicate to insure as far as possible continuity of service.

When the plant is completed the entire system will be changed from two-phase, 2200-volt to three-phase, 4000-volt four-wire operation. According to present plans, the change in phase will be effected by means of transformers installed on one feeder circuit at a time, and the motors of the customers will either be exchanged or rewound and replaced. However, the saving in copper will much more than balance the expense incurred in changing customers' motors.

Sargent & Lundy, of Chicago, Ill., are the engineers for the redesign of the station.

## Illumination Topics at International School Hygiene Congress

During the last two days of the International Congress on School Hygiene held at Buffalo, N. Y., Aug. 25 to 30, joint sessions were held with the Illuminating Engineering Society, subjects of schoolroom lighting being discussed by the educators and illuminating engineers present. The meetings were held at the City Hall, and an exhibit was arranged at the Broadway Auditorium, where copies of the I. E. S. "Illumination Primer" and booklet on "Glare" were available for distribution. The American Association for the Conservation of Vision also exhibited glazed and unglazed papers and blackboards, illustrating glare from reflecting surfaces.

Dr. Herbert E. Ives, Philadelphia, presided at the meetings, and in the absence of Mr. E. L. Elliott, New York, opened the Friday afternoon session with a brief talk on the subject of the "Illumination Primer," which he illustrated with lantern slides.

### Ocular Hygiene

In the absence of Dr. E. M. Alger, of New York City, his paper on "The Relation of Illumination to Ocular Hygiene" was read by Dr. Roeber, of Philadelphia. The paper was a general résumé of the effects of bad lighting as far as definite statements can be made at present. Bright sources, it was shown, are detrimental owing to the exhaustion of the photo-chemical process essential to vision. In fact, permanent blindness can be caused by focusing the sun's image on the retina. Adaptation was declared to be very important, for bright light sources blunt the retinal sense while faint sources produce the reverse effect. Flickering light is harmful, especially when the flicker is so rapid that retinal adaptation cannot follow the fluctuations. The author impressed the desirability of proper arrangement of schoolroom desks and explained the principles of the eye parts. In closing, he made the statement that while day-

light is the most pleasant to the eye, there is no doubt that innumerable cases of very bad day-lighting exist.

### Visual Efficiencies of Lighting Systems.

Prof. C. E. Ferree, Bryn Mawr, Pa., followed with a paper on "The Efficiency of the Eye Under Different Systems of Lighting," in which he described recent experiments with daylight, indirect, semi-direct and direct lighting systems. He is carrying on work with various systems, taking as a measure of comparison the loss in visual efficiency by means of a method previously described. The tests lasted two and three hours and the results show scarcely any loss in visual efficiency under daylight and indirect lighting, although a comparatively large decrease was noted under the semi-direct and direct systems. The fatigue seemed to be muscular rather than retinal. It must be remembered that Prof. Ferree's results apply only to the particular installations he used, for it can hardly be supposed than an ideal direct system would be more fatiguing than a bad case of day-lighting. The most favorable intensity found with the semi-indirect system used was 1.7 ft.-candles on the horizontal plane, which also gave 1.23 ft.-candles on a 45-deg. plane and 0.4 ft.-candle on the vertical plane. At the intensities commonly used semi-direct lighting was found practically as fatiguing as the direct system. For the latter the intensity causing least fatigue or loss in efficiency of the eye was 1 ft.-candle on the horizontal plane, which also gave 0.34 ft.-candle on the vertical plane. In all cases clear tungsten lamps were used.

Joint discussion of the three papers followed.

### Discussion on Ocular Efficiency

Dr. Schereschewsky declared that amber glasses are not as good as green glasses. Dr. Roeber, of Philadelphia, objected to the use of anything but a neutral-tint glass except in very special cases. Dr. F. Park Lewis stated that glare should be avoided, on the psychological ground that when it is difficult to see it is difficult to think. Dr. Roeber then called attention to Nature's protection of eyesight by evolving the upper and lower portions of the retina of various animals to meet their condition of living.

Dr. Miles Standish, Boston, Mass., cautioned the public against accepting laboratory tests too completely, stating that more persons complained to him of indirect systems than of any other. He qualified his remark, however, by saying that they often complained for less cause in these cases. Dr. James Kerr, ophthalmologist of the London County Council, thought that results often depend on the standard of measurement and wondered what results Professor Ferree would have obtained had he used as his criterion the threading of a number of needles in a given time. He further emphasized the importance of retinal adaptation. Asked regarding the relative cost of indirect and direct lighting, Professor Ferree stated that he had obtained better illumination in point of uniformity and intensity with the indirect system than with the direct using the same lamp wattage, a result contrary to general experience. Mr. G. H. Stickney, Harrison, N. J., called attention to the inadequacy of designating lighting systems as "direct," "indirect," etc. There are many kinds of direct lighting. In fact, the distribution from a bare lamp often differs but little from that obtained with a large diffusing sphere. He suggested that so far as the results of Professor Ferree's work relate to direct, indirect and semi-direct systems, the question be left open.

### Glare from Paper

Mr. M. Luckiesh, Cleveland, Ohio, next presented a paper on "Glare from Paper" in which he described the influence of glazed paper in destroying the good effects of a well-designed lighting system. He referred to the work of the society's committee on glare from reflecting surfaces, of which he is chairman. Attention was also called to the exhibit booth illustrating glare from polished surfaces, and glare from paper was next analyzed, showing how the ability to read is interfered with by the elimination of contrast between the paper and printed matter. The analysis showed that a decrease in intrinsic brightness of the light source results in an actual decrease in glare from the paper and an increase in the ability to read.

### Effect of Blackboards on Illumination and Glare

Dr. Mathilde Gstettner, assistant oculist of the Vienna Polyclinic High School, next read a paper on "The Influence of Blackboards' Position on the Lighting of Desks." After a description of some of the retinal processes of vision she described measurements on desks with the blackboards raised and lowered. When in the normal position it was found that the outlying desks were illuminated less brightly than when the blackboards were raised. Experiments with various wall coverings were also described.

Dr. Roeber, of Philadelphia, said that the Pennsylvania commission recommends the use of matte paper and the pasting of a slip in the front of each school-book giving directions regarding holding the book and the position to be taken relative to the light sources.

Mr. Luckiesh described his experiences in inspecting conditions in schoolrooms, concluding that it is in many cases difficult to avoid glare due to regular reflection from blackboards when light comes from side windows. He recommended tilting blackboards downward in some cases, but suggested ultimately the use of matte-surfaced blackboards.

Dr. Kerr stated that the influence of blackboards in decreasing illumination is greatest near the boards, as Dr. Gstettner stated, and hence was a serious matter. He recommends high illumination on the blackboards. It was suggested by Dr. Lewis that white paper and black crayon be employed, unrolling fresh surfaces as needed, in "paper-towel" fashion.

### Schoolhouse Lighting

The session of Saturday morning was opened by Dr. D. W. Weaver, of Greensburg, Ind., who read a paper on "Schoolhouse Lighting." The author described his work in this field as a commissioner of health, and declared that he favored diffused daylight as the best means of illumination. He emphasized the disadvantages of light from windows and strongly advocated the use of skylights with prismatic glass placed horizonally near the ceiling. The eyebrows and other anatomical features, he said, protected the eye from light falling from above. Dr. Weaver also expressed belief that direct and indirect lighting are equally advisable when properly designed.

Dr. James Kerr, of the London County Council, next presented his paper on "The Illumination of Classrooms." He drew attention to the great variability of the absolute intensity of daylight and the relatively wide variation in illumination found in different parts of the same room. He said he thought the practical test of illumination must measure its adequacy for visual work. Someone has proposed an empirical criterion which stamps an illumination as satisfactory when ordinary type can be seen through a smoked glass which absorbs 96 per cent of the light. He called attention to two kinds of glare—one that causes permanent physical changes in the eye media and another which causes only temporary discomfort. Twenty per cent of the pupils examined by him showed acuity below normal, while 10 per cent were only one-third of normal. He gave rules regarding the angle of the sky that should be suntended by the window and stated that the lower sky line should not be lower than 25 deg. from the horizontal line to the eye. He further pointed out that heating and ventilating requirements affect the size of the window, and he called attention to the effects of adjacent buildings, suggesting that the lower floors have higher ceilings than the upper floors in order to compensate for the latter's advan-

tage. The committee of the British Illuminating Engineering Society has decided that 2 ft.-candles is the minimum artificial illumination advisable, and that 4 ft.-candles is necessary for reading. Only 1 ft-candle is believed necessary, however, where no reading or writing is to be done. He said he thought the best results in artificial lighting are obtained by semi-direct units where the opal globe is not appreciably brighter than the surroundings. In closing the speaker strongly advised a minimum illumination of not less than 2 ft-candles.

In the absence of Mr. B. B. Hatch his paper on "Schoolhouse Lighting from the General Standpoint of an Engineer" was not read.

### Discussion on Schoolroom Illumination

In discussion, however, Mr. G. H. Stickney said that to have too much light coming directly from above is inadvisable, although prismatic glass changes the direction of the skylight rays satisfactorily. Dr. Weaver said that glazed surfaces are not so serious with overhead lighting, and he strongly advocated general illumination. Mr. Rowe suggested the use of wax finish for all schoolroom furniture. Another member declared that overhead skylighting is found satisfactory in a school which he inspected. He added that brown, depolished blackboards were both satisfactory and artistic. Mr. M. Luckiesh reported that his experience in inspecting schoolrooms had convinced him that neither overhead lighting nor side-window lighting is satisfactory from the single standpoint of glare from glazed surfaces. Paper is never flat, and therefore, acting as a cylindrical mirror, it reflects a bright image of all light sources in many positions. He strongly advocated the simple remedy of removing all glazed surfaces from general use. Mr. Lancaster stated that all factors must be considered in schoolroom lighting and emphasized the adaptive power of the eye as a help in overcoming the non-uniformity of illumination from window lighting. Mr. Ward Harrison, Cleveland, Ohio, described an office lighted by means of diffused light from a saw-tooth roof, where the area of glass was 20 per cent of the total floor area. The artificial light sources were hung directly below the vertical glass, causing a distribution of artificial light quite similar to that of daylight. This was satisfactory and advisable. Dr. H. E. Ives called attention to the genius of the illuminating engineer in developing devices for special cases. Mr. Stickney spoke of the production of glare by adjacent buildings, and Dr. Miles Standish, of Boston, discussed the work of the schoolhouse board of that city. In closing Dr. Kerr called attention to the irritable effect of red light as compared with that of other colors.

In the absence of Mr. W. L. Coffee, his paper on "Rural School Illumination" was not presented.

### Methods of Testing Illumination

Dr. George Fitz, Peconic, N. Y., next read his paper on "Practical Methods of Testing Light in Schoolrooms, with a Demonstration of the Photometer for Lighting Tests in Schoolrooms and Workrooms." His paper considered illumination from the standpoint of the teacher. He stated that a minimum of 1 ft.-candle was the least advisable on the darkest day. He thought visual acuity an incomplete test and he discussed some of Weber's famous work on sky area subtended by windows, afterward describing his own apparatus for roughly determining the sky area. The instrument consists of a spherical convex lens blackened inside and graduated by a simple means of calibration. The image of the window is seen in the mirror, and by means of the scale the sky area is roughly measured. Closing the discusssion, Dr. Kerr described a scale combined with a lens which measures the available sky area at any part of the room.

Both of the joint sessions were well attended, and the delegates evinced much interest in the proceedings.

## Public Service Commission News

### Massachusetts Commission

The Gas and Electric Light Commission has issued a fifty-two-page bulletin of legislation passed in the State in 1913 which is of special interest to gas and electric light companies and to municipalities owning lighting plants. In addition to the acts previously reviewed in these columns, the bulletin includes statutes bearing upon the sale of commodities by weight, special licenses of engineers and firemen, admission of accounts as evidence, interest on damages awarded for death caused by negligence, prohibition of making up time lost on legal holidays, workmen's compensation, legislative counsel, storage of explosives, approval of bills against municipalities, reports upon accidents, and the municipal financing of improvements.

### West Virginia Commission

Hearings before the West Virginia Public Service Commission on the application of the West Virginia Hydro-Electric Company, which seeks authority to construct a power plant and dams on the Cheat River, were ended on Aug. 25. A formal session of the commission to consider the proposition will be held on Sept. 9 at Charleston, W. Va. The company is controlled by Pittsburgh capitalists. The Elkins Coal Company urges that the hydroelectric company be ordered to provide locks in its dams. The hydroelectric company offered, in case a railroad is built above the new high-water line after the dams are completed and costs more than one above the present high-water line would, to pay the difference in the cost of construction.

### Indiana Commission

The Merchants' Heat & Light Company and the People's Light & Heat Company of Indianapolis have been merged in accordance with a decision of the Indiana Public Service Commission. The companies complied in all respects with the decision of the commission on the question. The franchises of both companies were surrendered and the Merchants' Heat & Light Company, as the consolidated corporation, will take out an indeterminate permit.

### Wisconsin Commission

The Wisconsin Railroad Commission has ordered a slight reduction in the rates of the Milwaukee Gas Light Company. The rates ordered are as follows: First 7000 cu. ft. per month, 75 cents net per 1000 cu. ft.; next 13,000 cu. ft., 65 cents; next 80,000 cu. ft., 55 cents; next 100,000 cu. ft., 50 cents; all over 200,000 cu. ft., 45 cents. The old rates ranged from a charge of 75 cents net for the first 10,000 cu. ft. per month to a charge of 50 cents for all gas used in excess of 100,000 cu. ft. The present value of the property as determined by the commission is $8,770,148, and the cost of reproduction $9,841,986. No objection was made to the physical valuation but considerable testimony was introduced by witnesses for the company to prove that the commission's allowance of 15 per cent to cover engineering, superintendence, interest during construction, contingencies, etc., was too low. The opinion points out that many of the factors making up the somewhat larger allowances urged by the witnesses were taken into account in the unit prices used in the valuation.

No allowance was made for going value, although the defendant attempted to justify a claim of approximately $2,000,000. The commission concluded that from all available records it appeared that the earnings had been amply sufficient to provide a reasonable return on the investment and to take care of depreciation. Attention was called to the fact that, although the population of the city has increased by only 93 per cent since 1890, the number of consumers has increased 640 per cent, the gas sales 645 per cent and the sales per capita from 1900 cu. ft. in 1890 to 7300 cu. ft. in 1911. An allowance of from $500,000 to

$550,000, of which $350,000 represents the value of stores and supplies, was made for working capital. Depreciation was provided for at the rate of 2.5 per cent on the depreciable property.

The company contended that certain economies, particularly that effected through the introduction of the booster system, should be capitalized. While not accepting the claim in its entirety, the commission gave considerable weight to the matter of "economies resulting from unusual engineering foresight" in arriving at the value of $10,700,000, which was used as the basis of rates.

A study of the consumer data showed that under the present rates about 70 per cent of the consumers are not paying their just share and that this number use about one-third of the gas sold. The commission declared that it would be impossible to remedy this condition entirely without making the rates for the small consumer exorbitant, and consequently the schedule as ordered is designed to distribute the burden over all the consumers instead of over a small group.

In the matter of the application of the Citizens' Telephone Company of Eau Claire for authority to issue securities for the purpose of acquiring the property and permits of the Chippewa County Telephone Company, located in Eau Claire, and to extend the same and conduct a local exchange business, the commission has granted the request in so far as it applies to the acquisition of the property but has refused that portion of the request which relates to the extension of the business.

# Current News Notes

Citizens' Terminal Investigation in Chicago.—A group of public-spirited citizens in Chicago has secured pledges of $77,000 toward a fund of $100,000 to defray the expense of an expert and disinterested investigation of the railroad terminal problem in Chicago. Mr. Bion J. Arnold has been retained to make a general inquiry of a preliminary nature, for which $25,000 has been set aside.

* * *

Edison Service Ousts Isolated Plant in Brooklyn Post Office.—The United States Treasury Department has just concluded a contract with the Edison Electric Illuminating Company of Brooklyn for the exclusive supply of electrical energy to the Brooklyn Post Office. The isolated plant supplanted by central-station service has been in operation for the past decade, and the equipment comprises one 75-kw and two 50-kw units directly connected to standard vertical automatic engines.

* * *

Predicts Talks by Wireless Telephony.—Mr. Godfrey Isaacs, of the Marconi Wireless Telegraph Company, in a recent statement said that the day is not now far distant when passengers on ocean steamships will talk with those on land over a wireless telephone. He intimated that the Marconi company would be able to turn wireless telephony to practical commercial account at an early date, but until the company is prepared to show exactly what definite results can be obtained he will vouchsafe no further information.

* * *

Instruction in Utility Valuation.—The establishment of a chair in the University of Missouri for instruction on the subject of physical valuation and appraisement of public utilities of every character has been recommended by Mr. J. M. Atkinson, chairman of the Missouri Public Service Commission, to the curators of the university. Mr. Atkinson believes there should be such a course opened in connection with the economics and engineering department, the graduates from which would be eligible for employment by the Public Service Commission.

* * *

Massachusetts Water-Power Investigation.—The chairmen of the Massachusetts Gas and Electric Light Commission and of the Harbor and Land Commission and the Attorney-General of the State have been named by recent legislation as a special board to investigate the better conservation of waters and the utilization and equalization of stream flow within the commonwealth, with authority to hold public hearings and to employ such engineers and assistants as may be required. The board is to submit its report with recommendations for legislation to the next General Court not later than Jan. 14, 1914.

* * *

Government Conservation Policy Criticised in Epigram.—Mr. W. P. Hepburn, for twenty-two years a representative in Congress from the State of Iowa, is still, at the age of eighty, keenly observant of public affairs. He delivered an address at the Keokuk-Hamilton water-power celebration in Keokuk, Ia., on Aug. 26. In the course of it he referred unfavorably to the modern governmental theories of the conservation of natural resources. Alluding particularly to forestry administration, he said: "In foreign countries, as in Great Britain and Germany, the forestry service plants trees; in this country we plant inspectors and rangers."

* * *

Union Electric Picnic in St. Louis.—The fourth annual field day and picnic of the Union Electric Light & Power Company Section of the National Electric Light Association in St. Louis was held in Ramona Park on Aug. 23 and was a great success. The number present was nearly 500, embracing employees and members of their families, and an interesting program of athletic contests and games was carried out. Prizes were awarded to the winners. Mr. F. D. Beardslee was grand marshal of the occasion. Messrs. H. W. Eales, H. W. Korhammer, John Fay, R. L. Beall and others were also active in seeing that everybody had a good time.

* * *

Interurban Electric Roads Unprofitable.—According to President Mortimer of the Milwaukee (Wis.) Electric Railway & Power Company, interurban electric lines do not pay under present conditions. He maintains that few interurban electric railways have ever proved either paying or profitable investments. Such money as has been made out of them has come through the sale of the securities rather than from the operation of the utility. These facts, according to Mr. Mortimer, are getting to be very generally known by investors and those who have capital for the development of such enterprises, and it is becoming correspondingly hard to obtain money with which to carry on such work.

* * *

Pacific Gas & Electric Company Seeks to Avoid Government Restraints.—The officers of the Pacific Gas & Electric Company, of San Francisco, Cal., have instituted a suit against Secretary of Agriculture David F. Houston and Mr. Henry S. Graves, chief of the Forest Service, to restrain the government from preventing improvements by the company on its property adjoining the Tahoe National Forest. The company seeks permission to build an aqueduct over a corner of the forest reserve and contends that the Tahoe Forest is a state property over which the federal government has no jurisdiction. It sets forth that its improvement work, including the raising and enlarging of the Lake Spaulding reservoir, is to cost approximately $5,000,000. The Forest Service objects to further elevation of the reservoir on the ground that the water will overflow parts of the Tahoe National Forest. It also opposes the construction of an aqueduct across the forest reserve.

X-Ray Cure for Cancer.—Roentgen rays filtered through silver, copper or tin plate are said to have been used by Dr. Roberts, senior surgeon of the General Hospital at Hobart, Tasmania, in the treatment of cancer. The surgeon states that he has successfully treated forty persons suffering from the disease.

* * *

Bibliography on Valuation of Public Utilities.—The August issue of the *Proceedings* of the American Society of Civil Engineers contains a bibliography on the valuation of public utilities. It was first prepared by the library force of the society on May 15, 1912, for the use of the special committee on valuation of public utilities and has been brought up to date.

* * *

Wireless Explosion Denied.—The *Eclair* of Paris in a long article argues that the ultra-violet rays with which Ulivi, an Italian inventor, asserted he was able to set off explosives by wireless at a great distance did not exist, and that such explosions as those which occurred in recent tests were merely accidental. Newspapers have recently printed long but vague accounts of Ulivi's success with what he calls "F" rays.

* * *

Government Wireless Station to Be Erected in Illinois.—At a recent conference between Mr. Josephus Daniels, the Secretary of the Navy, and Capt. George R. Clark, commandant of the United States naval training station at Great Lakes, Ill., it was decided that a high-power radio station and plant should be erected at the latter place. The Great Lakes station is near Lake Bluff, Ill., on the shore of Lake Michigan, and about 30 miles north of Chicago.

* * *

Push-Button Gas-Lighting Fixture.—An electric gas valve is combined with an ignition device in a new French gas-lighting attachment which can be screwed onto the jet beneath the burner. Pressing a button sends a current through the electromagnetic valves, opening it and admitting gas to the adjoining ignition chamber. Here the current has meanwhile heated to redness a coil of fine platinum wire, which by occlusion of hydrogen rises to a white heat, igniting the gas.

* * *

Abandoning Telegraph Lines in Africa.—Wireless telegraphy is interfering with the happiness of natives of Central Africa, for it has deprived them of an unfailing supply of wire to be worked up into ornaments and weapons. Some big mines operated by European capital in Central Africa have recently abandoned their wire-telegraph lines from railroads to the mines, and established communication by wireless. Maintenance of the wire lines has been difficult because of the demand for the wire by native belles, and also because of the occasional wanton destruction of pole lines.

* * *

Couldn't Stop Their Car.—A rather amusing but somewhat vexatious incident is reported as having happened at Huntington, Ind. A mother and her daughter found that they were unable to stop their electric car when they wanted to get out. Finally the vehicle was headed up a steep hill, the brakes applied and the speed reduced sufficiently so that the mother could jump out. The elder lady telephoned her husband and shortly afterward he jumped aboard the car when it was going up the same hill. Masculine ingenuity was also unable to check the mad career of the car, however, and it was driven up one street and down another for nearly four hours until the battery was exhausted. To culminate its mischief, the car "died" on the outskirts of the town, and the owner had to walk a considerable distance to his home.

## SOCIETY MEETINGS

Jovian Activities Renewed.—The weekly luncheons of the New York Jovians were resumed on Sept. 3, when Mr. F. E. Watts, eleventh Jupiter of the order, spoke on the plans for the Jovian Congress to be held in New York on Oct. 14-16 inclusive. There are to be a number of rejuvenations and joviations on Jovian Day, Sept. 6, among them one in connection with the National Conservation Exposition.

* * *

Picnic of the Electric Club of Chicago.—The annual picnic of the Electric Club of Chicago was held at Northfield Grove, near Shermerville, Ill., on Aug. 21. About 200 ladies and gentlemen attended and indulged in athletic contests, dancing, guessing contests and other games. Prizes were awarded to the successful contestants, and, in spite of some railroad delays in reaching the grounds, the participants enjoyed themselves thoroughly.

* * *

Convention of the Electric Vehicle Association of America.—The fourth annual convention of the Electric Vehicle Association of America will be held in Chicago, Oct. 27 and 28. The convention program is now nearing completion, and the tentative arrangements indicate that papers of great interest not only to manufacturers and central-station companies but also to users and prospective users of electric vehicles will be presented.

* * *

Annual Meeting of Eastern New York Section, N. E. L. A.—The annual convention of the Eastern New York Section of the National Electric Light Association will be held at the Hotel Saginaw at Lake George, Sept. 15. The papers committee is preparing an elaborate program which will consist of a number of papers of interest to central-station people. Mr. Robert E. Russell, General Electric Company, Schenectady, N. Y., is secretary of the association.

* * *

Special Cars from Chicago to Pittsburgh Convention.—The Chicago Section of the Illuminating Engineering Society has selected the Lake Shore Railroad as the official route from Chicago to Pittsburgh on the occasion of the seventh annual convention of the society to be held in Pittsburgh on Sept. 22 to 26 inclusive. Special sleeping cars will be attached to the "Pittsburgh Limited," leaving the Lake Shore station in Chicago at 8:20 p.m. on Sept. 21 and arriving in Pittsburgh at 7:40 a.m. the next day. Stop-overs of ten days will be allowed at South Bend, Toledo, Sandusky, Cleveland and Youngstown. The stop-over at Cleveland will afford visitors an opportunity to inspect the engineering laboratory of the National Electric Lamp Association. Mr. J. B. Jackson, 28 North Market Street, is secretary of the Chicago Section.

* * *

Jovian Club Established in Montreal.—A Jovian Club has been opened at Cooper's Restaurant, Montreal, Que. The executive committee is composed of Messrs. W. B. Shaw, president of the Montreal Electric Company, representing electrical contractors; W. J. Doherty, sales manager of the Northern Electric & Manufacturing Company, representing supply houses; R. M. Hannaford, engineering department of the Montreal Tramways Company, representing the traction interests; C. E. Duncan, representing the manufacturing interests; C. M. Tate, chief inspector electrical department Canadian Fire Underwriters' Association, representing inspection interests; W. H. Winter, plant superintendent of the Bell Telephone Company, representing telephone interests, and P. T. Davies, of the Montreal Light, Heat & Power Company, representing the central stations. Mr. James Bennett, president of the club, and Mr. D. H. Ross, vice-president, are also on the committee.

# Intensified Lighting of Business Thoroughfares

**Luminous-arc installations in Boston, Cambridge and Lynn, Mass.—Data on illumination and arrangement of units—Merchants' associations instrumental in movements for more light**

THE luminous-arc lamp with ornamental standard is rapidly taking its place in the field of downtown street lighting. Being a single unit of high intensity with a light distribution curve suited to the needs of business thoroughfares, it is favorably regarded by merchants, although in intensity of illumination and quality of light it contrasts greatly with the tungsten cluster, its greatest competitor in this class of work. A number of installations of ornamental luminous arcs have been made recently in and near Boston which are typical in a way of many others that have been made and are being made in various parts of the country. The chief features of some of these systems are outlined below.

### Ornamental Lighting in Boston Back Bay

An ornamental luminous-arc system was inaugurated on Aug. 1 on Huntington Avenue, Boston, one of the widest and most important thoroughfares in the Back Bay district. The section of the avenue equipped is about 3000 ft. long, extending between Copley Square and Massachusetts Avenue and offering unusually favorable conditions for effective display lighting. The installation is the first permanent one of its kind in Boston and was designed to stimulate the growth of lower Huntington Avenue along lines of modern business enterprise, paralleling the extensive development of mercantile interests along Boylston Street. The installation is the outcome of vigorous work by the Huntington Avenue Improvement Association, an organization of merchants and property owners interested in the proper development of this street, which is rapidly passing from a residential to a business avenue of traffic.

Fig. 3 is a view of the avenue looking west from Irvington Street and showing the previous illumination of the thoroughfare by 6.6-amp series direct-current magnetite-arc lamps. There were fourteen of these installed in the section under consideration, the lamps being supported on wooden poles 250 ft. apart as a rule and occupying locations in the center of a double-tracked reservation used by the Boston Elevated Railway Company. This installation gave excellent lighting for residential purposes but an insufficient illumination for commercial needs. As a result of the efforts of the improvement association, the city of Boston increased the number of municipal arc lamps to eighteen, and these were changed to the luminous 6.6-amp type, mounted on 18-ft. Lundin ornamental poles and relocated on the curb, the lamps being operated all night on the regular city schedule. To provide additional lighting, twenty-three more lamps of the same kind have been installed on poles on the curbs, and spaced as evenly as possible with the municipal lamps. The twenty-three lamps were supplied at the expense of abutters, the cost being about $200 per lamp, and these form a "private property" system which is operated from dusk until midnight daily, energy being supplied from the Scotia Street substation of the Boston Edison company, from which point the installation is controlled. Fig. 1 shows substantially the same section of the street as Fig. 3, but viewing it in the opposite direction, east from Falmouth Street. Huntington Avenue is about 100 ft. wide from curb to curb, with broad sidewalks and a central reservation about 15 ft. in width, as noted.

The diagram printed as Fig. 6 shows the intensity of illumination on the center line of the reservation both before and after midnight, and on the center lines of the south and



FIG. 1—ILLUMINATION OF HUNTINGTON AVENUE, BOSTON, MASS., WITH 6.6-AMP ORNAMENTAL LUMINOUS-ARC LAMPS

north sides of the avenue, the readings being taken with a Sharp-Millar photometer on a plane 3 ft. above the ground. The illumination on the center lines of the north and south roadways is on the whole remarkably even, often varying from side to side at the points taken by less than from 0.05 to 0.1 ft.-candle. It is of interest to note that

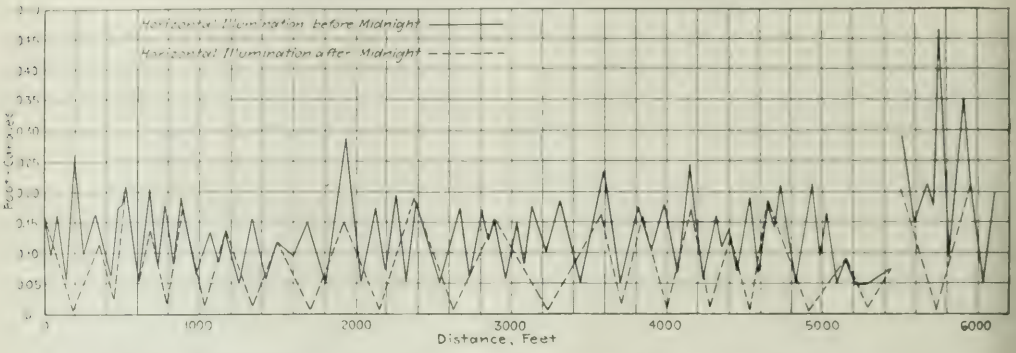



FIG. 2—CURVES SHOWING HORIZONTAL ILLUMINATION BEFORE AND AFTER MIDNIGHT AT CAMBRIDGE

in the reservation, which is used exclusively by street cars, the range of illumination with all lamps in service is from about 0.3 ft.-candle to 0.5 ft.-candle, while the range in the center of each roadway is from 1.5 ft.-candles maximum to about 0.1 ft.-candle. The location of the lamps on the opposite curbs in a street of this character, which in the Boston instance is treeless, provides illumination exactly where it is most needed, and even at the crossing breaks in the grassed reservation the illumination on the pavement is sufficient to make it easy for pedestrians or vehicle passengers to cross the car tracks without difficulty. The headlamps of the cars provide for the longitudinal illumination of the reservation and at great economy, since each car carries its own specialized and intensified directional lighting at its front, thus making it unnecessary for either the city or the improvement association to meet the special requirements of powerful reservation lighting in the direction of traffic movement. The total fund raised by the Huntington Avenue Improvement Association was about $6,500, of which about $81 per lamp of the private property system was set aside to meet the first year's cost of service.

### Performance of Lamps at Cambridge

In connection with the installation of fifty-five ornamental luminous-arc lamps of the 6.6-amp size on Massachusetts Avenue, North Cambridge, Mass., a test has recently been made by the engineers who furnished the equipment to the Cambridge Electric Light Company, on whose system the lamps are located. The arrangement of lamps is somewhat different from the usual installation of this kind, on account of local geographical conditions. Massachusetts Avenue in this part of Cambridge combines residential and business functions, besides varying considerably in width throughout the section equipped, which is some 6000 ft. long. The arcs are each 14.5 ft. above the sidewalk, and medium alabaster globes are used. The avenue is about 70 ft. wide for the first mile of the installation, starting from a point 350 ft. north of North Cambridge



FIG. 3—PREVIOUS INSTALLATION OF ARC LAMPS ON HUNTINGTON AVENUE, BOSTON

Junction. At Porter Square the width increases, narrowing again to 63 ft. for the remainder of the way. In general the lamps are somewhat staggered, although the distances apart vary greatly. For a distance of about 540 ft. in North Cambridge, between stations 350 and 890 on the accompanying diagram of illumination throughout the route, the

lamps are all on one side of the avenue on account of local conditions. Shade trees are found on a large part of the route.

The horizontal illumination down the center line of the avenue opposite and half way between each lamp was taken with a Sharp-Millar photometer at a height of 3 ft. above the ground, the result being shown on the diagram (Fig. 2). The full-line curve shows the illumination before midnight, the dotted line that after midnight. At midnight the lamps on the east side of the avenue are all cut out of service, and midnight and 0.086 ft.-candle after midnight. Reference to the diagram (Fig. 2) shows several high values. That at station 1940 is due to the fact that two lamps are placed only 26 ft. apart, the reading being half way between the lamps only and not opposite. At station 3600 two lamps were only 30 ft. apart and at station 4150 only 24 ft. apart.



FIGS. 4 AND 5—LIGHTING ON MASSACHUSETTS AVENUE, CAMBRIDGE, LOOKING TOWARD PORTER SQUARE BEFORE AND AFTER MIDNIGHT

The break in the curve at station 5425 is due to a railroad bridge with solid plate girders, making it impossible to read the photometer at a height of 3 ft. above the highway. On account of the extreme width of the avenue, 70 ft., the

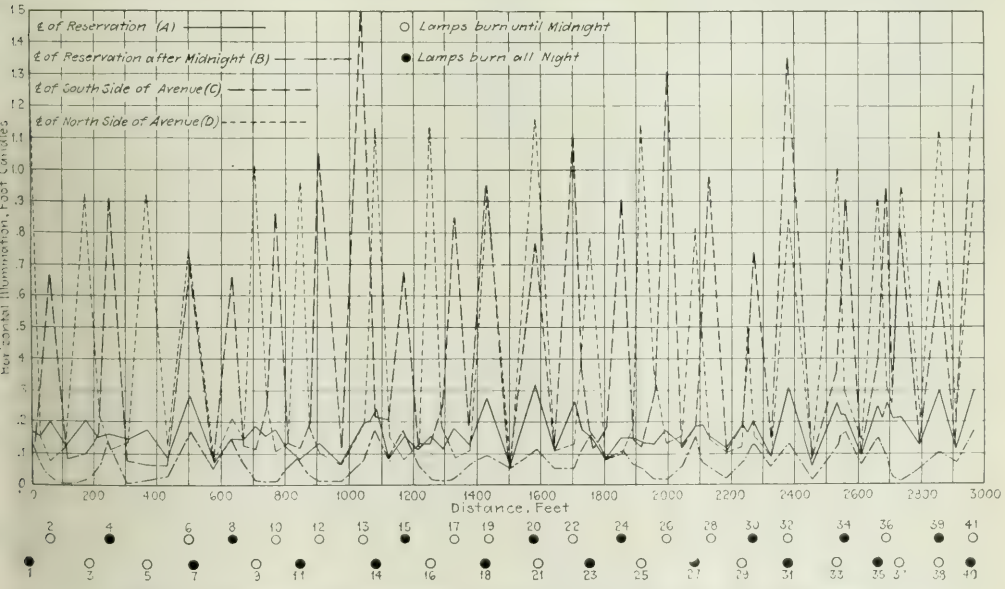



FIG. 6—CURVES SHOWING INTENSITY OF ILLUMINATION ON HUNTINGTON AVENUE, BOSTON

approximately every other one on the opposite side, making an average spacing of about 300 ft. At other times the average spacing is 115 ft. Two of the lamps are located on North Beacon Street, and after midnight one of these and thirty-three lamps on the avenue are out of service. The average horizontal illumination is 0.136 ft.-candle before midnight and 0.086 ft.-candle after midnight. Reference to the diagram (Fig. 2) shows several high values. That at station 1940 is due to the fact that two lamps are placed only 26 ft. apart, the reading being half way between the lamps only and not opposite. At station 3600 two lamps were only 30 ft. apart and at station 4150 only 24 ft. apart.

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The break in the curve at station 5425 is due to a railroad bridge with solid plate girders, making it impossible to read the photometer at a height of 3 ft. above the highway. On account of the extreme width of the avenue, 70 ft., the readings opposite the lamps, taken after midnight, agree very closely with those taken earlier, whereas the half-way readings are much lower, being about 0.005 ft.-candle.

In this installation the company was obliged to supply energy to the ornamental lamps from overhead circuits, for the reason that the underground service could not be

completed in time for the opening of the display lighting. Contrary to the general impression, it has been found that the use of wires running from cross-arms overhead to the ornamental posts below is not materially objectionable. The wires are brought into the post interiors through holes bored in the upper part of the post and fitted with porcelain bushings. They are run down the inside of each post to a standard Lundin cut-out in the lower portion, and thence back to the arc lamp at the top. Upon casual inspection, the wires are scarcely noticeable, even when they have been carried from the top of a pole on one side of the street across to the ornamental post on the other side.

### Results at Lynn

In the *Electrical World* of Jan. 11, 1913, page 101, there was printed an illustrated description of the ornamental

DATA ON LYNN (MASS.) ORNAMENTAL LUMINOUS-ARC LAMPS

| | Number of Lamps | Length of Street | Average Width of Street | Average Spacing in Feet | Total Watt | Watts per Square Foot | Watts per Front Foot | Maximum Horizontal Illumination, Ft.-Candles | Minimum Horizontal Illumination, Ft.-Candles | Average Horizontal Illumination, Ft.-Candles | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Andrew Street | 9 | 576 | 34 | 60.7 | 4,788 | 0.24 | 4.16 | 1.110 | 0.260 | | 0.73 |
| Munroe Street | 14 | 828 | 32 | 60.1 | 7,448 | 0.28 | 4.50 | 1.000 | 0.275 | | 0.68 |
| Oxford Street | 11 | 665 | 36 | 55.1 | 5,852 | 0.24 | 4.40 | 0.990 | 0.290 | | 0.62 |
| Market Street before midnight | 38 | 1686 | 60 | 45.2 | 20,216 | 0.20 | 5.60 | 0.751 | 0.113 | | 0.42 |
| Market Street after midnight | 7 | 1686 | 60 | 278.7 | 3,724 | 0.037 | 1.10 | 0.459 | 0.0125 | | 0.13 |
| Market Street from City Hall Square to railroad viaduct | 38 | 1260 | 87 | 38.9 | 17,556 | 0.24 | 6.97 | 0.751 | 0.115 | | 0.47 |
| Market Street from railroad viaduct to Broad Street | 5 | 420 | 72 | 67.6 | 2,760 | 0.087 | 3.12 | 0.196 | 0.113 | | 0.15 |

luminous-arc lighting system at that time newly installed in the city of Lynn, Mass., and emphasis was laid upon the large area of the downtown district covered by the new service as distinguished from the ordinary practice of confining display lighting of this character to one or two thoroughfares only. The installation has now been in use over eight months and has given admirable service. It provides a basis for suggestive tests, and in the following paragraphs are given illumination data recently secured on the system, with a description of its essential features and mention of several points not included in the former article.

The installation was made possible through the co-operation of the local merchants, the municipality and the Lynn Gas & Electric Company. The arc is carried 14.5 ft. above the sidewalk, the post being of the Lundin combination wooden and iron type as required by the Massachusetts laws, with fluted wooden column. There are in the complete installation 150 6.6-amp ornamental luminous-arc lamps, two ornamental bracket lamps, one combination trolley and twin bracket pole with two lamps of the same type carried at a height of 27.5 ft., ten 4-amp ornamental luminous-arc lamps of the parkway type carried at a height of 18 ft., and one 4-amp ornamental luminous-arc lamp of the residential type with the arc 12 ft. above the sidewalk. Of these, thirty-five 6.6-amp lamps and all of the 4-amp lamps burn all night. The cost to the city is $8,260 for the 6.6-amp lamps burned until midnight and $2,884 for those burning all night, the parkway lamp service costing $906.40 a year, making a total cost for the entire service of $12,-050.40 for the year. The standard pole is mounted on a concrete foundation 2 ft. square at the top, 3 ft. square at the bottom and 3 ft. deep, and each pole is provided with an absolute cut-out for lamp disconnection. At present there are 165 lamps in actual service, all being operated from mercury-arc rectifiers. The city of Lynn pays for the maintenance of the lamps, the prices being $70 per lamp a year for service until midnight and $82.40 for all-night service.

The cost of installation per pole was as follows:

| | |
|---|---|
| Pole, including wiring and cut-out | $35.00 |
| Twin cable wiring and absolute cut-out | 6.40 |
| Casing to cover lamp mechanism | 4.00 |
| Excavation and forms for concrete | 2.00 |
| Concrete foundation | 7.00 |
| Replacing broken sidewalks of concrete | 2.00 |
| Painting | 1.44 |
| Framing | 0.50 |
| Foundation bolts | 0.40 |
| Protective casings on pole | 1.64 |
| Total cost of pole | $61.08 |

In the previous installation the district was lighted by 45 4-amp pendent-type luminous-arc lamps burning all night at a yearly cost of $82.40 per lamp, and these were removed in making the "white way" installation, the city being credited with $3,708, making the actual increased cost to the city for each year $8,342.40. Work is under way at present for the location of lamps on Ocean and Nahant Streets, the 4-amp residential type being used.

The cross streets in the district are well provided for in the way of ornamental lighting, Munroe, Oxford and Andrew Streets being active business thoroughfares as well as Central Avenue and Market Street. In general the lamps are staggered both on main and cross streets. The quantity and quality of light on the streets is at present probably unequaled, and notwithstanding the great amount of light coming from sources only 14.5 ft. from the ground, there is no glare and persons and objects can readily be distinguished from one end of the street to the other. Mar-

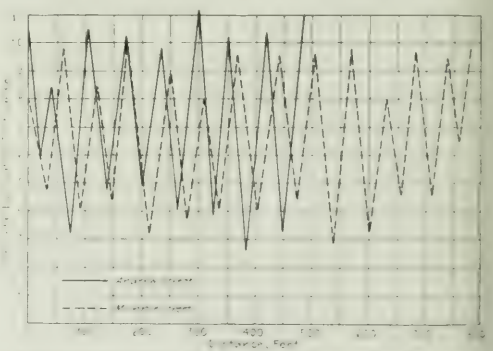


FIG. 7—HORIZONTAL ILLUMINATION CURVES FOR ANDREW AND MONROE STREETS, LYNN

ket Street, the principal business thoroughfare of the city, is lighted by thirty-eight lamps, of which thirty-three are located between City Hall Square and the Boston & Maine Railroad viaduct, the lamps being spaced on an average 38.9 ft. apart, though they are 67 ft. apart in the case of five lamps between the viaduct and Broad Street. After midnight there are seven lamps burning the rest of the night. Illumination tests have been made on the principal streets with a Sharp-Millar photometer, readings being made opposite and half way between each lamp down the center line of the street. On Market Street readings were also made after midnight, when all but seven of the lamps had been cut off. Readings were also made on Munroe, Oxford and Andrew Streets, and the results are shown in the accompanying diagram for the two last-named thoroughfares. The accompanying table gives the dimensions, number of lamps, spacing of lamps, energy consumption and illumination data for Andrew, Monroe, Oxford and Market Streets.

# Central-Station Developments at Hartford

**Electric-truck battery interchange system on mileage basis—Codification of electric rate schedules —Development of industrial electric heating**

AMONG significant recent developments in central-station service on the system of the Hartford (Conn.) Electric Light Company, the inauguration f a battery interchange plan with respect to electric-truck peration marks an important movement in the administra-on of this organization, always noted for its pioneer work the field of popularization of electrical applications. The ompany is probably the first in the country to take up the ork of stimulating the growth of electric-truck service by aking entire care of the problem of battery supply, from oth the investment and maintenance points of view. The nterchange system has been in use in Hartford for about a ear and is meeting with the cordial co-operation of local usiness establishments besides furnishing a most desirable oad for the generating stations and diversifying the com-any's output along at-ractive lines. Nothing ike a final development as, of course, been at-ained as yet, but much as been learned about the ractical application of an nterchange system under he jurisdiction of a cen-ral station, and the com-any's practice is falling nto well-standardized lines s each month passes.



FIG. 1—TRUCKS OF BOSTON BRANCH GROCERY USING SERVICE OF HARTFORD (CONN.) ELECTRIC LIGHT COMPANY

### Battery Interchange System

In establishing the sys-em it was necessary to pecialize at the outset on a single make of truck and a single form of battery. Arrangements were ac-ordingly made with the General Vehicle Company and the Edison Storage Bat-ery Company whereby the Hartford company acts at pres-nt as the local agent of each. The interchange system, or "Edison battery service system," as it is called by the com-any, was worked out on this basis, with the fundamental bject of reducing truck operation to its simplest form. Under this system the Hartford Electric Light Company uys, maintains, charges and installs in the customer's ruck all batteries necessary for its continuous operation, he price of the service being graduated upon a mileage asis according to the size of the truck, with a correspond-ng fixed monthly charge also dependent upon the capac-ty of the vehicle in service. By the company's plan the ruck owner obtains a substantial reduction in his invest-ment. No charging apparatus or private garage is neces-sary; the entire relief is secured from the care of batteries by employees of the truck owner; the cost is not increased by poor roads or busy seasons, and battery repairs and electric charging bills are unknown to the possessor of the vehicle. The customer exchanges batteries at a service depot owned by the company on State Street, in the heart of the business district. The facilities for interchange enable a battery to be taken out and another substituted in a very short time, from three to five minutes being enough.

The schedule of prices for service where the Hartford company furnishes the battery interchange and where all the charging is done at the central-station's depot is shown in the table on page 475.

### Equipment of Battery Depot

The battery depot of the company occupies an unused boiler room and, although somewhat temporary in its arrangement, is equipped with a hydraulic lift set into the floor for raising and lowering batteries between truck frames and a Cowan 2-ton portable hand truck. The wall panels are equipped in each case with fuses, ammeters, Sangamon ampere-hour meters, circuit-breakers and rheostats. Each panel provides for two charging circuits, and fourteen of the latter are at present in service. The circuit-breakers are provided with trip coils electrically operated by the pointers of the ampere-hour meters as they reach the zero indication upon the batteries' attaining full charge. The batteries are supported on 4-in. by 7½-in. timbers when being charged, and the hand truck is designed to permit raising any battery by manipulation of the handle. The hydraulic elevator in the floor is 70 in. long by 36 in. wide and is set between guide timbers in which the trucks are run to get an accurate line-up for changing batteries. Four hydraulic jacks, each 6 in. in diameter with a 14-in. lift, are provided, with attachments at the corners of the lift platform, and these jacks are controlled by a master valve which raises the platform uniformly in height. In case all the cradle hooks do not release quickly, one of four multiple valves will permit the raising or lowering of a corresponding corner of the platform independently of the others. These control valves are mounted on the wall out of the way of entering and departing vehicles. City water pressure of about 100 lb. per sq. in. is used in their operation.

### Contracts for Service

The contracts covering this service are in card form, 5¾ in. by 7 in. in size, with tables to permit quick use in the file, and set forth the agreement of the company to provide battery equipment and service, the responsibility of the customer for the purchase of the truck without the battery, operation of the vehicle in and out of the central charging and exchange station, and the use of the odometer as the basis of billing. The company furnishes and installs an odometer for each vehicle, maintains the instrument, and checks its accuracy by request of the consumer. In case an odometer does not register, the mileage is esti-

mated from previous records on the same vehicle until the instrument can be replaced and repaired, the latter being done at the earliest possible moment. The customer assumes no responsibility as to batteries and odometers, except as they may be damaged by accident or fire when not under the control of the central-station company. The vehicle owner assumes the responsibility for the truck with regard to fire or accident. A regular inspection, not oftener than twice a month, is made by the central station upon the truck without extra charge. When exchanging a discharged for a charged battery the central station furnishes the driver with a coupon giving the miles which the charge should propel the truck, and if this mileage is exceeded, a towing-in charge is made by the Hartford company for bringing back cars stalled by reason of exceeding such mileage.

Every General Vehicle car in Hartford is now using this service, and at this writing the company is handling or has on order forty-three Edison battery service trucks. Prior to the adoption of the system at Hartford only seven trucks were sold in the city in twenty months, while in the seven months following the middle of February, 1912, when the company's plans became known, fifteen trucks were

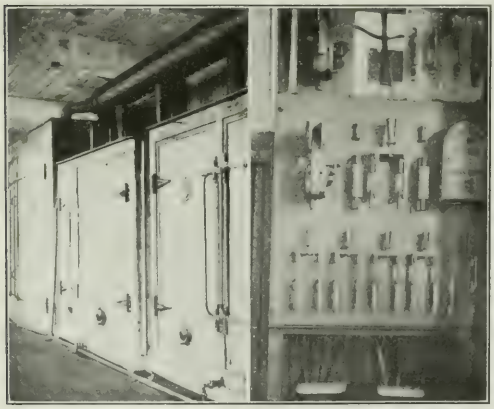


FIG. 2—ELECTRIC JAPANNING OVENS, GRAY TELEPHONE PAY STATION COMPANY, HARTFORD, CONN.



FIG. 3—SWITCHBOARD CONTROLLING JAPANNING OVENS, GRAY TELEPHONE PAY STATION COMPANY, HARTFORD, CONN.

purchased in the company's territory. The sliding scale of rates per mile promotes satisfaction to both the central station and the consumer, because any reduction in the rate which the consumer enjoys produces long-hour use of the truck per day, which is what the central station desires. Eighty-two per cent of the present users of the Edison battery service system operated gasoline trucks and delivery wagons prior to the adoption of electricity.

Among the records kept at the central battery station are a daily report of battery charges in vehicles, with battery and car numbers, odometer readings and mileage data, with the charging rate of batteries. A daily battery exchange record is kept, showing the car number, odometer reading, battery number, mileage and charging data for each battery put in and taken out of a truck. A monthly operating record is kept, in which the detailed handling of each battery on each day is tabulated with full particulars of charging rates, energy input, mileage and unit ampere-hour demands, labor, material and power costs. Another similar record carried through on a monthly tabulation gives the mileage, charging and trouble record of each vehicle by days, with a space on the reverse side for inspection entries.

### Results Obtained in Practice

Among the users of this service are the firm of Downing & Perkins, teamsters, freight handlers and transfer men. In a recent interview a member of this firm stated that as compared with the capactiy of a 1-ton team, with a single horse, the 1-ton electric truck shows an efficiency of three to one. He pointed out that the peace of mind resulting from the use of a truck in place of horse traction is worth about half the initial cost of the vehicle, and emphasizes the capabilities of the electric vehicle in turning otherwise unprofitable orders into desirable ones through the saving in time of delivery effected. This firm is one of the best authorities on horse service in Hartford and has found that the use of a 1-ton electric truck since last August enables one spare horse to be eliminated, besides increasing the efficiency of the remaining horses in the establishment, since these now get the shorter hauls and the lighter loads in express service, which are most favorable to the best usage of the remaining equipment in the establishment. The truck has frequently performed work in two or three hours which would require all day with horse traction. The estimated yearly cost of operation of this truck, based upon the owner's experience, is as follows, the first cost of the car being $2,025:

| | |
|---|---|
| Interest at 5 per cent | $101.00 |
| Depreciation at 10 per cent | 202.50 |
| Maintenance at 10 per cent | 202.50 |
| Tires, 10,000 miles yearly | 175.00 |
| Liability insurance | 110.00 |
| Taxes at 2 per cent | 40.50 |
| Garage charges | 120.00 |
| Edison battery service of Hartford Electric Light Company | 252.00 |
| Drivers' wages | 700.00 |
| Total | $1,903.75 |

This shows a daily cost of $6.34 based on 300 working days per year. The truck averages daily earnings of $10.50, showing a margin of over $4 per day. The truck will pay for itself at this rate inside of two years. During the Christmas season the truck was used all day in the regular freight business of the firm and at night was utilized in collecting mail from street boxes, simply by the substitution of a second battery at the battery station on State Street. A record of 66 miles in a single day was made by the truck, despite the snowy weather then prevailing.

The department store of Wise, Smith & Company operates four trucks of from 750-lb. to 2000-lb. capacity in its delivery service. The 750-lb. wagon recently ran 536 miles in one week, displacing six horses in this work and taking the place of two regular routes and one special delivery route. The 2000-lb. wagon makes 30 miles a day in furniture delivery. Other large users are the Boston Branch Grocery, the Eagle Dye Works, the Sage & Allen department store and the grocery house of Tucker & Goodwin In five months' operation the Eagle Dye Works averaged 45 miles per working day per car. The total number of electric commercial cars in service in the company's territory is now 45, and of electric pleasure cars, 300.

### Codification of Electric Rates

The codification of the company's rates became effective on Dec. 1 last and is of particular interest on account of the encouragement which the various prices give to the cultivation of desirable classes of service. The rates automatically give the customer the benefit of long-hour use of energy and present graduated scales for wholesale service for lamps and motors, with reductions for succeeding blocks of energy, together with substantial decreases for long hour lighting. The maximum rate is 9 cents per kw-hr.

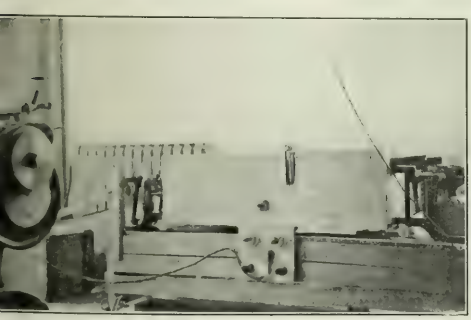
Energy for residence lighting is offered on a meter rate of 9 cents per kw-hr., less 5 per cent discount for payment within ten days, or, upon the option of the customer upon a flat-rate contract of one year's minimum service for low-voltage tungsten lighting. The flat-rate schedule i

per month for ten 10-cp lamps, each additional 10-cp mp being billed at 6 cents per month, or $1.50 per month r ten 20-cp lamps, with a charge of 12 cents per month r each additional 20-cp unit. In each case a 5 per cent scount for prompt payment is in force. The low-voltage mps are supplied at about 58 volts, and the company had ,816 low-voltage lamps on its circuits on March 1 last. The wholesale lighting rates at Hartford are 9 cents per w-hr. for the first 500 units, 7 cents for any part of the xt 1000 kw-hr., 4 cents for the next 2500, 3.5 cents for e next 6000, and 2.5 cents for all energy in excess of ove. Under this contract discounts are allowed varying om 35 per cent for over 350 hours' use of the installed ad per month to 2 per cent for over 100 hours' use, with further 5 per cent discount for punctual payment. This te enables the customer to increase his consumption subantially through long-hour usage, as illustrated by the folwing typical bills: The net bill of a customer, including e 5 per cent discount, for 10 kw of lamps installed and a eter reading of 1200 kw-hr. amounts to $84.60, or 7.05

SCHEDULE OF PRICES FOR BATTERY INTERCHANGE SYSTEM

| Truck apacity | Fixed Charge, Monthly | Rates per Mile in Cents | | | | |
|---|---|---|---|---|---|---|
| | | 0–500 | Next 250 | Next 250 | Excess of 750 Miles | Excess of 1000 Miles |
| 750-lb. | $15 | 2½ | 2¼ | 2 | . . | 1½ |
| ½-ton | 20 | 3 | 2½ | 2¼ | . | 2 |
| 1-ton | 30 | 3½ | 3 | 2½ | . | 2 |
| 2-ton | 40 | 4½ | 4 | 3½ | . . | 3 |
| 3½-ton | 50 | 6 | 5 | . . | 3 | . . |
| 5-ton | 60 | 7 | 6 | | 4 | . . . |

nts per kw-hr. If he were to use 2400 kw-hr. or twice much energy with the same installation, the net bill ould be $107.40, or at a rate of 4.47 cents per kw-hr. The rates for motor service are 4.5 cents per kw-hr. for e first 500 units used, with discounts down to a minimum 1.3 cents per kw-hr. for all energy used in excess of ,000 kw-hr. Energy used directly or indirectly for lightg is metered separately, but when in any month the energy



G. 4—ELECTRIC EMBOSSING MACHINE, CAMEO EMBOSSING & PRINTING COMPANY, HARTFORD, CONN.

ed for motors exceeds 90 per cent of the total, the amount energy used for lighting is included with that for motors d the total is billed at motor-service rates. In order to courage the use of energy at night, any customer conacting for energy upon either the motor or the cooking hedule, upon a guarantee of a minimum payment of $20 r month for his night service, is allowed a discount of 40 r cent on such fraction of his total energy as is used beveen 10 p. m. and 7 a. m. The company installs special meters for recording this energy without extra charge, provided the demand for night motor service amounts to at least 10 per cent of the total. The night meter on the motor load is automatically cut in and out of circuit by a thirty-day clock movement controlling a switch in series with the meter potential coil.

### Low Rates for Electric Heating Service

The company furnishes energy for operating electric heating and cooking apparatus upon a contract rate of 3

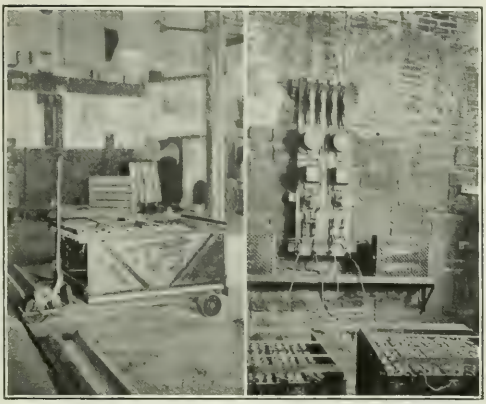


FIG. 5—BATTERY ON TRUCK, HARTFORD ELECTRIC LIGHT COMPANY'S STATION



FIG. 6—CHARGING PANEL, HARTFORD BATTERY SERVICE STATION

cents per kw-hr., on a guaranteed minimum payment of $1 per month. This schedule is applicable to residences, to include such other household appliances as flatirons, cleaners, etc., as may be desired in addition to the cooking apparatus under the contract rate.

Special attention is being given by the company to industrial electric-heating service, and extensive experiments are being conducted in this field in its private laboratory to determine the energy consumption and most economical methods of handling equipment under commercial conditions. The work along the lines of fireless-cooker or storage-stove service previously outlined in this journal is being continued commercially, and it is hoped to present the results at a later time. Among the representative industrial electric-heating installations on the system, that of the Gray Telephone Pay Station Company is of much interest. In the japanning department of this concern are now five electric ovens occupying a space 26 ft. long, 6 ft. wide and 7 ft. high, each having adjustable shelves and being operated between the hours of 10 p. m. and 6 a. m. on the night-power schedule. The total connected load of these ovens is 43.5 kw, the sizes ranging from 4 kw to 21 kw. All are supplied with single-phase current at 220 volts and are run at an interior temperature of about 300 deg. Fahr. The ovens are provided with from one to two 5-in. vent outlets discharging into a 14-in. trunk duct carried above the battery, but in a new installation to be made in the near future, in a new building to be occupied by the concern, it is planned to run the ovens only an hour on the vent piping when starting up, the outlets then being cut off through the operation of a time switch. It is found that with electric heating no danger of fire exists, whereas with the use of gas in this field serious results are liable to occur at any time.

The ovens are each controlled by a switch and circuit-breaker mounted upon a small switchboard in the japanning department, and an electric time switch is installed on this board to close and open the breakers at the designated hours. It is found that a better finish is given the product

of this house by the use of electric heating. All the ovens are operated on a single heat. Similar ovens are being installed for the New Departure and John Pratt companies.

Two other installations are those of the Cameo Embossing & Printing Company and the Smith-Worthington Company. The former concern has developed a machine with a connected load of about 1 kw. by which a special type

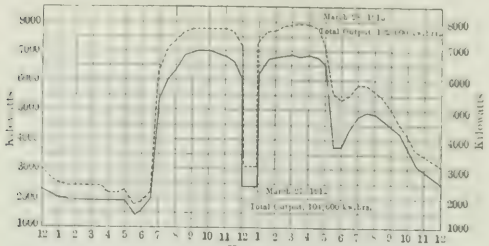



FIG. 7—LOAD CURVES OF HOUR-TO-HOUR OUTPUT

of raised printing or embossing is accomplished on cards and high-grade paper, in place of the former method of die engraving. Energy is supplied on a day-load basis, and the machine can be operated either at 2000 deg. or 500 deg. Fahr., being driven by a ⅛-hp direct-connected motor. General Electric "P" tubes are used as the heating element and the heat is applied to the ink at a stage in the process of printing which enables the product to be turned out at a much reduced cost in comparison with die engraving. In the plant of the Smith-Worthington Company, maker of saddlery, electricity is used in heating the wax thread on stitching machines. The work was formerly done by steam at 40 lb. pressure distributed through ⅛-in. copper tubing.

### Tungsten Lamp Renewal Policy

Besides renewing all carbon standard and graphitized-filament lamps free, the company now offers free renewals of 500, 400, 250, 100 and 60-watt tungsten lamps with either clear or frosted globes, provided a burned-out lamp is returned with unbroken glass, and it also renews 40-watt and 25-watt lamps at 15 cents and 30 cents each respectively. In making this offer the company at present restricts it to one renewal per socket per year, in order to prevent the use of such lamps in locations subject to excessive breakage. Renewals of low-voltage tungsten lamps are furnished at 10 cents each, provided burned-out lamps are returned with glass unbroken.

### Growth of Business

The accompanying load curves of the company's hour-to-hour output on March 27, 1912, and March 28, 1913, furnish a suggestive comparison of the lines of development in the utilization of electricity in its territory. The total output in the 1912 day was 104,600 kw-hr. and the maximum load 7000 kw, giving a load-factor for the day of about 61 per cent. For the 1913 date the total output was 122,600 kw-hr., a gain of over 17 per cent, and the maximum load was 7900 kw, giving a load-factor of 64.5 per cent. There was a gain in the forenoon and afternoon day loads of about 1000 kw, and the noon valley was filled to the extent of an output about 700 kw greater in the present year. A significant increase in output is that between midnight and 5 a. m., about 400 kw having been added to the demands upon the system in the ordinarily low-load period of the early morning hours. This increase is in part due to the extension of the company's industrial heating and electric-vehicle battery-charging service. It is noteworthy that the evening lighting peaks in both years were far below the day-load maxima.

The growth of the company's business has necessitated its temporary removal from its former offices, where a new five-story stone and brick building will shortly be erected for its use. The new building will cost over $200,000 and will have a frontage of 130 ft. and a depth of 100 ft. The present offices are on the opposite side of the street, and the appliance exchange of the company is on Asylum Street, a neighboring thoroughfare. The new building will house all the executive and business departments, with ample space for the exhibition and sale of appliances. In closing, data bearing upon the company's growth are suggestive. The gross receipts have increased from $345,705 in 1901 to $1,025,918 in 1912; the present per capita earnings of the system are approximately $9; the maximum net rate has been reduced from 20 cents per kw-hr. in 1901 to 9 cents at present, and the income from residential lighting has risen from $23,437 in 1901 to $187,413 in 1912. In the last three years the lighting income (residential) has practically doubled, mainly through the introduction of flat-rate, low-voltage service. The sales of energy for motor service have increased from $81,340 in 1901 to $337,345, or $2.94 per capita, in 1912, and the total output of the generating stations has risen from 8,616,000 kw-hr. in 1901 to 36,897,000 kw-hr. in 1912. The latter output, of approximately 322 kw-hr. per capita per year, is one of the record productions of individual American central stations. The total connected motor load as of March 1 was 16,804 hp.

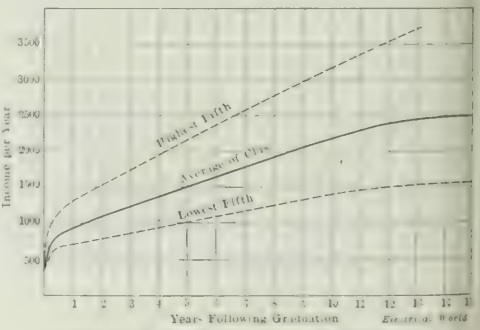
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## Incomes of Electrical Graduates

The School of Science and Technology, Pratt Institute, Brooklyn, N. Y., has just completed a detailed investigation into the incomes earned by its alumni, the results of which as concerns the graduates of its electrical department are presented in the accompanying curves, based on figures quoted by Prof. D. F. Rice, secretary.

The instruction given in the School of Science and Technology is intended for energetic, purposeful young men who have had a certain amount of preliminary training, although graduation from a high school or other equivalent preparatory institution is not required for entrance into this branch of the Institute's work.

In general, the curriculum of the Pratt technology school is of an essentially practical nature, the course continuing only two years. While the work of the school does not profess to be of an engineering grade, the industrial




INCOMES OF GRADUATES OF PRATT INSTITUTE TWO-YEAR COURSE

training administered is expected to prepare men for positions of responsibility in mechanical and electrical plants. Data were gathered from more than 1000 graduates in mechanics, electricity and chemistry, the returns showing that in general the mechanical and chemical students rise more rapidly and to better-paying positions than those in the more popular electrical courses.

# Data Concerning Incandescent-Lamp Reflectors

**Facts and figures relating to the effectiveness and efficiency of various types of incandescent-lamp reflectors. By G. H. Stickney and A. L. Powell.**

THE extensive use of the tungsten-filament lamps has brought on the market so many types and styles of reflectors that it is not a simple matter to make oper selection for particular purposes.

Eliminating the numerous designs of which selection is de principally on the basis of ornamental effect, there e a considerable number of forms making claims for ective distribution of light which may be grouped or ssified, and their general characteristics approximately scribed, without making reference to particular trade mes.

In order to obtain specific information concerning these rious forms of reflectors, sample reflectors of all known kes in the sizes intended for use with the 100-watt tung- n lamp were secured in the open market and subjected to reful examination and test. This particular size of lamp s chosen as it is the one most frequently used in general mmercial work, and also since it is a medium size, and e results obtained on this will give a general indication what can be expected of the other sizes. The photo- tric measurements were made in the illuminating engi- ering laboratory of the General Electric Company at henectady, N. Y. Since the information obtained has en found of general interest to lamp users, it has been cided to present it in this article.

## The Lamp

In order to eliminate any variations due to lamps, as small number of lamps as possible was used, and these were refully checked for rating and with each other. All flectors were tested with 100-watt clear tungsten lamps, d those frequently used with bowl-frosted lamps were ted with similar lamps with the standard bowl frosting. e tests were actually run with lamps operated at 1.18 tts per mean horizontal candle-power (clear). Since t time the standard rating of the 100-watt lamp has been anged to 1.08 watts per mean horizontal candle-power. order to make the data as general as possible and most sily convertible for other ratings, all the values have been rrected to correspond to a specific consumption of 1 watt

BLE I—ILLUMINATION VALUES—100-WATT TUNGSTEN AMP (WITHOUT REFLECTOR) OPERATED AT 1 WATT PER MEAN HORIZONTAL CANDLE-POWER

| | Clear | Bowl-Frosted |
|---|---|---|
| an lower hemispherical candle-power | 83.5 | 59.5 |
| an spherical candle-power | 79.5 | 75. |
| mens in 0–60 deg. zone | 209.0 | 163 |
| ward lumens (0–90 deg. zone) | 524.0 | 7 |
| l lumens (0–180 deg. zone) | 999.0 | 48 |

r mean horizontal candle-power. Since this does not olve any change in characteristic distribution, the lues simply vary inversely with the ratio of specific con- mption.

In comparing the values given in the following tables th other figures, or in comparing different makes of reflectors, it is necessary to refer them to the same basis of lamp efficiency, in order to obtain a fair relation.

The corrected values for the lamps used in the test are given in Table I.

## Classification of Reflectors

The commercial types of reflectors may be divided into two main groups, namely, metal and glass. These may be further classified as to composition, shape and finish as follows:

*Metal Reflectors.*—Shapes: Flat dome; radially fluted; bowl; angle. Finish: Porcelain (fire) enamel; aluminum; paint enamel (baked or air-dried).

*Glass Reflectors.*—Kinds of glass: Opalescent; clear (prismatic). Types of opalescent: "Alba" type; opal; cased. Types of prismatic: Class A, accurate prisms; class B, inaccurate prisms. Method of forming: Blown; pressed.

## Metal Reflectors

Metal reflectors, or, as they are sometimes designated from their principal use, "industrial reflectors," are usually made of steel formed into shape by stamping or spinning, or a combination of the two. Stamping requires expensive dies and hence is commercially practicable only where a large number of reflectors can be stamped at one time. With deep reflectors several sets of dies may be required to draw them into shape.

Porcelain enameling consists of applying what is practically opal glass to the surface. A fusing heat is required. In the better types two or three coats are applied. As this is a rather difficult process, requiring considerable care to produce an even finish and avoid cracks, there is a wide variation among commercial reflectors of different makes. Good heavy enameling appears white or a trifle yellow. A bluish appearance is generally due to the base metal showing through a thin coating of enamel, and it usually means a slightly less efficient reflector on this account.

Brittle enamel should be avoided, as well as too light a metal stock, or else the finish may crack off. In reflectors exposed to moisture, vapor or fumes it is especially essential that all cracks in the enamel (at edges or joints) be covered, otherwise corrosion of the metal is liable to occur, followed by the chipping off of the enamel.

The enamel surface acts principally by diffuse reflection, so that a concentrated distribution cannot be secured without excessive loss of light, although a certain degree of concentration can be secured by the use of a large reflector.

The important advantages of the porcelain enamel are:

(1) It does not readily accumulate dirt and dust, on account of the smooth, glazed surface.

(2) It is easily cleaned. Soap and water, or even a wet cloth, will readily restore the bright, clean surface, even though it has become greasy and soiled from being handled by workmen.

(3) It resists acid fumes and moisture. Unless the finish is cracked, ordinary acid fumes will not have any deteriorating effects. It can be exposed to the weather without injury.

(4) It resists heat. It is not blistered, discolored or in any way affected by ordinary heat such as may emanate from the lamp.

(5) It has no inherent depreciation. An old reflector becomes as efficient as a new one simply by cleaning.

Paint enamel costs considerably less than the porcelain and, when new, is about as effective. However, as it accumulates dust more readily, is not so easily cleaned and will not withstand exposure to moisture, this finish is being used less and less for industrial lighting.

*Aluminum Finish.*—The aluminum finish is painted or sprayed on the under surface of the reflector, spinning the reflector meanwhile to distribute the paint evenly. The outer surface is then painted with some colored paint.

With the aluminium interior finish it is possible to vary the photometric curve through a wide range. If the finish is not good, there is deterioration through the wearing of the surface in cleaning and the embedding of small dust particles in the pores of the metal. In one make now on the market a coat of lacquer is given to the interior after applying the aluminum finish. This coating closes the pores and gives a smooth, hard surface.

*Flat-Dome Type (Porcelain-Enamel Finish.)*—These reflectors give a so-called distributive, or wide-angle, type of distribution and are well adapted for use where the spacing is comparatively wide and where general or local-

TABLE II—ILLUMINATION VALUES—FLAT-DOME-TYPE REFLECTOR, PORCELAIN-ENAMEL FINISH. LAMPS AS PER TABLE I. TEST OF TEN REFLECTORS OF SEVEN DIFFERENT MAKES

| | Clear Lamp | | | Bowl-Frosted | | |
|---|---|---|---|---|---|---|
| | Avg. | Max. | Min. | Avg. | Max. | Min. |
| Mean lower hemispherical cp. | 123 | 133.5 | 111 | 114 | 119 | 98.6 |
| Mean spherical cp. | 65 | 72 | 55.4 | 59 | 66 | 49.3 |
| Decrease in mean spherical cp over lamp without reflector, per cent. | 18 | 9 | 30 | 21 | 11 | 34 |
| Lumens in 0–60 deg. zone | 479 | 571 | 408 | 440 | 508 | 380 |
| Downward lumens (0–90 deg. zone) | 785 | 839 | 697 | 715 | 753 | 619 |
| Total lumens (0–180 deg. zone) | 820 | 888 | 697 | 741 | 840 | 619 |
| Weight in ounces | 38½ | 55 | 30 | | | |
| Diameter in inches | 15¼ | 20 | 12 | | | |

ized general illumination is required. The maximum candle-power of the reflectors tested is found between the angles of 40 deg. and 60 deg. and is approximately constant throughout the zone. The downward candle-power is increased by using a larger-diameter reflector. Selection is often determined by a compromise between the cost of reflector and the illuminating efficiency. The lumens in the 0 deg. to 60 deg. zone are increased by using a reflector with the edge bent downward, approaching the bowl shape.

*Flat-Dome Type (Aluminum Finish).*—These reflectors, acting by spread reflection, can be made to give a number of types of distribution, but, as usually made, they are very shallow, so that there is liability of producing excessive glare, particularly where the units are hung low.

*Radial Fluted Type (Porcelain-Enamel Finish).*—These give a very wide angle of distribution and are well suited for street or yard lighting, or for use in interiors on low suspension and very wide spacing where high intrinsic brilliancy is not objectionable. The maximum candle-power is at 75 deg., and a little light is allowed to escape above the horizontal to light the surrounding buildings at a low intensity—a desirable condition in street illumination. As with the flat-dome type, the larger the reflector the greater the mean candle-power below the horizontal, for rays in a greater angle are intercepted.

*Bowl Type (Porcelain-Enamel Finish.)*—The light distribution is extensive (its maximum being at 45 deg.) and serves well for general illumination, with reasonably high hanging and moderate spacing or localized general illumination. Intensive distribution can be obtained by using a relatively large reflector with a given lamp.

The bowl type, while not as efficient with regard to total lumens as the wider reflectors, has the great advantage that the lamp is hidden, thus shielding the eyes from glare. The

TABLE III — ILLUMINATION VALUES — RADIAL-FLUTED-TYPE METAL REFLECTOR, PORCELAIN-ENAMEL FINISH. LAMPS AS PER TABLE I. TESTS OF TWO REFLECTORS OF TWO DIFFERENT MAKES

| | Clear | | |
|---|---|---|---|
| | Average | Maximum | Minimum |
| Mean lower hemispherical cp. | 109 | 112 | 107 |
| Mean spherical cp. | 72.8 | 75 | 70.8 |
| Decrease in spherical cp over lamp without reflector, per cent. | 9 | 7 | 11 |
| Lumens in 0–60 deg. zone | 339 | 347 | 330 |
| Downward lumens (0–90 deg. zone) | 688 | 702 | 673 |
| Total lumens (0–180 deg. zone) | 913 | 936 | 896 |
| Weight in ounces | 40 | 48 | 32 |
| Diameter in inches | 18 | 20 | 16 |

maximum candle-power varies with the type of distribution.

*Bowl Type (Aluminum Finish).*—Acting by spread reflection, characteristic extensive, intensive and focusing distributions can be obtained, depending on the shape and position of the reflector. With extensive or intensive distribution, this class is applicable for localized general or general illumination, or, with the more concentrating curves, it is applicable for local lighting and has the advantage of the bowl type. The maximum candle-power is found at angles from 0 deg. to 45 deg., depending on the shape. No one curve is characteristic of the group. One reflector having a maximum efficiency in desired angles may be better adapted for the case in hand, although another may have a higher over-all efficiency.

TABLE IV—ILLUMINATION VALUES—BOWL-TYPE METAL REFLECTOR, PORCELAIN-ENAMEL FINISH. LAMPS AS PER TABLE I. TEST OF FOUR REFLECTORS OF FOUR DIFFERENT MAKES

| | Clear Lamp | | | Bowl-Frosted | | |
|---|---|---|---|---|---|---|
| | Avg. | Max. | Min. | Avg. | Max. | Min. |
| Mean lower hemispherical cp. | 95.4 | 101.5 | 91.3 | 80.5 | 81.8 | 69.2 |
| Mean spherical cp. | 47.6 | 50.6 | 45.6 | 40.2 | 41.0 | 34.7 |
| Decrease in spherical cp over lamp without reflector, per cent | 40 | 36 | 42 | 56 | 55 | 58 |
| Lumens in 0–60 deg. zone | 510 | 528 | 503 | 441 | 453 | 420 |
| Downward lumens (0–90 deg. zone) | 600 | 658 | 574 | 506 | 516 | 497 |
| Total lumens (0–180 deg. zone) | 600 | 638 | 574 | 506 | 516 | 497 |
| Weight in ounces | 22 | 33 | 13 | | | |
| Diameter in inches | 8½ | 9 | 8½ | | | |

*Angle Reflectors.*—Bowl-shaped industrial steel reflectors, aluminum and porcelain finish, are available with the holder or socket set at various angles, giving asymmetrical light distributions. In the smaller sizes this class finds application in localized machine lighting, art-gallery lighting, stage lighting, etc., and in the larger sizes it is suitable for tennis or athletic court lighting, as well as foundry and

o lighting, the units being located at the side below the ne tracks. Owing to the asymmetrical distribution the formance is not readily expressed in tabulated data.

### Glass Reflectors

here are two general methods in the manufacture of s reflectors, the blown and the pressed. The blown re- tor is of even thickness throughout, as the glass is

LE V—ILLUMINATION VALUES—BOWL-TYPE METAL RE- FLECTORS, ALUMINUM FINISH, EXTENSIVE, INTENSIVE AND FOCUSING DISTRIBUTIONS. LAMPS AS PER TABLE I. TESTS OF FOUR REFLECTORS OF THREE DIFFERENT MAKES

| | Clear Lamp | | | Bowl-Frosted | | |
|---|---|---|---|---|---|---|
| | Avg. | Max. | Min. | Avg. | Max. | Min. |
| n lower hemispherical cp. | 90.6 | 102 | 75.8 | 84.5 | 97 | 63.1 |
| n spherical cp | 45.3 | 51.3 | 37.9 | 41.8 | 49.3 | 31.6 |
| ease in mean spherical cp er lamp without reflector, r cent | 43 | 35 | 52 | 44 | 34 | 58 |
| ens in 0—60 deg. zone | 490 | 585 | 376 | 460 | 550 | 328 |
| nward lumens (0—90 deg ne) | 570 | 645 | 475 | 525 | 610 | 397 |
| l lumens (0—180 deg. zone) | 570 | 645 | 475 | 525 | 610 | 397 |
| ght in ounces | 11½ | 13 | 11 | | | |
| neter in inches | 8½ | 9 | 7 | | | |

nly distributed over the surface of the mold, and the er surface has the same convolutions as the outer. The er surface of the pressed reflector is smooth, taking the pe of the plunger, while the exterior follows the outline he mold. In general, the blown reflector is thinner and ce lighter in weight. The glass in the blown reflectors st be quite dense, or else roughened on one or both sur- es, in order to produce good diffusion. If these require- nts are not fulfilled, the ridges and hollows are light and k, owing to the thinness of the glass, and the reflector s not present an attractive appearance. The pressed ector, with its greater thickness, can use a lighter den-

LE VI—ILLUMINATION VALUES—BOWL-SHAPE, OPALESCENT- GLASS REFLECTORS, "ALBA" TYPE GLASS (PRESSED). LAMPS AS PER TABLE I. TEST OF FIFTEEN RE- FLECTORS OF ELEVEN DIFFERENT MAKES

| | Clear Lamp | | | Bowl-Frosted | | |
|---|---|---|---|---|---|---|
| | Avg. | Max. | Min. | Avg. | Max | Min |
| n lower hemispherical cp | 86.2 | 95.5 | 75.8 | 77 | 85.6 | 67.8 |
| n spherical cp | 72 | 74.8 | 65.1 | 67.0 | 70.0 | 61.7 |
| ease in mean spherical cp er bare lamp, per cent | 9.3 | 6 | 18 | 10.5 | 7 | 18 |
| ens flux in 0—60 deg. zone | 358 | 416 | 288 | 315 | 378 | 246 |
| nward lumens (0—90 deg ne) | 543 | 600 | 477 | 480 | 538 | 426 |
| l lumens (0—180 deg. zone) | 906 | 940 | 815 | 842 | 876 | 775 |
| ght in ounces | 38.5 | 49 | 30 | | | |
| neter in inches | 8⅛ | 7½ | 8¼ | | | |

glass yet have good diffusion and be evenly lighted hout a roughed surface.

An excellent description of the methods of manufacture glass reflectors was given in a paper by Mr. E. H. Bos- , entitled "The Manufacture of Glass for Illuminating poses," published in the *Transactions* of the Illuminat- Engineers' Society, 1911.

### Opalescent or White-Glass Reflectors

If their interior surface is polished or in its natural state, there is considerable direct reflection from white-glass reflectors. If the interior surface is depolished, little variation is produced in the light-distribution curve by changing the shape of the reflector. The light reflected comes from three sources: (1) the glazed interior surface; (2) the opal particles in the body of the glass; (3) the outer surface, after passing through the body and striking at less than the critical angle.

TABLE VII—ILLUMINATION VALUES—FLARED-SHAPE OPAL- ESCENT-GLASS REFLECTORS, "ALBA" TYPE GLASS (PRESSED). LAMPS AS PER TABLE I. TEST OF TEN REFLECTORS OF TEN DIFFERENT MAKES

| | Clear Lamp | | | Bowl-Frosted | | |
|---|---|---|---|---|---|---|
| | Avg. | Max | Min. | Avg. | Max. | Min. |
| Mean lower hemispherical cp | 100 | 109 | 94.5 | 93 | 99.6 | 87.8 |
| Mean spherical cp | 72.8 | 77.5 | 68.1 | 70.2 | 73.3 | 67.1 |
| Decrease in mean spherical cp over bare lamp, per cent | 8 | 3 | 14 | 6.2 | 2 | 10 |
| Lumens flux in 0—60 deg. zone | 363 | 418 | 331 | 326 | 366 | 295 |
| Downward lumens (0—90 deg. zone) | 626 | 684 | 582 | 584 | 628 | 551 |
| Total lumens (0—180 deg. zone) | 915 | 972 | 856 | 880 | 918 | 844 |
| Weight in ounces | 47 | 54 | 37 | | | |
| Diameter in inches | 11 | 11 | 11 | | | |

The opalescent reflector is exploited in two principal shapes, bowls and flared. The bowl is made in numerous contours, but the flared reflectors made by the different manufacturers approximate very closely to a standard. An intermediate shape is listed by some of the manufacturers, known as the "semi-flared." As to size, the various companies follow very closely in one another's footsteps. For example, the 100-watt bowl-shape, opalescent reflector is almost always about 8 in. in maximum diameter, and the flare-shape for the same size lamp is 11 in. in diameter.

The bowl type is to be preferred for most uses in that it covers a larger portion of the lamp, so that the filament is

TABLE VIII—ILLUMINATION VALUES—BOWL-SHAPE, OPAL- ESCENT-GLASS REFLECTORS, OPAL GLASS (PRESSED AND BLOWN). LAMPS AS PER TABLE I. TEST OF THIR- TEEN REFLECTORS OF TEN DIFFERENT MAKES

| | Clear Lamp | | | Bowl-Frosted | | |
|---|---|---|---|---|---|---|
| | Avg. | Max. | Min. | Avg. | Max. | Min |
| Mean lower hemispherical cp | 95.8 | 114 | 82 | 84.5 | 107 | 71.6 |
| Mean spherical cp | 65.3 | 73 | 55 | 59.5 | 64.5 | 54.3 |
| Decrease in mean spherical cp over bare lamp, per cent | 18.7 | 9 | 31 | 21.2 | 15 | 32 |
| Lumens 0—60 deg. zone | 430 | 535 | 372 | 377 | 493 | 283 |
| Downward lumens (0—90 deg zone) | 600 | 720 | 513 | 478 | 673 | 448 |
| Total lumens (0—180 deg. zone) | 806 | 907 | 681 | 748 | 800 | 678 |
| Weight in ounces | 21½ | 33 | 13 | | | |
| Diameter in inches | 7.8 | 8 | 6¾ | | | |

not visible at quite so flat an angle as with the flared type. This class of reflector is not so efficient as a mirror or other opaque reflector. They are suitable for use in places where decoration and some upward light are of more importance. Practically none of these reflectors has a smooth exterior surface, all being broken by a number of small prisms or convolutions which are for purely decorative

purposes and have nothing to do with the illuminating efficiency. With almost all of the opalescent reflectors quite a percentage of the total light flux is in the upper hemisphere and serves to illuminate the side walls and ceiling.

### "Alba" Type Glass

The distinction between the so-called "Alba" type glass and other opal glass is that the latter appears homogeneous,

TABLE IX—ILLUMINATION VALUES—FLARED-SHAPE, OPALESCENT-GLASS REFLECTORS, OPAL GLASS (PRESSED AND BLOWN). LAMPS AS PER TABLE I. TEST OF NINE REFLECTORS OF EIGHT DIFFERENT MAKES

| | Clear Lamp | | | Bowl-Frosted | | |
|---|---|---|---|---|---|---|
| | Avg. | Max. | Min. | Avg. | Max. | Min. |
| Mean lower hemispherical cp | 111 | 133 | 101 | 100 | 119.5 | 94.3 |
| Mean spherical cp | 68.4 | 72.9 | 64.1 | 63.3 | 67.6 | 61.5 |
| Decrease in mean spherical cp over bare lamp, per cent. | 14 | 9 | 19 | 15.6 | 10 | 18 |
| Lumens in 0–60 deg. zone | 428 | 518 | 387 | 392 | 478 | 332 |
| Downward lumens (0–90 deg. zone) | 696 | 856 | 630 | 629 | 750 | 568 |
| Total lumens (0–180 deg. zone) | 872 | 919 | 805 | 795 | 850 | 773 |
| Weight in ounces | 30½ | 45 | 20 | | | |
| Diameter in inches | 11 | 11½ | 10 | | | |

while the former appears to have innumerable opaque, white particles suspended in clear glass. This glass is employed in several makes of pressed reflectors. The glass in these reflectors is usually quite thick and hence the weight is fairly high. The light diffusion is good, varying as it does almost directly as the thickness of the glass. Absorption is moderate, as is also the reflective power. There is no selective absorption; that is, the color of the light transmitted through the glass is the same as that from the light source. None of the specimens tested had rough surfaces, and hence they were easy to clean.

The distribution of light with the bowl shape is, in general, a mean between that of the extensive and the intensive, the bowl frosting on the lamp tending to concentrate

TABLE X—ILLUMINATION VALUES—LOW-SHAPE, OPALESCENT-GLASS REFLECTORS, CASED GLASS (BLOWN). LAMPS AS PER TABLE I. TEST OF THREE REFLECTORS OF THREE MAKES

| | Clear Lamp | | | Bowl-Frosted | | |
|---|---|---|---|---|---|---|
| | Avg. | Max. | Min. | Avg. | Max. | Min. |
| Mean lower hemispherical cp | 88.1 | 90 | 83 | 78.3 | 85.6 | 72.8 |
| Mean spherical cp | 69 | 73 | 61 | 63.8 | 68.2 | 56.4 |
| Decrease in mean spherical cp over bare lamp, per cent | 23 | 18 | 23 | 14.7 | 9 | 21 |
| Lumens in 0–60 deg. zone | 417 | 510 | 338 | 338 | 417 | 283 |
| Downward lumens (0–90 deg. zone) | 603 | 721 | 490 | 537 | 450 | |
| Total lumens (0–180 deg. zone) | 844 | 923 | 766 | 695 | 845 | 705 |
| Weight in ounces | 21 | 23 | 18 | | | |
| Diameter in inches | 8 | 8 | 8 | | | |

the flux. The flared type gives a light distribution which is widely extensive.

### Opal Glass of Varying Densities

This glass is employed in both blown and pressed commercial reflectors. In opal glass the white particles are so small as to be invisible to the naked eye, and hence it has the appearance of uniform whiteness.

The pressed reflectors are invariably thicker than the blown reflectors. With the denser opals diffusion is good and the absorption is quite high. The reflective power is good. Most of the specimens examined absorbed light selectively from the blue end of the spectrum; that is, the transmitted light appears more yellow or red than that from the source. On some of the reflectors the interior surface was roughed to aid diffusion. In many of the light-

TABLE XI—ILLUMINATION VALUES—FLARED-SHAPE, OPALESCENT-GLASS REFLECTORS, CASED GLASS (BLOWN). LAMPS AS PER TABLE I. TEST OF TWO REFLECTORS OF TWO MAKES

| | Clear Lamp | | | Bowl-Frosted | | |
|---|---|---|---|---|---|---|
| | Avg. | Max. | Min. | Avg. | Max. | Min. |
| Mean lower hemispherical cp. | 105 | 116 | 93.7 | 98.0 | 104.5 | 81.5 |
| Mean spherical cp | 72.3 | 72.3 | 72.3 | 67.0 | 67.5 | 66.5 |
| Decrease in mean spherical cp over bare lamp, per cent | 9 | 9 | 9 | 11 | 10 | 12 |
| Lumens in 0–60 deg. zone | 415 | 465 | 364 | 356 | 402 | 312 |
| Downward lumens (0–90 deg. zone) | 655 | 723 | 587 | 581 | 653 | 512 |
| Total lumens (0–180 deg. zone) | 910 | 910 | 910 | 841 | 847 | 835 |
| Weight in ounces | 39.5 | 41 | 38 | | | |
| Diameter in inches | 11 | 11 | 11 | | | |

density opals the diffusion is poor. The downward candlepower and the value of the 0—60 deg. lumens are usually greater than with the "Alba" type glass. The bowl shape gives an extensive curve, while the flared type distributes the light over a wide angle.

### Cased, Plated, Flashed or "Alabaster" Glasses

In making this type of glass, which is commercially employed in a number of blown reflectors, the workman gathers upon his pipe first a small quantity of white or colored glass and afterward the needed quantity of crystal. When the article is blown there is very evenly applied on the inside a flash or film of the white glass. The glass is thin and the weight low; the diffusion is excellent; the reflective

TABLE XII—ILLUMINATION VALUES—LOW-SHAPE, CRYSTAL PRISMATIC-GLASS REFLECTORS, ACCURATE PRISMS (PRESSED). LAMPS AS PER TABLE I. TEST OF FOUR REFLECTORS OF VARIOUS DISTRIBUTIONS; ONE MAKE

| | Clear Lamp | | | Bowl-Frosted | | |
|---|---|---|---|---|---|---|
| | Avg. | Max. | Min. | Avg. | Max. | Min. |
| Mean lower hemispherical cp. | 114 | 117 | 111 | 104 | 108 | 99 |
| Mean spherical cp. | 72.3 | 73.6 | 70 | 67.8 | 70.2 | 65 |
| Decrease in mean spherical cp over bare lamp, per cent. | 9 | 7 | 11 | 9.5 | 5 | 12 |
| Lumens in 0–60 deg. zone | 540 | 564 | 506 | 485 | 520 | 446 |
| Downward lumens (0–90 deg. zone) | 717 | 734 | 698 | 681 | 678 | 620 |
| Total lumens (0–180 deg. zone) | 908 | 926 | 888 | 855 | 885 | 870 |
| Weight in ounces | 27 | 29 | 25 | | | |
| Diameter in inches | 9½ | 11 | 8 | | | |

power is between that of the "Alba" and the opal; the absorption is moderate and not selective. The light distribution characteristics are very similar to that of the opal-glass reflectors.

### Prismatic Reflectors

The prismatic glass reflector, while treated last in this article, really antedates all the other forms of reflectors

described, and there are probably more of this type of reflector in use to-day than of any of the other classes.

Prof. André Blondel, of Paris, was the first to apply the principle of changing the angle of light and at the same time obtaining diffusion by means of prisms. To obtain the best results each prism must be calculated with reference to the light source in its correct position. This makes desirable the use of the holder which the manufacturers recommend with a certain lamp and reflector combination. Since the prismatic reflectors act by direct reflection, any desired distribution is obtainable. One manufacturing company in America, which controls the fundamental patents, has on the market a large variety of types. A standard line, giving the distributions mentioned above, is available in all sizes of the tungsten-filament lamp. Other lines have been developed of a more decorative nature for use in residences, stores, etc. As stated, the light distributions vary widely, and these reflectors are applicable for general illumination with almost any height and spacing, or for localized lighting. For any given height and spacing the proper reflector should be chosen, and the manufacturer's engineers have prepared tables and charts showing the proper combinations.

Other companies market prismatic reflectors which may have been correctly calculated when originally designed but apparently have not been redesigned to accommodate correctly the newer forms of tungsten-filament lamps. As these reflectors act by direct reflection, the light distributions vary widely.

TABLE XIII—ILLUMINATION VALUES—BOWL-SHAPE, CRYSTAL, PRISMATIC-GLASS REFLECTOR, INACCURATE PRISMS (PRESSED). LAMPS AS PER TABLE I. TEST OF TWELVE REFLECTORS OF SEVEN MAKES

| | Clear Lamp | | | Bowl-Frosted | | |
|---|---|---|---|---|---|---|
| | Avg | Max | Min | Avg | Max | Min |
| Mean lower hemispherical cp | 94.0 | 102 | 85.2 | 81.8 | 94.5 | 72.5 |
| Mean spherical cp | 68.3 | 71.9 | 64.8 | 63 | 66.8 | 57.1 |
| Decrease in mean spherical cp over bare lamp, per cent | 14 | 10 | 18 | 16 | 11 | 24 |
| Lumens in 0—60 deg. zone | 371 | 448 | 314 | 328 | 400 | 276 |
| Downward lumens (0—90 deg zone) | 590 | 641 | 535 | 515 | 594 | 458 |
| Total lumens (0—180 deg. zone) | 760 | 905 | 814 | 793 | 840 | 717 |
| Weight in ounces | 25 | 31 | 21 | | | |
| Diameter in inches | 7½ | 8½ | 6 | | | |

In conclusion, we may briefly sum up the points to be considered in the choice of a reflector, mentioning the factors which must receive consideration. The various items here noted are arranged, as far as possible, in the order of their importance with reference to the two principal uses.

Industrial

(a) Protection of the eyes of the workmen.

(b) Efficiency.—As a rough measure of the relative efficiencies of the various reflectors, the following empirical comparison has often proved of value: Assume all the lumens in the 0—60 deg. zone and one-half the remaining lumens as useful.

(c) Distribution.—The reflector chosen should produce the desired intensity at a given spot with a certain hanging height.

(d) Strength and durability.—This naturally includes ease of cleaning and resistance to blows.

(e) Holding device.—This must be such that the reflector cannot be jarred loose.

(f) Protection of bare-metal parts.—For out-of-door use this is very important.

(g) Appearance and general workmanship.

(h) Cost.

Decorative and Semi-Decorative

(a) Prevention of the lamp filament from being in the line of vision.

(b) Appearance.—The units, both cold and lighted, should blend with the general artistic scheme and harmonize with the fixtures.

(c) Diffusion.—Lack of this quality usually results in a glaring condition and also an unattractive appearance.

(d) Efficiency.

(e) Distribution.

(f) Ease of cleaning.

(g) Weight.

(h) Cost.

## Turning Gas-Lamp Posts Into Tungsten Standards

At New Orleans good use has been made of a number of discarded gas-lamp posts by converting them into modern attractive tungsten lighting standards carrying one, two or four lamps, as desired. The old gas fixtures ended in a hollow-cone frustum carrrying the former lantern. At small cost a casting was designed to fit over this conical member, supporting in a groove on its upper edge the tungsten opal ball. Another casting with a similar base forms the central member of the double-armed fixture shown in the accompanying illustration. This may also be adapted to support four arms. After the first outlay for the patterns was met the cost of the pieces was but a few cents per pound. The two-lamp post shown above was converted by the New Orleans Railway & Light Company.



RECONSTRUCTED GAS-LAMP POST IN NEW ORLEANS PARK

# Syndicate Interests in Central Stations

**Statistical analysis of number of plants operated by holding companies or other controlling interests, and by independent owners and municipalities**

TABLES herewith give the results of an investigation recently made primarily to show the number of electrical plants owned or controlled by syndicate interests and the number owned independently. In connection with the same study the number of municipally owned plants was tabulated. The statistics were confined to towns and cities of 1000 population or over. They are divided so as to show the results separately in communities of 1000 to 5000 population, 5000 to 10,000 population, 10,000 to 50,000 population, 50,000 to 100,000 population, and over 100,000 population. The results are shown by states.

TABLE I—INDEPENDENT TOWNS BETWEEN 1000 AND 5000 POPULATION

| | Number | Population | Average |
|---|---|---|---|
| New England States | 218 | 473,129 | 2270 |
| Eastern States | 357 | 799,491 | 2239 |
| Middle States | 585 | 1,187,321 | 2029 |
| Southern States | 461 | 979,214 | 2124 |
| Western States | 321 | 660,686 | 2089 |
| Total | 1942 | 4,099,841 | 2111 |

The totals for the entire country, eliminating, of course, the communities under 1000 population, show that, out of 4774 plants, 29 per cent have syndicate affiliations, 48 per cent are independent and 23 per cent are municipal.

The data from which the figures were compiled were taken from the McGraw Electrical Directory, Poor's Manual of Industrials and Moody's Manual. The properties listed as controlled by syndicate interests are those in which there is a well-defined or widely known affiliation with an interest, usually large, that controls other similar properties. This affiliation of course has different forms. The connection may be through a holding company, an influential individual director, a common president or leading executive, or an engineering firm that is recognized as a dominant factor. The syndicate interests total 110.

Table I is reproduced to show the average population of the towns listed between 1000 and 5000 population, which is found to be 2111.

Table II shows the figures briefly, divided into groups of states. This table indicates that the largest proportion of syndicate plants is in the Eastern States with the next largest in the New England States; the Western States are third, the Middle States fourth and the Southern States fifth. The proportion of independent plants, according to the compilation, is largest in the Southern States, with the other groups of states following in the order named: New England, Western, Eastern and Middle. The percentage of municipal plants is largest in the Middle States, with the Southern States next and the Western States third.

Table III shows the detail figures of the distribution between syndicate, independent and municipal plants. It indicates that the proportion of syndicate plants becomes larger as the size of the communities increases. Thus the proportion of syndicate plants advances from 20 per cent of the total number of plants for the smallest towns in the compilation to 44 per cent in the next group, that based on the returns from communities of 5000 to 10,000 population. In the group of cities from 10,000 to 50,000 population, 63 per cent of the plants, according to the statistics, are in the hands of syndicates, while in the next larger group, based on the returns from cities of 50,000 to 100,000 population, the proportion is 84 per cent. In the cities of the largest size the proportion is 87 per cent.

Conversely, the proportion of independent plants decreases as the size of the community increases. Where the proportion of independent plants was 55 per cent of the total in the towns of 1000 to 5000 population, it decreased to 35 per cent in the towns of the next larger group with between 5000 and 10,000 population. In the group of cities of 10,000 to 50,000 population the proportion was 26 per cent. In the group of cities of 50,000 to 100,000 population the proportion was 10 per cent and it was the same in cities of the largest size.

The proportion of municipal plants decreases as the size of the community increases. Where it was 25 per cent of the total for the towns of 1000 to 5000 population it was 21 per cent in the next larger group. The proportion was 11 per cent in the cities of 10,000 to 50,000 population, 6 per cent in the next larger group and 3 per cent in the group of the largest cities.

The figures should not be taken as an indication that the service in the towns and cities listed is furnished exclusively either by a syndicate, an independent or a municipal plant. In other words, a given town or city may have a syndicate plant, one or more independent plants and a municipal plant. In such a case, the total number of the plants furnishing electrical service would be listed under the respective headings in the table.

TABLE II—CENTRAL STATIONS BY GROUPS OF STATES

| | Syndicate Control | | | Independent | | Municipal | | Total |
|---|---|---|---|---|---|---|---|---|
| | Number of Syndicates | Central Stations | Per Cent | Number | Per Cent | Number | Per Cent | |
| New England States | 6 | 224 | 40 | 288 | 50 | 55 | 10 | 562 |
| Eastern States | 5 | 385 | 43 | 433 | 47 | 91 | 10 | 909 |
| Middle States | 9 | 363 | 22 | 717 | 45 | 524 | 33 | 1604 |
| Southern States | 13 | 170 | 17 | 534 | 55 | 273 | 28 | 977 |
| Western States | 15 | 252 | 35 | 354 | 49 | 116 | 16 | 722 |
| Total | 48 | 1394 | 29 | 2321 | 48 | 1059 | 23 | 4774 |

TABLE III—ELECTRIC CENTRAL-STATION PLANTS OF THE UNITED STATES IN TOWNS AND CITIES OF MORE THAN 1000 POPULATION

| | In Cities of 1,000-5,000 Population | | | | In Cities of 5,000-10,000 Population | | | | In Cities of 10,000-50,000 Population | | | | In Cities of 50,000-100,000 Population | | | | In Cities of Over 100,000 Population | | | | Grand Total | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Syndicate Control | Independent | Municipal | Total | Syndicate Control | Independent | Municipal | Total | Syndicate Control | Independent | Municipal | Total | Syndicate Control | Independent | Municipal | Total | Syndicate Control | Independent | Municipal | Total | Syndicate Control | Independent | Municipal | Total |
| 1. Alabama | 10 | 20 | 24 | 54 | 2 | 3 | 1 | 6 | 3 | 1 | 1 | 5 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 17 | 24 | 26 | 67 |
| 2 Arizona | 3 | 6 | 0 | 9 | 4 | 1 | 0 | 5 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 7 | 0 | 16 |
| 3 Arkansas | 3 | 36 | 13 | 52 | 2 | 3 | 1 | 6 | 3 | 1 | 2 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 40 | 16 | 64 |
| 4 California | 53 | 51 | 7 | 111 | 10 | 1 | 0 | 11 | 18 | 2 | 3 | 23 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 6 | 87 | 54 | 10 | 151 |
| 5 Colorado | 15 | 19 | 4 | 38 | 5 | 2 | 0 | 7 | 3 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 24 | 21 | 4 | 49 |
| 6 Connecticut | 14 | 38 | 2 | 54 | 9 | 10 | 1 | 20 | 4 | 8 | 2 | 14 | 1 | 0 | 0 | 1 | 2 | 1 | 0 | 3 | 30 | 57 | 5 | 92 |
| 7. Delaware | 0 | 6 | 6 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 6 | 6 | 13 |
| 8 Florida | 7 | 16 | 10 | 33 | 0 | 3 | 2 | 5 | 3 | 0 | 0 | 3 | 1 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 11 | 19 | 13 | 43 |
| 9 Georgia | 4 | 24 | 44 | 74 | 3 | 2 | 9 | 14 | 5 | 2 | 0 | 7 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 14 | 30 | 53 | 97 |
| 10 Idaho | 8 | 17 | 2 | 27 | 1 | 3 | 0 | 4 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 20 | 2 | 32 |
| 11 Illinois | 73 | 109 | 54 | 236 | 21 | 16 | 4 | 41 | 23 | 3 | 3 | 29 | 5 | 0 | 0 | 5 | 1 | 0 | 0 | 1 | 123 | 128 | 61 | 312 |
| 12 Indiana | 13 | 63 | 46 | 122 | 11 | 11 | 7 | 29 | 12 | 4 | 6 | 22 | 3 | 1 | 0 | 4 | 1 | 1 | 0 | 2 | 40 | 80 | 59 | 179 |
| 13. Iowa | 7 | 91 | 39 | 137 | 1 | 8 | 1 | 10 | 13 | 4 | 1 | 18 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 22 | 103 | 41 | 166 |
| 14 Kansas | 4 | 45 | 34 | 83 | 4 | 2 | 5 | 11 | 7 | 1 | 1 | 9 | 4 | 0 | 1 | 5 | 0 | 0 | 0 | 0 | 19 | 48 | 41 | 108 |
| 15 Kentucky | 6 | 44 | 7 | 57 | 6 | 5 | 1 | 12 | 3 | 0 | 3 | 6 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 17 | 49 | 11 | 77 |
| 16 Louisiana | 0 | 16 | 14 | 30 | 0 | 2 | 4 | 6 | 3 | 2 | 2 | 7 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 4 | 20 | 20 | 44 |
| 17 Maine | 18 | 54 | 2 | 74 | 10 | 4 | 1 | 15 | 4 | 2 | 1 | 7 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 33 | 60 | 4 | 97 |
| 18 Maryland | 0 | 22 | 2 | 24 | 0 | 4 | 0 | 4 | 0 | 3 | 3 | 6 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 30 | 5 | 35 |
| 19 Massachusetts | 47 | 53 | 12 | 112 | 25 | 13 | 16 | 54 | 26 | 13 | 5 | 44 | 2 | 3 | 1 | 6 | 4 | 1 | 0 | 5 | 104 | 83 | 34 | 221 |
| 20 Michigan | 17 | 51 | 66 | 134 | 8 | 8 | 10 | 26 | 12 | 6 | 4 | 22 | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 2 | 40 | 65 | 80 | 185 |
| 21 Minnesota | 5 | 38 | 62 | 105 | 2 | 8 | 6 | 16 | 3 | 1 | 1 | 5 | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 2 | 13 | 47 | 69 | 129 |
| 22 Mississippi | 0 | 25 | 28 | 53 | 0 | 7 | 4 | 11 | 4 | 1 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 33 | 32 | 69 |
| 23 Missouri | 10 | 57 | 48 | 115 | 9 | 4 | 5 | 18 | 4 | 2 | 1 | 7 | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 2 | 26 | 63 | 54 | 143 |
| 24 Montana | 5 | 12 | 2 | 19 | 3 | 0 | 0 | 3 | 5 | 1 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 13 | 2 | 28 |
| 25 Nebraska | 4 | 39 | 23 | 66 | 3 | 4 | 2 | 9 | 2 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 10 | 44 | 25 | 79 |
| 26. Nevada | 2 | 8 | 0 | 10 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 8 | 0 | 11 |
| 27 New Hampshire | 9 | 48 | 3 | 60 | 2 | 3 | 0 | 5 | 2 | 5 | 0 | 7 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 14 | 56 | 3 | 73 |
| 28 New Jersey | 60 | 36 | 3 | 99 | 22 | 0 | 1 | 23 | 20 | 3 | 0 | 23 | 6 | 0 | 0 | 6 | 3 | 0 | 0 | 3 | 111 | 39 | 4 | 154 |
| 29 New Mexico. | 1 | 12 | 1 | 14 | 1 | 2 | 0 | 3 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 14 | 1 | 18 |
| 30 New York | 36 | 151 | 31 | 218 | 11 | 9 | 5 | 25 | 24 | 18 | 4 | 46 | 5 | 0 | 0 | 5 | 4 | 1 | 0 | 5 | 80 | 179 | 40 | 299 |
| 31 North Carolina | 7 | 21 | 25 | 53 | 2 | 4 | 9 | 15 | 5 | 2 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 27 | 37 | 78 |
| 32 North Dakota | 0 | 18 | 7 | 25 | 1 | 2 | 0 | 3 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 20 | 7 | 30 |
| 33 Ohio | 22 | 75 | 65 | 162 | 17 | 16 | 13 | 46 | 15 | 11 | 3 | 29 | 2 | 0 | 0 | 2 | 5 | 0 | 0 | 5 | 61 | 102 | 81 | 244 |
| 34 Oklahoma | 7 | 43 | 38 | 88 | 4 | 4 | 1 | 9 | 5 | 2 | 0 | 7 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 17 | 49 | 39 | 105 |
| 35 Oregon | 17 | 17 | 2 | 36 | 2 | 4 | 0 | 6 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 21 | 21 | 2 | 44 |
| 36 Pennsylvania | 107 | 142 | 20 | 269 | 12 | 21 | 11 | 71 | 36 | 14 | 4 | 54 | 5 | 2 | 0 | 7 | 3 | 0 | 1 | 4 | 163 | 179 | 86 | 428 |
| 37 Rhode Island | 14 | 1 | 0 | 15 | 7 | 0 | 0 | 7 | 6 | 1 | 0 | 7 | 1 | 1 | 0 | 2 | 1 | 0 | 0 | 1 | 29 | 2 | 0 | 31 |
| 38 South Carolina | 7 | 21 | 12 | 40 | 3 | 2 | 1 | 9 | 2 | 1 | 0 | 3 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 13 | 24 | 16 | 53 |
| 39 South Dakota | 1 | 23 | 5 | 29 | 2 | 2 | 0 | 4 | 1 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 26 | 5 | 35 |
| 40 Tennessee | 0 | 31 | 25 | 56 | 2 | 2 | 0 | 4 | 3 | 1 | 0 | 4 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 2 | 7 | 34 | 25 | 66 |
| 41 Texas | 4 | 155 | 6 | 165 | 9 | 10 | 2 | 21 | 14 | 3 | 2 | 19 | 4 | 0 | 1 | 5 | 0 | 0 | 0 | 0 | 31 | 168 | 11 | 210 |
| 42 Utah | 6 | 14 | 11 | 31 | 2 | 0 | 1 | 3 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 10 | 14 | 12 | 36 |
| 43 Vermont | 7 | 24 | 9 | 40 | 4 | 1 | 0 | 5 | 3 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 25 | 9 | 48 |
| 44 Virginia | 7 | 26 | 8 | 41 | 1 | 5 | 1 | 7 | 6 | 2 | 1 | 9 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 16 | 33 | 10 | 59 |
| 45 Washington | 23 | 30 | 3 | 56 | 3 | 1 | 1 | 5 | 5 | 0 | 0 | 5 | 1 | 0 | 0 | 1 | 2 | 0 | 1 | 3 | 34 | 31 | 5 | 70 |
| 46 West Virginia | 10 | 24 | 2 | 36 | 1 | 6 | 0 | 7 | 3 | 3 | 1 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 33 | 3 | 50 |
| 47 Wisconsin | 8 | 58 | 38 | 104 | 6 | 10 | 2 | 18 | 6 | 12 | 0 | 18 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 21 | 80 | 40 | 141 |
| 48 Wyoming | 1 | 10 | 0 | 11 | 1 | 2 | 0 | 3 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 13 | 0 | 15 |
| Total | 682 | 1942 | 868 | 3492 | 284 | 230 | 131 | 645 | 325 | 138 | 54 | 517 | 54 | 6 | 4 | 64 | 49 | 5 | 2 | 56 | 1394 | 2321 | 1059 | 4774 |
| Per cent | 20 | 55 | 25 | 100 | 44 | 35 | 21 | 100 | 63 | 26 | 11 | 100 | 84 | 10 | 6 | 100 | 87 | 10 | 3 | 100 | 29 | 48 | 23 | 100 |
| Per cent of grand total, corresponding columns | 49 | 81 | 82 | 73 | 20 | 9 | 12½ | 13 | 23 | 6 | 5 | 11 | 4 | 2 | ½ | 1½ | 4 | 2 | 0 | 1½ | | | | |
| Per cent of all plants | 14 | 41 | 18 | 73 | 6 | 4 | 3 | 13 | 7 | 3 | 1 | 11 | 1 | 0 | 0 | 1½ | 1 | 0 | 0 | 1½ | 29 | 48 | 23 | 100 |

Column "Syndicate Control" indicates those believed to be controlled by holding companies, bankers and prominent individuals or firms. "Independent" column includes plants, not municipal, which are not under syndicate control. Data obtained from McGraw's Electrical Directory, Poor's Manual of Industrials and Moody's Manual

# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## The Electric Fan in the Perfume Salesroom

It was a wise confectioner who put an electric fan in his salesroom doorway to project the appetizing odors of his shop into the street where they greeted the olfactories of the passing crowd.

Similar beneficent use of a fan is being made by a famous perfumery merchant in the French quarter of New Orleans, La. M. D. R. Constant Pichet, whose shop on Bourbon Street has for years been furnishing special scents to the aristocracy of the South, has an electric fan mounted on his counter just inside the door. Behind the fan is a perfume atomizer, and when the fugitive fragrance of the little storeroom is depleted by the strong outward draft into the street the Gallic attendant presses the atomizer bulb, once more sending sweet scents of Arcadie into the quaint old-world thoroughfare outside.

## Remedy for Electric-Vehicle Trouble

The electric trucks employed in delivering keg beer for a brewery in a northern Indiana town caused much complaint and were said to be depreciating at a rate which rendered it almost imperative for the brewery to return to the use of horse-drawn trucks. The manufacturers and central-station representatives were consulted, and the central-station man, who was a shrewd judge of human nature, suggested that a "speedograph" be put on one vehicle that a graphic record might be made showing what the truck did each day.

The instrument was installed without the knowledge of the driver, and on his return from the day's trip the speedograph record was compared with the driver's own verbal account of length of stops, speed between stops, etc. The disagreement between the verbal account and the speedograph record of the trip was surprising and exceedingly enlightening. It was found that the truck driver had been loafing and consuming the brewery's product for approximately thirty minutes at each stop and had been exceeding the speed limit and pushing the truck to its utmost capacity between stops, with absolutely no regard to road conditions or other factors which should influence a driver's judgment.

Since the dismissal of the driver who presented the false oral report it is now stated that the trucks are giving excellent service and a wonderful drop in vehicle maintenance charge has been discovered.

## A Commercial-Truck Cost Comparison

The average city should support one electric commercial truck for every 1000 of its population, declared Mr. H. W. Hillman, of the General Vehicle Company, Long Island City, N. Y., in a paper presented by him before the Macon (Ga.) convention of the Southeastern Section, N. E. L. A. The exact figure will vary somewhat with the policy of the local central station, but the methods which have been used successfully in such cities as Hartford, Conn., Vancouver, B. C., Baltimore, Md., and other places cited by the author tend to show that the saturation point will be reached somewhere in the vicinity of one truck per 1000 inhabitants. In the accompanying table, presented as a supplement to Mr. Hillman's paper, there is given a comparison of the costs of operating a 2-ton electric truck, a 2-ton gasoline truck and a two-horse wagon with one extra horse. The conditions assumed represent furniture-delivery service, the average load being about 4000 lb. with average trips of 12 miles each, the calls averaging about one to the mile. For loading, 0.7 hour per trip is allowed, with six-minute stops per call and a nine-hour working day. The data are taken from researches conducted by the Massachusetts Institute of Technology.

RELATIVE COST OF OPERATION, ELECTRIC COMMERCIAL VEHICLES

| Vehicle | 4000-Lb. Electric | 4000-Lb. Gasoline | Two-Horse Wagon, One Extra Horse |
|---|---|---|---|
| Average running speed, miles per hour | [illegible] | [illegible] | [illegible] |
| Hours per trip, standing | 1.[illegible] | 1.[illegible] | 1.[illegible] |
| Hours per trip, moving | 1.[illegible] | 1.[illegible] | 2.4 |
| Hours per trip, total | [illegible] | [illegible] | 4.[illegible] |
| Average number trips per nine-hour day | 2.[illegible] | 2.[illegible] | 2.1 |
| Miles per day | 32 | [illegible] | 25 |
| Calls per day | 32 | [illegible] | 25 |
| Days used per year | 285 | 270 | 285 |
| Vehicle-miles per year | 9100 | 9000 | 7150 |
| Calls per year | 9100 | 9000 | 7150 |
| Expense, annual: | | | |
| Tires or shoeing, etc. | $225 | $270 | $108 |
| Repairs | 260 | 550 | 125 |
| Battery | 270 | | |
| Veterinary | | | 18 |
| Lubricants | 15 | 50 | |
| Electricity, at 3 cents per kw-hr. | 200 | | |
| Gasoline, at 16 cents per gal. | | [illegible] | |
| Feed | | | 570 |
| Garage or stable | 220 | 220 | 220 |
| Driver and helper | 1140 | 1215 | 1140 |
| Depreciation | 240 | 500 | 210 |
| Interest | 84 | 97 | 81 |
| Insurance | 140 | 180 | 85 |
| Total annual expense | $2794 | $[illegible] | $2457 |
| Cost per day | [illegible] | 12.50 | [illegible] |
| Cost per call | 0.[illegible] | 0.38 | 0.[illegible] |
| Cost per mile | 0.[illegible] | [illegible] | 0.[illegible] |

SUMMARY VALUES IN CENTS PER MILE

| | Electric | Gasoline | Horse |
|---|---|---|---|
| Electricity, gasoline or feed | 2.2 | [illegible] | 8.0 |
| Maintenance | [illegible] | [illegible] | [illegible] |
| Storage, driver and helper | 14.[illegible] | [illegible] | 19.1 |
| Overhead charge | 5.1 | [illegible] | 4.0 |
| Total | 30.7 | [illegible] | [illegible] |

## Ice-Making an Ideal Adjunct

"Properly operated I believe that ice-making is an ideal adjunct to a small electric-light plant," comments an Ohio central-station man who has served as superintendent for a combination ice-electric station in a town of 4000 population. "My advice to a small company contemplating installing ice machinery would be to get an experienced and successful ice-making expert to go over the local conditions and get up plans and specifications. In building a new plant as an adjunct to an existing electric station with condensing prime-movers I would recommend installing a motor-driven compressor, employing also a raw-water system to avoid the bother of distilling, skimming, reboiling, filtering, etc."

## Prize Winner in Chicago Washing-Machine Contest

In all some 500 persons contributed replies to the washing-machine contest recently conducted by the Electric Shop, Chicago, the plan of which, as mentioned in these columns, was to offer a Federal electric washer worth $85 to the person estimating nearest the amount of saving possible in one year by the use of such an outfit.

The campaign was started by a number of newspaper advertisements which illustrated the machine and gave full details of the contest including blanks to be filled out by the contestants. Each contestant was then to write a twenty-five word article on the advantages of using an electric washing machine in the home. Circulars giving these details were handed to customers at the Electric Shop and were inclosed with bills.

Replies began to come in almost immediately, and while some estimates were entirely beyond reason, the majority showed that the matter had been carefully considered and the saving figured out upon a logical basis.

Twenty-three judges were selected from representative Chicago business men to pass on the contest. They awarded the prize to Mr. O. P. Tidd, whose estimate of savings is printed herewith. For comparison the column at the right gives the figures prepared by the judges.

At the close of the contest letters were sent to all taking part, announcing the result, thanking each contestant for his interest, and stating that a representative of the Electric




WINDOW DISPLAY ANNOUNCING CONTEST

Shop would call to thank him personally for the trouble taken. The salesman then followed these letters.

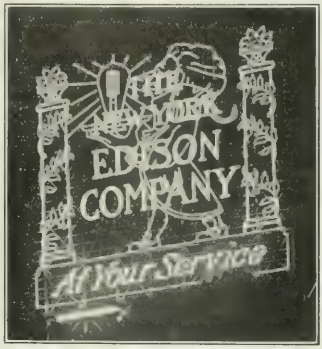
As all of the contestants were obviously already convinced of the saving to be effected by an electric washer, it was not difficult to secure orders from those who were not already using the machines. The estimates and savings and the articles submitted afford very good matter for future advertisements, and altogether the campaign proved far more successful than had been expected even by its enterprising projectors.

ESTIMATED SAVING BY USE OF WASHING MACHINE

| | Prize-Winning Estimate | Judges' Estimate |
|---|---|---|
| Wages to servants and washwomen | $63 00 | $78 00 |
| Food and carfare to servants and washwomen | 8 40 | 18 20 |
| Labor | 22 00 | 22 00 |
| Fuel | 6 30 | 6 30 |
| Soap | 4 50 | 4 50 |
| Wear and tear on clothing and materials washed | 13 50 | 13 50 |
| Tearing out buttons | 0 60 | 1 [illegible] |
| Laundry damage, such as marks of iron rust, etc. | 1 30 | 2 50 |
| Laundry losses | 2 70 | 2 75 |
| Cleaners' bills | 6 00 | 6 00 |
| Time | 37 80 | 20 20 |
| Space | 10 50 | 4 50 |
| Damage from quantities of steam in the room | 2 75 | 2 75 |
| Long boiling | 1 00 | 1 00 |
| Health | 4 20 | |
| | $184 55 | $183 87 |

## Advertising Electric Service in New York

A large flashing roof sign 50 ft. square has just been erected by the O. J. Gude Company for the New York Edison Company on the roof of the Columbia Theater building, at Forty-seventh Street and Seventh Avenue. The sign is placed diagonally across the top of the building, and from its commanding position can be seen in all parts of Long




ROOF SIGN FOR NEW YORK EDISON COMPANY

Acre and Times Squares. There are 2800 10-watt tungsten lamps used in the sign, which is lighted from approximately one-half hour after sunset to one-half hour after midnight each night. The sign combines the company's name and its trademark, the Edison man. First the Edison man is flashed and then the company's name. The effect is brilliant, and the sign as a whole is one of the most conspicuous and pleasing of the many marvelous exhibitions of the kind in that vicinity. The illustration shown herewith gives some little idea of its appearance.

## Shutting Down a 1425-kw Isolated Plant at Macon, Ga.

The comparatively new 1425-kw steam-turbine isolated plant at the Central Railroad of Georgia shops, Macon, Ga., has now been shut down, and energy to operate the 3500 hp in motors in the great shops is being furnished from



FIG. 1—1425-KW ISOLATED PLANT AT MACON SHOPS

the central-station lines of the Central Georgia Power Company, of Macon, Ga.

As shown in the accompanying illustration, the isolated-plant equipment consisted of three 440-volt, 60-cycle, three-phase Westinghouse turbo-alternator sets, of ratings re-

spectively 300 kw, 500 kw and 625 kw. There are also a 200-kw motor-generator set and a 300-kw rotary converter, used to supply direct current for the operation of a number of variable-speed motors in the machine shops. Direct current is distributed throughout the plant at 250 volts, while the standard distribution pressure for the alternating-current lines is 440 volts. The total lighting and motor connected load aggregates 3500 hp, but the load-factor observed under ordinary operating conditions is about 25 per cent.

The railroad company purchases its central-station energy at its premises at 6600 volts and provides its own transforming equipment for connection to the isolated-plant bus from which the imported energy is distributed. Under its new operating conditions the shop management thus effects a considerable saving over the former isolated-plant costs. If necessary, however, the central station reserves the right to transfer the shop load back to the railroad's plant during three months of heavy winter load, as well as at other times of heavy peak demand. As the shop boilers have to keep up steam to operate a large air compressor, relay service is always available.

Besides the varied use of motors—chiefly individual drive—in the shops, electrical energy is largely employed for welding and for building up repair parts. A special electric-welding motor-generator set has leads extended to



FIG. 2—120-TON ELECTRIC CRANE LIFTING PASSENGER LOCOMOTIVE

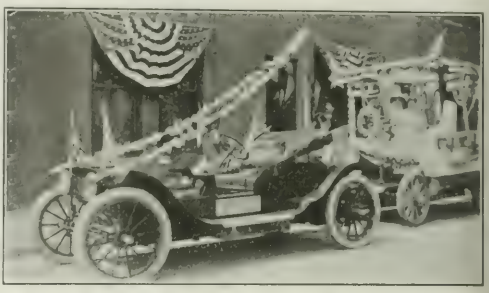
numerous plugs located in the various bays of the locomotive repair shop so that work can be done directly on any part of a dismantled engine undergoing repairs. Fig. 2 shows a 120-ton Niles electric crane transferring bodily one of the largest locomotives in use by the Central of Georgia Railroad.

## Distributing Central-Station Prizes at Summit, N. J.

One of the most attractive entries in a recent holiday parade at Summit, N. J., was the electric truck of the local "electric-service company," the Commonwealth Water & Light Company, which was accorded the first prize by the judges. The truck was decorated with tungsten-lamp emblems, bunting and flags, and on each side it carried a large lamp model built on a wooden frame with iron wire for the supports and white tape for filaments.

The feature of the traveling exhibit, however, was the distribution of prize cartons representing chances on 150 electric-appliance premiums, ranging from flatirons to lamps. From the truck were handed out 600 of these tungsten-lamp carton boxes in each of which was pasted a blank coupon like the one reproduced.

Of the total 600 slips 150 were good for premiums, and of the number returned 171 were accompanied by names and addresses of good "prospects" for either new or additional service. Each box also contained several small pamphlets, one showing the relation between increased cost of living and decreasing electric rates, while another gave the history and meaning of the word "Mazda," a booklet on



READY TO DISTRIBUTE PRIZE CARTONS AT SUMMIT, N. J.

wiring, a blotter and a return post card. It was necessary for the holder of a box to take it home over night, this making it likely that the contents would be read and that

**PREMIUM BOX NO. 398.**

Fill in your name and address and present this box at the office of the COMMONWEALTH WATER & LIGHT COMPANY, Beechwood Road and Bank Street. This box must be presented by an adult. Only one premium will be allowed in one family, living in one house. If more than one box is presented by one person, all of the boxes must be given up and not more than one premium will be allowed therefor. One box in every four draws a premium. No premium will be allowed after July 7, 1913.

Mr. .....

Town .....

Street and No. .....

the boxes would be kept off the streets. In the parade the company's electric roadster preceded the truck, as shown in the illustration.

## An Electric-Fan Estimating Contest

The attention of passers-by on Canal Sreet, New Orleans, was recently attracted by an estimating contest under way in the display window of the Consumers' Electric Light & Power Company, the purpose of the contest being to calculate how much energy a 12-in. Westinghouse electric fan would consume running fifteen hours a day for seventeen days. The fan was controlled by a time-switch which automatically turned it on and off, and its consumption was registered by a watt-hour meter whose dial was closed and sealed against inspection. The public was invited to offer estimates, and the sales staff stood ready to explain to all comers the method of calculation. A prize of $1 was offered to the contestant making the nearest estimate. At the end of the seventeenth day when the meter was opened the registration showed 6.4 kw-hr., making the cost of operating the fan, at 10 cents per kw-hr., $0.64 for the seventeen-day run. Supplementing the contest announcement was a placard explaining that such a 12-in. fan could be operated four hours per day at a cost of $0.30 per month, eight hours per day for $0.60 per month, and all night long for $0.90 per month.

# Illumination and Wiring

## Ornamental Lighting at Mattoon, Ill.

The accompanying illustration shows part of the ornamental tungsten lighting system installed at Mattoon, Ill., and operated from the lines of the Central Illinois Public

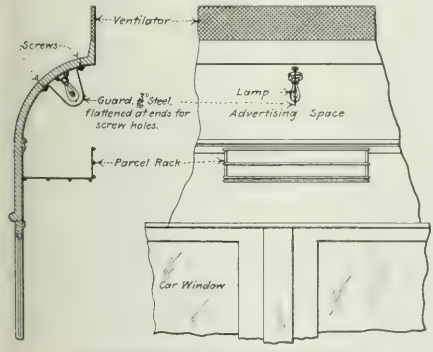


ORNAMENTAL TUNGSTEN LIGHTING AT MATTOON, ILL.

Company. At the end of the street is also seen the large new central-station sign of the Central Illinois company, showing a motor belt-connected to a pulley, the entire display having the appearance of rapid motion given to it by means of a flasher. Each of the ornamental lighting standards carries four 40-watt tungsten lamps and one 60-watt lamp. This tungsten lighting system is operated by the city of Mattoon from dusk to midnight.

## Inexpensive Lamp Guard for Interurban Cars

Following the installation of tungsten lamps on its interurban cars operating between Fort Wayne, Ind., and Lima, Ohio, the Ohio Electric Company discovered that a large



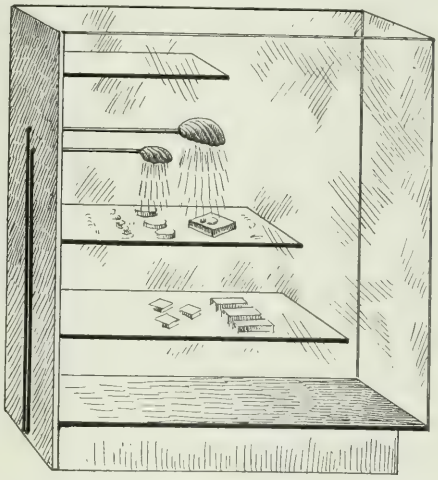

LAMP GUARD FOR INTERURBAN CARS

percentage of lamp breakage was due to the careless passenger who tossed his suitcase, grip or parcel into the parcel rack without noticing the tungsten lamp above the rack. A number of small steel rods 3/16 in. in diameter were therefore bent as shown in the illustration and flattened at each end to receive holes for the wood screws which hold them in place. These rods, when fastened to the woodwork of the car above the advertising space, protect the lamps and are said to have reduced the breakage from the above cause without in any way impairing the efficiency of the illumination or obstructing speedy lamp renewals. The cost of the guards was found to be slight in comparison with former lamp bills.

## Influencing the Curio Seekers' Choice Electrically

When the proprietor of a certain little curio shop in the city of Niagara Falls, N. Y., wishes to push the sale of any article or to emphasize the presence of any timely trinket in his showcase he does so by simply changing its position in the case. As is shown in the illustration, auxiliary illumination is furnished by 10-watt tungsten lamps supported by extension arms and shades so as to throw the full intensity of their light upon the object beneath them. Catching the eye on account of its comparatively greater illumination, the tourist's attention is immediately directed to the very article which the shrewd shopkeeper is anxious to dispose of first.

The low price of electrical energy in the Power City



INFLUENCING THE CURIO SEEKERS' CHOICE ELECTRICALLY

makes it practicable for shopkeepers to burn lamps all day as well as during the evening hours in places where illumination will increase the volume of the sales.

## An Improvised Pendent Switch

By Roger P. Heller

A pendent switch being urgently needed and none being at hand, the writer recently made use of an ordinary key socket with a rubber cord-bushing. The insulating collar and the brass shell or clamp for holding the lamp base were removed and the device was short-circuited by screwing a copper washer, about the size of a dime, under the central screw originally intended to connect with the center stud on the lamp. The open socket was then plugged with a cork of suitable size, pushed in flush, with the exposed end blackened with india-ink, after which it was treated to a coat of shellac.

This arrangement was found preferable to the ordinary push-button pendent switch, as the latter must be steadied by the fingers or the other hand, whereas the improvised switch requires only a simple twist on the key, the counterbalancing torque being met by the cord.

## Electric Vacuum Cleaner for Fishing Conduit

A Richmond (Ind.) contractor was perplexed as to how to "fish" wires through a 0.375-in. gas pipe for a newel-post lamp. The pipe had three bends in it and could not be disconnected. A friend suggested to him that he get an electric vacuum cleaner on the job. When the cleaner was brought the two men took a piece of string and made a ball of the string nearly as large as the opening in the pipe. Leaving the remainder of the string attached, they inserted the ball in one end of the pipe and put the smallest nozzle on the cleaner hose at the other end and sucked it through. The entire operation took about two minutes, and after they had a string through the pipe they were able to draw the wires after it without any further trouble. By this method they accomplished a task in less than five minutes which a man had tried to do by hand for the greater part of the previous day.

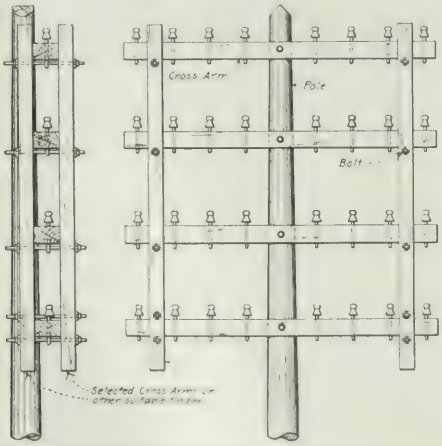
## "Safety First" Electrical Warnings

Realizing the necessity of protecting the traveling public from every-day dangers that surround them, the New York Central Railroad has adopted an effective method of accomplishing its aim. About the depots where excursion crowds collect all electrical apparatus, wiring, switch boxes and the like bear the plain white legend "Safety first" upon a black background in clear-cut stenciled letters, warning away the person with over-curious tendencies without awakening within him the childlike desire to peer into whatever is labeled "Danger" or "Keep out."

The same methods have been extended and the "Safety first" signs are to be seen in conspicuous places near railroad crossings and in other locations where warning signs are necessary.

## Temporary Cross-Arm Braces to Aid Construction Crews

Quantities of strong and vivid language are often wasted by the foremen of line gangs when they find that the cross-



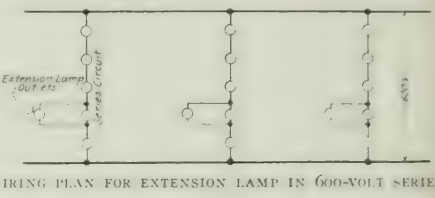

SCHEME FOR KEEPING CROSS-ARMS IN ALIGNMENT WHILE LINEMEN ARE WORKING

arms on a pole which has been used by the men for a "resting place" while pulling wires, splicing and testing are out of line when the job is finished. An Ohio foreman is saving much of his formerly wasted energy by resorting to the expedient shown in the accompanying illustration. A set of cross-arms of straight 2-in. by 4-in. pine timbers properly bored and fitted with bolts is carried as part of the construction equipment, and when it is necessary for several men to work on a pole for any considerable length of time the temporary braces are used to hold the arms in place. Ordinary 0.25-in. space bolts are found satisfactory for holding the braces to the arms.

In work of reconstruction where the old cross-arms and poles are rotted at the gains this brace is also useful.

## Wiring for Extension Lamp in 600-Volt Series Circuit

The plans for the wiring of a new railway substation called for extension outlets so arranged that five lamps

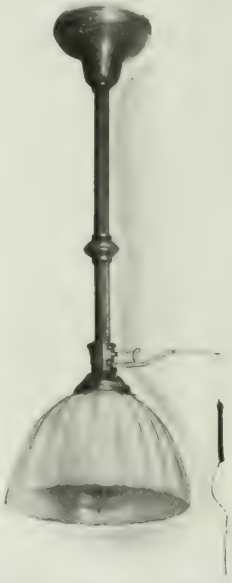



WIRING PLAN FOR EXTENSION LAMP IN 600-VOLT SERIES

would be in series across 600 volts, the fifth lamp being the portable extension outlet and the other four being stationary. The arrangement finally adopted was, therefore, to shunt duplicate outlets in parallel with the portable outlet of the regular series circuit. To operate an extension lamp at any point it is thus only necessary to plug into the desired receptacle, at the same time backing out or switching off the other lamp in multiple.

## Tungsten-Lamp Fixture with "Hamstring" Switch

Frequent campaigns for new business are undertaken by the contract department of the Commonwealth Edison Company of Chicago. One to which particular attention is being devoted at the present time relates to tungsten-lamp fixtures for stores. The fixture selected is made by the Federal Sign System (Electric) and is illustrated herewith. It is used for individual 100-watt or 150-watt tungsten lamps and is provided with a "hamstring" switch attachment as shown in the illustration.



LAMP FIXTURE WITH "HAMSTRING" SWITCH

This fixture is sold outright by the electric-service company for $3, the Alba shade being $1.50 extra. However, the fixtures can be rented also, the rate being 50 cents each per month, with maintenance, provided not less than two fixtures are installed. This rental arrangement is made on a two-year contract, and after the expiration of this contract the fixtures may be rented at 25 cents a month each, provided not less than two are used. The energy needed for the operation of the lamp is charged for, in addition, at the regular lighting rate. The fixture is made of brush brass and presents an attractive appearance.

## Construction Costs of Transmission Line Lowered by Use of Portable Concrete Mixer

With the increasing cost of high-grade wooden poles numerous expedients have been resorted to for preserving transmission-line poles at the ground line, and among the many methods which have been tried the scheme of concreting the poles to a distance of a foot or more above and

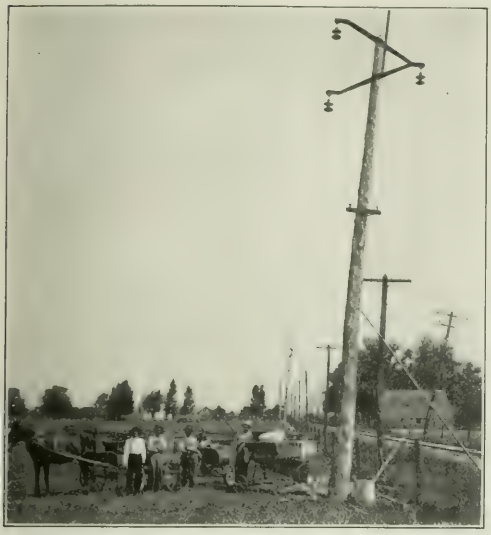


FIG. 1—CONSTRUCTION CREW WITH PORTABLE HAND-OPERATED CONCRETE MIXER

below the ground line has found considerable favor among the central stations. The cost of labor incidental to mixing the concrete for this type of reinforcement has in some cases been very high, and many schemes for reducing the cost have been tried with more or less success.

Fig. 1 shows a construction crew of the Marion Light &



FIG. 2—CONCRETE IN PLACE AT GROUND LINE

Heating Company, of Marion, Ind., with the portable hand-operated concrete mixer which was used in setting the poles on one of the 35,000-volt transmission lines just out of that city. With this machine the ingredients for the concrete for one pole were dumped into the hopper, and when the crank was turned by one man the finished product was delivered directly to the hole from the mouth of the mixer. The poles on this line were large and heavy, with 8-in. tops, so that about 1.25 yd. of concrete was required for each hole. The span length was 350 ft., and as soon as the concrete had been mixed for one hole the apparatus was moved to the foot of the next pole along with the wagon which carried the supply of cement, gravel and water.

It is stated that the use of this concrete mixer in connection with the line construction saved approximately 50 per cent on the cost of concreting the butts of the poles.

## "Booster" Illumination at Arlington, Wash.

"The livest electric town anywhere for its size, 2000 population," is the characterization given Arlington, Wash., a feature of whose night display is the use of strings of "booster" lamps along the center of the principal business streets. This lighting is paid for by the adjoining merchants, the installation having been promoted and installed by Mr. E. G. Robinson, manager of the Jim Creek Water, Light & Power Company, of Arlington. The central-station company has a quantity of surplus power rating which it makes use of in this way for boosting the town. Another feature of the display lighting of Arlington is the ingenious "arrow" sign described and illustrated in these columns. In this double-reading design the outlines are formed by



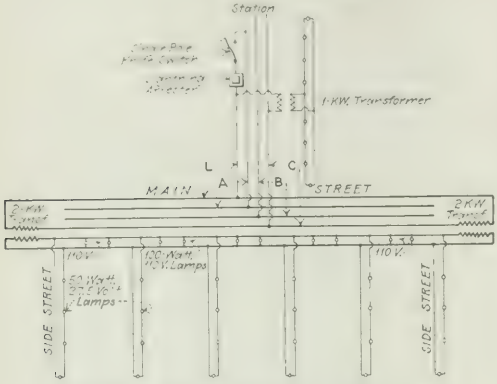
"BOOSTER" ILLUMINATION AT ARLINGTON, WASH.

the filaments themselves, the lamps being supported vertically from a distorted frame which brings the filaments into alignment. The illustration gives a bird's-eye view looking down the main street of Arlington, which is seen at the right; while at the left is the illuminated railway station and the row of lamps leading uptown. Attention of passengers on passing trains is also arrested by a large electric-lighted sign on the depot roof, "Trade in Arlington."

## Tungsten Lighting Layout for a Small Town

Formerly the streets of Pincher Creek, Alberta (population, 1500), were lighted by sixty 32-cp, 110-volt carbon lamps. The simplest form of hood was used, and the lamps were wired in parallel with the house services, making it necessary to burn these street lamps all the time unless extinguished by patrolling. The Town Council finally desired to change this arrangement so that it might use 50-watt tungstens in place of the 32-cp carbons on the side streets and 100-watt tungstens on the main street. It was also desired to use the old hood as it was only possible to expend $1,000 on this work, but the insulation of the old hoods was too poor to permit using 2200-volt series construction. As the estimated cost of the change including control lines and new hoods for a series system was $3,000, the plan illustrated herewith had to be adopted.

A tap taken from phase *A* on the 2200-volt busbars was led through a single-pole knife switch in the power house and thence downtown to three step-down transformers having 110-volt secondaries. These transformers were placed at the points where needed, the other side of the primary windings being connected to phase *B* on the respective transformer poles. The 110-volt secondaries were then run



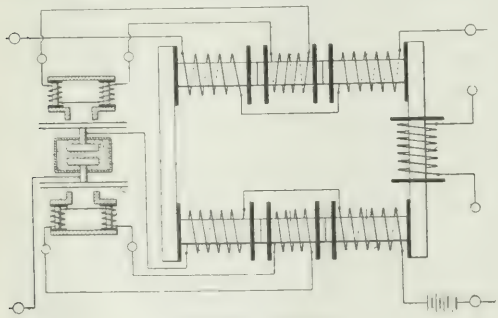

TUNGSTEN LIGHTING LAYOUT FOR A SMALL TOWN

down Main Street, feeding 110-volt, 100-watt multiple tungsten lamps connected in parallel every 100 yd. At each side street a tap was taken from these secondaries and run through four 27.5-volt, 50-watt tungstens wired in series and placed 150 yd. apart.

All of these lamps have since stood up very well in service and the 100-watt tungstens have averaged 3500 hours' life. The change, including seven miles of No. 8 wire, 100 lamps, three transformers and necessary insulators, brake-arms and cross-arms, cost about $600.

## Recent Telephone Patents

In the accompanying illustration is shown a repeater which has been patented by Mr. D. H. Wilson, of New York City. The magnifying transmitter is directly in the main-line circuit, which in this case is led through the coils of the apparatus. A battery must also be included in the line circuit. An incoming undulation not only passes forward but



TELEPHONE REPEATER

induces a current in both middle coils which in turn affects their respective receiver parts so as to adjust the electrodes of the transmitter. This action causes the current to augment the original undulation. The coil shown at the right is merely an auxiliary listening-in coil.

Cords are dispensed with on the switchboard patented by Mr. A. Lawrence, of Elizabethtown, Ill. Behind each jack are pairs of contacts. All pairs of contacts in the same vertical plane are connected. Long plugs numbered in pairs reach through the jacks beyond the last set of contacts. Each pair of plugs is equipped to register with its own set of contacts so that two plugs of the same number register with the same plane of contacts and thus effect a connection.

### Lock-out Systems

The lock-out party-line system patented by Mr. W. L. Campbell, of Chicago, is applied to automatic systems. It comprises a dial lock which prevents interference on a party line from any station not wanted.

Three patents issued to Mr. R. C. M. Hastings, of Columbus, Ohio, describe a lock-out system and special parts of the apparatus. The line is looped to all stations. The apparatus operates on a step-by-step system and centers around a key device which may be set for any station and which, after being actuated, carries out the necessary series of steps under the control of clockwork.

# Letters to the Editors

## A New Notion in Ventilation

*To the Editors of the Electrical World:*

Sirs:—In your issue dated Aug. 9, 1913, the ozone apparatus is highly commended by you as a means of removing the contamination in air due to respiration, thus doing away with unnecessary ventilation. However, users of this apparatus should be cautioned against using poor types or defective instruments, as a certain amount of atmospheric nitrogen may be fixed as oxides by them. These oxides are intensely irritating to the throat; and the last state of a man is worse than the first. It is a common saying among the workmen I have known around plants where nitrous fumes exist that "they always give you consumption if you breathe them much." Bacilli are necessary before this can happen, but I cannot imagine any worse predisposing influence than the action of the higher oxides of nitrogen on the mucous membrane.

*Elizabeth, N. J.* Donald M. Liddell.

## The Metric System and Cables

*To the Editors of the Electrical World:*

Sirs:—Permit me to say a few words of qualified approval of Mr. Everett Morss' suggestion, in your issue dated Aug. 9, 1913, to express the electrical properties of wires and cables in terms of thousands of feet instead of miles.

Instead of "megohms per mile," it would indeed be better to say "megohms per thousand feet." However, "megohms per mile" is an inaccurate and misleading term, because, while the word "per" indicates division, the value of the so-called megohms per mile of a cable is less the greater the length in miles. For this reason I prefer the term "megohm-miles" to "megohms per mile."

A difficulty then arises with Mr. Morss' scheme, for if "megohms per mile" is replaced by "megohms per thousand feet," "megohm-miles" would have to be replaced by "megohms-1000 feet." This, being uneuphonious, may be replaced by thousand megohm-feet, abbreviated t.m.f. For example, a cable having an insulation resistance of 500 megohm-miles would have $500 \times 5.28 = 2640$ t.m.f.

It is unfortunate that our wire manufacturers and consumers have isolated themselves from the rest of the world by using peculiar units, such as the circular mil and the American wire gage. Is there any valid reason why we cannot have wires rated in square millimeters and their lengths in kilometers? The megohm-kilometer would be a really rational unit.

*New York, N. Y.* Wm. A. Del Mar.

# Field of the Operating Engineer

## A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

### Accidents from Electrical Causes

It is a part of the duty of the Bureau of Electrical In- ection of the Department of Electricity of the city of hicago to investigate the causes of electrical accidents. n the year 1912 216 accidents of this character were re- orted and investigated. Of these, 178 were to employees

ELECTRICAL ACCIDENTS IN CHICAGO IN 1912

| Cause of Accidents | AGE | | INJURY | | | VOLTAGE | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Minor | Adult | Slight | Serious | Fatal | Low | High | Extra High | Employees | Others |
| reet-car accidents: | | | | | | | | | | |
| Injured by controller flash | | 5 | 5 | | | 5 | | | 4 | 1 |
| Blowing out of canopy switch | | 10 | 9 | 1 | | 10 | | | 10 | |
| Blowing of fuse | | 10 | 8 | 2 | | 10 | | | 9 | 1 |
| Broken trolley wires | 4 | 10 | 13 | 1 | | 14 | | | 2 | 12 |
| Shock or burned other than above | | 32 | 31 | | 1 | 32 | | | 25 | 7 |
| ort-circuit or flash: | | | | | | | | | | |
| Operators | | 11 | 7 | 4 | | 4 | 7 | | 11 | |
| Electrician (inside) | | 24 | 21 | 3 | | 24 | | | 24 | |
| Meter men | | 17 | 17 | | | 17 | | | 17 | |
| Cranemen | | 11 | 11 | | | 11 | | | 11 | |
| Linemen or repairmen | | 13 | 12 | 1 | | 10 | 3 | | 13 | |
| Others not electricians | | 14 | 12 | 2 | | 14 | | | 13 | 1 |
| cidental contact: | | | | | | | | | | |
| Repairmen (inside) | | 4 | 3 | 1 | | 2 | | 2 | 4 | |
| Electricians and station employees | 1 | 2 | 2 | | | 3 | | | 3 | |
| Linemen and troublemen | | 15 | 6 | 5 | 4 | | 15 | | 15 | |
| Employees (not electrical) | | 8 | 6 | | 2 | 7 | | 1 | 8 | |
| Trespass, climbing arc lamp poles | 3 | 1 | | 4 | | | 4 | | | 4 |
| Persons at work near live circuits | | 4 | 2 | | 2 | 1 | 3 | | | 4 |
| Broken wires | 1 | 1 | 1 | 1 | | | 2 | | | 2 |
| Defective wires | 1 | 2 | 1 | 2 | | | 3 | | 2 | 1 |
| cidental crossing of power wires with other wires | | 3 | 2 | 1 | | 1 | 2 | | 2 | 1 |
| aking incandescent lamps | | 3 | 3 | | | 3 | | | 2 | 1 |
| scellaneous | 1 | 5 | 6 | | | 5 | 1 | | 3 | 3 |
| Total | 11 | 205 | 178 | 29 | 9 | 173 | 40 | 3 | 178 | 38 |

the owners of the apparatus and thirty-eight were to her persons. By far the greater portion of the accidents vestigated were due to low-voltage circuits, the number ing 173. The accidents resulted in death in nine cases, hile there were twenty-nine reported as serious and 178 slight. The accompanying summary gives an interesting bulation of these electrical accidents.

### ost of Operating Evaporators in 20-Ton Ice Plant

If electrical energy can be sold at 0.875 cent per kw-hr. less, a 20-ton electrically operated ice-making plant using ulti-effect evaporators for producing distilled water can operated at a rate to compete with a similar 20-ton eam-driven plant, according to data presented by Mr. T. Burch, of the Griscom-Russell Company, New York, fore the Macon (Ga.) convention of the Southeastern ction, N. E. L. A. Under the same conditions a 100-ton plant can afford to purchase energy at 1.1 cents per -hr. and still compete with steam-driven ice factories. With coal at $3 per short ton, the fuel cost of operating 20-ton all-steam-driven plant would be $10.28 per day. run a four-effect evaporator (requiring 1 lb. of steam, 100 lb. pressure per sq. in., for each 3.5 lb. of distilled water produced) would cost but $2.68 per day. The evaporator system, declared Mr. Burch, is both simpler and less costly to operate than raw-water schemes requiring aeration of the freezing cans and withdrawal of successive core waters. Subtracting the cost of evaporator fuel from that required to operate an entire steam-driven plant, the remainder, $7.60, represents the limiting charge which may be made for electrical energy. Producing ice at an expenditure of 43.4 kw-hr. per ton, 868 kw-hr. will be required to freeze 20 tons, so that this energy must be purchased at a rate within 0.875 cent per kw-hr. The labor cost in the electric-evaporator plant will about equal that in a purely steam-driven plant.

For a 100-ton plant a rate as high as 1.1 cents per kw-hr. will similarly permit of competition with steam drive. In a certain 160-ton electrically driven ice factory the cost of manufacture per ton is divided up as follows: Fuel for evaporator, 12 cents; labor, 37 cents; electrical energy, 46 cents. The motor rating required averages 2.5 hp for each ton of ice-making capacity. The evaporators provided deliver 25 per cent excess of the needed quantity of distilled water.

### A Runaway Waterwheel

A runaway turbine set caused serious damage in the Underwood (Ore.) plant of the Northwestern Electric Light Company, when one of the dam gates burst recently, and the normal speed of 360 r.p.m. was increased to about 1000 r.p.m. The revolving element weighed 41.5 tons and continued to run wild while the gate remained open. Reports estimate the damage at about $6,000, and declare that the machine became literally a ball of fire and that White Salmon Canon was lit up as by sunlight. Although burning projectiles were hurled about the turbine room, the engineer and his oiler stuck to their posts and finally succeeded in effecting a temporary closure of the gateway.

### Methods of Spraying Oil Fuel

By R. T. Strohm

The atomizing of liquid fuel, or the breaking up of the oil into a spray or mist, so as to enable the air to mix thoroughly with it, may be accomplished in a number of different ways. The most common method is that in which a current of steam or a blast of air is directed into or across the flow of the oil so as to divide it into fine particles. Another way is to subject the oil to a high pressure and then to allow it to escape through small orifices. These orifices are so shaped and placed that the escaping oil is expanded, scatttered and properly atomized. A third method involves the use of centrifugal force. A whirling motion is given to the oil, and the centrifugal force set up causes the oil particles to fly off in the form of spray.

The principles involved in all of these methods are used in modern liquid-fuel burners, but centrifugal force alone is not relied upon to produce the desired atomization. In the lengthy and exhaustive tests made by the Bureau of Steam Engineering of the United States Navy several attempts were made to use an atomizer consisting of a steel disk that was rotated at a high speed and over which the

oil was allowed to flow. The earlier constructions warped under the effect of the heat or were wrecked by the centrifugal force developed, but by altering the construction in accordance with the experience gained from these initial experiments a centrifugal apparatus was eventually produced.

It consisted of a circular disk of saw steel riveted to a

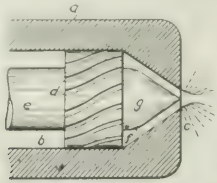


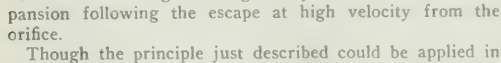

FIG. 1—CENTRIFUGAL TYPE OF ATOMIZER

hollow pivot that was held solidly in vertical bearings. Buckets or vanes were attached in a circle to the under side of the disk, and a jet of steam from a single nozzle was directed on this series of vanes, thus rotating the disk at a high speed. The oil to be sprayed was forced up through the hollow pivot under a small pressure and overflowed on to the disk at the center. Under the action of the centrifugal force set up by the very rapid rotation, it was flung off at the outer edge, and when ignited by a torch it burned in a ring of flame from 4 ft. to 5 ft. in diameter.

In spite of the fact that a mechanical rotary atomizer had thus been developed, this type has not been adopted in commercial installations using oil fuel. The reason is that the spraying force is derived from the jet of steam, and it is simpler to use the steam directly for spraying, without the introduction of the rotating disk. Also, it is probable, from the results of the experiments referred to, that trouble would arise through warping of the disk and wearing of the pivot. It is true that the flow of the oil across the face of the disk has a tendency to cool it somewhat and thus reduce the warping effect, but the fact remains that the purely centrifugal sprayer has not met with favor.

In connection with pressure spraying from an orifice, however, the centrifugal principle has been used successfully. This combination may be illustrated by the simple sketch shown in Fig. 1. At the end of the pipe *a* that conveys the oil, the oil passage *b* is tapered down to the opening *c* through which the oil is discharged. The series of slanting vanes *d* on the rod *e* deflect the oil and break it up into a number of currents, each of which has a whirling motion as it enters the space *f* around the end *g* of the rod. These separate currents are intermingled in the space *f*, and on emerging from the orifice *c* they spread as shown by the diverging lines. The oil is forced into the pipe *a* under fairly high pressure, and thus the atomizing is due both to the twisting motion given by the vanes and the expansion following the escape at high velocity from the orifice.

Though the principle just described could be applied in any installation, it would doubtless be most advantageous in



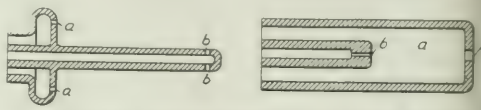

FIGS. 2 AND 3—COMMON FORMS OF OUTSIDE MIXING BURNERS

the case of a plant in a district where suitable water is scarce or hard to obtain. For the steam that is used to atomize the oil by direct action goes along with the products of combustion and escapes at the top of the chimney. It is thus lost absolutely, so far as the chances of recovering it are concerned; whereas by using a device similar to that shown in Fig. 1 there is no waste of steam. It is true that steam would be required to run the pressure pumps, but it could afterward be led to some form of condenser and thus recovered for boiler-feed water.

A disadvantage of the system of spraying oil by pressure lies in the fact that the openings through which the oil is forced must not be much greater than 1/16 in. in diameter. An opening of this small size can very easily become clogged by a bit of dirt or a grain of sand; therefore a strainer should always be inserted in the oil system. The holes in the strainer, of course, must be small enough to catch and retain all dirt of sufficient size to clog the burner. Usually they are made about half the size of the hole or holes through which the oil is sprayed.

By far the greater number of oil-fuel plants use steam or air as the atomizing agent. If steam is used, it is obtained from the boiler being fired or from another boiler in the plant, and if air is used, it is obtained by means of a positive blower or an air compressor. No matter which agent is used, it is led in a sheet or a jet against the oil to be atomized. The mixing of the oil and the steam or the air may take place inside the atomizing device or outside it, but in either case the spraying is due to the expansion that occurs when the steam or air under pressure escapes from the orifice and mingles with the oil.

The device that accomplishes the atomization of the oil is called the burner, though it has nothing to do directly with the combustion. There are two main classes of burners, namely, outside mixers and inside mixers. A common form of outside mixing burner is shown diagrammatically in Fig. 2. The oil to be atomized is led through the passage *a* and is allowed to flow out and down at the orifice *b*. The steam or air is conducted through the passage *c* and




FIGS. 4 AND 5—PROJECTOR BURNER AND INSIDE MIXING BURNER

allowed to escape through the narrow orifice *d* just below the oil orifice. The oil that oozes or drools out is thus caught by the rapidly escaping and expanding steam or air and is thoroughly sprayed. This type is ordinarily termed the drooling burner.

Another form of outside mixing burner is shown in Fig. 3. It differs from the other only in that the oil passage is turned downward at the outlet end, and the steam or air issuing from the orifice *a* sweeps directly across the face of the oil orifice *b*. This type is called the atomizer burner.

The type shown in Fig. 4 is called the projector burner and also belongs to the outside mixing class. In this case, however, the orifices *a* through which the steam or air escapes are at some distance from the oil orifices *b*, so that the steam or air has expanded considerably by the time it meets the oil.

One form of inside mixing burner is shown in Fig. 5. The oil flows into the chamber *a* surrounding the nozzle through which the steam or air is led, and the latter meet and mingles with the oil in the chamber, after which both are discharged at *c*. This form of burner is termed a chamber burner.

The diagram in Fig. 6 illustrates the principle of the injector burner. The steam or air flows from the orifice into the passage *b* containing the oil, and the mixture carried forward with increasing velocity toward the narrowest part *c* of the burner. Beyond this throat the mouth is flared, and the rapid expansion atomizes the oil.

The various types of burners employed in steam plants involve the use of one or more of the foregoing principles. Air is used only in special instances as the atomizing agent, steam being the most common. So far as economy is con-

rned, there is little to choose between the two, for the ason that the amount of steam required for direct atom-ng is about the same as that required to run an air mpressor to furnish a sufficient supply of air at the cessary pressure. On the other hand, the addition of compressor means increased cost for installation over at for a plant using steam directly; also, the amount of




FIG. 6—SKETCH SHOWING PRINCIPLE OF INJECTOR BURNER

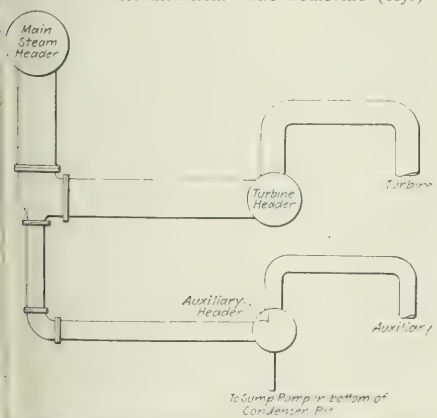
ing and apparatus is increased by the use of a compres-r, with the natural result that accidents are more likely happen and so cause partial or complete shut-downs.

The amount of steam used to atomize 1 lb. of oil, whether ectly or indirectly, may be taken as about 0.5 lb. for erage cases. There are plants in which only about 0.3 of steam per pound of oil is used for atomization, and in tests made by the Bureau of Steam Engineering some rners used as low as 0.15 lb. of steam per pound of oil. is last was an exceptionally good performance and was usual. The average plant may consider that its economy fair if its steam consumption for atomization only ounts to from 0.3 lb. to 0.5 lb. per lb. of oil.

In addition to the steam required for atomizing the oil, re is the steam required for running the pumps by ich the oil is supplied under pressure and the steam ed in some cases for heating the oil. The amount of am used for atomization is roughly 2 per cent of the total ount generated by the boiler; that is, out of every 100 of steam formed, 2 lb. are taken to spray the oil. The -pressure pumps and the oil heater require about 2 per nt more, so that the total steam consumption of the oil stem is in the neighborhood of 4 per cent of the steam nerated.

## rangement of Headers to Eliminate Steam Traps

Steam traps are often sources of annoyance and may uire considerable attention. The Louisville (Ky.) Gas




RANGEMENT OF HEADERS TO ELIMINATE STEAM TRAPS

lectric Company avoids their use in its Waterside sta-d by the construction illustrated herewith. This station ains six Babcock & Wilcox boilers, each of which is able of supplying 35,000 lb. of steam per hour. The r sure maintained is 200 lb. per sq. in., with a superheat f bout 125 deg. Fahr. furnished by superheaters having o sq. ft. of surface installed in each boiler.

Steam traps are eliminated by using three steam headers placed horizontally one above the other and connected by drop pipes which drain the condensate to a point where it is disposed of without damage to machinery. One of the lines is the main steam header and the other two are the turbine and auxiliary headers respectively.

From the lower part of the auxiliary header two pipes are led to pumps which circulate the water supplied to the plant turbine condensers. Below the steam connections to the circulating pumps pipes are connected feeding steam to the slow-speed reciprocating sump pumps located in the bottom of the condenser pit about 53 ft. below the level of the engine-room floor. By this method of systematic draining the condensate is disposed of without the use of steam traps. The water which eventually reaches the sump pumps can do no damage to the slow-speed engines and is disposed of through their exhaust.

## Effect of Power-Factor on Automatic Starters

Will a change in the power-factor of a circuit have any effect on the automatic starters used with elevator motors? G. G. S.

No. The strength of the solenoids is affected only by a change in ampere turns, so that as long as the current remains the same their operation is not hampered by change in power-factor.

## Use for Scrap Carbon Electrodes

We have quite a quantity of broken pieces of carbon from arc lamp electrodes. Can any use be made of them? F. A.

The pieces may be made into electrodes of standard size by grinding them to fit and joining them under pressure by means of a mixture of water glass and powdered cargon. The resistance of the electrode will be slightly greater than one not so jointed, and the joint will be stronger than the rest of the electrode.

## Location of Watt-Hour Meters on Switchboards

Where should watt-hour meters on large power house switchboards be placed, on the front or on the back of the board? There seems to be no established practice in this respect. C. A. C.

Unless there are very good reasons for placing watt-hour meters on the front of a switchboard, they should always be placed on the rear. A switchboard attendant in a large station should have before him only such instruments and apparatus as he must necessarily use in the operation of the system. All others should be placed elsewhere.

## Fusing Currents for Copper Wire

Are reliable tables available showing the current strengths required to fuse copper wire? It sometimes happens that regular alloy fuse wire cannot be had quickly when motors or other circuits have blown their protective links. To restore service temporarily it would be useful to know what sizes of copper wire might be employed with safety to the circuit. L. M. K.

The following table has been tested for copper-wire fusing currents and was found to be closely correct for average conditions:

| Size Wire, B. & S. | Fusing Current, Amp. | Size Wire, B. & S. | Fusing Current, Amp. |
|---|---|---|---|
| 30 | 10 | 18 | 80 |
| 28 | 15 | 17 | 100 |
| 26 | 20 | 16 | 120 |
| 25 | 25 | 15 | 140 |
| 24 | 30 | 14 | 160 |
| 22 | 40 | 13 | 200 |
| 21 | 50 | 12 | 240 |
| 20 | 60 | 11 | 280 |
| 19 | 70 | 10 | 330 |

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*Definition of Alternating-Current Terms.*—The committee on units and notation of the German Association of Electrical Engineers publishes a report, signed by Strecker, in which the following definitions are recommended. If $I$ is the effective current, $E$ the effective voltage between two points, and $L$ the power consumed between these points, then the following names are proposed: $L/E$, Werkstrom (work-current); $\sqrt{I^2-(L/E)^2}$, Blindstrom (blind current); $L/I$, Werkspannung (work voltage); $\sqrt{E^2-(L/I)^2}$, Blindspannung (blind voltage); $EI$, Scheinleistung (apparent power); $L$, Leistung (power); $\sqrt{(EI)^2-L^2}$, Blindleistung (blind power); $E/I$, Scheinwiderstand (apparent resistance); $L/I^2$, Werkwiderstand (work resistance); $\sqrt{(E/I)^2-(L/I^2)^2}$, Blindwiderstand (blind resistance); $I/E$, Scheinleitwert (apparent conductance); $L/E^2$, Werkleitwert (work conductance); $\sqrt{(I/E)^2-(L/E^2)^2}$, Blindleitwert (blind conductance); $L/(EI)$, Leistungsfaktor (power-factor). The resistance measured with direct-current is called Gleichwiderstand (direct resistance). The resistance which when multiplied with the time and the square of the current gives the Joulean heat is called Echtwiderstand (real resistance). Explanatory notes of these definitions are added by J. Teichmueller and R. Richter.—*Elek. Zeit.*, Aug. 14, 1913.

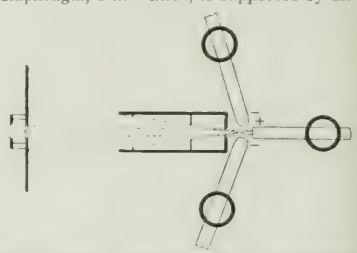
*Single-Phase Commutator Machines.*—Johann Lissner.—The author first explains in what respects his method of mathematically investigating single-phase commutator machines differs from other methods for this purpose. He then applies his method to calculate several special problems. His method leads to simple results for the series motor, while the theory of the repulsion motor and of the separately excited motor becomes more complicated. Although problems of single-phase commutator machines cannot be treated as simply as those of machines without commutators, the author's method permits the necessary number of simultaneous linear differential equations to be ascertained quickly and their integration offers no difficulties, although the results obtained are only in very special cases sufficiently simple.—*Elek. u. Masch.* (Vienna), July 13 and 20, 1913.

*Speed Regulation of Induction Motors.*—F. W. Meyer.—An article illustrated by diagrams, discussing in a simple way the fundamental principles of the methods of speed regulation of large induction motors with the aid of small auxiliary commutator motors. The author shows that in such systems it is easy to combine speed regulation with a compensation arrangement to obtain a high power-factor in a simple way without complications.—*Elek. Zeit.*, Aug. 7 and 14, 1913.

*Transformers.*—W. M. Dann.—An illustrated article on 150,000-volt power transformers with special reference to the installation of the Pacific Light & Power Corporation.—*Elec. Journal*, August, 1913.

### Lamps and Lighting

*Electric Arc as Standard of Light.*—J. F. Forrest.—A number of methods are described by which it was sought to obtain a workable standard of light from the electric arc, using carbon electrodes. Among these may be mentioned concentric carbons. Satisfactory results were finally obtained by using two negatives and one positive. This gives an arrangement which is easily controlled and easily reproduced. The three electrodes are set in a horizontal plane, each negative making an angle of 100 deg. to the single positive. Each negative has its own series resistance so that when current is flowing there proceed from the end of the positive electrodes two distinct stable arcs. The underlying idea of this arrangement was to force as much current as possible through the end of positive electrode without causing hissing, so as to cause the bright quadrant shown to spread over the whole surface. It is possible to work with current densities as high as 0.4 amp per square millimeter of cross-section of the positive carbon. As far as experiments go at present, the two steadying resistances must be kept entirely separate, as if the combined current of the two arcs traverses any resistance the currents rapidly assume an unstable equilibrium. A nickel diaphragm, 1 mm thick, is supported by an adjustable tube at a distance of 15 mm from the crater, the hol in the diaphragm being about 1 mm in diameter. Two stop inserted in the tube cut off reflected light, and the ligh from the crater is thrown onto a white screen about 1 cm from the arc. A hole in this screen passes a beam o light of sufficient dimensions to cover the photometri screen. The edges of this hole are specially guarde against reflection by the small stop placed immediatel after it. The angle of the carbons was obtained exper mentally and is that giving at once the steadiest arcs ar the best view of the crater. The edges of the hole in tl diaphragm turned toward the arc were beveled, the beve ing forming protection against the flame should the a accidentally sweep across the face of the diaphrag These diaphragms were found to be useless, owing to t fact that they buckled and were easily burned throug Solid carbons of equal size in all three places were us the unsteadiness caused by particles of the cores of cor carbons falling out being found to be very disturbing. D tails are given of the arrangements and results obtained London *Electrician*, Aug. 8, 1913.



SKETCH SHOWING ARRANGEMENT OF ELECTRODES

*Street Lighting with Tungsten Lamps.*—G. H. Stiney.—An illustrated article on city-street lighting w series tungsten lamps. Diagrams are given of the var tion of candle-power during the life of tungsten series carbon series lamps, also curves showing the net yearly come to central stations from operating tungsten se lamps and the saving effected by substituting tungsten carbon lamps. Typical photometric curves of tung lamps are also given.—*Gen. Elec. Review*, September, 1

*British Gas-Electric and By-Product Recovery Plant.*—An illustrated article on the Accrington Electricity Works in England, which are working in conjunction with a gas-producer and by-product recovery plant. There are two 250-hp. Mond pressure producers running on bituminous coal, which costs $3.37 per ton. Sulphate of ammonia and tar are recovered. There are two 1000-hp gas engines driving alternators each generating three-phase currents at 6000 volts to 6600 volts. This plant is linked up to the older high-speed direct-current steam plant through three motor-generators which permit the economical distribution of the load between the steam and the gas plant. In the gas plant the fuel consumption is a little more than 1½ lb. per kw-hr. and costs about 0.25 cent, and against this there is to be credited from the sale of by-products 0.14 cent, leaving a fuel cost of 0.11 cent per kw-hr. generated.—London *Elec. Review,* Aug. 15, 1913.

*Waste Heat for Electricity Generation.*—An illustrated article on the West Hartlepool central station, which is the first municipal station in Great Britain to adopt the system of generating electricity from waste steam obtained from outside sources. The station receives exhaust steam from the Seaton Carew Iron Company and in exchange supplies, free of charge, to this company a certain amount of electrical energy. The present steam requirements of the plant, however, are supplied from the exhaust steam from six blowing engines, which in turn are supplied with steam at 80 to 100 lb. pressure from a battery of sixteen gas-fired boilers, evaporating 200,000 gal. of water per day. There are two steam-turbine-driven three-phase alternators, each of 1250 kva.—London *Elec. Review,* Aug. 1, 1913.

*Cooling Gas Engines.*—BERTRAM HOPKINSON.—A paper in abstract read before the (British) Institution of Mechanical Engineers. A description is given of a method of cooling gas engines by injecting water into the cylinder in the form of a coarse spray. The advantages of this arrangement are discussed, and the results on some tests made on an engine fitted in this way are given.—London *Electrician,* Aug. 8, 1913.

**Traction**

*Berlin.*—An article, illustrated by maps, on extensions of the Berlin elevated railroad and subway from Spittelmarkt to Alexanderplatz and Schoenhauser Allee.—*Elek. Zeit.,* Aug. 7, 1913.

**Installations, Systems and Appliances**

*Electrical Industries in Italy.*—While the general industrial condition of Italy has recently been unfavorable, the Italian electrical industries have stood the crisis better than any other industry. There are various large water-power plants in course of development. Congress has granted funds to aid in the development of the Tila water-power system. There will be four large storage reservoirs, and when completed there will be available 150,000 hp in three falls, of together 1000 m. Notes are given on some railway lines to be electrified. A table is given showing the financial results of the twenty-nine most important companies supplying electrical energy in Italy. Sixteen of these have paid the same dividend as last year, ten have increased their dividend and three have reduced it. The average dividend has increased from 6 per cent to 6.3 per cent. Only two companies have passed their dividends, against three last year.—*Elek. Zeit.,* Aug. 7, 1913.

*European Versus American Practice in Lightning Arresters.*—E. E. F. CREIGHTON.—Nearly all the usual features of European practice in lightning arresters are embodied in a 15,200-volt Mexican installation, which, for the sake of definite basis for comparison with American practice, was selected by the author for discussion. In the first section of the paper formerly published a comparison was made between the space occupied by the European arrester and its equivalent in American apparatus, showing a ratio of something like ten to one to the credit of the latter. The American equipment was also shown to possess the advantage of lower cost as regards installation, operation and maintenance. European practice is divided into six distinct sections, five of which are found in the Mexican installation. All six are fully discussed—one in the first part of the article and the rest in the present instalment. Of the lot, there seems to be no justification, theoretical or practical, for the employment of two of these arrangements. The remaining four, while possessing advantages under certain circumstances, are more prone to trouble-making than the aluminum arrester and do not provide adequate protection in the same high average number of cases.—*Gen. Elec. Review,* September, 1913.

*Oil Switches.*—A. SIMON.—A note on what occurs when the contact of an oil switch is broken. The author claims that the oil itself does not extinguish directly the arc by its cooling effect, but that the arc is extinguished by the gas formed by evaporation of the oil. On account of the inertia of the surrounding oil, this gas is under a comparatively high pressure.—*Elek. u. Masch* (Vienna), Aug. 10, 1913.

*Current Distribution in Busbars.*—W. O. SCHUMANN.—A mathematical paper on the distribution of alternating current in two infinite parallel plates. The effective resistance and the "internal" self-inductance are determined. The author finally estimates how far his results may be used for the case of copper bars of finite dimensions.—*Elek. u. Masch.* (Vienna), July 27 and Aug. 3, 1913.

*Switchboard Relays.*—D. BASCH.—The third article of his serial on the application of switchboard relays to the protection of power systems. In the present instalment the author deals with line short-circuits.—*Gen. Elec. Review,* September, 1913.

*Switchboards.*—C. H. SANDERSON.—In a sixth article of his serial on switchboards for alternating-current power stations the author discusses electrically operated switchboards.—*Elec. Journal,* August, 1913.

**Wires, Wiring and Conduits**

*Electrical Contractors.*—An account of the eleventh annual meeting of the German Association of Electrical Contractors. Ely read a paper on the relation of central stations to wiring contractors. A report was presented on co-operation with the Association of German Central Stations. The present great tendency to sell or rent municipal stations to private companies was discussed. Other objects of discussion were monopoly tendencies in the electrical industry, organization problems, etc.—*Elek. Zeit.,* Aug. 7, 1913.

*Bakelite Micarta.*—R. W. E. MOORE.—An illustrated article on the characteristic thermal, electrical, chemical and physical properties of bakelite micarta and its applications for brush-holder tubes, collector insulation, etc.—*Elec. Journal,* July, 1913.

**Electrophysics and Magnetism**

*Experimental Proof that the Electric Current in Metals Is Best Carried by Electrons.*—O. W. RICHARDSON.—The idea has recently become rather prevalent that the emission of electrons from hot bodies is a secondary effect arising in some way from traces of chemical action. The author's experiments with tungsten filaments do not confirm this view. The author has made a series of experiments to test the various possibilities of the origin of the electronic emission from tungsten at high temperatures. His experiments prove that the emission of electrons does not arise from any interaction between the hot filament and surrounding gases or vapors nor from any process involving consumption of the material of the filament. It thus follows that the emission of electrons from hot tungsten, which there is no reason for not regarding as exhibiting this phenomenon in a typical form, is not a chemical but a physical process. This conclusion does not exclude the possibility that, under other circumstances, electrons may be emitted from metals under the influence of various chemical reagents. The

author's experiments "also show that the electrons are not created either out of the tungsten or out of the surrounding gas. It follows that they flow into the tungsten from outside points of the circuit. The experiments therefore furnish a direct experimental proof of the electron theory of conduction in metals."—*Philos. Magazine*, August, 1913.

*Electric Contact Resistance.*—F. W. Harris.—An article in which the author formulates the following laws of contact resistances: All other conditions being constant, the voltage across a contact joint will increase directly with the current; or the joint between two materials behaves exactly like a resistance. When the conditions of the surface in contact are not affected thereby, the voltage across a contact will vary inversely with the pressure. The resistance between materials depends directly on the internal resistance of the materials, those having a low resistance having also a low contact resistance. The resistance between contacts depends not upon their area but only on the total pressure with which they are forced together.—*Elec. Journal*, July, 1913.

**Electrochemistry and Batteries**

*Electrolytic Production of Caustic and Chlorine.*—J. B. C. Kershaw.—An illustrated article on the Billiter-Siemens electrolytic cell and process, with a brief description of two plants in Germany and in Bohemia where this cell is in use. —London *Elec. Review*, Aug. 15, 1913.

**Units, Measurements, and Instruments**

*Total Radiation Pyrometers.*—G. K. Burgess and P. D. Foot.—An abstract of an American Physical Society paper. Although the relation between the energy $J$ emitted by a black body and its temperature $T$ follows the law $J = \sigma T^4$, since the fraction absorbed by the radiation pyrometer is in general not a constant factor for all temperatures but rather of the form $f(T)$ there is for this type of pyrometer an equation which does not necessarily follow the fourth-power law but has the form of $E = aT^b$, where $E$ is the electromotive force generated by the thermo-element, and $a$ and $b$ certain empirical constants, $b$ varying from 3.5 to 4.2 with the seventeen instruments tested. The emf indicated by several Féry total radiation pyrometers showed a marked lag effect due to a slow heating of the couple. Frequently as long an exposure as ten minutes is required before the maximum reading is attained. In other cases the time lag was less than twenty seconds. After the maximum reading was shown, the emf for several instruments dropped by an equivalent of 10 deg. C. during the first ten minutes, when sighted as a furnace at 1300 deg. C., while other instruments maintained a constant value. This drop is due to the conduction of heat from the hot to the cold junction of the thermo-element and can be easily minimized by increasing this distance. Preliminary measurements upon the total emissivity of various substances met with in industrial work have shown that the equation $E = b(\log S - \log T)$ is applicable where $E$ is the total emissivity, $b$ the exponent for the particular radiation pyrometer used, $S$ the apparent temperature and $T$ the true temperature absolute. Using this relation, $E$ for iron oxide was found to be 0.86, for nickel oxide 0.83. A slight indication of a temperature variation of emissivity was found, $E$ increasing with temperature, but the variation was almost within the limit of errors of observation.—*Phys. Review*, July, 1913.

*Rheostat.*—H. H. Broughton.—An illustrated description of an inexpensive loading rheostat, built up on the interchangeable unit system, of simple and sound mechanical construction, for use in test rooms and engineering laboratories is described. The units are made of Eureka wire in frames of standard sizes so as to dissipate 750 watts (3 amp at 250 volts). Details and illustrations are given of the construction.—London *Electrician*, Aug. 15, 1913.

**Telegraphy, Telephony and Signals**

*Wireless Telegraphy.*—J. J. C. Mueller and J. R. Grall. —An illustrated description of a transmitting and receiving station for wireless telegraphy with damped oscillations for demonstration purposes in schools.—*Elek. Zeit.*, July 10, 1913.

**Miscellaneous**

*Legal Knowledge Essential to Engineers.*—W. A. J. O'Meara.—An abstract of a lecture held before the students of Faraday House. The author discusses those points in the law of torts and contracts which are likely to be met with by the engineer in the course of his practice. Some notes on the discharge of contracts and the way in which they should be constructed are also given.—London *Electrician*, Aug. 15, 1913.

# Book Review

The Motor and the Dynamo. By James Loring Arnold, Ph. D., professor of electrical engineering, New York University. 178 pages, 166 illus. Price, $1.50. Easton, Pa.: The Chemical Publishing Company.

This book is not only concerned with the principles underlying the design and operation of dynamo-electric machinery, but it is also descriptive of machines and auxiliary apparatus. The illustrations are numerous and, on the whole, clear and instructive. The language and exposition are generally simple and clear. Both are the outcome of a mind accustomed to mathematical thinking, although the mathematics used is not of high order; the calculus—assumed by common assent to be difficult of understanding—makes its appearance only at rare intervals. The author makes no claim to originality in the presentation of his subject—or subjects. He says what he has to say without preamble, clearly, concisely, almost breathlessly. Herein seem to lie the originality and peculiar fascination of the book. It is so utterly without superfluous matter, so direct, and has withal a pace so rapid that it carries one forward with the same disregard of personal comfort as the most exciting detective story. The atmosphere of undue haste is accentuated by the occasional—although by no means serious—typographical errors that have remained undetected by the proofreaders, and by the still rarer occurrence of unsuitable words hurriedly chosen. An instance occurs on page 86, where the speed control of "constant-speed motors" is seriously discussed. The introduction (Chapter I) plunges the reader in the discoveries of Oersted and the underlying principles of all dynamo-electric machinery. It covers three pages of the book. Chapter II, which fills eight pages, deals with the mathematical principles of electromagnetic phenomena. As we proceed, the practical interest increases, but the principles, and the explanations of the reasons of things, are never overlooked. The book is consistent—lucid, terse and time-saving. On page 169 the reader is introduced to the alternating-current series motor; the two following pages contain characteristic curves of direct-current and alternating-current motors respectively, and page 172 is blank. We realize that the end has been reached with a precipitate abruptness entirely in keeping with the introductory paragraphs. In the preface the author states that the book is the result of many years' experience in presenting "the essentials of electrical science" to college students and practical engineers, and that he "hopes that the book may be found practical and direct and sufficiently exhaustive to both college men and electricians." It is probable that the calculus and the photographs of machines have been introduced for the edification of the college students, and the simple explanations and diagrams for the instruction of operating engineers in charge of machinery. The book may have a large circulation, which it seems to deserve, but it is not easy to call to mind the particular type of man who will find in this book not only the facts but the inspiration and food for thought which he fails to find in other books dealing with the various phases of the same subject.

# New Apparatus and Appliances

**An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers**

## Pot-Type Electric Coffee Percolator

A percolator which is more economical than the elaborate styles is being introduced by the Westinghouse Electric & Manufacturing Company. All metal parts are heavily tinned inside and nickel-plated outside. The heater is of special design, projecting from the bottom of the vessel into the water. If always operated immersed in water,

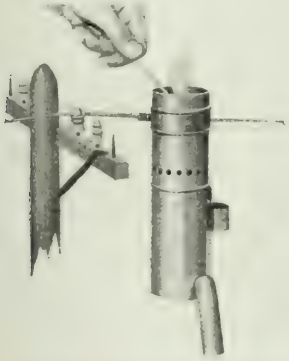


POT-TYPE ELECTRIC COFFEE PERCOLATOR

the heater, it is stated, will last a lifetime, but if for any reason repairs are needed, new heaters can be easily installed. Connections from the heater are made to suitable terminals carried in the base of the percolator. A 6-ft. silk-covered cord complete with detachable nickel-plated receptacle and attachment plug is furnished with each percolator. The coffee retainer being made of German silver guarantees it against chemical action and corrosion. This percolator consumes 380 watts and has a capacity of 2.5 pints of coffee.

## Lineman's Torch for Soldering Connections

A lineman's torch has recently been brought out by Mathias Klein & Sons, of 562 West Van Buren Street,



LINEMAN'S TORCH FOR SOLDERING

Chicago, Ill. The torch is small and light in weight and can be carried by a lineman in his belt. It is said to burn without odor or noise, and the flame will not be extinguished in the wind while the wind shield is in place.

In use the torch is suspended upon the wire beneath the connection to be soldered by placing the wire in the slot in the upper rim and giving the body of the torch a half turn to the right. A half turn to the left when the connection is finished removes the torch from the wire. The device has the further advantage that it can be lighted or extinguished almost momentarily as it is needed. A cup for holding soldering paste is provided with the torch.

## Improved Vacuum Cleaner

The National Stamping & Electric Works, of Chicago, have brought out an electric vacuum cleaner bearing the name "Red Ring." Small rollers connected to the base in the manner indicated in the accompanying illustration permit the device to stand alone in an upright position. For cleaning under beds and other furniture, however, the apparatus can be dropped to an 8-in. clearance. A universal 1/6 hp motor, operating at 110 or 220 volts, is used. This drives a small fan and the weight of the cleaner with-



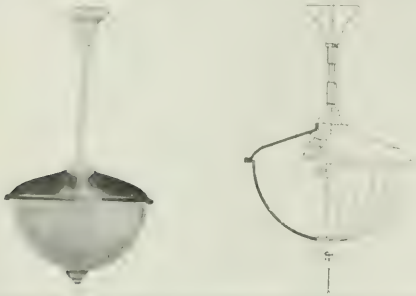
VACUUM CLEANER

out attachments is said to be only 9 lb. The body of the device and of all the tools and attachments is made of hard fiber, not apt to injure polished floors, floor coverings or furniture. The manufacturer says that the machine has a displacement of over 100 cu. ft. of air a minute. It cleans a strip 11 in. wide. The fan pulls the dust and dirt down into the bag from the top and not up from the bottom. The suction is from the nozzle through tubing to the top of a cylindrical housing and into it through an opening. A little window at the top of this housing enables the operator to see the entrance of the dust and to know whether the machine is operating constantly. The handle of the machine contains a suction pipe. By manipulating a valve

the machine is ready for cleaning walls, stairs, radiators, etc. The dust and dirt are all arrested by the dust fabric without passing through the fan. It is thus declared that no fan trouble can occur with the Red Ring cleaner, as the fan handles nothing but air.

## Dust-Proof Lighting Unit for Hospitals

A lighting unit especially designed for hospital service has been brought out by the Lighting Studios Company, New York City. The fixture is of the semi-indirect type, the lower bowl being of Doric moonstone glass. The



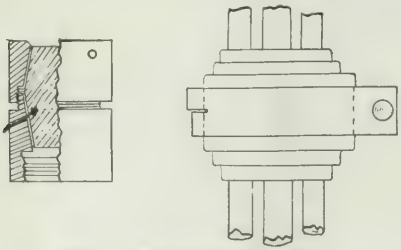
EXTERIOR AND SECTION OF DUST-PROOF LIGHTING UNIT

interior of the unit is protected from dust by an inclosing covering of transparent glass. The unit is provided with a three-way electrolier pull switch wired so that one, two or three lamps may be operated in the bowl or all may be turned off. The stem and other parts are of plain design finished in white enamel.

## Cable Supports and Sleeves

The feeder support which is shown in Fig. 1 consists of a block of lignum vitæ bored to admit one, two or three cables, the block being finished on the outside with oppositely inclined faces. When the outer pieces shown in the illustration are screwed down upon the block the sawed openings in the circumference which lead to each of the three holes close up on the cables and hold them securely in place. By this method the weight of the cables is transferred to the conduit, which in turn may be secured to the building at suitable places. This device is regularly made in four stock sizes and can be installed on any conduit ranging from 1.25 in. to 3.5 in. in diameter.

The illustration Fig. 2 shows another type of feeder support which may be slipped on the cables after they have



FIGS. 1 AND 2—FEEDER SUPPORTS

been installed. The blocks of lignum vitæ in this case are held together by a two-part metal clip. This device can be used on conduit varying in size from 1.5 in. to 3.5 in. in diameter.

The appliance shown in Fig. 3 has been made to supplant the sheet-iron box used as a pull box and consists of two cast-iron telescoping shells. The upper section rests upon an ordinary bushing and the lower one upon a feeder

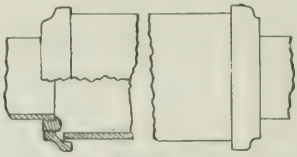


FIG. 3—SUBSTITUTE FOR PULL BOX

support. By the use of this device scrap pieces of conduit may be worked up and used as sleeves which are in reality pull boxes for either horizontal or vertical conduit runs.

These appliances are being manufactured by the Norris Electric Specialty Company and sold by Mr. Colman J. Mullin, 38 Park Row, New York City.

## Portable Derrick for Erecting Heavy Poles

A steel-frame pole erector so designed that it may be taken apart for convenience in shipping and which may also be assembled on a 12-ft. wagon bed in less than four hours by a single man has been put on the market by W. N. Matthews & Brother, St. Louis, Mo. The weight of the derrick complete is said to be less than 700 lb. As will be seen from the illustration, the main A-frame of the derrick rests on the street when the pole is in the process of erection but is lifted clear of the ground when the wagon is being moved. Two sets of block and tackle regulate the height and angle of the A-frame and lift the pole so that it



PORTABLE DERRICK FOR ERECTING HEAVY POLES

may be dropped into the hole without the attendant risks which accompany "piking in" a pole of such great weight. It is said that two linemen and a teamster are able to erect from forty to fifty poles a day with the aid of this device,

ovided the poles are not over 50 ft. in length. Longer les may be handled with the derrick but the time re- ired for erecting is somewhat more.

## Electrically Heated Earthenware Teapot

Formerly nearly all lines of electrically heated house- ld devices were finished either in nickel or in copper, but step in advance has recently been made by the Rochester amping Company, which has brought out a line of domes- appliances made in china and earthenware. Both the rthenware teapot and the percolator are being made with e heating unit which was formerly used in the metal oducts of the same size. The bodies of the devices are id to be made of Guernsey earthenware. To add at- activeness, the bodies are decorated with a design of ckel appliqué over sterling inlay.

For persons desirous of having a percolator of light eight there has been developed an aluminum device uipped with a built-in heating unit. The handle is ebon-



ELECTRICALLY HEATED EARTHEN TEAPOTS AND PERCOLATOR

ed with an aluminum tip to prevent burning. The whole evice is said to present a very pleasing appearance.

## Sign Illuminated with Reflected Light

An electric sign erected in the town of Framingham, lass., presents an attractive appearance from the railroad



SIGN ILLUMINATED WITH REFLECTED LIGHT

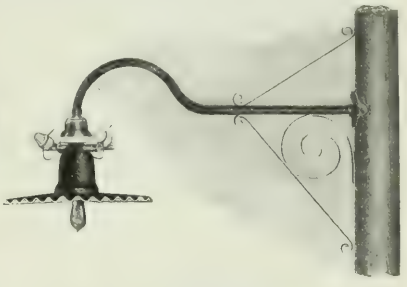
ecause of its distinctive color, a light emerald green. The eflected light from the hidden lamps gives the sign the ap- earance of being painted on its background of clouds in hosphorescent paint.

The letters in the sign, which reads "Dennison Mfg. Co.," are made of wood, painted white and mounted on a framework of galvanized-iron pipe. The capital letters are 10 ft. high and the small letters 5 ft. high. The illumination is accomplished by eight Cooper Hewitt automatic lamps, each placed in a galvanized-iron box with glass door. The lamps are equipped with a specially designed reflector which directs the lights so as to cover the entire surface of the letters. The sign is 80 ft. long and the top of the tallest letter is 19 ft. from the roof. The eight lamps furnish a connected load of 1380 watts, or about half the energy, it is estimated, that would be required to illuminate properly a sign of this size with incandescent bulbs.

The lamps for this sign were supplied by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

## Outdoor Lighting Fixture

The Public Service Company of Northern Illinois has designed a standard type of outdoor tungsten street fixture,



OUTDOOR LIGHTING FIXTURE

which is being made by the Line Material Company, South Milwaukee, Wis. A clover-leaf iron pole plate which is large enough for any pole is provided for securing the fixture. The plate is made of malleable iron and can be shaped to fit small poles. Ornamental steel scrolls above and below the pipe add to the appearance and strength.

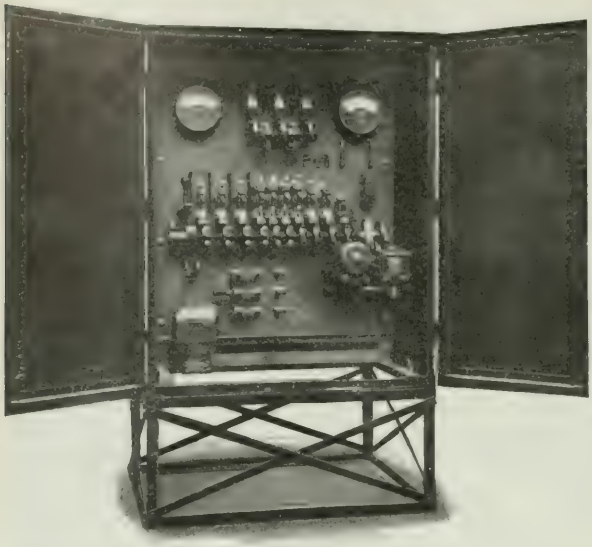
To one end of the 5-ft. 1-in. pipe goose-neck is attached a non-drop insulator. Between the reflector and insulator there is a malleable-iron spread arm, to which are attached two ordinary wooden pins. Glass insulators can be used upon these pins for supporting the wires to the lamp, insuring good insulation.

## Motor-Driven Alternating-Current Fire-Pump Controller

The Cutler-Hammer Manufacturing Company, of Milwaukee, Wis., has recently put on the market a new type of motor-driven alternating-current fire-pump controller. The controller shown in the illustration is intended for use with a 100-hp, 440-volt, three-phase, 60-cycle slip-ring motor. Mounted on the control panel are a voltmeter, an ammeter, a three-pole, rigid-arm, plain-overload circuit-breaker, a three-pole, double-throw knife switch, a pressure governor and a combined manual and automatic fire-pump motor starter. At the back of the panel in a suitable angle-iron frame are mounted the cast-iron resistance grids which are used as the starting resistance in the secondary circuit of the motor. The whole controller is inclosed in a sheet-iron splash-proof case mounted on a pedestal 2 ft. high.

The double-throw knife switch at the base of the panel is used for transferring the motor from one set of service lines to another, as connection to two separate power lines is often provided for reliability. The starter proper consists

of a square shaft above which are mounted the three primary and the six secondary cam-operated switches. There is also an auxiliary cam-operated switch at the extreme right which controls the pilot motor during automatic



STARTING PANEL FOR ALTERNATING-CURRENT FIRE PUMPS

operation. When operated manually the cam shaft which actuates these switches is revolved by a hand lever shown at the extreme left of the shaft.

## Focusing-Type Flame-Arc Lamp

The focusing-type, long-life flame-arc lamp shown herewith is now being built for operation on either direct-current or alternating-current multiple circuits, multiple series circuits or constant-current series circuits.

The products of combustion of the arc circulate in the inner globe and condensing chamber and are deposited in the latter, keeping the inner globe clear. The condens-

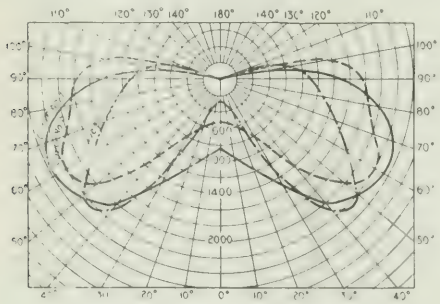



FIG. 1—PHOTOMETRIC CURVES

ing chamber is of copper, easily removed and cleaned. The only entrance for water to the condenser is well up under the lamp skirt and is fully protected. A continuous band of copper protects the top of the outer globe. There are no joints exposed to the weather.

In the multiple lamps a pair of series solenoids raise the upper carbon through the agency of the clutch acting directly on the carbon. The carbon is raised the entire length of the arc and floated by the solenoids until the lamp feeds, when the lower carbon rises and the arc starts again at the same place.

The feature of the lamp lies in the mechanism of the type built for operation in series on constant-potential, direct-current circuits. These lamps are operated with series solenoids only, avoding the trouble which is occasioned by differential windings in constant-potential series lamps

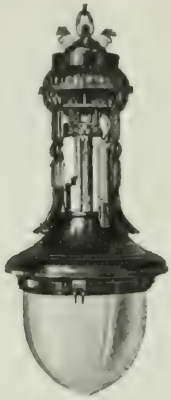


FIG. 2—FOCUSING-TYPE FLAME ARC

with internal resistance. The solenoids are of a special design which permits of the automatic regulation of the lamps in a series.

The differential principle is used in the constant-current series lamps where the reduction of losses in the mechanism is of prime importance. Separate pairs of series and shunt solenoids operate the clutch through the agency of a walking beam and thus the danger of baked-out shunts is avoided.

OPERATING DATA FROM FLAME-ARC LAMPS

| | Multiple Direct-Current Lamp | Multiple Alternating-Current Lamp | Series Alternating-Current Lamp |
|---|---|---|---|
| Terminal volts (average) | 110 | 110 | [illegible] |
| Terminal watts (average) | 715 | 507 | 112 |
| Terminal power-factor (average) | [illegible] | .62 | [illegible] |
| Ar[illegible] volts | [illegible] to 70 | [illegible] to [illegible] | [illegible] |
| Ar[illegible] watts average | 438 | 422 | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] |
| Late per [illegible] | 120 | 120 | 120 |
| Photometric curve | 1 | 2 | |

The data in the accompanying table and the drawings showing the photometric curves for the various lamps give an idea of operating characteristics of the lamps. Curve 1 has been taken from the multiple direct-current lamp operating on a 110-volt circuit and taking a current of 6.5 amp. Curves 2 and 3 were taken from the multiple alternating-current lamp operating on a 110-volt, 60-cycle circuit and taking 7.5 amp and the series alternating-current lamp operating on 60-cycle circuit and taking 7.5 amp at 76 volts.

These lamps are manufactured by the Adams-Bagnall Electric Company, of Cleveland, Ohio.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**New Building of Laclede Gas Light Company.**—The aclede Gas Light Company, which supplies electrical ergy for industrial purposes in the central business dis- ict of St. Louis, has moved into its fine new eleven-story fice building on the corner of Olive and Eleventh Streets. r. C. L. Holman is president and general manager.

**Flaming-Arc Lamp Business Improving.**—The H. M. irschberg Company, of 39 East Twentieth Street, New ork, reports that its present business in flaming-arc lamps d carbon electrodes is exceptionally good, recent orders ing from the Mead Morrison Company, of Boston, and om the Grand Opera House and the Metropolitan Opera ouse, both of Philadelphia, Pa. H. M. Hirschberg, the esident of the company, is planning a trip to Europe dur- g the first week in October, to investigate some improve- ent work in progress there in connection with both arc mps and carbons.

**Kansas City Firm Pushing Industrial Lighting Business.** The R. W. Hodge Electric Company, of Kansas City, o., is just beginning its annual industrial lighting cam- ign. This is the third year that it has made a special mpaign on industrial fixtures, consisting of white- ameled steel shades, principally, made up into several fferent designs for factory and warehouse lighting. Last ar a persistent effort for this kind of fixture business sulted in many more orders than it had anticipated the ld would produce. The company is now extending its mpaign to a number of adjacent cities in Missouri and ansas.

**Hartford Company Working Overtime.**—The Arrow Elec- ic Company, of Hartford, Conn., is employing at the esent time the largest force of men ever used in its shops, d overtime work is being done in several departments. regard to this unprecedented activity, the following atement was given out by E. R. Greer, vice-president of e company: "Our present business is only normal, but nen fall comes and the days become shorter we expect at there will be an increased demand for our electrical oducts. That is the reason for our overtime work and r maximum force of employees. We expect a fine fall siness."

**Coal Company Orders Electric Mine Locomotives.**— he Delaware, Lackawanna & Western Coal Company has st ordered from the Jeffrey Manufacturing Company enty 7-ton electric locomotives, each equipped with two -hp ball-bearing motors of the Jeffrey type, and three -ton locomotives, each of which carries three 110-hp otors of the same design. All of these tractors have mor-plate side frames. The order is said to be one of e largest single purchases of this class of equipment er made in the East, and the larger size locomotives are id to be the first of their kind to be used in the anthra- e-coal district.

**Industrial Applications of Electrical Machinery.**—The dustrial applications of electricity are growing more nu- erous every day, and a report on recent orders for gen- ating control and drive equipment, just received from the eneral Electric Company, illustrates the diversity of busi- ss enterprises in which electricity helps do the work. o mention a few of the different applications of the above ture, the following concerns which have been recent pur- asers of General Electric products may be cited: New astle (Pa.) Portland Cement Company; Delaware, Lack- anna & Western Railroad Company; United States luminum Company, New Kensington, Pa.; H. U. L. ase Bag Company, St. Louis, Mo.; Standard Oil Com- ny, New York; New Haven (Conn.) Clock Company, and the Snider Manufacturing Company, of Logan, Ohio, furniture manufacturer.

**Louisville Exposition a Success.**—A "Made-in-Louisville" exposition was held last week at Louisville, Ky., and the Louisville Gas & Electric Company turned over to the exhibitors the Electric Building, which was headquarters for the Kentucky Electric Company before the recent merger. A number of electrical exhibits were housed in this structure, among them an electric-welding outfit shown by the Stratton & Terstegge Company. The James Clark, Jr., Electric Company, manufacturer of electrical apparatus, attracted wide attention with its line of direct-connected, motor-driven machine tools, one of which was displayed in a Fourth Avenue shop window.

**New St. Louis Office of the General Electric Company.**— The General Electric Company has moved its district offices in St. Louis from the Wainwright Building to the thirteenth floor of the Pierce Building, on Fourth Street, extending from Chestnut to Pine Street. The Pierce Building is across the street from the Planters' Hotel, a location well known to visitors in St. Louis. The new quarters are larger than the old ones and have been made necessary by increasing business. Mr. F. N. Boyer is the district manager in charge of the St. Louis office, which now reports directly to the main office in Schenectady and is no longer a sub-office of the Chicago office.

**New Electric Vehicle Marketed.**—From C. F. Guyon, of 100 William Street, New York, representing the Champion Electric Vehicle Company, of Owego, N. Y., it is learned that the company is prepared, after a lengthy period of development, to give prompt deliveries on its new line of 750-lb., 1000-lb. and 2000-lb. delivery wagons. These cars have a maximum speed of 12 to 14 miles per hour and are good for 60 miles on one charge of the battery. They will be on exhibition at the electric-vehicle show in the Grand Central Palace, New York, next month. The Eastern sales agent for these new cars is the Henry Tobin Company, Inc., of 150 West Fifty-fifth Street, New York.

**Central Stations Buy York Refrigerating Machines.**— Among the recent purchasers of refrigerating apparatus from the York Manufacturing Company, of York, Pa., are the United Electric Light & Power Company, of New York, which took an 8-ton machine, and the Fayette Light, Ice & Coal Company, of Fayette, Mo., to which a 30-ton machine was sold. The aggregate capacity of the refrigerating machines sold by the York company since its last report is 1422 tons, mostly in small units, although there are included in that total two machines of 175 tons capacity each, one of which was sold to the Long Island Ice Company, of Brooklyn, N. Y., and the other to the Duquoin (Ill.) Utility Company.

**Cleveland Electrical Companies Merged.**—Three large electrical companies in Cleveland, Ohio, have been merged to create the Elliott Electric Company, which will have its office at 322 Champlain Avenue, N. W. The new concern has taken over the business of the S. K. Elliott Electric Company, retaining for the present the old company's headquarters and equipment. S. K. Elliott will now be associated wth the new corporation. In addition to taking over the S. K. Elliott Electric Company the new concern acquires the Motor Rental & Sales Company and the Ripple Engineering Company. With the new organization will be associated the Miller-Seldon Electrical Company, Detroit, Mich. The company will sell, rent and exchange electrical machinery for engineering and construction work and will also act as selling agent for the Sterling Electric Lamp Company. A specialty will be made of renting motors and

power machinery. W. H. Seldon, Jr., of Detroit, is president of the new company; M. C. Ripple is treasurer and general manager, and L. B. Holt is secretary.

**Rubber Company Installing Electric Drive.**—The Pennsylvania Rubber Company, of Jeannette, Pa., will equip its plant with new apparatus for electrical drive, consisting of a 500-kw Curtis turbo-generator, one 300-hp motor, four motors of 40 hp and 75 hp, control panels, switchboard and accessories. All of this apparatus has been ordered from the General Electric Company.

**Detroit Electrics to Be Sold at Reduced Prices.**—A. Weatherby, Boston manager of the Anderson Electric Car Company, of Detroit, Mich., stated in a recent interview that prices on the 1914 models will be materially reduced from those prevailing this year. Next year's cars will contain many improvements including larger battery capacity, larger tires, electric brakes, longer wheelbase, roomier bodies and longer and wider seats. Purchasers will be allowed the choice of worm or bevel-gear drive and rear seat or duplex steering control.

**Dayton Company Replaces Old Power-Plant Apparatus.**—At the plant of the National Cash Register Company, Dayton, Ohio, extensive changes in power equipment are in progress. Two new Stirling boilers of 610-hp rating are being put in to replace four old boilers. Steam will be generated at 175 lb. pressure and carried through a Foster superheater, where it will be raised to 75 deg. superheat. The boiler auxiliaries will include Murphy stokers, two to each boiler, Simplex blow-off valves and a Williams combination feed regulator and water column. An Allis-Chalmers turbo-generator set of 2000-kw normal capacity is also being installed. This will operate at 3600 r.p.m. on 155 lb. of steam at 75 deg. superheat. The generator will deliver three-phase, 60-cycle current at 440 volts. A Westinghouse-La Blanc condenser will supply the vacuum in the turbine, and a reducing valve will also be installed to assist one of the present reciprocating units in maintaining a constant pressure of 13½ lb. on the exhaust-heating system.

**Optimistic View of the Lamp Situation.**—Supplementing the note contained in the issue of Aug. 26, one received from J. W. Morrell, president of the Eastern Electric Lamp Company Division of the Franklin Electric Manufacturing Company, reflects a spirit of optimism which seems to prevail generally among the members of the electric-lamp fraternity. Mr. Morrell says, in part: "The Eastern Electric Lamp Company anticipates no changes in management or sales methods, having obtained satisfactory results with the personnel and sales system at present employed. The growth of the business has, however, justified the acquisition of additional large manufacturing plants located at Middletown, Conn., which this concern, in conjunction with its associated companies, expects to equip, as rapidly as possible, to handle the growing demand for its goods. In addition to two large plants already in full operation, the factory property referred to above will probably be partly equipped and running by Oct. 1, on which date the company expects to be producing 3000 finished lamps per day, a production which will be steadily augmented during the late fall and winter as additional equipment is installed." This statement corrects the statement previously made in these columns to the effect that the Middletown plant would start operations on or about Jan. 1, 1914.

**General Electric Equipment Sold to Steel Mills.**—In addition to the large motor order from the Bethlehem Steel Company noted elsewhere, the General Electric Company, of Schenectady, N. Y., has recently received orders for various kinds of electrical equipment from a number of other companies in the same field. The American Sheet & Tin Plate Company, of Pittsburgh, Pa., will add to its electrical equipment at Gary, Ind., two 1600-hp General Electric mill-type motors with sectional control equipments and panels. From the Otis Steel Company, Cleveland, Ohio, has been received an extensive order for electric drive equipment, including two 4500-kw Curtis turbo-generator units with a 100-kw turbo-exciter and a 50-kw motor-generator exciter set; two 1000-kw two-unit two-bearing motor-generator sets; three 400-kva transformers; one 1500-hp, two 1200-hp and one 200-hp motor; switchboard panels and accessories. An installation of one 875-hp and four 75-hp mill-type motors is to be made at the plant of the Brier Hill Steel Company, Youngstown, Ohio, and the National Tube Company will add to the electrical equipment of its Pennsylvania works two 150-hp induction motors. The Illinois Iron & Bolt Company, of Carpentersville, Ill., will equip for electric drive and install fifteen motors ranging from 3 hp to 40 hp, with oil switches and accessories, all of which will be furnished by the General Electric Company.

**Central Stations Use New Flexible Coupling.**—Among the leading central stations in which the Francke flexible coupling is being used are those of the Public Service Railway Company of New Jersey, the New York Edison Company and the Interborough Rapid Transit Company of New York. The Rochester (N. Y.) Railway & Light Company is one of the most recent purchasers. This all-metal coupling, sold by the Smith-Serrell Company, New York, is adaptable to a wide range of service. With the growing popularity of the direct-connected turbo-generator set has come an increasing demand for the coupling from the leading manufacturers of such units, and the General Electric Company is furnishing it with the new 1000-kw set recently placed on the market and operating at 3600 r.p.m. Other places where the device has been installed with entire satisfaction are on gas-engine generator sets, on motor-driven fan equipment and on regular line-shaft connections. The couplings are made for all shaft sizes from ¾ in. up to 20 in.

**Electrification of Bethlehem Steel Plant Extension.**—The Bethlehem Steel Company is at present equipping the bar-mill extension at its Lehigh plant, South Bethlehem, Pa. Electric drive is to be used throughout. Three General Electric three-phase alternators of 2500-kw rating will be installed, directly connected to Bethlehem Steel gas engines, and will supply energy at 80 per cent power-factor, 25 cycles and 6600 volts, for the power demands of the mill. Excitation will be furnished from a motor-generator set at 240 volts, and arrangements are to be made so that the present direct-current system will serve as an emergency source. The switchboard gallery will contain control panels for the alternators and feeder circuits and the motor-operated oil switches will be located beneath it. Duplicate full-capacity buses will be used with an auxiliary bus carrying a spare switch for the alternators and the same arrangements for the feeders. A 1500-kw reversible motor-generator set will tie the two systems together. The energy-consuming apparatus to be installed in the mill is varied. A 10-ton Girod electric furnace will be put in and fed through furnace transformers of the Pittsburgh Transformer Company. The General Electric Company will supply for drive purposes fourteen induction motors (seven of them two-speed motors), ranging from 350 hp up to 4500 hp, for direct connection to the rolling mills. The Westinghouse Electric & Manufacturing Company is furnishing a 35-in. reversing blooming-mill equipment, consisting of a flywheel motor-generator set, made up of a slip-ring induction motor and two 600-volt direct-current generators connected in series, together with complete switchboard and exciter apparatus. The motors on the blooming mill will be similar to the above generators, being 600 volts each and connected in series. The Crocker-Wheeler Company will supply for this installation three 500-kw motor-generator sets which will furnish direct current at 240 volts for operating mill tables, cranes and small motors. The mill tables will be driven by Westinghouse motors, operated by the Electric Controller & Manufacturing Company's magnetic controllers. The crane equipment is being built by the Morgan Engineering Company and the Alliance Machine Company and includes about twenty cranes, all designed after modern steel-mill specifications and equipped with the latest safety devices. The cranes will be driven and operated in the same way as the mill tables. This equipment work is going on under the direction of W. F. Roberts, general superintendent of the Lehigh plant, and it is interesting to note that, while all the small motors are to be operated on 240 volts, alternating or direct current according to the character of the service the give, all alternating-current motors above 350-hp capacity are to be operated directly at 6600 volts.

# Corporate and Financial

**Plant at Sault Ste. Marie Sold to Bondholders.**—The plant of the Michigan & Lake Superior Power Company at Sault Ste. Marie, Mich., was sold on Aug. 26 to a representative of the first-mortgage bondholders for $3,500,000. The property will be transferred to the Michigan Northern Power Company, a new corporation, which will make improvements in order that all the water available may be utilized, which would give 35,000 hp for industry purposes.

**Earnings of the Southern California Edison Company.**—In connection with an offering of bonds of the Southern California Edison Company by N. W. Harris & Company, of Boston, a statement of earnings has been issued for the year ended June 30, 1913. It shows total operating revenue, including other income, of $4,538,893, operating expenses of $2,383,479 and net income of $2,155,414. Interest charges were $773,200 and deduction of $650,000 was made for depreciation, leaving a surplus of $732,214.

**Purchase of Control of the American Cities Company.**—The United Gas & Electric Corporation plans to purchase the majority of the common stock of the American Cities Company. For each $100 share of common stock of the American Cities Company it will pay $75 of a new issue of graduated second preferred stock and $25 of common stock. The additional class of stock which it is proposed to create, graduated second preferred, will bear cumulative dividends at the rate of 2 per cent per annum for the year 1914, 3 per cent for 1915, 4 per cent for 1916, 5 per cent for 1917 and 6 per cent for all succeeding years. The American Cities Company controls the New Orleans Railway & Light Company, the Birmingham Railway, Light & Power Company, the Little Rock Railway & Electric Company, the Memphis Street Railway Company, the Knoxville Railway & Light Company, and the Houston Lighting & Power Company.

**Washington Water Power Company Notes.**—An issue of about $500,000 of 7 per cent notes of the Washington Water Power Company, offered to shareholders, has been fully subscribed. Another issue of notes, extending for six weeks, will probably be made in December. The total amount of notes outstanding on Feb. 1, 1914, will be about $2,000,000. To provide for the notes maturing on that date the company will probably issue 10 per cent of new stock. It is proposed to issue this stock on April 1, 1914, but to offer it to shareholders with the right of prepayment on Feb. 2, 1914. The amount of capital stock outstanding now is $14,081,900. There has been expended on the hydro-electric development at Long Lake $3,427,215 of the estimated total cost of $5,000,000. The company also has acquired for $450,000 the distributing system of the Idaho-Washington Light & Power Company, and it has made other capital expenditures.

**Certificates in Small Denominations Issued by Middle West Utilities Company.**—The last $1,500,000 of an authorized issue of $3,500,000 of three-year 6 per cent collateral gold notes of the Middle West Utilities Company are offered for sale at 97½ and interest. At this price they yield the investor 7 per cent. The notes are secured by the deposit with a trustee of $4,667,000 par value of mortgage bonds of subsidiary companies. In his letter describing the issue Samuel Insull, the president, calls attention to the arrangement whereby certificates in denominations of $100 and $500 are available. These are secured by the deposit with the trustee of an equal amount of the collateral notes, and they offer the small investor, therefore, substantially the same opportunity of investment as the buyer of the notes, which are issued only in denominations of $1,000. The certificates are convertible directly into the notes if presented for this purpose in amounts of $1,000 or multiples thereof. The indenture securing the issued notes provides that the issue may be redeemed in whole or in part at par and interest on any interest date upon sixty days' notice. If any of the notes pledged as security for certificates of the smaller denominations should be called, at least an equivalent amount of the certificates issued against the notes will be redeemed at the same time. The letter of Mr. Insull shows that the number of communities served by the subsidiary operating companies is 274, with an estimated population of 829,600. The communities and estimated population of the properties located in the various states are as follows: In Illinois, 195 communities, 433,400 population; in Indiana, 29 communities, 151,000 population; in Kentucky, 13 communities, 53,500 population; in Missouri, 2 communities, 15,000 population; in Michigan, 6 communities, 36,000 population; in Oklahoma, 6 communities, 61,700 population; in New England, 23 communities, 79,000 population. Except in Michigan, separate operating subsidiary companies have been formed in all the states.

**Standard Gas & Electric Company Preferred Dividend Paid in Scrip.**—The quarterly dividend of 2 per cent due on Sept. 15 on the preferred stock of the Standard Gas & Electric Company will be paid in scrip instead of in cash. The scrip will bear 6 per cent interest and will be due on Sept. 1, 1923, although the company reserves the right of payment before that date. H. M. Byllesby, president of the company, issued a statement on Aug. 28 explaining the reasons for this action. He says in part: "With what is deemed to be at present a proper maintenance and depreciation charge taken from the net earnings of the subsidiary companies and dealing with the results of the elapsed net earnings of these companies for the twelve months ended July 31, 1913, Standard will receive from its holdings in the subsidiary companies in the ensuing twelve months, without cramping or straining these subsidiary companies, an income which, after providing for its operating expenses and bond and coupon note interest, will be equivalent to more than 6 per cent upon Standard's preferred capital stock. With the cessation of a cash distribution on its preferred stock Standard will be able to retire from its income, after paying its operating expenses and interest on its bonds and coupon notes, the $500,000 par value of its coupon notes maturing June 1, 1914, and the balance of its surplus income, together with the proceeds of the reserved $350,000 par value of coupon notes, will, it is believed, enable Standard to supply that part of the construction requirements of its controlled companies which cannot be economically provided from the sale of the treasury securities of those companies. Judged by all previous experience and by a close study of the individual conditions surrounding the subsidiary companies, it appears fair to believe that they have successfully passed through their trying experiences; that the protection against reckless competition which is being afforded by the various commissions and regulatory bodies in consideration of the rights of these bodies to regulate the charges of the utility companies in their jurisdiction, within reasonable limits, is resulting in a more satisfactory condition of operations than has heretofore existed and leading to the belief that the income of Standard from its holdings in its subsidiary companies will increase, and that in the interest of all of its stockholders the suspension for a time of the payment of cash dividends is in the direction of building up the intrinsic value of all of its holdings, which, it is believed, will show, within a reasonable time, satisfactory results."

## NEW YORK METAL MARKET PRICES

| | Aug. 25 Bid. | Aug. 25 Asked. | Sept. 2 Bid | Sept. 2 Asked. |
|---|---|---|---|---|
| Copper: | | | | |
| Standard, spot* | .. | 16.00 | .... | .... |
| | Selling Prices | | Selling Prices | |
| | £ s d | | £ s d | |
| London, standard, spot* | 69 10 0 | | 71 12 6 | |
| Prime Lake | 15.85 | to 15.95 | .... | 16.25 |
| Electrolytic | 15.70 | to 15.80 | 16.12½ | to 16.25 |
| Casting | 15.60 | to 15.70 | 15.87½ | to 16.00 |
| Copper wire base | 16.75 | to 17.00 | 17.00 | to 17.25 |
| Lead | 4.70 | 4.75 | 4.75 | |
| Nickel | 40.00 | to 45.00 | 40.00 | to 45.00 |
| Sheet zinc, f. o. b. smelter | 7.75 | | 8.00 | |
| Spelter, spot | .... | 5.87½ | .... | 5.90 |
| Tin, spot* | 41.15 | to 41.50 | 42.00 | to 43.25 |
| Aluminum: | | | | |
| Prompt delivery | 22.25 | to 22.75 | 21.50 | to 22.50 |
| Future | 20.00 | to 21.00 | 20.60 | to 21.00 |

## *OLD METALS

| | | |
|---|---|---|
| Heavy copper and wire | 14.50 | 14.50 |
| Brass, heavy | 9.25 | 9.25 |
| Brass, light | 8.25 | 8.25 |
| Lead, heavy | 4.65 | 4.65 |
| Zinc, scrap | 4.62½ | 4.62½ |

## *COPPER EXPORTS

Total tons to Sept 2 ..... 1790

*From daily transactions on the New York Metal Exchange.

## Business Notes

**The Straight Filament Lamp Company,** formerly of 125 West Forty-second Street, New York, has moved its sales office to 42 East Twenty-third Street in the same city.

**The General Insulate Company,** of Brooklyn, N. Y., manufacturer of hard-rubber specialties, has appointed the William J. McKenna Company, 9 South Clinton Street, as its agent in the Chicago territory in place of A. J. Cox & Company, former representatives.

**The Birtman Electric Company,** of Chicago, Ill., opened an Eastern office at 71-73 Murray Street, New York, on Sept. 2. This office is in charge of A. J. Saunders, who has had a wide experience in handling this company's line of suction clearners, massage vibrators and electric hair driers. The company intends to carry at this office a complete stock of all its goods and to be prepared to compete in every way with Eastern manufacturers.

## New Industrial Companies

**The Pennsylvania Telectrophone Company** has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $1,500,000. The incorporators are W. G. Taylor, C. B. Bishop and H. W. Davis, of Wilmington, Del.

**The Illumination Development Company,** of New York, N. Y., has been incorporated by Clinton D. Tabor, John F. Harrington and Harry M. Kimball, 312 West Twenty-second Street, New York. The company is capitalized at $50,000 and proposes to do a general contracting and electrical engineering business.

**The Golson Electric Company,** of Selma, Ala., has been chartered with a capital stock of $2,000 for the purpose of doing a general electric and wiring business. The officers are: B. J. Schuster, president; Rudolph Richards, vice-president; Albert Thalheimer, treasurer, and D. H. Golson, secretary and general manager.

**The Spanish-American Engineering Company,** of New York, N. Y., has been granted a charter with a capital stock of $25,000 for the purpose of manufacturing and dealing in machinery and engineering appliances. The incorporators are Edward R. Aparicio, Manuel S. Ayau and Eduardo A. Brun, 15 William Street, New York, N. Y.

## Trade Publications

**Pole-Line Anchors.**—A six-page booklet has been issued by the Oshkosh Manufacturing Company, Oshkosh, Wis., which describes in detail the new Oshkosh patent anchor.

**Portable Electric Hoists.**—A folder has been issued by the Northern Engineering Works, Detroit, Mich., which refers briefly to its various types of portable electric hoists for either direct-current or alternating-current circuits. Seven illustrations are given.

**Cable Supports and Sleeves.**—A catalog and price list of the Hercules and Ajax vertical feeder or cable supports and sleeves has been issued by the Norris Electric Specialties Company, Chicago. Brief descriptive matter and a number of illustrations are given.

**Generator Sets.**—Brief references to its electric-light, gas-engine-driven plants for moving-picture work, motor-generator sets, switchboards and instruments are made in a leaflet, 6 in. by 9 in., recently issued by the Barber-Dwinnell Company, 600 East Fifteenth Street, Kansas City, Mo.

**Battery-Charging Rheostats.**—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has just printed a new edition of Bulletin 8540. It contains prices and data on the various types of battery-charging rheostats for both lead and nickel-iron batteries, including wall, floor and switchboard types, and also two styles of automatic rheostats.

**Farm-Lighting Outfits.**—In a booklet of eighteen pages being sent out by the Commercial Electrical Supply Company, Fifteenth and Pine Streets, St. Louis, Mo., entitled "Electric Light for the Farmer," the "Commercial" lighting outfits for farms are discussed. The company installs plants of from ten lamps to 1500 lamps. A photograph of a fifteen-lamp plant is shown.

**Electric Welding.**—In a booklet issued by the Electric Welding Company, 220 West Forty-second Street, New York, is given a historical account of electric-arc welding and considerable general information on the subject. In the foreword the company sets forth its facilities for scientific welding, as it maintains a staff of specialists to solve welding problems and a corps of skilled welders to undertake work at short notice.

**Lead-Lined Iron Pipe.**—The Lead-Lined Iron Pipe Company, Wakefield, Mass., is sending out large post cards on which is given a table of comparison of net prices of brass pipe and lead-lined iron pipe in sizes that are available. Lead-lined iron pipe is used for conveying acid, hot or cold water, boiler-feed and corrosive liquids. The company also manufactures tin-lined iron stopcocks and valves and lead-lined iron stopcocks and valves.

**Water Softeners.**—Mr. Elbert Hubbard is the author of a "little journey" to the plant of the Kennicott Company, Chicago Heights, Ill. In this booklet is told the story of the Kennicott water-softening process and of other manufactures of the Kennicott Company. Some interesting information on the general subject of water is also given, as well as a brief history of the personnel of the company, written in Fra Elbertus' inimitable style.

**Electric Washers.**—Automatic electric and power washers are the subject of a recent catalog issued by the Automatic Electric Washer Company, Newton, Ia. The power washer is equipped with a pulley for engine drive, and the electric washer is equipped with a motor. Illustrations are given of both types, as well as of an automatic wringer and of an ironer—a complete home laundry equipment of interest to all householders, and to central stations as a means of increase in the day load.

**Asbestosteel.**—Bulletin 53, just issued by the Asbestos Protected Metals Company, of Beaver Falls, Pa., describes the use of its product in the fabrication of modern walls and roofs, the principal application being in factory, mill and electrical station construction and in railroad buildings. Physically the booklet presents a finished appearance that invites attention, and the text contains matter of vital interest to all concerns who have structures of the above description to build or repair.

**Instruments.**—The Esterline Company, Indianapolis, Ind., has recently distributed a number of sheets for insertion in a binder furnished for the purpose. These sheets are issued periodically and are arranged in the loose-leaf form. They contain brief references to the various instruments manufactured by the company, tabulated in a form convenient for the prospective purchaser. In addition, a number of sheets are included giving instructions for operating graphic meters. The binder is provided with space for additional sheets as issued.

**Electric Hoists.**—Electric hoists are the subject of Bulletin No. 12 of the Lidgerwood Manufacturing Company, 96 Liberty Street, New York. The facility with which electricity can now be obtained and the convenience and economy of its distribution have created a large demand for this class of apparatus. In this bulletin are given data and illustrations of the single-friction drum electric hoist with brake, the double-friction drum, electric hoists with drums revolving in opposite directions, jaw-clutch reversible electric mining hoists, and a number of other types.

**Pumps.**—The wide interest in the subject of irrigation makes timely the recent publication of Henry R. Worthington, 115 Broadway, New York City, which has for its subject "The Conservation and Distribution of Water for Irrigation." Many of the data contained therein and also the methods described are based on results from government and commercial work, both experimental and by actual practice in the field. The text is full of interest and the illustrations are attracive. The publication contains descriptions of various types of Worthington pumping apparatus for irrigation purposes and also some useful data and tables.

# Personal Mention

**Mr. T. V. Smith** has resigned as engineer of the Laramie Wyo.) Electric Company.

**Mr. E. N. Cunningham** has assumed the management of e Mount Pleasant (Tenn.) Electric Company, which he cently purchased.

**Mr. C. A. Semrad** has been appointed manager of the heyenne (Wyo.) Light, Fuel & Power Company as suc- ssor to Mr. W. L. Kemper.

**Mr. H. M. Harris** has been elected superintendent of the ckson (Tenn.) Municipal Electric Light and Water Works successor to Mr. T. H. Hartmus.

**Mr. Edward J. McGuire,** of Buffalo, has been appointed ngineer in the division of light, heat and power of the ublic Service Commission, Second District, New York.

**Mr. J. E. Weiss,** superintendent of electrical distribution the Racine division of the Milwaukee Electric Railway Light Company, has tendered his resignation, effective pt. 15.

**Mr. L. L. Stone,** Pikeville, Ky., is general manager of the ndy Valley Light & Power Company, Inc., which re- ntly took over the Pike Light & Power Company, of ikeville.

**Mr. F. C. Maurer,** formerly connected with the Lake Su- erior Paper Company at Sault Ste. Marie, Mich., has been ppointed operating engineer of the Des Moines (Ia.) Elec- ic Company.

**Mr. D. W. Smith,** formerly with the Westinghouse Elec- ic & Manufacturing Company, has been appointed mana- er of motor sales of the Robbins & Myers Company, pringfield, Ohio.

**Mr. W. T. Pratt,** formerly superintendent of the United lectric Light & Water Company of Waterbury, Conn., as been made superintendent of the company's system at augatuck, Conn.

**Mr. J. R. Paschall,** of Richmond, Va., a director of the iedmont Railway & Electric Company, of Burlington, . C., returned Aug. 27 on the *Imperator* from a trip of o months abroad.

**Mr. J. S. Viehe** has resigned from the engineering de- rtment of the Electric Bond & Share Company and is w connected with Westinghouse, Church, Kerr & Com- ny, New York City.

**Mr. B. D. Christian,** who was formerly with the new- siness department of the Merchants' Heat & Light Com- ny, Indianapolis, Ind., has recently been made chief elec- ician of that company.

**Mr. Guy E. Fairly** has resigned as superintendent of the rona (Cal.) Gas & Electric Company, which is controlled the Southern Sierras Power Company, and has been ceeded by Mr. C. C. Bartlett.

**Mr. Lawrence Whittredge Cady,** formerly consulting en- neer for the Browning Engineering Company and its allied mpanies, has opened an office at Lakewood, Ohio, for neral consulting engineering work.

**Mr. F. H. Hill,** operating engineer for the United Gas & lectric Corporation, of 40 Wall Street, New York, has en made acting general manager of the Elmira (N. Y.) ater, Light & Railroad Company.

**Mr. J. F. L. Clack** has resigned his position as manager the municipal lighting and water plant at Portales, N. M., d has become associated with the Mountain State Tele- aph & Telephone Company, Phoenix, Ariz.

**Mr. P. A. Rogers,** commercial agent of the Dallas (Tex.) lectric Light & Power Company, has been appointed local anager of the Texas Power & Light Company at Deni- n, Tex., in place of Mr. W. A. Everett, resigned.

**Mr. P. L. Nourse,** superintendent of distribution for the ome (N. Y.) Gas, Electric Light & Power Company for ven years, has been appointed division superintendent at lsinore (Cal.) for the Southern Sierras Power Company.

**Mr. J. C. Kennedy,** chief engineer of the Brenham (Tex.) ompress Oil & Manufacturing Company, which does the ectric-lighting business in that town, has been elected ecretary of the company vice Mr. W. R. Jahnke, resigned.

**Mr. F. J. Lyon,** superintendent of the Naugatuck branch of the United Electric Light & Water Company and also of the Seymour (Conn.) Electric Light Company, has been appointed assistant superintendent of the Waterbury division.

**Mr. Arthur B. Carpenter,** Southern representative of the Rumsey Electric Company, of Philadelphia, Pa., has resigned and removed to Valdosta, Ga., to take charge of the branch office of the Electric Supply & Engineering Corporation.

**Mr. William Laidlaw,** formerly owner of the Ohio (Ill.) Electric Company, has purchased the stock of the Meeker (Col.) Electric Light, Heat & Power Company and removed from Ohio to Meeker on Sept. 1 to take up the management of the property.

**Mr. W. A. Cullinane** has been appointed manager of the Pryor (Okla.) Ice & Light Company. Mr. Cullinane is a son of Mr. John R. Cullinane, of St. Louis, for a number of years prominent in the management of utilities in Texas and other Southwestern States.

**Mr. E. R. Chisholm** has been appointed superintendent of the Tupelo (Miss.) Municipal Electric Light, Water & Sewerage Company, and the former incumbent, Mr. W. H. St. John, has been made assistant superintendent. The manager of the company is Mr. C. E. Goodlett.

**Mr. F. H. Miller,** local manager for the Interstate Public Service Company at Lebanon, Ind., has been transferred to the central Indiana district, with headquarters at Columbus, Ind. Mr. Miller will have charge of the system in Seymour, Columbus, Franklin and Greenwood.

**Mr. C. A. Orr** has been appointed superintendent of the plant and shops of the Arkansas Valley Railway Light & Power Company of Pueblo, Col., vice Mr. C. M. Caster, resigned. Mr. Orr was formerly engaged in similar work at Peoria, Ill., Sioux Falls, S. D., Ottumwa, Ia., and other points.

**Mr. E. B. Nance** has been appointed chief accountant of the Idaho Railway, Light & Power Company, of Boise, Idaho. The Idaho company has five power plants and more than 100 miles of interurban lines and supplies numerous towns with electrical energy from its high-tension system.

**Mr. H. V. Slasor,** formerly superintendent and chief engineer of the County Electric Company, of New Philadelphia, Ohio, has severed his connection with the company to engage in the electric contracting and supply business in New Philadelphia under the name of the Advance Electric Company.

**Mr. Harold Almert,** chief of the department of examinations and reports of H. M. Byllesby & Company, has been appointed appraiser for the Chicago Reducton Company, to be one of three to fix the valuation of the p of the company, which the city of Chicago is under contract to purchase.

**Mr. A. H. Kimball,** general manager of the Fall River (Mass.) Electric Light Company, was presented with a pin by the employees of the company as a memento of the opening of Fall River's "great white way." The pin is a model "white-way" pole with a diamond center and rim penetrating a gold circle.

**Mr. Norman McD. Crawford,** who recently resigned as president of the Mahoning & Shenango Railway & Light Company, of Youngstown, Ohio, the principal subsidiary of the Republic Railway & Light Company, has removed to New York City, where he will be connected with electric railway and lighting interests.

**Mr. Thomas A. Edison,** who is at present on an automobile trip through New England, was reported ill at Portland, Me., on Sept. 1. The report, however, was unfounded. Mr. Edison had motored 500 miles on the two previous days and felt somewhat fatigued. He continued his trip the next morning with his family.

**Mr. Edson O. Sessions** has opened an office in the Marquette Building, Chicago, for consulting and expert engineering work. Mr. Sessions, who is a fellow of the A. I. E. E., a member of the A. S. M. E., an associate of A. S. C. E. and a member of the I. E. S., has been engaged in construction and engineering work for over twenty years.

**Mr. C. G. M. Thomas,** vice-president and general manager of the New York & Queens Electric Light & Power Company, Long Island City, N. Y., was elected president of the company at a recent meeting of the board of directors. This is a fitting testimonial of appreciation of Mr. Thomas's efficient services to the lighting industry in New York City during the past twenty-five years.

**Mr. Claude Curtis,** of Boston, Mass., has been appointed superintendent of the Houghton County Electric Light Company, of Houghton, Mich., owned by the Stone & Webster Company, of Boston. Mr. Curtis recently returned from a three months' trip to Cuba in the interests of his firm. For four years he was manager of the company's plant in Porto Rico. Mr. Curtis was graduated from the University of Michigan in 1907.

**Mr. Elmer A. Holbrook,** professor of mining engineering in the Nova Scotia Technical College, has been appointed assistant professor of mining engineering at the University of Illinois, where he will have charge of the recently equipped coal-washing and ore-dressing laboratory and a course in mine design. Professor Holbrook graduated from the Massachusetts Institute of Technology in 1904 and spent five years in active mine and mill management work in the United States, Canada and Mexico. He has been connected with the Nova Scotia Technical College for the past three years.

**Mr. James D. Robertson,** formerly sales manager for the Pittsburgh (Pa.) Valve, Foundry & Construction Company, has again assumed charge of the sales of that company, returning as second vice-president after two years' absence. Mr. Robertson in the meantime completed the organization, plant, etc., of the Warren (Ohio) Tool & Forge Company. He began his business career with Atwood & McCaffrey, and when that concern was absorbed by the Pittsburgh Valve, Foundry & Construction Company he continued his services and at the time of his withdrawal had completed his twenty-first year with the company.

**Prof. Lewis E. Young,** who for the past six years has been director of the Missouri School of Mines, will take up graduate work in the department of economics at the University of Illinois in September and will also give part of his time to teaching in the department of mining engineering. Professor Young was graduated from the Pennsylvania State College in 1900, since which time he has studied at the Michigan College of Mines and at the University of Chicago. He has taught at the Iowa State College and has been professor of mining at the Colorado School of Mines and director of the Missouri School of Mines. For some years Professor Young has made a special study of the economics of mining, taxation and political economy.

**Mr. John Hunter,** chief engineer of the Union Electric Light & Power Company of St. Louis, is the subject of an interesting sketch, with portrait, printed in the *Union Electric Bulletin* for August. Mr. Hunter, who was for a number of years an engineer in the marine service, left the sea in 1905 with the rank of chief engineer United States Navy. Captain (afterward Admiral) Sigsbee, in an official report made in 1896, said of Lieutenant Hunter: "On one occasion, when there were two fires in a coal bunker, he worked without food, and nearly to physical collapse, for a whole day and succeeded in putting out the fires—one of the finest achievements that I have ever known on shipboard." Mr. Hunter became connected with the St. Louis company in the year first mentioned. At the present time he is also the president of the Engineers' Club of St. Louis.

**Mr. J. R. McKee,** a vice-president of the General Electric Company and one of the pioneers in the electrical industry, has tendered his resignation and will retire from the company. This announcement confirms the rumor which has been current for several months that Mr. Kee desired to devote all of his time to personal affairs and would therefore sever his long-standing connection with the General Electric Company. Mr. McKee joined the Thomson-Van Der Poel Electric Mining Company as president at the time of its organization. He was also manager of the Thomson-Houston Motor Company. These activities in 1890 and 1891 resulted in his being made manager of the power and mining department of the General Electric Company when it was organized in 1893. The tremendous growth of this branch of the business is perhaps the best evidence of the success which has crowned Mr. McKee's untiring efforts. His field of endeavor was greatly broadened when in 1908 he was appointed chairman of the sales committee. In 1912 Mr. McKee was elected a vice-president of the company. Mr. McKee's resignation after twenty-three years of active service with the General Electric Company has been reluctantly accepted. As a pioneer in the effort to apply electricity to industrial purposes, Mr. McKee's activities have extended into all parts of the country and through various industries. His circle of friends and acquaintances is unusually large.

## Obituary

**George H. Collins,** an electrical engineer of Brooklyn, N. Y., died at his home, 1258 New York Avenue, that city, Aug. 30, at the age of forty-six.

**Joseph C. Eichmeyer,** an inventor and designer of fire-alarm and police-telegraph signal systems, died at Utica, N. Y., Aug. 31, aged fifty-four years. Mr. Eichmeyer invented and installed in Schenectady the first police flash system of the selective type, this being used to summon policemen whenever the central office desired to get in touch with them.

**F. V. T. Lee,** who was one of the best known electrical engineers on the Pacific Coast and associated with Messrs. J. Martin, E. J. De Sabla, Jr., and others prominently identified with hydroelectric developments in California, died at Victoria, B. C., on Aug. 14. Mr. Lee was a native of England and came to America at the age of seventeen, entering the employ of the Manhattan Electrical Supply Company in New York City. While there he attracted the attention of the late Dr. F. A. C. Perrine, at that time professor of electrical engineering at the Leland Stanford, Jr., University and later chief engineer of the Standard Electric Company of California. Dr. Perrine induced him to come to California and enter the Leland Stanford, Jr., University, where he worked his way through. Mr. Lee had a hand in the construction of several of the hydroelectric plants which are now the property of the Pacific Gas & Electric Company. In 1906 he left John Martin & Company and entered the service of the Pacific Gas & Electric Company, with which he remained until 1910, being assistant general manager of the company when he resigned and went North. Mr. Lee was a member of the American Institute of Electrical Engineers and several kindred societies.

**Fred H. Daniels,** chief engineer of the American Steel & Wire Company, president of the Washburn & Moen Manufacturing Company, of Worcester, Mass., and chairman of the board of engineers of the United States Steel Corporation, died at the age of sixty, at his home in Worcester on Aug. 31. Mr. Daniels was known throughout the wire-manufacturing world as one of its most productive inventors, having taken out 151 patents in his forty years' service in the industry and having served as consulting engineer in the establishment of many of the largest steel plants of America. He was a native of Hanover, N. H., and after graduation at the Worcester Polytechnic Institute in 1873 entered the Washburn & Moen wire plant in that city as a draftsman. With the exception of a short time spent outside in the study of metallurgical chemistry, Mr. Daniels made his headquarters at Worcester until his death. He was an extensive traveler on both sides of the Atlantic, and supervised the erection of mills and machinery at Worcester, Waukegan, Ill., San Francisco, Birmingham, Ala., Gary, Ind., and Cleveland, Ohio. At Gary he was a prominent member of the board of consulting engineers in charge of the installation and design of that mammoth plant, and he served in a like capacity at the Duluth mills of the Minnesota Steel Company. In all, 143 plants were under his direction. He was the recipient of a gold medal at the Paris Exposition of 1900, and in 1909 he was decorated by King Oscar of Sweden. He was a member of many engineering societies in Europe and America. He is survived by a widow and three sons

# Construction

## New England

WOODSVILLE, N. H.—The electric plant of the Woodsville Aqueduct Co., which was destroyed by fire in February, has just been rebuilt. The equipment consists of two 150-kw, three-phase, 60-cycle General Electric generators with direct-connected exciters; one 10-kw constant-current transformer for street circuit; one 150-hp Brown engine; one 150-hp waterwheel (Holyoke Machine Co.); one 165-hp S. Morgan Smith waterwheel; one Lombard waterwheel and governor for the Smith wheel. George E. Mann is engineer of power station.

FISHERVILLE, MASS.—The Fisherville Mfg. Co. is reported to be preparing plans for the construction of a transformer station to be used as an auxiliary to its present power plant.

MIDDLETON, MASS.—At a special town meeting held recently the proposition to purchase the local electric-light plant for $4,500 was carried.

EAST PROVIDENCE, R. I.—Work has begun on the erection of a substation for the Narragansett El. Ltg. Co. on Second Street, East Providence, to cost about $10,000. Energy for operating the station will be secured from the main plant in Providence.

ESSEX, CONN.—The Essex Lt. & Pwr. Co. has filed a certificate showing an increase in capital stock from $75,000 to $100,000.

KENT, CONN.—Steps have been taken to organize a company to operate an electric-light and power plant. The capital stock is placed at $3,000.

WINDSOR LOCKS, CONN.—A movement has been started by the Windsor Locks Business Men's Association for the installation of an ornamental street-lighting system on Main Street. Cluster lamps erected on ornamental standards are under consideration.

## Middle Atlantic

BROOKLYN, N. Y.—Bids will be received by the commissioner of docks, Department of Docks and Ferries, Pier A, foot of Battery Place, North River, borough of Manhattan, New York, until Sept. 9, for furnishing materials and labor required for track work and overhead trolley installation on the Thirty-third Street pier and adjacent upland, borough of Brooklyn (contract No. 1380). Blank forms and further information may be obtained and plans and drawings may be seen at the office of the department. Charles J. Farley is first deputy and acting commissioner of docks.

FLUSHING, N. Y.—The New York & Queens County Ry. Co. is planning to enlarge its substation on Lawrence Street in Flushing.

LOCKPORT, N. Y.—The Council has awarded the Lockport Lt., Ht. & Pwr. Co. a contract for street-lighting for a period of three years. Under the terms of the contract the company agrees to install a new street-lighting system.

MONTICELLO, N. Y.—The Public Service Commission has granted the Murray El. Lt. & Pwr. Co., of Monticello, permission to issue bonds to the amount of $50,000, the proceeds to be used for the purpose of paying indebtedness, to provide for working capital and new construction and equipment.

NEW YORK, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 4 for remodeling the fire-alarm system at the navy yard, New York, N. Y. Specifications may be obtained on application to the bureau or to the commandant of the navy yard named. The cost of the work is estimated at $3,080. H. R. Stanford is chief of bureau.

NEW YORK, N. Y.—Bids will be received by Joseph Johnson, fire commissioner, headquarters of the Fire Department, 157 East Sixty-seventh Street, New York, N. Y., until Sept. 9 for furnishing material and installing extensions to the fire-alarm telegraph system in the borough of the Bronx under Bronx contracts No. 2 and No. 3. Blank forms and further information may be obtained and plans and drawings may be seen at the office of the Bureau of Fire Alarm Telegraph of the Fire Department, 157 East Sixty-seventh Street.

FORT HENRY, N. Y.—The Port Henry Lt., Ht. & Pwr. Co. is building a concrete dam at North Pond for storage purposes. George H. Barwise is secretary.

SOLVAY, N. Y.—The Solvay Process Co. has awarded the McClintic, Marshall Co., of Pittsburgh, the contract for the steel-work in connection with its new boiler house in Solvay. The building will be 70 ft. by 250 ft. and will be equipped with five boilers having a rating of 6000 hp. A chimney 250 ft. high will be erected, probably of iron. Charles G. Herbert, acting chief engineer, has charge of the work.

ALLENTOWN, PA.—Bids will be received by the County Commissioners, Court House, Allentown, until Sept. 19 for furnishing material and labor for extensinon of the electric-light system in the Hospital Building at the Lehigh County Home, near Wescosville. Plans and specifications may be seen at the office of the County Commissioners, and copies can also be obtained upon deposit of $25, to be refunded upon return of plans. Bids should be addressed to H. C. Weinert, clerk.

INTERCOURSE, PA.—The Intercourse El. Lt., Ht. & Pwr. Co. has nearly completed its substation to connect with the 11,000-volt transmission line of the Edison El. Co. of Lancaster, transforming the energy to 2200 volts. When completed the company will close down its steam plant. The company is also extending its transmission lines to Vintage, Ronks and Bird-in-Hand to furnish electrical service in those towns. Enos L. Zimmerman is secretary and manager.

OIL CITY, PA.—Plans are being prepared, it is reported, by Day & Zimmerman, engineers, 608 Chestnut Street, Philadelphia, Pa., for the erection of a power house and plant at Oil City for the Citizens' Trac-Co., Oil City.

READING, PA.—The Metropolitan El. Co. will begin workk on the erection of a transmission line from its plant in West Reading to Lebanon to furnish energy for lamps and motors in that city. The line will be carried on steel towers erected on private right-of-way. The cost of the work is estimated at $150,000. Clarence C. Long, electrical engineer for the company, and W. S. Bartow, of New York, N. Y., will have charge of the work.

BUCKHANNON, W. VA.—The Buckhannon Lt. & Wtr. Co. expects to purchase within the next 30 days a 180-hp to 200-hp National gas engine and a 135-kw, three-phase generator (both second-hand); also a 1,000,000-gal. motor-driven pump (new) and switchboard for above equipment. J. G. Mayfield is general manager.

WHEELING, W. VA.—The Wheeling Valley El. Lt. & Pwr. Co. has applied to the County Commissioners for a 50-year franchise to erect high-tension transmission lines along the county roads in and out the pike district.

MONTEREY, VA.—The Highland Garage & Lt. Co., of Monterey, expects to purchase within the next two months wiring supplies, etc. Charles Lumsford is interested in the company.

ROCKY MOUNT, VA.—The Lt. & Pwr. Co., of Rocky Mount, expects to build within the next few months a small power dam and transmission line about 1½ miles in length and to purchase one water turbine, with governor. B. L. Fisher is manager.

STAUNTON, VA.—The Board of Aldermen has decided to establish a municipal electric-light plant, to cost approximately $23,000. The purchase of a site for the proposed power plant has been authorized.

WASHINGTON, D. C.—Tenders are invited by the Egyptian Ministry of the Interior for furnishing and installing an electric-light plant and distribution system in the town of Samanhour. For further information address No. 11,568, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C.

WASHINGTON, D. C.—Bids will be received at the office of the superintendent of United States Capitol Building and Grounds, Washington, D. C., until Sept. 10 for lighting, heating and power system for the court house, Washington, D. C. Plans and specifications may be secured upon application to the above office, for which a deposit of $10 will be required, to be refunded upon return of plans. Elliott Woods is superintendent of United States Capitol Building and Grounds.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Sept. 27 for furnishing and installing four multiple $CO_2$ recorders of four units each with 14 recording gages, 14 auxiliary boiler-room indicators and 14 condensing filters and 14 recording flue-gas thermometers, all in central power plants, navy yards, Mare Island, Cal., and Puget Sound, Wash.; estimated cost is $3,500. Plans and specifications can be obtained on application to the bureau or to the commandants of the navy yards named. H. R. Stanford is chief of bureau.

WASHINGTON, D. C.—Bids will be received at the office of the superintendent of United States Capitol Building and Grounds, Washington, D. C., for interior wood trim and finish, interior plain and ornamental plastering, interior marble work, plate glass, extension of mail chutes and gravity conveyors, hardware, electric-lighting fixtures, plumbing and steamfitting material. Plans and specifications will be issued as soon as possible, together with information as to date of opening bids. Parties intending to submit bids are herewith notified that applications for plans and specifications for any or all of the above work can be filed with this office immediately. Elliott Woods is superintendent of United States Capitol Building and Grounds.

## North Central

BAY CITY, MICH.—W. H. Fitzhugh, secretary of the Electric Light Department, is receiving bids for remodeling the pumping station into an electric-light plant. Clark & Munger are architects.

BLISSFIELD, MICH.—The Council has instructed Ray Ellis, superintendent of the municipal electric-light plant, to prepare estimates of the cost of enlarging the plant and the installation of additional machinery to provide for a 24-hour service.

CARSONVILLE, MICH.—The contract for the installation of a complete municipal electric-light plant has been awarded to the Detroit office of the Fairbanks-Morse Co.

CRYSTAL FALLS, MICH.—Bids will be received by the City Council of Crystal Falls, at the office of W. J. Gribble, city clerk, until Sept. 10 for the general construction, also heating, plumbing and electric wiring, of a new city hall building in Crystal Falls. Plans and specifications are

on file at the office of the city clerk, Crystal Falls, also at the office of John D. Chubb, architect, Chamber Opera House, Chicago, Ill., also at Builders' Exchanges, Milwaukee, Wis., St. Paul and Minneapolis, Minn. Copies of plans and specifications may be obtained upon application to the architect, for which a deposit of $25 will be required; specifications without plans, $10; said deposits to be refunded upon return of same.

DETROIT, MICH.—The Wayne County Creamery is planning to erect a new [illegible] Howe Street, to cost about $500,000. A modern power plant will be installed. John C. Stahl is architect.

DETROIT, MICH.—Bids will be received by the Board of Education, Detroit, until Sept. 9 for erection of the George M. Condon School building and detached power house at the Boulevard and Vinewood Street. Bids will be received for the entire work, or separate bids will be received as follows: For general masonry work, general carpentry work, heating, plumbing and electrical wiring. Plans and specifications may be seen in the office of the supervisor of school buildings, Detroit. Charles A. Gadd is secretary of board.

JONESVILLE, MICH.—The Village Council has awarded contracts for a new 175-hp boiler for the municipal electric-light plant and for extension to power house to provide space for same and for extra coal storage.

LANSING, MICH.—The State Board of Auditors has decided to secure electrical service for the Capitol Building from the municipal electric plant. The Michigan Pwr. Co. has furnished the service in the past.

MUNISING, MICH.—The El. Lt. & Pwr. Co., of Munising, expects to install within the next six weeks one 150-hp tubular boiler. James Hosking is vice-president.

SAULT STE. MARIE, MICH.—The property of the Michigan & Lake Superior Pwr. Co., of Sault Ste. Marie, was purchased by A. S. Weil, of Philadelphia, Pa., representing the bondholders, at an auction sale held on Aug. 27 for $3,500,000. It is understood that the property will be taken over by the Michigan Northern Pwr. Co., recently organized. The new owners, it is said, expect to develop about 45,000 hp.

BLUFFTON, OHIO.—The Board of Public Affairs expects to purchase next spring two boilers having a rating of about 200 hp.

LOWELL, OHIO.—The Parkersburg, Marietta & Interurban Ry. Co. is contemplating the construction of a hydroelectric power plant on the Muskingum River, near Lowell, to cost about $200,000. C. C. Gallagher, of Marietta, is chief engineer.

NEW CUMBERLAND, OHIO.—The installation of a new street-lighting system in New Cumberland is under consideration.

PORT CLINTON, OHIO.—The Port Clinton El. Lt. & Pwr. Co. is remodeling its distribution system, changing to a three-phase, 60-cycle system with a 24-hour service. The company purchases energy from the Northern Ohio Ry. & Pwr. Co. C. A. Matthews is superintendent.

UPPER SANDUSKY, OHIO.—The proposition to issue $25,000 for the installation of a municipal electric-light plant will be submitted to the voters.

CAMPBELLSVILLE, KY.—A company is being organized under the name of the Campbellsville Wtr. & Lt. Co. to install and operate an electric-light plant here. The City Council has granted the company a franchise.

CARLISLE, KY.—The Carlisle El. Lt. & Pwr. Co. is contemplating the erection of a 10-ton ice factory.

ERLANGER, KY.—The Erlanger Lt. & Pwr. Co., recently organized, has been granted a franchise to construct and operate an electric-light system in Erlanger. A site for the proposed plant has been secured.

HARRODSBURG, KY.—Plans are being considered for increasing the output of the municipal electric-light plant.

HENDERSON, KY.—Contracts have been awarded by the City Council for additional equipment for the municipal electric plant as follows: To the Westinghouse El. Mfg. Co., for steam turbine and condenser, at $14,695; Babcock & Wilcox Co., for 400-hp boiler, at $5,691, and to the Heine Chimney Co., of Chicago, for erection of 225-ft. smokestack, at $6,077. L. P. Hite is superintendent of the municipal electric plant.

JEFFERSONVILLE, IND.—A proposition has been submitted to the City Council for lighting the streets of the city by Owen L. Carr, of Rushville, Ind. Mr. Rush, it is stated, will install a plant at once if he obtains the contract. The United Gas & El. Co., of Jeffersonville, now has the contract for street-lighting.

BUNKER HILL, ILL.—The electric light committee is contemplating the purchase of meters for the municipal electric-light plant within the next twelve months. Harry McPherson is chairman of committee.

CHICAGO, ILL.—Improvements will be made to Yates Avenue, the southeastern entrance to Jackson Park, involving an expenditure of about $35,000. The street will be paved and electric lamps installed as far south as the South Shore Country Club.

JACKSONVILLE, ILL.—The Jacksonville Ry. & Lt. Co. has recently closed a contract with Swift & Co. to furnish energy to the amount of 150 hp for its branch in Jacksonville. The company has also recently taken a contract for pumping the city water from deep wells, which requires 250-hp load 24 hours per day. W. B. Miser is general superintendent.

NEWTON, ILL.—The electric light commission expects to purchase a new generator for the municipal electric-light plant within the next few months. A new engine has recently been installed. When the new generator is installed a day service will be established. John W. Mathers, is city clerk.

DODGEVILLE, WIS.—The Dodgeville El. Lt. & Pwr. Co. expects to erect within the next three months a smokestack or brick chimney and to purchase one horizontal tubular boiler. W. J. Pearce is manager.

EAU CLAIRE, WIS.—The Chippewa Valley Ry., Lt. & Pwr. Co., of Eau Claire, expects to build within the next three months an electric railway from Eau Claire to Altoona and to erect a 66,000-volt transmission line 6 miles long, 5 miles of 33,000-volt transmission line, and to insulate 25 miles of 66,000-volt transmission line; also to purchase one pair of 3600-hp waterwheels (50-ft. head), with governor. A. E. Pierce is assistant manager.

HUDSON, WIS.—The Burkhardt Milling & El. Pwr. Co., of Hudson, expects to erect within the next two months 25 miles of 14,000-volt transmission line, east through North Line, Roberts, Hammond and Baldwin, also to purchase one switch and will instrument and 200 kva in 13,200-volt transformers. H. E. Zimmermann is superintendent and purchasing agent.

JANESVILLE, WIS.—The Janesville El. Co. expects to purchase within the next month one 400-kva, three-phase, 60-cycle, 2300-volt, 600-r.p.m. generator with switchboard panel. P. H. Korst is secretary.

LA CROSSE, WIS.—The City Council is reported to have decided to award the contract for energy for lamps and motors at the new municipal water plant to La Crosse Gas & El. Co.

LUCK, WIS.—At an election held Aug. 19 the proposition to issue $4,500 in bonds for the installation of a municipal electric-light plant was carried. Work will begin on construction of the plant immediately. As yet no engineer has been engaged. Andrew Pederson is village clerk.

MADISON, WIS.—The Chicago & Wisconsin Valley R. R. Co., of Madison, which was recently reorganized, has been granted the necessary franchises by various cities and counties on condition that within 60 days the company shows proof that $300,000 has been set aside to start construction and to pay debts contracted previous to the reorganization. The first line will be built from Madison to Portage, including street-car systems in both cities. About 250 miles of electric railway will ultimately be built radiating from Madison.

PRAIRIE DU CHIEN, WIS.—The plant of the Prairie City El. Co., which was recently destroyed by fire, was rebuilt temporarily and placed in operation in six days. The company has purchased a new generator. Contract for new building has not yet been awarded and date not yet decided upon. L. P. Haupt is superintendent.

SOLDIERS' GROVE, WIS.—The Soldiers' Grove El. Co. expects to purchase within the next two months about 200 incandescent lamps. Thomas O. Sims is manager.

SPOONER, WIS.—The city of Spooner has purchased 40 acres of land on the Namekagen River, 9 miles distant, where it proposes to build a hydroelectric power plant and transmit energy to Spooner for manufacturing purposes. The present municipal electric plant is driven by power from the Yellow River.

DULUTH, MINN.—The Duluth Edison El. Co. has recently purchased 38,000 lb. 0000 solid weather-proof wire to replace 4½ miles of single-phase No. 2 weather-proof lighting feeder in the new steel plant district beyond West Duluth. C. W. Higgins is assistant to manager.

GAYLORD, MINN.—The electric light committee expects to purchase within the next 30 days some incandescent lamps. F. J. Hecht is superintendent.

JORDAN, MINN.—The Jordan El. Ltg. & Htg. Co. is adding about 500 ft. of mains to its heating system.

KEEWATIN, MINN.—Bids will be received by the Village Council until Sept. 9 for furnishing and installing one reciprocating engine, generator, exciter, switchboard and equipment, plans and specifications for which are on file in the office of J. J. Roberts, village clerk.

AFTON, IA.—Beginning about Sept. 1, energy for operating the municipal electric-light system will be obtained from the plant of the Creston Mutual Lt. & Pwr. Co. in Creston, 10 miles west of Afton. F. A. White is city clerk.

ALBIA, IA.—We are informed that no definite action has yet been taken in connection with the installation of a municipal electric light plant in Albia. An engineer has not yet been engaged. C. C. Atchison is city clerk.

FAYETTE, IA.—The municipal electric light and water-works commission expects to purchase within the next six months one standpipe for water-works system. W. J. Irvin is superintendent.

MENLO, IA.—George C. Buckley & Co., owners of the local electric light plant, are installing a 60-hp engine and boiler. George C. Buckley is president and manager.

CHAFFEE, MO.—The Missouri Public Utilities Co., of Cape Girardeau, will extend its high-tension transmission line now furnishing energy to Illmo and Fornfelt to Chaffee. Energy for operating the entire service will be furnished from the plant in Cape Girardeau. A. M. Tinsley, of Cape Girardeau is local manager.

COLUMBIA, MO.—We are informed that the installation of an electric plant at the University of Missouri is not contemplated in the near future. A site was purchased some time ago but will not be used for the present. Work is nearly completed on additions to the present plant. C. S. Lynch is superintendent of buildings.

JEFFERSON CITY, MO.—The contract for construction of power use and tunnel at the State Capitol Building has been awarded to Anderson & Co., of St. Louis, Mo., at $42,495.

VELVA, N. D.—Arrangements have been completed by O. J. Kaufan, of Hillsboro, who was recently granted a franchise, to establish an ectric-light plant in Velva.

BRIDGEWATER, S. D.—The Bridgewater El. Pwr. Co expects to rchase within the next six months some transformers and meters; also me vacuum cleaners and washing machines. G. W. Laing is president.

MOBRIDGE, S. D.—The Mobridge El. Lt., Ht. & Pwr. Co. expects purchase within the next 60 days equipment for central heating station, aterial for about 3 miles of line extension for the present lighting sysm, also equipment for ornamental street-lighting system (to cost about ,500). B. S. Hill is proprietor.

SALEM, S. D.—The Salem Milling, Lt. & Htg. Co. has recently purased a 54-in. by 18-ft. tubular boiler for its plant. L. V. Schneider president.

STURGIS, S. D.—Beginning with Sept. 15, the Sturgis Pwr. & Lt. . expects to close down its local plant and to purchase energy from the ater-power company. U. S. Allison is manager.

ATKINSON, NEB.—J. Skedla & Sons, owners of the local electric ht plant, expect to erect within the next month an 80-hp oil engine d are now installing a new generator and switchboard.

STRATTON, NEB.—The village of Stratton contemplates removing triplex pumps to a better water supply, which will necessitate the rchase of a 15-hp or 20-hp motor. Elmer E. Martin is engineer.

## Southern States

LA GRANGE, N. C.—H. H. Hutton & Sons, owners of the local elec-light plant, expect to erect a new power house and install a new el overshoot waterwheel. A. R. Hutton is manager.

OLD FORT, N. C.—William Robinson has purchased a water-power e on Curtis Creek, about 2 miles from Old Fort. It is understood that r. Robinson contemplates development of same.

KINGSTREE, S. C.—The Kingstree El. Lt. & Ice Co. is reported to ve increased its capital stock from $15,000 to $25,000.

NEWBERRY, S. C.—The proposition to issue $30,000 in bonds to rchase the electric-light plant and water-works now being built in ewberry by the J. B. McCrary Co., of Atlanta, Ga., will soon be subtted to the voters.

LAKELAND, FLA.—The installation of an electric system at the keland Dairy Farm is reported to be under consideration. For further formation address A. J. McDonough.

HENDERSON, TENN.—At a municipal election to be held the last of tober the proposition to issue $30,000 in bonds for the construction a water-works system, also from $6,000 to $8,000 in bonds for vers, will be submitted to the voters. If the bond election carries, e Priestley-Loyd Lt. & Pwr. Co. will build a new power house, to cost out $1,800. C. W. Priestley is president.

LEWISBURG, TENN.—The Lewisburg Lt. & Pwr. Co. expects to rchase equipment for increasing the output of its ice plant by 20 tons r day within the six months. J. B. Hardison is secretary and treasurer.

SEVIERVILLE, TENN.—Arthur Brown, of Knoxville, is interested a project to establish an electric-light plant in Sevierville.

HOPE, ARK.—The managers of the water and light plant are buildg an addition to the power house of the municipal electric-light plant 0 ft. by 38 ft., brick and concrete) to provide space for pumps, and are w completing the installation of a new 600-ft. air compressor and a 0-kw. two-phase generator directly connected to a Corliss engine. harles M. Richards is manager.

PRAIRIE GROVE, ARK.—The construction of a municipal electric-ht plant and water-works system at a cost of $50,000 is under conderation.

GIBSLAND, LA.—The North Louisiana Lt. & Pwr. Co., of Arcadia, s submitted a proposition to the Town Council to furnish energy to ht the streets of the town. The company also proposes to furnish ectrical service to private consumers.

NEW ORLEANS, LA.—A contract has been closed whereby the New rleans Ry. & Lt. Co. will extend its service to the plant of the Planters' rtilizer Co. in Shrewsbury, a suburb of New Orleans. The contract lls for about 500 hp. The company will also furnish energy for lamps d motors for residents in that suburb and also to manufacturing terprises.

RINGGOLD, LA.—A stock company is being organized by local citens for the purpose of installing a water-works system. Plans are also ing considered for establishing an electric-light plant.

LEHIGH, OKLA.—The Public Service Co., of Oklahoma, which reently purchased the municipal electric-light plant in Lehigh, expects erect a 6600-volt transmission line from Coalgate to Lehigh to furnish ergy to operate the local system. All material for the line has been rchased.

MEDFORD, OKLA.—The managers of the municipal electric-light ant expect to erect within the next two months a new power house d to purchase generating equipment, a six-panel switchboard and instruments and also one 6.6-amp. constant-current series tungsten regulating transformer. Charles Berger is superintendent.

COLORADO, TEX.—The Colorado El. Lt. Co. expects to install an oil engine within the next six months.

COMANCHE, TEX.—The Comanche Lt. & Pwr. Co. expects to purchase within the next few months a 125-kw to 150-kw single-phase generator and a tungsten-lamp street lighting system. E. W. Harris is manager and proprietor.

CONROE, TEX.—The Conroe Gin, Ice & Lt. Co. expects to establish a day service and to purchase machinery for an ice plant within the next 12 months. C. C. McDade is secretary and treasurer.

COOPER, TEX.—The Delta El. Mfg. Co. expects to purchase one 30-kw generator directly connected to a 40-hp or 50-hp engine (would prefer a good second-hand machine) within the next six months. The company has erected 2 miles of distribution lines within the last two months. R. J. Thomas is president.

LONGVIEW, TEX.—Bids will be received by the city of Longview, City Hall, Longview, until Oct. 8 for the construction of a mechanical filtration plant of 1,000,000-gal. capacity, a pumping and electric-light plant, and a discharge main 3½ miles long, to cost approximately $110,000. Complete plans and specifications may be seen at the office of the city secretary, Longview, or at the office of the Aetna Engineering Bureau, 17 North La Salle Street, Chicago, Ill. Plans may be obtained from the engineers upon payment of $2.50, which will not be refunded. G. A. Bodenheim is Mayor.

RUNGE, TEX.—At an election held Aug. 27 the proposition to issue $20,000 in bonds for the construction of an electric-light plant and water-works was carried. J. F. Murray is clerk.

SAN ANTONIO, TEX.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 25 for the installation complete of an electric elevator in the United States post office and court house at San Antonio, in accordance with specifications, copies of which may be had at the above office. O. Wenderoth is supervising architect.

SAN BENITO, TEX.—The franchise which was granted to the S. A. Robertson Co. a few months ago for the construction of an electric-light plant and telephone system has been declared forfeited. It is expected that a franchise will be granted to other parties.

SULPHUR SPRINGS, TEX.—B. F. Ashcroft & Sons, owners of the local electric-light system, are preparing to build an electric light and power plant and expect to purchase two 150-kw, 2300-volt, three-phase, 60-cycle generators (directly connected type); also engines, water-tube boilers and switchboard.

WEATHERFORD, TEX.—The capital stock of the City of Weatherford Wtr., Lt. & Ice Co., it is reported, has been increased from $80,000 to $90,000.

## Pacific States

LEAVENWORTH, WASH.—The Tumwater Lt. & Wtr. Co., of Leavenworth, expects to purchase one carload of poles within the next six months. L. R. Hart is secretary.

PE ELL, WASH.—The Central Lt. & Mfg. Co., of Pe Ell, expects to extend its distribution lines throughout the surrounding farming country; also to purchase within the next 30 days a 50-kw, three-phase, 2300-volt generator and to establish a 24-hour service, and within the next five months to purchase 50 meters. L. A. Webb is secretary and treasurer.

TACOMA, WASH.—Options have been obtained by the Tacoma Ry. & Pwr. Co. on a site at the corner of Twelfth Street and Sprague, on which it proposes to erect a new power house, storage sheds and offices for headquarters in place of the present building on A Street in Tacoma.

ADIN, CAL.—The Pitt River Pwr. Co. has applied for permission to build and operate a power plant at Burney Falls. The present plans provide for the development of 1000 hp and eventually to expand to a larger system. The company now operates a small plant in Adin. E. M. Wilson, Lawrence A. Wilson, of Adin, and others are interested.

BERKELEY, CAL.—The city attorney has been instructed to sell bonds to the amount of $95,000 for the installation of a fire-alarm system, etc.

BURBANK, CAL.—The State Railroad Commission has granted the Burbank El. Lt. & Pwr. Co. permission to sell its entire system to the city of Burbank for $3,212.

HEMET, CAL.—Notice of appropriation of 10,000 in. of water at the South Fork of the San Jacinto River has been filed with I. S. Logan, county recorder, by Ralph Bandini, attorney, of Los Angeles. The application states that about 7000 hp will be developed at a cost of about $200,000. Energy generated at the plant will be used for pumping water and for lamps in the San Jacinto, Hemet and Perris Valleys.

LOS ANGELES, CAL.—The City Council has adopted the report of the public service committee recommending that a bond election be called as soon as possible to submit the proposition to issue $6,500,000 in bonds for the completion of the aqueduct power project and the electrical distribution system in connection with the power project.

OAKLAND, CAL.—The State Railroad Commission has granted the Oakland, Antioch & Eastern Ry. Co., of Oakland, permission to issue $1,000,000 in bonds, the proceeds to be used for the construction of an electric railway from Bay Point to Sacramento.

RIVERSIDE, CAL.—A merger of four power systems, which will furnish energy to electric industries in western Nevada, the eastern portion of California and a large part of southern California, has been announced by Delos Chappell, president of the Southern Sierras Pwr. Co. The various systems will be connected by the erection of a transmission line from Bishop and Lundy Lake. The full connection will be effected by the construction of a line from Bishop to Long Valley by the Silver Lake Pwr. & Irrig. Co., and by an extension to be made by the Pacific Pwr. Co. from Long Valley to Lundy Lake. The Silver company has power projects on the Ownes River, while the Pacific company has its plant on Lundy Lake. The parent company is the Nevada-California Pwr. Co., which gets its energy from five hydroelectric plants on Bishop Creek, also the source of supply for the Southern Sierras Pwr. Co.

SACRAMENTO, CAL.—The city commissioners have authorized the extension of the electrolier lighting district from Twelfth to Sixteenth Street on J and K Streets. Flaming-arc lamps will be erected along the cross streets. The total cost of the extension is estimated at $12,806.

ASHTON, IDAHO.—The Ashton & St. Anthony Pwr. Co. has applied to the State officials for permission to build a dam on the Snake River, 2 miles west of Ashton.

SHOSHONE, IDAHO.—We are informed that the local substation of the Great Shoshone & Twin Falls Lt. & Pwr. Co. was not destroyed by fire, as reported in the issue of Aug. 23. The 44,000-volt bushings on incoming lines of the substation were destroyed by lightning.

BOUNTIFUL, UTAH.—Arrangements have been made by the Utah Lt. & Ry. Co., of Salt Lake City, for the construction of a substation in Bountiful. The equipment will consist of a 500-kw General Electric motor-generator (direct-current output), switchboard complete for alternating-current and direct-current machine and alternating-current and direct-current feeder panels, and four 300-kva transformers. Approximately 11 miles of overhead transmission line will be erected. Contracts have been awarded for the work.

SALT LAKE CITY, UTAH.—A movement has been started by the Salt Lake Real Estate Association to persuade the city of Salt Lake City to erect a municipal electric-light plant on City Creek Canyon to supply energy for street-lighting. W. G. Tuttle is interested in the project.

WARREN, ARIZ.—The Warren-Bisbee Ry. Co. expects to purchase a 5-kw or 10-kw transformer within the next month. The C. & A. Mining Co. will furnish energy to operate the railway system. Jesse Yoakum is superintendent.

ALAMOSA, COL.—The Mutual El. Lt. & Pwr. Co., of Alamosa, expects to purchase switches to change its switchboard from two-phase to three-phase, also totalizing recording wattmeter for entire output, two carloads of poles and probably one tub transformer next spring. H. A. Goodridge is manager.

FORT LUPTON, COL.—The Fort Lupton Lt. & Pwr. Co. is installing a 50-hp General Electric motor to operate the pumps at the municipal water-works system. The company expects to place orders soon for heating and cooking appliances for the holiday trade. D. W. McGee is local manager.

STEAMBOAT SPRINGS, COL.—The Steamboat Springs El. Co. expects to erect ½ mile of high-tension line to the mill of the Sarvis Timber Co. W. L. Carver is superintendent.

SEARCHLIGHT, NEV.—The forty-stamp mill, engine room and electric plant at the Quartet Mine was destroyed by fire on Aug. 20, causing a loss of about $115,000.

AZTEC, N. M.—The Aztec Lt. & Pwr. Co. has recently installed a new boiler and engine in its power house. W. Gott Blake is manager.

## Canada

POINT GREY, B. C.—The City Council has decided to engage an engineer to make investigations and report on the cost of the construction of a municipal electric-light plant.

VANCOUVER, B. C.—Mayor Baxter is considering a proposition for the construction of a hydroelectric power plant to furnish energy for lamps and motors for this city. The plan contemplates the construction of dams on Seaton Lake and Bridge River, which, it is estimated, would develop 250,000 hp.

WINNIPEG, MAN.—Tenders will be received by the chairman of Board of Control at the office of M. Peterson, secretary, until Sept. 20, for furnishing material and labor necessary for the erection of a duplicate transmission system on the present right-of-way of the city of Winnipeg, between Point du Bois and Winnipeg. Instructions to bidders, plans and specifications and form of tender may be obtained at the City Light and Power Department, 54 King Street, Winnipeg.

BRANTFORD, ONT.—Arrangements have been completed whereby the high-tension transmission line of the Hydro-Electric Power Commission of Ontario from the Brant substation will be erected on the right-of-way of the Lake Erie & Northern Ry. Co. into the city of Brantford. Negotiations are also under way for erecting the high-tension line for Paris over the right-of-way of the railway company.

NIAGARA FALLS, ONT.—The City Council has adopted a resolution authorizing the expenditure of $7,215 for improvements and extensions to the electric-lighting system.

TORONTO, ONT.—The Hydro-Electric Power Commission of Ontario has definitely decided upon the route for the transmission line between Chatham and St. Thomas. Right-of-way has been secured and work will be started at once. Material for the line has already been purchased.

WALKERVILLE, ONT.—Arrangements have been made whereby the Edison Illg. Co. of Detroit and the Walkerville Lt. & Pwr. Co. will within a short time control the electric lighting of an extensive area in Essex County. The Edison company recently purchased power plants in Harrow, Leamington, Essex and Kingsville; it also purchased a site for a power plant in Sandwich and obtained permission to erect power cables across the river from Delray to Sandwich.

## New Incorporations

COLUMBIANA, ALA.—The Columbiana Ice, Lt. & Pwr. Co. has been incorporated by J. M. Crump and others. The company is capitalized at $25,000 and proposes to generate and distribute electricity for lamps and motors.

SOPER, OKLA.—The Soper El. Co. has been incorporated with a capital stock of $4,500 by W. F. Breathwit, A. J. Steen and J. Breathwit.

STAYTON, ORE.—The West Stayton Pwr. & Ry. Co. has applied for a charter to build an electric railway between Stayton and Salem. The company is capitalized at $100,000 and the incorporators are S. N. Arnold, L. O. Stadter and Grant Thomas.

## Directory of Electrical Associations, Societies, Etc.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, H. O. Hanson, Mobile Gas Co., Mobile, Ala.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Permanent secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTRIC RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary-treasurer, Matthew R. Boylan, Public Service Railway Co., Newark, N. J. Annual convention, Atlantic City, N. J., Oct. 13-17.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, H. C. Donecker, 29 West 39th St., New York. Annual convention, Atlantic City, N. J., Oct. 13-17.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION. Secretary, H. C. Donecker, 29 West 39th St., New York. Annual convention, Atlantic City, N. J., Oct. 13-17.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Semi-annual meeting, Denver, Sept. 9-11.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary, Eugene W. Stern, 101 Park Ave., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio. Annual meeting, Atlanta, Ga., December.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, Edwin A. Scott, 29 West 39th St., New York.

AMERICAN WATER WORKS ASSOCIATION. Secretary, J. M. Diven, 47 State St., Troy, N. Y. Annual meeting, May, 1914.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, W. J. Tharp, Little Rock, Ark. Annual meeting, May, 1914.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Geo. C. Holberton, Pacific Gas & Electric Co., San Francisco, Cal. Annual meeting, Cooperstown, N. Y., Sept. 8-11.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, James Farrington, Steubenville, Ohio. Annual meeting, New York, Sept. 22-27.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago. Annual meeting, Chicago, Oct. 20-24.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 112 West Adams St., Chicago. Annual meeting, New Orleans, May 19-22, 1914.

CALIFORNIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, W. Hanbridge, 1408 Merchants' National Bank Building, Los Angeles, Cal.

ADIAN ELECTRICAL ASSOCIATION. Secretary, H. G. Martin, Toronto ic Light Co., Ltd., Toronto, Can.

ORADO ELECTRIC CLUB. Secretary, C. F. Oehlmann. Meets every day at Albany Hotel, Denver, Col. Annual meeting, Denver, Oct. 6.

ORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secre- Thomas F. Kennedy, 900 15th St., Denver, Col. Annual meeting, er, Oct. 6.

CTRIC CLUB OF CHICAGO. Secretary, Fred M. Rosseland, Monadnock Chicago. Meets every Thursday noon at Hotel Sherman.

CTRICAL CONTRACTORS' ASSOCIATION OF GREATER BOSTON. Secretary, Hale, 39 Boylston St., Boston.

CTRICAL CONTRACTORS' ASSOCIATION OF MASSACHUSETTS. Secretary, Temple, 30 Foster St., Worcester, Mass.

CTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secre- Geo. W. Russell, Jr., 25 West 42d St., New York.

CTRICAL CONTRACTORS' ASSOCIATION OF THE CITY OF CHICAGO. Sec- , M. N. Blumenthal, 179 West Washington Street. Meets at on the second and fourth Wednesday of each month at 424 South sh Ave.

CTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secre- Ernest S. Cowie, 1613 Grand Ave., Kansas City, Mo.

CTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert mann, 626 Lloyd St., Milwaukee, Wis.

CTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederick P. 1343 Marquette Building, Chicago. Annual meeting, Chicago, mber.

CTRICAL CREDIT ASSOCIATION OF PHILADELPHIA. Secretary, John W. , 1324 Land Title Building, Philadelphia, Pa.

CTRICAL DEVELOPMENT ASSOCIATION, INC. Secretary, Zenas W. r, 53 State St., Boston, Mass.

CTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 igan Ave., Chicago, Ill.

CTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Frank- Overbagh, 411 South Clinton St., Chicago, Ill. Fall meeting, Niagara Canada, Sept. 9-11.

CTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. ly, Royal Insurance Building, Montreal, Can.

CTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, t H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. ing, San Francisco, second Thursday of each month.

CTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, Harvey Rob- , 124 West 42d Street, New York. Annual convention, Chicago, 27 and 28.

CTRIC VEHICLE ASSOCIATION OF AMERICA, NEW ENGLAND SECTION. tary, L. L. Edgar, 39 Boylston St., Boston.

PIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. Thapin, 29 West 39th St., New York. Annual meeting, New York. ber.

RADAY ELECTRICAL ASSOCIATION. Secretary, W. J. Collins, 1129 nic Temple, Chicago. Meets at noon on the first and third Wednes- of each month at Planters' Hotel.

S, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Sec- y-treasurer, Prof. H. V. Bozell, Norman, Okla. Annual meeting, , 1914.

LINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, ia, Ill.

LUMINATING ENGINEERING SOCIETY. General secretary, J. D. Israel, neering Societies Building, 29 West 39th St., New York. Sections New York, New England, Philadelphia, Chicago and Pittsburgh. ual meeting, Pittsburgh, Sept. 22-26.

DEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW . Secretary, A. Newburger, 1153 Myrtle Ave., Brooklyn, N. Y.

DIANA ELECTRIC LIGHT ASSOCIATION. Secretary and treasurer, J. V. man, 49 Lombard Building, Indianapolis, Ind. Annual meeting, napolis, Sept. 24 and 25.

STITUTE OF OPERATING ENGINEERS. Secretary, L. Houmiller, 29 39th St., New York.

STITUTE OF RADIO ENGINEERS. Secretary, E. J. Simon, 81 New St., York. Annual meeting, New York, January, 1914.

TERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, George, Houston, Tex.

TERNAL-COMBUSTION ENGINEERS' ASSOCIATION. President, Charles rch, 416 West Indiana St., Chicago. Meeting second Friday of each dh at Lewis Institute.

TERNATIONAL ELECTRICAL CONGRESS. Secretary, Dr. E. B. Rosa, eau of Standards, Washington, D. C. San Francisco, Sept. 13-18, 1915.

TERNATIONAL ELECTROTECHNICAL COMMISSION (international body rep- senting various national electrical engineering societies contributing to s support). General secretary, C. le Maistre, 28 Victoria St., West- ster, London, S. W., England. Meeting at San Francisco, Sept. 6-11, 01

IOWA ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Secretary, H. B. Maynard, Waterloo, Ia.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia. Annual meeting, Cedar Rapids, April 23, 1914.

JOVIAN ORDER. Jupiter (president), F. E. Watts, 239 West 39th St., New York; Mercury (secretary), E. C. Bennett, St. Louis, Mo. Annual meeting, Hotel Astor, New York, Oct. 14-16.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary-treasurer, Ivor Thomas, 237 South Main St., Wichita, Kan. Annual convention, Hutchinson, Oct. 9 and 10.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, W. H. Bower Spangenberg, 625 Poydras St., New Orleans, La. Meets second Thursday of each month.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Waterville, Maine.

MINNESOTA ELECTRIC ASSOCIATION. Secretary-treasurer. F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn. Annual meeting, Minneapolis, March, 1914.

MISSISSIPPI ELECTRIC ASSOCIATION (affiliated with the National Electric Light Association). Secretary-treasurer, Frank J. Duffy, Natchez, Miss.

MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATER WORKS ASSOCIATION. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis. Annual meeting, May, 1914.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, Wm. L. Smith, Concord, Mass.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York. Annual meeting, Philadelphia, May, 1914.

NATIONAL ELECTRIC LIGHT ASSOCIATION, COMMERCIAL SECTION. Secretary, J. F. Becker, 1170 Broadway, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION, EASTERN NEW YORK SECTION. Secretary, R. E. Russell, Schenectady, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION, HYDROELECTRIC SECTION. Secretary, S. A. Sewall, 29 West 39th St., New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MICHIGAN SECTION. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEBRASKA SECTION. Secretary-treasurer, S. J. Bell, David City, Neb.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEW ENGLAND SECTION. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass. Annual convention, Burlington, Vt., Sept. 17, 18, 19.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NORTHWEST SECTION. Secretary, N. W. Brockett, Pioneer Building, Seattle, Wash. Annual meeting, Seattle, Wash., Sept. 10-12.

NATIONAL ELECTRIC LIGHT ASSOCIATION, SOUTHEASTERN SECTION. Secretary-treasurer, A. A. Wilbur, Columbus, Ga.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago. Annual meeting, June, 1914.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk Street, Boston, Mass. Open meeting, New York, March, 1915.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, Richard Valentine, Janesville, Wis.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 60 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, H. A. Faulkner, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, S. J. Stewart, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

NEW YORK ELECTRIC RAILWAY ASSOCIATION. Secretary, Charles C. Dietz, 598 Broadway, Albany, N. Y.

NEW YORK ELECTRICAL CREDIT ASSOCIATION (affiliated with the National Electric Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Annual meeting, Dec. 9.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 33 West 39th St., New York. Annual meeting, New York, June, 1914.

NORTHWESTERN CEDARMEN'S ASSOCIATION. Secretary, N. E. Boucher, 743 Lumber Exchange, Minneapolis, Minn. Annual meeting, Jan. 6, 1914.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio. Annual meeting, Columbus, Ohio, Nov. 20-22.

Oregon Electric Operators' Association. Secretary, J. L. Kilkenny, St. John's, Ore.

Pennsylvania Electric Association (State Section N. E. L. A.). Secretary-treasurer, Walter E. Long, 1000 Chestnut St., Philadelphia, Pa. Annual convention, Delaware Water Gap, Sept. 16-18.

Railway Signal Association. Secretary, C. E. Rosenberg, Bethlehem, Pa. Annual convention, Nashville, Tenn., Oct. 14-17.

Society for Electrical Development, Inc. Acting secretary, Stephen L. Coles, 29 West 39th St., New York.

Society for the Promotion of Engineering Education. Secretary, Prof. H. H. Norris, Ithaca, N. Y. Annual meeting, Princeton, N. J., June, 1914.

Southwestern Electrical and Gas Association. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

Vermont Electrical Association. Secreary-treasurer, A. B. Marsden, Manchester, Vt. Annual meeting, Burlington, Vt., Sept. 18.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 76 West Monroe St., Chicago, Ill. Annual meeting, Cincinnati, Jan. 27-29.

Western Society of Engineers, Electrical Section. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

Wisconsin Electrical Association. Secretary, George Allison, Stephenson Building, Milwaukee, Wis. Annual meeting, Jan. 15 and 16, 1914.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED AUG. 26, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,071,036. METHOD OR PROCESS OF PRODUCING HOLLOW TAPES, RIBBONS OR BANDS OF METAL; F. A. Feldkamp, Newark, N. J. App. filed April 2, 1912. Electrodeposition of copper or lead.

1,071,037. APPARATUS FOR ELECTROPLATING HOLLOW TAPES, RIBBONS OR BANDS; F. A. Feldkamp, Newark, N. J. App. filed Dec. 7, 1912. Movable wire anode; for making cooling radiators, etc.

1,071,044. PROCESS OF MAKING BEARING COMPOSITIONS; E. G. Gilson, Schenectady, N. Y. App. filed July 7, 1910. From metallic oxide and graphite.

1,071,060. VAPOR-ELECTRIC APPARATUS; O. O. Kruh, Schenectady, N. Y. App. filed March 16, 1904. Storage-battery charging.

1,071,070. POWER INSTALLATION FOR THE PROPULSION OF MARINE VESSELS AND FOR OTHER PURPOSES; H. A. Mavor, Glasgow, Scotland. App. filed July 1, 1911. Gas engine and motor-generator set.

1,071,087. ELECTRIC SWITCH; G. B. Reisbach, Milwaukee, Wis. App. filed Dec. 26, 1908. Automatically operated distance control.

1,071,138. CURRENT-CONTROLLING DEVICE; L. Bradley, Milwaukee, Wis. App. filed Jan. 8, 1912. Automatic variable resistance. (Improvement on patent No. 81,697).

1,071,142. AUTOMATIC VIBRATING CIRCUIT-BREAKER; E. B. Craft, Hackensack, N. J. App. filed Oct. 24, 1910. Adjustment of induction coils.

1,071,169. SAFETY APPLIANCE LOCK FOR AUTOMOBILES AND THE LIKE; J. H. Mertz and E. Schatz, Washington, D. C. App. filed March 11, 1912. Key-controlled coil box.

1,071,171. SUPERVISORY SYSTEM; J. G. Nolen, New York, N. Y. App. filed July 23, 1909. Electro-pneumatically-operated enunciator.

1,071,196. INFLUENCE ELECTRIC MACHINE; H. Wommelsdorf, Schoneberg, Germany. App. filed Dec. 11, 1911. The charge is conducted away from the periphery of the disk.

1,071,200. ELECTRIC SWITCH; T. E. Barnum, Milwaukee, Wis. App. filed Nov. 25, 1905. Automatic circuit-breaker with blow-outs.

1,071,204. ELECTRIC SADIRON; J. Cayéré, Oakland, Cal. App. filed Jan. 23, 1913. Handle support for Tyler machine.

1,071,207. TELEPHONE SYSTEM; E. R. Corwin & C. A. Bals, Chicago, Ill. App. filed Sept. 17, 1908. Automatic calling and operator's control mechanism.

1,071,208. TELEPHONE SYSTEM; E. R. Corwin, Chicago, Ill. App. filed Oct. 12, 1908. Multiple switchboard apparatus.

1,071,209. TELEPHONE EXCHANGE SYSTEM; E. R. Corwin, Chicago, Ill. App. filed March 3, 1909. Calling and line signals with controllable disconnecting means to enable the user to stop a signal.

1,071,210. TELEPHONY; E. R. Corwin, Chicago, Ill. App. filed April 24, 1911. Controllable test signal.

1,071,211. TELEPHONY; E. R. Corwin, Chicago, Ill. App. filed April 24, 1911. Connection with a semi-automatic exchange.

1,071,212. TELEPHONY; E. R. Corwin, Chicago, Ill. App. filed April 24, 1911. Intercommunicating system.

1,071,234. DUST SEPARATOR; H. Howard, Boston, Mass. App. filed Dec. 5, 1911. Vibrating dust shelves.

1,071,267. TELEGRAPHIC TRANSMITTER; W. E. Shaw, Sheridan, Wyo. App. filed Feb. 10, 1912. A number of dots may be sent by a single movement of the key.

1,071,279. PROTECTIVE DEVICE FOR ELECTRICAL CIRCUITS; H. R. Van Deventer, Sumter, S. C. App. filed Nov. 5, 1909. Lightning arrester with interchangeable parts.

1,071,292. LOCKOUT TELEPHONE FOR PARTY LINES; E. Bowman, Elmwood, Ont., Canada. App. filed Feb. 16, 1912. Automatic depolarization of the armature.

1,071,322. STORAGE-BATTERY PLATE; M. Koener, Chicago, Ill. App. filed Aug. 28, 1912. Staggered relation of cells and ribs.

1,071,325. MANUFACTURE OF FILAMENTS OF TUNGSTEN OR MOLYBDENUM FOR ELECTRIC INCANDESCENT LAMPS; A. Lederer, Vienna, Austria-Hungary. App. filed April 24, 1906. The dioxide and ammoniacal solution of casein.

1,071,336. MEANS FOR USE IN CONTROLLING INDUCTION MOTORS; N. Pensabene, Birmingham, Eng. App. filed June 3, 1911. Centrifugal governor.

1,071,337. BURGLAR GUARD AND ALARM; E. S. Phelps, Elizabeth, N. J. App. filed March 19, 1913. Window or door grating starts signal.

1,071,338. DEVICE FOR CLEANING SILVERWARE; J. W. Phillips, Chicago, Ill. App. filed March 10, 1913. Zinc plate with tinned wires soldered on.

1,071,350. ELECTRICAL HEATING UNIT; H. H. Russell, New York, N. Y. App. filed April 6, 1911. Disks for fireless cooker.

1,071,359. SECONDARY BATTERY; A. M. Sherer, Philadelphia, Pa. App. filed March 25, 1912. Special grid for a Planté type.

1,071,370. RING-FORMING MACHINE; E. Truman, Toledo, Ohio. App. filed July 20, 1912. Bending and lap-welding hoops.

1,071,386. RING-FORMING MACHINE; A. M. Bates, Chicago, Ill. App. filed June 12, 1912. Wire-hoop forming and welding.

1,071,419. INSULATOR; B. Hetherington, Everest, Kan. App. filed Jan. 8, 1912. Twisted-slot type for pole arms.

1,071,442. PREPARATION OF GRANULAR CARBON; J. C. Lee, Brookline, Mass. App. filed March 29, 1913. Furnace with arc in a contracted neck.

1,071,488. PROCESS AND APPARATUS FOR SINTERING REFRACTORY MATERIALS; G. Weinstraub and H. Rush, Lynn, Mass. App. filed May 28, 1912. A melting current is passed through particles while under a continuous pressure.

1,071,490. BENDING AND WELDING MACHINE; W. C. Winfield and A. C. Taylor, Warren, Ohio. App. filed July 29, 1911. For forming angle bars for window frames, etc.

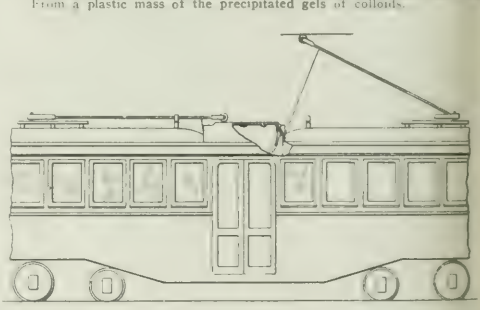
1,071,506. RAILWAY-CROSSING SIGNAL SYSTEM; G. Bryant, Highland Park, Ill. App. filed June 24, 1911. Automatically set in action by trolley movement.

1,071,522. ELECTRIC REVERSING GEAR; C. Krämer, Frankfort-on-the-Main, Germany. App. filed May 10, 1909. For submarine motors, etc.

1,071,546. MULTIPOLAR DYNAMO-ELECTRIC MACHINE; B. A. Behrend, Norwood, Ohio. App. filed Sept. 16, 1905. Brush connections for preventing unequal heating.

1,071,566. ELECTRIC-SWITCH CIRCUIT-BREAKER AND THE LIKE; D. K. Morris and G. A. Lister, Coventry, England. App. filed March 23, 1912. Release for thermal switch.

1,071,568. MANUFACTURE OF INCANDESCENT BODIES OF TUNGSTEN; A. Pacz, Cleveland, Ohio. App. filed June 12, 1911. From a plastic mass of the precipitated gels of colloids.



1,071,644.—Railway Car.

1,071,588. SYSTEM OF SELECTIVE CONTROL; C. E. Scribner, Jericho, Vt.; J. L. McQuarrie, Montclair, N. J., and E. B. Craft, Hackensack, N. J. App. filed March 12, 1910. For a plurality of stations as in train dispatching.

1,071,601. SUBSTATION TELEPHONE SET; W. O. Beck, Ridgefield, N. J. App. filed Feb. 16, 1912. Metal wall-shaft connection.

1,071,617. ELECTRICAL COUPLING; J. L. Hinds and J. J. Dossert, Syracuse, N. Y. App. filed May 2, 1910. Line-tapping device.

1,071,633. COMBINATION LOCK AND CIRCUIT-BREAKER; G. J. Buckeye, Kansas City, Mo. App. filed Sept. 9, 1911. Ignition circuit switch for automobiles, etc.

1,071,641. SWITCH-THROWING MECHANISM; H. C. Kinsey, Altoona, Pa. App. filed June 17, 1911. Operated by the motorman when on the car.

1,071,644. RAILWAY CAR; J. Lindall, Boston, Mass. App. filed April 19, 1912. The trolley rope passes through the roof.

1,071,649. ELECTRIC GLOW-LAMP; W. Nernst, Göttingen, Germany. App. filed March 29, 1898. A tungsten compound and normally non-conducting magnesia. (See patents Nos. 623,811, 685,725 and 900,416.

1,071,652. SIGNALING SYSTEM FOR PARTY LINES; R. F. Spamer, New York, N. Y. App. filed Sept. 15, 1910. For train dispatching, etc.

1,071,657. ELECTRICALLY CONTROLLED LOCK; H. G. Voight, New Britain, Conn. App. filed April 5, 1913. For hotel corridors, etc.

1,071,669. RAILWAY SIGNAL SYSTEM; J. Leitgeb, Great Falls, Mont. App. filed Oct. 2, 1912. Inter-block train signals.

1,071,675. ARC LAMP; C. E. Crane, Seattle, Wash. App. filed Dec. 1, 1910. Projecting display apparatus with carbon-trimming means.

# Electrical World

The consolidation of Electrical World and Engineer and American Electrician
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**Electricity as a Present-Day Necessity**

A considerable portion of the change in attitude of the public toward electric service companies during the past decade is attributed by State Senator Willard Howland, of Massachusetts, to the increasing belief that electricity is no longer a luxury to be enjoyed by the wealthy few but has become an everyday necessity for the rich and poor alike. The increased severity of the demands made upon public utility corporations now as compared with some years earlier, when the men willing to risk their money in electrical undertakings were looked upon as benefactors, is doubtless attributable somewhat to the cause mentioned by Senator Howland, augmented in some quarters by the belief that the rates of electric service companies are so arranged as to benefit the rich at the expense of the poor. To just what extent central-station managers will be willing to agree with Senator Howland it is difficult to predict, but no one can doubt the wisdom of considering seriously the idea brought forward by him. Perhaps it may be found that while holding strongly the opinion that electricity is a present-day necessity in all walks of life, many managers have so conducted their business as to leave the impression on their less wealthy customers that electricity is a luxury they cannot afford and that the seemingly high cost of service intended only for the rich is of little concern to those able to purchase merely necessities. Obviously what is needed is a campaign of education; the public must be made to understand the service problems of the utility corporations, and the companies must be taught the needs of the public. It is in work of this nature that the Society for Electrical Development can prove invaluable alike to the public and to the corporations.

**The Regulative Idea in Wisconsin**

In his address at the Association Island meeting Chairman Roemer of the Wisconsin commission presented the fair, reasonable point of view which from the beginning has generally been characteristic of the official utterances of members of this commission. Many of the states have copied parts of the laws of Wisconsin for the regulation of public utilities; if they would also follow as wise a policy as it has in the selection of commissioners and seek to preserve as even a balance as its commission has, in the main, the issues between the public and the companies would be less acute than they are. The Wisconsin commission has not pleased all of the companies; it has not pleased all of the public; but it has tried to produce results that would work toward the settlement of differences between the two interests and the removal of their contentions from the arena of politics. In so doing it has trodden upon vested rights. But it has not set out with a fixed purpose of interfering with such rights. It has not abated the closeness of its supervision of the properties, but it has considered their needs as well as the needs of the public. If more laxity had entered into the regulative practices of the commission, there might have been greater progress in the construction of properties, particularly in those districts of the State which are not closely settled, but we do not know that such would have been the fact nor do we know that the best and permanent interests of the State would have been promoted by such a policy. If regulation is to be a lasting success in Wisconsin and elsewhere, it must prove its success by its effectiveness. It will be effective in the degree in which it protects the reasonable interests of both the public and the companies and at the same time provides working conditions which assure good service at rates that perpetuate the properties and conserve the legitimate investment which produced these properties and made them capable of rendering service of high standard.

**The Beneficent Electric Sign**

Electric signs and electric-lighted billboards are among the culprits summoned to face a severe arraignment as advertising nuisances in the report just submitted by New York's billboard commission. The stringent rules which this body proposes for New York City would prohibit all outdoor advertising—except shop signs—in the vicinity of parks, public buildings and certain streets, and would prevent the operation of large or flashing electric signs in residential districts. Furthermore, a tax is recommended on all outdoor advertising, and it is proposed that moral and esthetic censorship be provided for regulating the character of the displays. No sensitive observer can conscientiously defend some advertising atrocities which mar the streets of American cities, but most electric signs, we feel very strongly, deserve a measure of immunity from this general attack, in consideration of the other benefits they confer on their communities. Chief among these, of course, is the electric sign's supplementary service in lighting the streets. There are cities in this country whose connected sign load is actually double the entire kilowatt rating of the local street-lighting system, and in the average progressive community this ratio is at least unity. Most of these sign lamps are directly effective as free public-lighting sources; this practical fact is attested by the ordinances of certain cities which permit electric signs only, absolutely prohibiting all "dead" signs. In the beforementioned residential sections, too, which are usually poorly lighted, electric signs and lighted billboards certainly contribute to the safety of late home-comers and timid householders. Nor should esthetic legislators and their advisers

overlook the business-creating values of electric displays and their direct bearing on the commercial activity and prosperity of their vicinities. The street with the flaring sky-line is always the one most traveled after dark, and a city's connected sign load is invariably the index of its progressiveness. By night most of our big electric signs, one may add, are spectacles of real beauty and artistic design, and we believe that the improvement thus noted is rapidly extending to smaller signs as well. If esthetic criticism is in order, it might be directed at the daylight appearance of the great steel structures properly required by city building departments to support roof and overhanging signs, for here is a place where some architectural veneer is badly needed. In this, as in other respects, the services of an intelligent regulative censorship might be of great use to the public and to the electric-sign industry itself, but we must enter a vigorous protest against any such unjust prohibitory measures as are proposed by the metropolitan commission.

## Mr. Vanderlip's Appreciation of the Electrical Industry

The stupendous totals of electrical capital and energy used by Mr. Vanderlip in his Association Island address are not new, but the glowing appreciation of them by a banker of highest rank gives a new realization of the strength and stability of the properties that compose the electrical industry. The various classes of these properties are so diversified that even to those who ought to be familiar with the general totals of business and capital investment in electrical fields the figures gain impressiveness by study, and to those who have not been familiar with past achievements and future possibilities the statistics will be a revelation. Naturally the address presents the point of view of the metropolitan banker. It is a narrative of progress, a critical review of the past and a prophecy for the future from the outside rather than from the inside of the industry. The speaker was deeply impressed by the totals of electrical investment, he was concerned about the problems which bear upon the question of fresh capital needs, and he was insistent in pointing out the responsibility which rests upon managers so to conduct their operations as to win and hold public regard.

The capital requirements of central stations during the last period of five years, as estimated by Mr. Vanderlip, were $900,000,000, or an average of $180,000,000 a year. Adding thereto the requirements of allied industries operating electrically, he figures that for the next period of five years the needs will average $400,000,000 annually, or, roughly, $8,000,000 a week. These conditions urgently demand consideration. The cost of financing an industry at its birth and until it reaches that mature period when its securities become "seasoned," as the bankers say, is high. It should become lower, however, as the industry progresses on the normal way toward stability. The high cost of financing is exacted by the bankers through the medium of a large discount on bonds, a bonus in securities or an excessive rate of interest. Much as a new industry may rebel against the charges of bankers it must admit that it is exploiting new fields and that it cannot refer to the past for any definite assurance of what the future will bring forth in regard to its permanent tenure of usefulness. Such was the situation in the electrical industry in the early days. The more recent development of the inherent great possibilities of the industry has carried the properties vigorously past those times.

There is no reason now why electrical properties should be regarded anywhere as experimental. There is every reason why the operators of the properties should see to it that they occupy a position of equal importance with the established companies of other classes whose securities stand high in public favor. The attainment and the permanent retention of this desirable result are dependent to a large degree, as Mr. Vanderlip indicates, upon the condition of the companies with reference to all matters of public policy. Certainly the companies can, or ought to, occupy a position of greater independence in their dealings with bankers for the sale of securities. Their physical properties are well developed, they meet a well-established public demand for service, and generally their revenues increase in leaps and bounds. The widespread acceptance of these factors gives the companies a lever with which they can move the banker as well as the investor to the acceptance of public utility properties as more desirable borrowers and thus keep their costs of property lower than they have been in the past.

We believe that Mr. Vanderlip miscalculates when he estimates that four out of five investors at the present time have their minds closed against any investment in securities of electrical undertakings and that this is true largely because they fear the effect of present political conditions and tendencies. If so serious a proportion of private investors had turned their faces against electrical properties, the industry would have been hampered so that failure rather than phenomenal success would have been its present condition. Perhaps Mr. Vanderlip, because of the very largeness of the investment units with which he is accustomed to deal, overlooks the situation in thousands of plants throughout the country whose securities are held mainly at home or are scattered in relatively small amounts elsewhere. Save in a comparatively few instances the central stations do not borrow in the large amounts which financial transactions of great steam railroad companies make familiar. However, where a prejudice or a feeling born of fear exists against electrical properties, the companies should certainly take steps to reveal themselves in the right light or try to remove such causes of fear as may exist.

No small part of the thanks which the industry owes to Mr. Vanderlip for his critical analysis is due to his cautionary words in regard to the treatment of the general public. Because it was a message to the industry, not to the public, the paper did not contain any similar cautionary words addressed to the public. It recognizes, however, that two separate parties are involved and that each has a duty to the other. Public service commissions, if conducted in the right spirit, will be a greater help in the considerate discharge of these respective duties than any other that can be secured.

## The International Illumination Commission

The International Photometric Commission, which was commonly called the Zürich commission, met at Berlin in the last week of August, 1913, and became converted into the International Illumination Commission, with a new constitution and an enlarged representation. Ten countries in all were represented by delegates, many of whose names are well known in all gatherings of photometrists. The new commission, after its decisions shall have been ratified by the various underlying national societies, will start on its career with officers, offices and a budget, all complete, and everywhere everyone interested in illumination will cordially wish it success.

The successful launching of the new commission is the more satisfactory because it has been accomplished through the medium of the preceding Zürich commission, which, although somewhat restricted in its organization, was at least an international body. It is clearly more suitable that the new commission should have been formed by proper enlargement of the previously existing international photometric commission than by forming an entirely new organization and thus leaving two separate international bodies in the field with similar yet unassociated purposes. The success of this difficult task of enlargement has been due in no small measure to the efforts of Dr. E. P. Hyde, of the American committee, who is one of the new vice-presidents.

A noteworthy feature in the constitution of the new International Illumination Commission is the fact that it has no official language or languages. It has one and only one basic language, but three recognized languages. All of the statutes, resolutions and official documents of the commission are to be internationally drawn up, agreed upon and promulgated in the basic language, which is French, while the national committees which use the recognized languages—thus far German and English—draw up translations, which are open to publication on their own respective responsibilities. In this way, discussions in the meetings, which may be in any or all of three languages, are directed solely toward securing international purposes expressed entirely in the French text, which stands as the reference text. The secretary's office has only to see that this text is faithfully recorded and printed in all the publications that may be issued from time to time. Translations of the French text into English and German can readily and conveniently be made by local national committees and may be printed along with the French text for the convenience of the various countries receiving reports, but in case of any question arising as to the precise meaning of phraseology, reference is to be had immediately to the basic text, upon which decision is to be rendered. Papers, discussions and communications from individual committees are acceptable in any of the three recognized languages; but if these lead to international action, the action will be recorded in the basic language.

The above-described agreement upon a single language as a basis of record, accompanied by freedom in selection from several languages as mediums of communication and discussion, constitutes in our opinion a great step in international organizations for applied science. It simplifies very greatly the work of legislative construction, of editing and of official publication, without the sacrifice of any useful principle. In the attainment of this notable result Mr. C. O. Mailloux, of the American committee, contributed great service to international co-operation. It is doubtful whether such a harmonious result could have been secured at this date in any international gathering outside of science or technology.

Another valuable international asset that has been gained in the constitution of the new commission, as set forth in its statutes, is that whereas internationally official resolutions must all be recorded by vote according to nationality, each country being allowed one and only one vote, no matter how many delegates it may send, yet in the sectional meetings, where technical matters are discussed, the voting is to be by individuals and not by countries, although all votes calling for international action must subsequently be ratified in plenary meeting, by countries. Consequently, while the statutes, resolutions and international actions of the commission are to be made by countries through their individual votes, it is the man and not the country that receives recognition in considering technical questions.

Seeing that the presidency of the new commission remains most properly in the hands of M. Vautier, the president of the old commission, and that French has been adopted as the basic language of the commission, the decision was most wise and expedient to place the secretary's office in England, and Mr. C. C. Paterson, as the new honorary secretary, thus receives worthy recognition for his labors in acting as secretary of the international committee which drew up the proposed constitution out of which the final statutes were successfully constructed.

## Company Teamwork

A broadened view of the commercial department's duties is presented in the interesting paper by Miss Sheridan, sales manager for the Detroit Edison Company, abstracted on a following page. Besides considerably amplifying the scope of the sales staff as usually conceived, the author points out the need for intelligent co-operation between central-station departments, emphasizing that such collateral divisions should obtain a better understanding of their own and each other's work in relation to the whole. The plan which has been so successful at Detroit not only involves granting some measure of authority to the sales department by which it can impress its necessities on other divisions but also includes the more important idea of educating the mechanical and accounting staffs up to the customer's viewpoint, showing them why their own precedents, routine or convenience must sometimes be sacrificed to the larger good of the company's service. Through his intimate contact with the public the salesman usually has in a high degree this appreciation of the "human touch," but in the more remote departments the men too often content themselves with doing their work in their own way, giving little thought to the public, which, after all, they are working to serve. Miss Sheridan's lesson of co-operation and mutual understanding deserves to be taught painstakingly throughout the central station's forces.

# The News of the Week

**Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.**

## Tariff Bill Passed by the Senate

The United States Senate passed the tariff revision bill on Sept. 9 by a vote of 44 to 37. Senator Poindexter, a Progresssive, and Senator La Follette, a Republican, voted with the Democrats in favor of the measure. Senators Ransdell and Thornton, of Louisiana, both Democrats, voted against the measure. The bill will now be considered in conference by committees of the Senate and the House of Representatives. It is estimated that ten days will be required for the consideration of the bill in this way.

President Wilson issued a statement in regard to the action on the bill in which he said: "A fight for the people and for free business, which has lasted a long generation through, has at last been won, handsomely and completely. I am happy to have been connected with the government of the nation at a time when such things could happen and to have worked in association with men who could do them."

## Pennsylvania Electric Association

The sixth annual convention of the Pennsylvania Electric Association will be held at Delaware Water Gap, Pa., Sept. 16, 17 and 18. Among the papers scheduled for the sessions are the following: "Rates," Mr. R. H. Conklin; "Rules and Regulations for Outside Employees," Messrs. S. W. Brown and James A. Metz; "Rules for Station Operation," Mr. Ira G. Walborn; "Boiler-House Practice," Mr. Thomas G. Coughlan; "Feeder Regulators," Mr. A. D. Fishel, and "Street Lighting," Mr. Preston S. Millar. Reports will also be rendered by the committees on lamps, welfare work and public-utility interconstruction. The Hon. Frederic W. Fleitz will deliver an address on "Public Service Company Law" at the executive session of Wednesday afternoon. Mr. Van Dusen Rickert, Pottsville, Pa., is president of the association, which is a state branch of the National Electric Light Association, and Mr. Walter E. Long, 1000 Chestnut Street, Philadelphia, Pa., is secretary.

## Third International Congress of Refrigeration

The Third International Congress and Exposition of Refrigeration, to be held in Chicago Sept. 17 to Oct. 1, will be marked by a large delegation of prominent scientists, experts and practical operators of refrigerating plants, representing more than forty of the principal governments of the world. During the week of Sept. 8 delegates from abroad have been received in New York City, where they have been entertained with inspection trips to local plants and at several social affairs. On Sept. 15 they will visit Washington, where a reception will be tendered to them by the President of the United States and the Secretary of Agriculture.

The delegates will then leave for Chicago for the first technical session of the congress, which will open Wednesday, Sept. 17. Arrangements have been made for half-day sessions, consisting of six sections to be held in the Hotel La Salle. Simultaneously the International Refrigeration Exhibition will be held in the International Amphitheater at the stock yards. For discussion at the sessions a large number of papers have been submitted by both foreign and American delegates. Each will be printed in English, French and German, and discussions will be conducted in these languages, as well as in Italian and Spanish, with the aid of interpreters.

From ten to twenty-five subjects are to be treated under each of the following general section topics: (1) physics, chemistry and thermometry; (2) design, construction, operation and methods of testing refrigerating machinery and insulating material; (3) application of refrigeration to preservation of foods; (4) use of refrigerating apparatus in the industrial arts; (5) consideration of refrigeration in railway and steamship transportation; (6) consideration of questions relating to legislation and administration.

Dr. Frank W. Gunsaulus, of the Armour Institute, Chicago, is president of the International Congress of Refrigeration, and Mr. J. F. Nickerson, of Chicago, is secretary-general. Arrangements have been made for the accommodation of about 4000 delegates.

## Lake George Convention, Eastern New York Section, N. E. L. A.

At the Hotel Sagamore, Lake George, N. Y., Monday, Sept. 15, the Eastern New York Section of the National Electric Light Association will hold its annual meeting. The opening address is to be delivered by Mr. Elmer J West, of the Adirondack Electric Power Company, Glens Falls, and papers will be presented as follows: "Public Policy," Mr. William McClellan, formerly engineer New York Public Service Commission, Second District; "Estimating the Comparative Value of Electric Vehicles and Other Methods of Transportation," Mr. C. S. Van Dyke Schenectady Illuminating Company; "Resuscitation," Dr C. A. Lauffer, medical director Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., and "Illuminatio of the Panama-Pacific International Exposition at San Francisco," Mr. W. D'A. Ryan, illuminating engineer General Electric Company, Schenectady. Mr. A. T. Thorn Utica, N. Y., is president of the Eastern New York Sec tion, and Mr. R. E. Russell, Schenectady, is secretary. A extensive amusement program, including motor-boat trip fishing, swimming, tennis, baseball and dancing, has bee arranged by the entertainment committee, of which Mr. L Hagood is chairman.

## Meeting of Electrical Supply Jobbers

The Electrical Supply Jobbers' Association held quarterly convention at the Hotel Clifton, Niagara Fal Ontario, Sept. 9, 10 and 11. Nearly 300 jobbers, manufacturers and representatives were present.

Aside from the scheduled sessions there was an op meeting on Sept. 9 at which Mr. Douglass Burnett, Ba more, Md., vice-chairman of the Commercial Section of t National Electric Light Association, made an address scribing the success met by progressive central s with their commercial and merchandising campaigns. Burnett read excerpts from several papers presented fore the Commercial Section at the Chicago convention

ne and pointed out some of the things already accomshed by the Consolidated Gas & Electric Company of ltimore, for which he is sales manager. He also rerred to the possibilities of the Society for Electrical evelopment in furthering the success of such efforts.

Mr. W. E. Robertson, of Buffalo, N. Y., also spoke, inting out to the jobbers the advantages of the Elecal Development Society to them as well as to the other anches of the electrical industry. Mr. C. P. Hill, of e Doubleday-Hill Electric Company, Pittsburgh, Pa., also oke.

The next meeting of the jobbers' association will be held Hot Springs, Va., Nov. 18 to 20.

## Convention of Edison Illuminating Companies

*By Telegraph*

The thirty-fourth convention of the Association of Edin Illuminating Companies was held at the Hotel Otesaga, ooperstown, N. Y., Sept. 8, 9, 10, 11 and 12. Never bere in the history of the association was there such a thering of the notable men of the electric-lighting instry. The registration list totaled over 360, and it was cessary to distribute the delegates in three hotels, the tesaga not being large enough to accommodate all. Alough the association numbers only about seventy-four ember companies, they are located chiefly in the large ties and represent the cream of the industry, and the nventions, though in a measure exclusive, are really teworthy events. Certainly no other body engaged in e lighting business commands such an array of talent places before its membership more interesting or inructive papers.

### High-Efficiency Lamps

The association is, of course, vitally interested in the ospective development of higher efficiency incandescent mps and the future promises of cheaper light, with conquent marked reductions of income probably in some asses of service. This is one of the great problems of e industry at present, and the association is fortunate in ving in charge of its lamp questions an exceptionally le committee, which is well informed and capable of ving the member companies wise and constructive guidce.

The report of the lamp committee was the most imrtant event of the week. In connection with the report e manufacturers of incandescent lamps told of the progss made in the art of lamp making and showed a lamp ving approximately 5000 cp. In addition, Mr. George aude, of France, told of his work with the neon lamp d showed a lamp giving orange-red light having a spefic consumption of about 0.5 watt per candle.

### President Williams' Address

The regular sessions of the convention began on Tuesy morning, opening with the address of President Arur Williams of the New York Edison Company. Mr. illiams reviewed briefly the early history of the assoation and the developments in the incandescent-lighting t, saying that just as a few years ago the amount of ergy necessary for a given volume of light was reced one-third so to-day there are distinctive indications at the near future holds equally radical changes in comrison with present standards. While the immediate efct may be to increase the number of customers supplied a loss or without profit, ultimately the change will ubtless be as beneficial to the industry as to the public. Standards of lighting are constantly being raised, and ite independently of illumination for light as it is genally understood, lamps are also used for signs, show ndows and interior and general advertising. With the w lamps indirect lighting is coming rapidly into vogue, calling for a great deal more energy than the older methods, so much more that were it not for improved lamps the cost would continue prohibitive. In Mr. Williams' estimation, where light is used for industrial and business purposes, lamp efficiencies may go on improving indefinitely without seriously affecting, at least permanently, the income of the service companies. However, unless other sources of revenue are devised, or other than prevailing methods of charging for electric service are adopted, lamp improvements may have a serious effect upon the income of the industry from home service. The electric iron, the vacuum cleaner, the washing machine and artificial refrigeration are perhaps the four most important features of available household service, and Mr. Williams showed what this apparatus can be made to mean in the sense of income. Another great income possibility pointed out by Mr. Williams is the almost unbelievable service values that can be obtained from trackless haulage throughout the entire country.

Speaking on the subject of public relations, Mr. Williams said that in his opinion the greatest responsibility resting upon the management of public utility corporations is to hold the respect, good-will and warm friendship of the communities in which they render service, such as are now entertained for a large part of the membership of the association. Anything which invites or permits the opposite of these conditions to exist, thus creating fertile soil for political and social agitators or tending to further hostility toward public service corporations, seems, in the light of present-day conditions, practically inexcusable.

### Meter Committee Report

Mr. S. G. Rhodes, New York Edison Company, chairman of the meter committee, submitted detailed results of laboratory investigations or actual service data, or both, for three types of direct-current meters materially cheaper both in original cost and maintenance than the present type of watt-hour meter. The meters are of the mercury type, which are practically free from the effects of stray currents and more desirable because of this than the present commutator type of watt-hour meter. The committee feels that the meter merits a careful investigation on the part of member companies as a pioneer cheaper meter which gives promise of very satisfactory performance. A German make of ampere-hour meter and an electrolytic ampere-hour meter were described as being sufficiently satisfactory to justify giving them serious consideration for use where low meter investment and maintenance must be obtained.

There is a tendency on the part of public-service commissions to look with disfavor on the use of the ampere-hour meter as a general type, but the meter committee urged member companies to assume a strong position in defense of the ampere-hour meter as a proper consumer's meter when it fulfils all the other requirements of good meter practice. Various forms of induction meters, maximum-demand meters, indicating and graphic instruments were also given attention.

### Industrial Uses of Electric Heat

No recent developments in the domestic heating field warrant another report covering that branch of electric-heating work at this time, according to the report of the committee on heating, of which Mr. E. W. Lloyd, Commonwealth Edison Company, Chicago, is chairman. The report was therefore devoted to giving an account of what has been done by member companies in the industrial heating field.

From the evidence submitted it appears that the increase in such applications is going on at a very rapid rate, and with a little stimulation will pay big returns. Complaint was made that the larger cooking utensils for restaurants and hotels are not being pushed to the extent that the apparatus warrants. Speaking of the application of electric-

ity to furnaces, the committee points out that in plants manufacturing large quantities of steel for purposes requiring high-grade open-hearth or low-grade crucible metal, the Heroult furnace is best adapted, inasmuch as it may be operated on three-phase circuits without serious difficulty in phase regulation.

### Report of the Lamp Committee

The first part of the report of the lamp committee, of which Mr. J. W. Lieb, Jr., New York Edison Company, is chairman, was taken up with a consideration of the details of the tests made by the Electrical Testing Laboratories of the lamps as supplied by the manufacturers to the member companies of the Edison association. It gave consideration to such matters as lamp-manufacturing facilities, reserves of lamp stock, the relative demands for the several sizes and types of lamps as compared with the corresponding demands of previous years, etc.

The report touched upon the radical change which the introduction of drawn-wire tungsten filaments has made in the state of the art, resulting in a more robust lamp and also in improved manufacturing methods. It has been found practicable to draw the wire to such a uniform standard that lamps can be manufactured to exact voltage as required. This raises the very interesting question of the possibility of the adoption of a general uniform standard voltage for all central-station lamps, and considerable time was given to a discussion of the various phases of this subject. It was pointed out that as the use of carbon lamps became less and less attention to the refinements of production was concentrated on the types of lamps more generally used. The report referred to the very rapid improvement in the performance of tungsten lamps, from the 250-watt unit up. These at the time of their introduction in 1911 consumed 1.13 watts per candle, with a useful life of about 685 hours, but with the improvements that have since been introduced they now operate at 1 watt per candle and have a useful life of nearly 2500 hours.

No extensive tests have been made during the year on foreign lamps, but such data as are available indicate that the American product is equal to the best European product, and the rating of American lamps is, on the whole, closer to the standard than are lamps of foreign manufacture. With the reduction in lamp prices by the manufacturers which went into effect on July 1 and with the great improvement made in tungsten lamps, it has been found possible to put some of the larger sizes of tungsten lamps on a free-renewal basis. This subject has already been covered in these pages.

The practice as to lamp renewals by the larger companies was next presented in some detail, indicating the types of tungsten lamps which are now being furnished on a free-renewal basis and the extra cost at which the standard sizes are being supplied where the customer's contract includes free renewals. As an appendix to the lamp committee's report, a printed pamphlet was presented giving details of lamp practice covering free renewals, deliveries to customers, identification of lamps, operating voltages, etc., for the various companies in the Edison association.

### Exhibition of "Half-Watt" Tungsten Lamps

Much interest was manifested in the announcement made recently of the development of a "half-watt" tungsten lamp. The new lamps are filled with nitrogen gas, and a number of the lamps, the first that have been exhibited publicly, were shown. They ranged from 500 cp to 5000 cp, the latter a splendid sunburst—being the largest incandescent lamp ever produced.

Discussion followed concerning these powerful and efficient units with specific consumptions ranging from 0.75 watt per candle-power in the smaller sizes, such as 500 cp, to 0.5 watt per candle-power in the largest size, 5000 cp, raising the question of the place which these illuminants will occupy in the field of street illumination as compared with the prevailing types of arc lamps. Comparative data were presented of the efficiencies of modern arc lamps, and an extended discussion followed, in which Dr. C. P. Steinmetz, Mr. John W. Howell and others participated. In this discussion free scope was given to the imagination as to the possibilities in the development of higher efficiency types of large arc lamps.

Mr. J. W. Lieb, Jr., dealt at some length with the subject of arc-lamp carbons and the lines of development which are being followed to produce a steady white light of high efficiency and without the production of ashes which tend to obscure the light. The report closed with a reference to the various types of arc lamps on exhibition illuminating the grounds of the hotel.

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## Co-operation for Electrical Development

Co-operation for the benefit of the consumer as well as the manufacturer was the keynote of a meeting of prominent men interested in the development of electrical business held at Association Island, Lake Ontario, Sept. 3 to 6, under the chairmanship of Mr. Joseph B. McCall, president of the National Electric Light Association. Of the several noteworthy addresses presented, perhaps the one that most accurately characterized the meeting as a whole was delivered by Dr. C. P. Steinmetz in discussing the elimination of competition. Dr. Steinmetz claimed that competition is dead as an industrial and economic force and that co-operation has taken its place. He said that on the day when engineering increased the means of production of a commodity beyond the amount that could be consumed under existing conditions competition ceased to be a progressive driving force and became a destructive force. The masses of people imagine that industrial consolidation is killing competition, while in reality the death of competition as a beneficent industrial force is the cause of consolidation. With the arrival of co-operation in industry, with the consolidation into giant corporations, must come also control by commissions, at least temporarily until the forces have adjusted themselves.

The opening address was delivered by Mr. Samuel Insull, president of the Commonwealth Edison Company, Chicago, Ill., his subject being "Distribution of Electric Energy, Present and Future."

### Distribution of Electrical Energy

Mr. Insull remarked that the problem of transmission of energy is perhaps of more importance than transportation. Before the widespread utilization of electrical transmission factories were located at the small water-powers. Many of these factories have been abandoned and the water-power is used for generating electrical energy for transmission. Electrical energy transmission has also expanded from another source, namely, steam. In the early days of electrical energy production, when steam was the source of energy, electricity was utilized largely for light, motor service being a by-product. To-day the conditions are reversed, and in many of the large systems electric light is a by-product and motor service is the chief source of income.

The return on the investment of central-station equipment depends largely on the motor-service business. In the cities of this country the lighting load represents from 27 per cent to 45 per cent of the total energy utilized. Mr Insull expressed the opinion that the central station should produce energy for all transportation and industrial purposes as well as for lighting. The production and distribution of energy for all purposes should be under the control of one organization, even if it must become a public rather than a private enterprise.

The economies brought about by the concentration of production and distribution of electrical energy can be a

tributed to the development of large turbo-generators, transformers and rotary converters. Mr. Insull cited the example of the Harrison Street station in Chicago, which is no longer a real factor in the production of energy throughout the Chicago territory. Although it cost from $1,500,000 to $2,000,000, it can carry a load equal to only about one-half of that which can be carried by one of the largest modern generators.

Energy can now be produced in a large station so economically and at such low cost that it can be distributed more economically that it can be produced locally. On account of the low load-factor the lighting load represents the poorest business a central station can obtain. However, it must supply energy for lighting as an obligation to the public rather than from the point of view of income. Taken in connection with the motor load it can be handled profitably, but it is a very poor load when considered alone.

Mr. Insull reported some interesting figures on the central-station situation in Great Britain as compared with that in the Chicago territory. Three hundred and three of the largest towns in Great Britain, having a combined population of 24,250,000 inhabitants, utilize stations having a combined rating of 961,000 kw, as compared with 264,000 kw in Chicago with its population of 2,285,000. The investment in central-station equipment in Great Britain represents about $310,000,000, as compared with $68,000,000 in Chicago, while the income in Great Britain is $40,000,000 per annum, as compared with $15,000,000 per annum in Chicago. In Great Britain the total energy sold equals 1,128,000,000 kw-hr., as compared with 712,000,000 kw-hr. in Chicago. The central-station investment per capita is $12.78 in Great Britain as compared with $31.24. The income per capita in Great Britain is $1.67, as compared with $7.03 in Chicago.

Contrary to the usual assumption that the prices in Great Britain are less than in America, the charges for energy in Great Britain exceed those in Chicago by from 70 to 80 per cent. The better showing in Chicago was attributed by Mr. Insull to the greater load-factor, namely, 42 per cent, as compared with about 25 per cent in Great Britain.

Under ordinary conditions the load-factor on central stations would be about 30 per cent. If industrial and motor service conditions are good, the load-factor may reach 45 per cent, thereby implying a 50 per cent increase in output from the same generating and distributing equipment. The most serious obstacle to concentration of generation of electrical energy is the prejudice on the part of engineers of isolated-plant owners, as well as the self-interest of the consulting engineer in advising his financial backers.

Concerning the future of energy distribution, Mr. Insull remarked that agitation with reference to the conservation of fuel will force the concentration of production of electrical energy. The concentration movement will also be forwarded by the limitations in finance, the trouble in financing small systems being much larger than that in combined large systems. Just as the country has found it desirable to combine its railroads into great trunk-line systems, so it will be found desirable to consolidate electrical transmission systems into networks supplying energy for all purposes. Concentration or production represents the solution of our great industrial problems in that it means low cost of production, low cost of transmission and a minimum selling price to the community.

*Discussion*

Dr. C. P. Steinmetz expressed his disagreement with Mr. Insull concerning the increase in the size of generating units, transformers and rotary converters. This increase has been due to the demand for large units created by the concentration of electrical energy production, such as has been brought about by Mr. Insull, and is not the cause for the concentration, as Mr. Insull intimated.

### Government in Relation to Business

State Senator Willard Howland, of Massachusetts, outlined the attitude of the government toward the industries with special reference to public utilities. Regulation which was once considered undesirable is now required. This result is attributable to developments that have rendered former luxuries present necessities. It is the belief on the part of the public that electric service should no longer be classed as a luxury that accounts for the attitude toward electric service companies. The remedy to be applied by the companies involves a recognition of this change in condition and an effort to treat electric service as a necessity.

With good service maintained at a price to produce a fair return on the investment, the service companies have nothing to fear from either public ownership or commission regulation. Regulation is essential to securing proper remuneration for both capital and labor. Senator Howland maintained that the attitude of the government toward industries is such as to protect and develop rather than destroy them.

*Discussion*

Dr. Thomas Darlington, New York, remarked that instead of criticising governmental officials everyone should take an active constructive interest in governmental affairs and assist the officials in solving the difficult problems presented to them.

### Electrical Development

In his lecture on the future technical development in the electrical business, Dr. C. P. Steinmetz remarked that the limit in size of steam turbines and turbo-generator apparatus has not yet been reached, and that units reaching much more than 30,000 hp will be built when a demand arises for such equipments. Although transmission systems have covered distances greater than 200 miles and areas as large as 20,000 sq. miles and are operating at electromotive forces as high as 150,000 volts, the limit has not been reached in either length of circuit, transmission area covered or voltage utilized.

Application has been made of the electric motor in transportation only for local work, there being as yet no long-distance railways operated electrically. However, local electric railway service has been developed to such an extent that these railways consume at present more power than would be required for operating all of the steam trains electrically. The development of local electric railway service has brought about a revolution not only in domestic life but also in industrial activity. Factories can now be located at the most economical sites from the point of view of operation and the workmen can select sites for their homes within a wide radius, from the point of view of convenience in domestic arrangements and comfort.

As compared with other forms of energy electricity is superior in three important characteristics relating to transmission, conversion and concentration. Electrical energy can be produced most economically at one place and transmitted efficiently to be utilized just when and where wanted without regard to the location of the source of supply of coal or water. Chemical energy can also be transmitted in the form of fuel, but not so economically as can electrical energy. Electrical energy can readily be converted into other forms, while fuel can produce only heat, usually at a low efficiency. The concentration feature of electrical energy is highly advantageous in many industrial applications, such as the separation of iron and aluminum from their ores, the production of calcium carbide and the recovery of nitrogen from air.

One of the prominent disadvantages of electrical energy resides in the fact that it cannot be stored but must be used as produced. The so-called electrical storage battery stores energy chemically. It can be used for short-time storage for a limited amount of energy, but is uneconomical when considered in connection with such problems as the sea-

sonal storage to assist in carrying the load on a hydroelectric station during the low-water period.

On account of the non-storage feature of electrical energy the load-factor is an important element in connection with the operation of an electricity supply system. The electricity must be produced in each instance just as utilized, and hence the cost of equipment for producing a certain amount of energy is a minimum while the load-factor is a maximum.

Recent developments in steam-turbine plants have shown that the larger the unit the less the specific steam consumption. This relation seems to hold true without limit so far as present knowledge goes. Considerable economies can be effected by combining small systems into larger ones and making use of prime movers and generating units of larger size. With the concentration of production from isolated systems to a single interconnected system, a serious problem is encountered in the possibility for destruction. This problem has been solved in the case of the Chicago system by means of reactance coils.

With reference to the utilization of electrical energy, one need not to-day discuss the possibilities but should consider merely the economical features. The question is not whether such and such a thing can be done electrically, but whether it can be done electrically more economically than by some other method. In many cases, such as the substitution of electricity for steam, marked economies can be obtained by revising the system to meet changes in the conditions brought about by the utilization of electricity. The problem involves reorganization to accommodate electrical service. For example, when electricity is substituted for steam for transportation, the electrical trains need not be duplicates of the steam trains. Better results could be obtained by utilizing a larger number of trains of shorter length. This change represents an improvement not only in service to the public but also in the load on the system.

In many cases it would be advantageous if industrial installations were so operated as to avoid the use of electricity during the lighting load period. It would be possible in some cases so to reorganize the service in certain industries as to use a little electricity during the low-water period on the hydroelectric installation. Arrangements of this kind mean co-operation in its highest and best sense.

### State Commission Control

Mr. John H. Roemer, chairman of the Railroad Commission of Wisconsin, discussed in a convincing manner the present attitude of the commissions toward the public service companies and explained the various rulings made by the Wisconsin commission. An abstract of this address is given on page 531 of this issue.

#### *Discussion*

Mr. Henry L. Doherty, New York, remarked that the Wisconsin commission has been a pioneer in the regulation of public utilities and has blazed the way for commissions subsequently formed. In many respects it has been liberal, but not liberal enough. The commission has not properly appreciated the trouble encountered in attempting to obtain the necessary capital for electrical development. The commissions are taking it upon themselves not only to regulate utilities but to assist in developing the country through the utilities. Mr. Doherty expressed the opinion that it is not proper to specify permissible capitalization on the basis of the cost. As a matter of fact the properties may be worth either more or less than the actual cost and should be capitalized at their value without reference to cost. Mr. Doherty claimed that an effort should be made to educate the public on all utility questions in order to remove any existing prejudices against the utilities.

### Financiers and Utility Securities

Mr. Frank A. Vanderlip, president of the National City Bank, New York, pointed out that for the normal needs of electrical development $2,000,000,000 of new capital will be required in America during the next five years. He argued that the securities of public service corporations are sounder and more secure, on the whole, because of the tendency to place the affairs of these corporations under commissions, and stated that financiers now look with much favor upon the investments in public utility securities. Mr. Vanderlip's address appears in full elsewhere in this issue.

#### *Discussion*

Mr. Henry L. Doherty, New York, confirmed the figures presented by Mr. Vanderlip, and stated that according to his own estimates at least $300,000,000 is needed in new electrical work during the present year. He stated that the rental value of capital has increased enormously during recent years, but the electrical interests are better able to obtain capital needed on account of rapid developments in electrical applications. Statistics show that the average American city has increased in size about 100 per cent in twenty years. On this account predictions as to service which electrical utilities can render are practically always well within the results obtained. The result is most frequently that the bond issues initially made are too small. Mr. Doherty claimed that under present conditions and with future prospects the ideal investment is one in electrical securities.

### Resale Price-Fixing

Mr. F. D. Fish, Boston, discussed the principle of resale control, stating that the subject is closely related to the trend of the times. The present hostility to the control of the resale price is a part of the general reaction from the older method of encouraging industrial progress. For example, some years ago much encouragement was offered to the builders of railroads in order to afford transportation facilities for developing the country. The laws passed at that time were liberal and well suited to the conditions then existing. As a result of the developments brought about by legislation which encouraged industrial progress, the past fifty years has witnessed the greatest progress in history, especially in this country. Intellectual activity has reached a plane never before attained. The best minds of the country have been devoted to industrial development and to the sciences associated therewith.

In the reaction that is now taking place certain evils formerly overlooked are now being noticed and magnified. In fact, the public as a whole may be considered to be unreasonable in its demand upon the persons now associated with industrial development. A portion of the change in public sentiment can be attributed to certain accidents of opportunity to a few individuals, who have accumulated enormous wealth and thereby acquired the hostility of poorer men.

The present tendency is to make laws to protect the individual small consumer at the expense of the larger and more powerful consumer. This plan is excellent if not carried too far. However, it is incorrect to assume that national prosperity is bound up with the cheapness of articles to the individual consumer. The great danger at present lies in the over-accentuation of the desirability of cheapness.

In former times competition was looked upon as the life of trade, but under present conditions it can well be considered the destruction of trade. It needs no argument to show that the more goods there are manufactured the cheaper the price per unit. Under present conditions the method which has proved most satisfactory is that involving large sales at small profits. It is this method which proves most highly satisfactory with such staple articles as can be looked upon as necessities.

In the case of special articles for which one must create a market, manufacturers have found it extremely desirable to establish a fixed price at which each article will be sold to the ultimate consumer. This method is essential for the

tability of the business created by the advertising and marketing of the special article. For instance, if a consumer discovers that some well-advertised article can be purchased at a low price in one neighborhood while it is being sold at a higher price in his own town he refuses to purchase from the local dealer, although he may or may not purchase from the dealer offering to sell at a lower price. In this way the business becomes demoralized and the reaction proves undesirable from all points of view.

The courts have held that an inventor can set the price at which his patented article will be sold but not the price at which it will be resold, his interest in the article ending with the first sale, from which he receives his compensation. A legally sanctioned method by which unpatented articles may be sold to the ultimate consumer at a fixed price is that involving the establishment of stores or agencies throughout the country for the distribution of the articles.

Although the courts have held that neither the manufacturer nor the inventor can specify the resale price of articles, yet Mr. Fish contended that their attitude is illogical and that the fixing of the resale price should be legalized in the case of special articles that cannot be considered luxuries. In many cases the compensation for the inventor is closely associated with the establishment of a fixed resale price, and unless the inventor is allowed to specify a uniform price at which the article will be sold he fails to obtain adequate return for his invention.

*Discussion*

Reference has already been made to comments by Dr. C. P. Steinmetz relative to the substitution of co-operation for competition in modern industrial activity. Dr. Steinmetz claimed that the fixing of a resale price in reality represents the elimination of competition between the jobbers and the retailers, and the opposition against it in the public opinion is the same as the opposition against eliminating competition which is the foundation of the opposition against the corporation. In the public mind competition is still the foundation and the driving force of our industrial progress. They have not yet realized that competition is dead as an industrial and economic force.

The idea of competition as a benevolent force in industrial progress was based upon the theory that by competition between the producers prices would be lowered just as much above the cost of production as is necessary to give a fair profit. But the fallacy involved in this reasoning is the neglect of the economic law that it is financially more economical to operate a factory or an industry at a loss than it is to have it stand idle. The result is that unlimited competition, with the ability of producing beyond the demand, forces the prices down to where it would begin to be cheaper to stop production; that is, where the loss in production exceeds the loss in having the industry stand idle. The limitation of price forced by competition therefore is below the cost of production, and as the result the level reached by free competition is an unstable condition, a condition of production at a loss, which can exist and continue for a limited time only, but finally ends in receivership and the destruction of the industry.

The natural result of this industrial law has been that competition could not continue, but intelligent people in charge of the industries got together before the level of destruction was reached. This led to co-operation as the force which is taking the place of competition. All of the attempts to resurrect to life a dead issue by legal enactments, by trying to break up the corporations and forbidding the control of the resale price, are contrary to the economic law underlying present industrial production, and are therefore hopeless and are a failure. You may destroy the industries, but you cannot restore competition. It is dead. The people must be educated to understand that with our industrial conditions, with our enormously increased means of production, competition cannot exist without self-destruction, and co-operation must take its place.

### Favorable Conditions for Labor

Dr. Thomas Darlington, secretary of the welfare committee of the Iron and Steel Institute, New York, delivered a highly interesting illustrated address showing the methods employed by many of the large corporations. He claimed that it is no longer necessary to place welfare work in the column of philanthropy, because it is found to represent a paying investment from a purely monetary point of view. He showed that when the conditions surrounding the workmen during both factory and home hours are conducive to health and happiness the company obtains a greatly improved result for the money expended in wages.

### The Society for Electrical Development

Mr. J. Robert Crouse, vice-president of the Society for Electrical Development, showed in what way central stations, electrical manufacturers, jobbers, dealers and contractors can co-operate economically in the expenditure of money for business expansion. The data presented by him were given on page 169 of our issue dated July 26, 1913.

The working plans of the society were outlined by Mr. J. M. Wakeman, general manager of the society. He explained that the society is an outgrowth of the idea now taking hold that co-operation and not competition is the life of trade. The campaigns of this society will include the publishing of articles in popular magazines showing the proper applications of electricity. These articles will be written to appeal to the general public. In the trade press use will be made of articles prepared by men identified in each case with the industry which the paper represents. For example, articles relating to the use of electricity in paper mills will be prepared by men of reputation in the paper industry who have had experience in the use of electricity. Articles will be prepared for the daily newspapers in order to present the truth concerning electrical devices, public utilities and corporations. Among the features of the educational campaign will be the preparation and distribution of moving-picture films showing the advantages of electricity in the home, factory, etc. Arrangements have already been made for renting these films in various localities at the rate of $5 per day. Plans are being formulated for equipping with electrical devices a demonstration car which will travel from place to place in an educational campaign conducted by the Society for Electrical Development in co-operation with central stations in various localities. The society will be prepared to render assistance to small central stations in launching new-business campaigns. It will maintain a bureau of statistics for the collection and dissemination of knowledge concerning the various applications of electricity.

Mr. W. E. Robertson, as vice-president of the society, claimed that the time is now ripe for beginning the work the society is planning to undertake and that the results cannot fail to be successful provided only that the necessary money is obtained. On account of the fact that these plans have been indorsed by the best men in the electrical industry he predicted that the money will be quickly raised and the success of the society assured.

Mr. H. L. Doherty, president of the society, stated that the membership now exceeds 400, with subscriptions amounting to more than $135,000, only $65,000 now being needed to complete the initial amount of $200,000. The society has received the helpful co-operation of the Jovian Order, with its membership of 13,000. The Jovians are assisting in harmonizing the interests in the various localities and in presenting the advantageous features of membership in the Society for Electrical Development. Assistance is also being received through the co-operation of the

Commercial Section of the National Electric Light Association, and plans are being made to co-operate in the same way with committees of numerous societies.

THE CO-OPERATIVE MOVEMENT

Mr. Frank W. Smith, vice-president of the Electric Vehicle Association of America, outlined the co-operative advertising campaign conducted by this association. It obtained subscriptions of about $42,600, 11 per cent of which came from vehicle manufacturers, 31 per cent from manufacturers of accessories and 58 per cent from central stations. This campaign has proved successful and will be continued. New subscriptions already received amount to about $34,000.

Mr. Norman Macbeth, vice-president of the Illuminating Engineering Society, called attention to the co-operative methods employed by this society in disseminating knowledge concerning proper illuminating engineering practice. Committees of this society work in harmony with committees of a large number of other societies not only in compiling information on illumination but also in obtaining papers for presentation before sessions of one or the other of the two co-operating societies. For example, two of the sessions of the recent International Congress on School Hygiene were devoted to the subject of illumination, the Illuminating Engineering Society co-operating in these sessions. In connection with its educational campaign the Illuminating Engineering Society works through various committees, such as the committee on the illumination primer, the committee on public lectures, the committee on factory lighting and legislation, and the committee on collegiate education.

Mr. D. L. Gaskill, secretary of the Ohio Electric Light Association, promised the co-operation of his association in the work which the Society for Electrical Development is undertaking. He claimed that each society interested in the work of electrical development should devote at least one session throughout the year to the subject of co-operation.

Mr. S. O. Richardson, Jr., as president of the Manufacturers' Club, stated that this club had been organized to exchange ideas along the lines of manufacturing, patent laws, standardization of material and welfare work. The club is greatly in favor of co-operation along the lines advocated by the Society for Electrical Development. For the purpose of introducing a proper feeling on the part of the general public toward electrical matters he suggested that the educational campaign include information concerning the development of various electrical devices—for example, the tungsten lamp.

Mr. W. E. Robertson, on behalf of the Electrical Supply Jobbers' Association, stated that the jobbers are willing and anxious to co-operate with the contractors, central-station men and manufacturers in the work of developing the electrical business.

Mr. Ernest McCleary, of the National Electrical Contractors' Association, stated that the attitude of the contractors concerning the Society for Electrical Development is best shown by the fact that contractors represent a larger portion of the members of this society than does any other group of men in the electrical business.

Mr. F. E. Watts, Jupiter of the Jovian Order, stated that the order has been pleased to assist in raising subscriptions for the Society for Electrical Development, which it is able to do on account of the large number and wide distribution of its membership. During the month of February the Jovian Order added to its enrolment more members than it had obtained in the first eight years of its existence. Jovians are able to harmonize seemingly conflicting interests in each locality by means of luncheon meetings and can help in suggesting constructive rather than destructive legislation. They can do effective work, also, along the line of educating the public concerning utilities.

## Objects and Benefits of the Society for Electrical Development

Mr. Stephen L. Coles, acting secretary-treasurer of the Society for Electrical Development, in discussing the field for activity of that society, stated that the electrical industry has reached its present tremendous volume and vital importance in the world's economics largely through co-operative efforts in various specialized directions. Each important division of the electrical industry has its own association, working intelligently and successfully for its members along certain lines of peculiar benefit to them.

There is at present but one general organization in the field whose membership is open to both technical and commercial men. That is the Jovian Order, composed of 12,000 individuals, allied in various capacities with the electrical industry. This order stands as a glowing example of true individual co-operation, which is fully expressed in its slogan, "All together, all the time, for everything electrical."

Until the formation of the Society for Electrical Development there was no non-technical association whose membership was open to companies and corporations doing business in all branches of the electrical field. Every organization heretofore formed by electrical men has been designed to benefit them inside their own particular class of work.

The ultimate consumer of the goods and service produced by the best engineering and inventive skill and the most highly developed manufacturing processes the world has known has been to a great extent ignored. All electrical development heretofore has been largely selfish, and the public, upon whose support the whole industry is dependent, has never been taken seriously into close affiliation. In other words, the real vital element of a great problem has been overlooked, while detail development has received minute and careful attention.

The electrical field has gone on indomitably, perfecting principles here, refining complications there, and generally progressing at a marvelous rate; and all the time, with one or two exceptions, no one thought it worth while to try to educate the public in the use of new devices, in the adaptation of the latest discoveries to special needs, or in demonstrating the value of full electric service in home and factory. Here exists an excellent opening for establishing not only co-operation among the several divisions of a great industry but real co-operation between that whole industry and the public at large, upon whom the industry is dependent for its full success.

A few years ago this great opportunity for double service was appreciated and grasped by Mr. J. Robert Crouse, who attracted to his standard a number of other equally enthusiastic pioneers with an understanding of the true meaning of co-operation. The embryonic idea gradually took form, and after the usual vicissitudes incident to acquiring momentum experienced by every forward movement, has emerged as an entity certain to occupy a large place in the public mind and in the business policies of the electrical industry.

The Society for Electrical Development is here, and here to stay, and to grow in value and in service. It has the best reason possible for existence, its field of effort is almost limitless, it is founded on correct co-operative principles, its form of government is truly representative and absolutely equitable, its requirements for financial support are extremely modest in comparison with the volume of business taxable, and the returns are sure and in true proportion to the effort the society is enabled to put forth.

The society has only one object—"to promote and increase the use, by the public, of electric energy for all useful purposes as an end in itself and as a means for increasing the demand for apparatus and supplies."

Where every effort of a thoroughly representative and perfectly balanced organization is concentrated on only one object, it follows logically that the results to its mem-

ers will be greater and more cumulative in effect than vhen several objects are sought, causing a scattering of ffort and usually a waste of energy.

The society is a money-spending organization and can, nder no circumstances, become a money-making scheme. ts board of directors receives no remuneration and pays its wn expenses. The only salaried officials are the general ıanager and the secretary-treasurer, who report to the xecutive committee, which is appointed from the board of irectors, who hold office through the votes of the member-hip. The vote of the small member is exactly equal to :at of the largest company in the society.

Outside of the two salaries mentioned and those of the ecessary office force, the entire income of the society will e used in the various campaigns and in the furtherance of ıe several plans which have been approved by the board f directors as best suited to accomplish the one object f the society.

In five months the society has received 412 applications or membership from manufacturers, central stations, job-ers and contractors, covering pledges for subscriptions ap-roximating $140,000. The society wisely has decided not o begin its work until $200,000 has been pledged. Active ampaigns are now being conducted to procure this amount s quickly as possible.

## Electrical Development Society Membership Campaign

At a meeting of the membership campaign committee of he Society of Electrical Development held at Association sland on Saturday, Sept. 6, it was decided to continue he present campaign for increasing the membership along he lines already laid down. Valuable assistance is being eceived from the Jovian Order. The society will engage a nan to help in the work now being done by the Jovian tatesmen. The salesmen of the member companies will e asked to co-operate in the new membership work. For he purpose of advertising the society among electrical men igns bearing the name of the society and its slogan will e prepared for distribution among the member companies, vhich will be requested to display them conspicuously in heir offices and, in the case of jobber and supply dealers, n their show windows. The last week in October has been lesignated as the "Society for Electrical Development Week," and during it everyone engaged in the electrical in-lustry will be asked to co-operate in obtaining members for his society. It is expected that the minimum amount of $200,000 will be pledged by the end of October and that he active work of the Society for Electrical Development vill commence during November.

## The International Photometrical Commission

The fourth meeting of the International Photometrical ommission was held on Aug. 27 and 28 in admirable uarters at the Reichanstalt, Berlin, Germany, placed at the isposal of the commission by Professor Warburg and ıade ready by the assiduous courtesy of Dr. Brodhun. he delegates from the several countries participating in-luded a large proportion of the names familiar in the art. he American delegates were Messrs. Louis Bell, E. P. Hyde, A. E. Kennelly, C. O. Mailloux, P. S. Millar and . H. Sharp.

President Vautier delivered an appropriate address set-ng forth the circumstances which had led to this remark-ble gathering and the nature of the work before it. He ated that the International Commission of Photometry ras founded by the International Congress of the Gas In-ustry in Paris on the occasion of the Universal Exhibition f 1900. All the nine countries having technical societies which represent the gas industry took part in that congress. The aim of the congress was to study the rules which should be applied in photometry of incandescence by gas and consequently to organize investigations which might lead to a better knowledge of the complicated mechanism of illumination of incandescence and to an improvement in its realization. The commission decided in 1911 to ask the electrotechnical committees of the nine countries which had joined its organization to send delegates who would take part in the study of all questions of common interest. In the spring of 1912 the American Gas Institute wrote to the International Commission of Photometry: "The best and most permanent results will be obtained if the method inaugurated by this commission [in its resolution to invite the representatives of the National Electrotechnical Committees] should be enlarged in such a way that the International Commission of Photometry could represent completely all the interests of illumination on an even footing and under reciprocally acceptable conditions, involving the illuminating engineering societies of America and Great Britain, besides the national laboratories and the technical societies dealing with gas, electricity, acetylene and other illuminants. If the commission should not think it opportune to enlarge itself in such a way, and prefers to remain exclusively a gas commission, it would still be advisable for it to take the initiative of sending an appeal to all principal societies interested in photometry, and to ask them to participate in the formation of an international commission which would treat all questions of nomenclature and units used in photometry. On choosing the first alternative the International Commission of Photometry would be responsible to all photometric interests represented in the commission: it would become an international commission of illumination."

The American Gas Institute had suggested that the work of elaborating a project of statutes should be given to a sub-committee consisting of the representatives of the national laboratories of Germany, England, America, Austria and France. This committee would assure impartiality. In consequence, Messrs. Brodhun, Paterson, Kosminsky, Rosa and Laporte were asked if they would help. Mr. Paterson was kind enough to accept the position of secretary and to present a first scheme, which was sent to all members of the sub-committee. They sent it back with their notes. This document, together with comments, was sent to all technical gas societies adhering to the commission, so that they might follow the proceedings. Mr. Paterson tried afterwards to harmonize as well as possible the various proposals of his colleagues and edited a second scheme, which was sent, first in French, and afterwards in English, German and French, to all the gas and electrical societies of the nine countries adhering to the commission.

The technical societies representing illumination by gas or electricity in the nine countries were asked to participate in the projected meeting. The Germans agreed on being represented through the Deutsche Beleuchtungstechnische Gesellschaft. Those of the United States formed a national committee which appointed its delegates, and the same was true in England. In the other countries the technical societies of illumination by gas and electricity appointed their own delegates.

President Vautier called attention to the importance of adopting a plan of government which should be as broad as possible, in order to permit the societies of the different countries to evolve their own organizations to suit their own purposes. The particular feature of the new commission will be that it will group for common work the representatives of industries who possess totally different means of production and who are themselves in competition in commercial matters.

The sub-committee had first thought the organization of the Electrotechnical International Society could be taken up. This commission has imposed on its adherents the

formation of a national electrotechnical committee for each country. This formation is certainly logical, because these committees, just like the Electrotechnical Commission itself, represent the interests of only one industry. Whether the national committees on illumination will be constituted as easily and will be able to act with such usefulness will depend to a great extent on those who are appointed, and also on the kind of problems they will attempt to solve, those of purely commercial interest being excluded. They certainly can be useful. It is easy to understand that the wishes and opinions they express, being based on an agreement of different industries, will secure impartiality much better than the opinions of a single industry would do. At all events, the interest with which certain countries formed or decided to form national committees shows that the idea was welcomed, especially in the United States, England, Germany and Austria.

At the close of the president's address consideration was given to the proposed statutes prepared in advance by the sub-committee charged with the important work of formulating the reorganization of the International Photometrical Commission into a body undertaking the larger responsibilities of dealing with the general problems of illumination. Progress was slow owing to the necessity of working in three languages, and the difficulties thus imposed loomed large in dealing with the exact phrasing necessary in the governing statutes. The lack of precise equivalents in various languages was much in evidence.

After much discussion and translation, substantial progress was made. An editing committee, consisting of Dr. Kruss, Mr. Mailloux and Mr. Monod, was appointed to reconcile differences of language in the final draft, and the sections of the statutes dealing with the name and purposes of the new organization gradually took form to be brought into final shape, like the rest of the statutes, by discussion in the sub-committee which had originally formulated them. It was then provided that all suggestions and emendations should be reduced in writing and presented with suitable briefs to this sub-committee, a procedure which will facilitate further action. Everyone who spoke seemed animated by a sincere desire to organize the enlarged commission on a broad, scientific basis, and the outlook is exceedingly good for results of great and permanent value.

The important third section of the statutes, dealing with the constitution of the national delegations, was then reached, and Mr. Mailloux presented for consideration some important modifications of the original scheme, intended to give a larger measure of flexibility in the selection of the national delegates. These proposals were deferred, to be reduced to written form for distribution among the members.

The sub-committee consists of Messrs. Brodhun, Kusminsky, Laporte, Paterson, Kennelly and Vautier, with various collaborators called in for advice and assistance.

During the second day's proceedings most of the statutes were disposed of with merely the usual amount of verbal quibbling and slight emendations, but two matters took on from the start a somewhat grave aspect. The first of these was that of representation. In the ordinary case a national committee could be readily formed by the concurrent action of the chief technical societies, and this in fact was done in the majority of cases. But a question arose as to the representation of countries in which there might chance to be internal dissension so that either no national committee could be formed, or if one were constituted, it might be far from representative even with the best of intentions. The original form of the statutes contained some elaborate provisions to meet such cases, which, however, would also tend to perpetuate existing disagreements and hinder the later expansion of representation. Strife waxed hot on the matter, which was finally left over night to the editing committee and the private consideration of the delegates in

The second troublesome matter was that of the formation of working sections of the international body. A certain part of the delegates showed a determination to split the commission into autonomous sections with restricted membership and merely subject to the main body in the case of passing resolutions of strictly international significance. This was opposed by others, who held that while for efficient work there must be committees in continuous action on special topics, no division of the membership must be permitted. Two propositions, brought forward by the British and American delegates respectively, were finally turned over to the editing committee for recasting into one in which sub-committees were authorized, but with the provisions that they must be under the full control of the general body and that any sectional meetings held as a matter of convenience must be absolutely open.

By Saturday morning the very serious complication over methods of representation was settled by a proposal of the French delegates, who were really the ones most involved in the affair. This done, the other matter, regarding the powers and functions of subordinate groups, came up. Having been put into a form which met all valid objections, this was promptly ratified. Much of the remaining time was taken up by a discussion of quorum, voting by proxy and such matters, which finally were put into acceptable shape. The statutes came up for ratification and acceptance as a whole, and at 6 p. m. on Aug. 30 the final vote was passed unanimously and the International Commission on Illumination became a duly constituted body.

Its first act was the election of officers, and amid great applause M. Vautier, France, was unanimously elected president on the nomination of Dr. Duddell, first by acclamation and then by a formal vote of nations. The three vice-presidents were then balloted for, this resulting in the election of Prof. Bunte, Germany, Dr. Hyde, America, and Dr. Kusminsky, Austria. For honorary secretary, Mr. Paterson, England, was chosen, and for treasurer, Mr. Weiss, Switzerland.

A temporary sketch of a budget was made so as to permit Mr. Paterson to organize his office, and on the invitation extended by M. Masse, of the French delegation, Paris was agreed upon as the next meeting place. The session ended with a most happy address of felicitation on behalf of the delegates by Mr. Mailloux and a cordial response by President Vautier.

The organization as finally worked out is not a complicated one. It has a president, three vice-presidents, a secretary and a treasurer as the officers, who, with two representatives from each contributing country, form the executive committee. This committee has practically plenary authority in the general affairs of the commission. The representatives of each country are selected by its national committee if there is one, which has the power, if it desires to allow important societies to send delegates directly representing them. In default of a national committee, societies interested may act directly, but in no case may more than ten delegates be sent by one country. The deliberations may be either in English, in French or in German, each language when used being promptly translated into the others. Likewise papers may be in any of these three languages. In the reporting of meetings and the proceedings in general, French is taken as the basic language so as to have a single verbal standard from which translations into the other tongues may conveniently be made. The wisdom of this single standard was amply shown in the discussion of the details of the statutes, in which there were all sorts of trouble due to the slight variation in meaning of nearly equivalent words.

The president has been authorized to reappoint the existing committees of the now superseded Photometric Commission with such additions as he may deem wise, pending the starting of the new organization, so that work in pro-

## Knight Templar Decorations at Denver

One of the most elaborate and artistic installations of decorative lighting ever undertaken in an American city was that which marked the thirty-second triennial conclave of the Knights Templar in Denver during the month of August. Preliminary work on these illuminating effects was begun over a year ago under the direction of Mr. W. J. Barker, general superintendent of the Denver Gas & Electric Light Company, who was chairman of the illuminating committee of the Knights Templar. He was assisted by Mr. George E. Williamson, illuminating engineer.

The central feature of the lighting was the Court of Honor on Champa Street, extending from Fourteenth to Eighteenth Street. Twelve columns showing electrical fountain effects were erected in each block, and lamps totaling 1000 cp were used in each column. The bases of the columns were composed of art glass, and on these were placed octagonal glass prisms surmounted by knights' helmets and plumes. Sprays of water were continually playing inside the glass cylinders, and several handsome color effects were worked out. Steam was also made to issue from lighted Holophane reflectors on the tops of the columns, giving the effect of incense rising from the entire Court of Honor. Twenty-four different conbinations of color were secured by the use of various kinds of glass in combination with reflectors. There were six large tungsten units in each column, four being 100-watt lamps, one a 500-watt lamp and one a 250-watt lamp. The columns were connected together at their bases by lighting conduit and by the pipes for the steam and water. These conduits were laid along the sidewalk close to the curb and were protected with boards. Rope covered with silver tinsel was stretched from column to column, giving a complete connected effect to the whole scheme of illumination used on this street.

Fourteenth Street had thirty-three stringers developing an attractive red, white and blue color scheme. Seven thousand lamps were used in the illumination of this street. The Fifteenth Street illumination extended twelve blocks. Each of the stringers was composed of lighted stars with an illuminated Passion cross in the center. The lamps were set in a white background and the effect was heightened by the red globes and tinsel on each of the ninety-six arc lamps of the twelve blocks. A total of 3456 lamps was used on this street. Red Maltese crosses formed the center pieces of the stringers in the Sixteenth Street illumination,



FIG. 1—FIFTEENTH STREET—STRINGERS OF STARS AND PASSION CROSSES

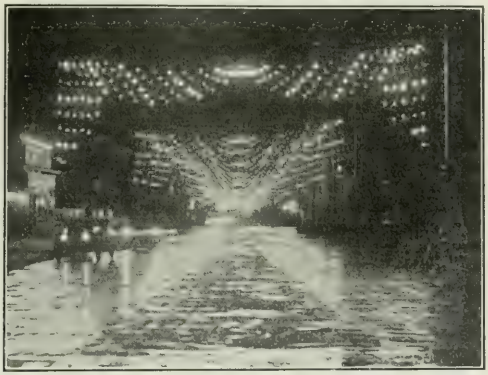


FIG. 3—FOURTEENTH STREET STREAMERS OF RED, WHITE AND BLUE LAMPS



FIG. 2—SOUTH END COURT OF HONOR, SHOWING ELECTRIC BUILDING



FIG. 4—CHAMPA STREET ILLUMINATION AND GIANT MOUNTED STATUE

which extended over eleven blocks. In each of the forty seven castles surmounting the trolley poles there were four 16-cp lamps, which brought out the features of this beautiful decoration.

Seventeenth Street had a striking novelty in its transparent shields representing the various commanderies. On one side of each shield was the commandery seal and on the other a photograph of the grand commander of the state designated. On Curtis Street the lighting was in the shape of rope effects extending between the trolley poles on both sides of the street. At intervals there were hung thirty-two Passion crosses and sixteen Maltese crosses, each illuminated by two lamps.

The sign of the seal of the Colorado Grand Commandery at Colfax Street and Broadway was a most striking piece of illumination and was much praised by the 35,000 visitors. Its dimensions were 36 ft. by 54 ft. The "C" in the sign was 36 ft. in diameter and the surface of the display was studded with 2260 lamps with amber, blue, frosted and red globes. The animated Maltese cross at Eighteenth and California Streets measured 48 ft. by 38 ft. There 1570 lamps were used—frosted, clear, opal, yellow, red, amber, green and purple. Each of the 100 stars on the top and bottom borders was jeweled with a single 4-cp lamp.

The north end of the Court of Honor on Champa Street was made highly spectacular by a giant horse mounted by an armored knight. The huge piece measured 48 ft. by 54 ft. over all and was lighted by two 100,000-cp General Electric search-lanterns on the roof of the Foster Building. A covering of glass flakes on the horse gave the illumination a beautiful sparkling effect, and no feature of the rich trappings of gold and silver was missed in the powerful illumination of the big search-lamps.

The sunrise structure in front of the entrance of the Auditorium contained 2500 4-cp lamps and 150 250-watt tungsten units in frosted-bowl and D'Olier steel-helmet reflectors. Ten thousand yards of colored tinsel were used.

The lighting of the big temporary grand stand was also a considerable task, as this large arena where the Templars passed in review had a seating capacity of 26,400. Circled around the arena were twenty-four magnetite-arc lamps, and stretched from the center were thirty multiple-type Westinghouse 3000-cp flame-arc lamps. On the back of the stand were thirty-seven 60-cp series tungsten lamps.

The entire lighting for the conclave required 70,000 extra sockets, and approximately 6000 kw was the connected load for the extra illumination. The committee appropriated $40,000 for the illumination, and all the pieces were planned and manufactured in one of the large warehouses of the Denver Gas & Electric Light Company.

## Meeting of the Kansas Public Utilities Association

The Kansas Gas, Water, Electric Light and Street Railway Association will hold its sixteenth annual convention at Hutchinson on Oct. 9, 10 and 11, at the Commercial Club rooms. The morning of Oct. 9 will be taken up with the registration of members. Following the address of the president, Mr. L. O. Ripley, Wichita, the following papers will be presented: "The Cost of Distribution Versus Cost of Production," by Mr. J. R. Murphy, manager of the Hoisington Electric & Ice Company; "The Relation of the Load-Factor to the Net Revenue of the Average Kansas Central Station," by Mr. F. F. Rossman, of the Westinghouse Electric & Manufacturing Company, Kansas City, Mo.; "Pumping Water for Municipalities," by Mr. M. Dunsworth, manager Emporia Railway & Light Company; "Treatment of Poles," by Mr. F. B. Uhrig, district manager Western Electric Company, Kansas City, Mo. In the evening Mr. P. Lloyd Lewis, of the Wagner Electric Manufacturing Company, Kansas City, Mo., will explain the work of the Jovian Order.

At the morning session on Oct. 10 the following papers will be presented: "Manufacture and Installation of Concrete Poles," by Mr. C. L. Brown, secretary of the Riverside Light & Power Company, Abilene; "Some Features in the Organization and Development of an Interurban Railroad," by Mr. Charles D. Bell, superintendent of the Arkansas Valley Interurban Railway, Wichita; "Some General Features Which All Public Utilities Have in Common," by Mr. A. M. Patten, assistant general manager Western Railways & Light Company, Topeka; "Small Central-Heating Plants," by Mr. H. C. Kimbrough, manager American District Steam Company, Chicago; "Intangible Values and Their Relation to the Valuation of Public Utilities," by Prof. George Shaad, Kansas University, Lawrence; "Special Street Illumination with Ornamental Concrete Posts," by Mr. F. A. Pielsticker, manager of the Eldorado Electric & Refrigeration Company, Eldorado, and a paper by Mr. L. M. Gazen, chief electrician Atchison, Topeka & Santa Fé Railway Company, Topeka, the subject of which will be announced later.

At the afternoon session papers will be presented as follows: "The Relation of Public Utilities to the Public," by the Hon. Henderson S. Martin, chairman of the Public Utilities Commission of the State of Kansas; "The Financing of Public Utilities," by Mr. H. P. Wright, president of the H. P. Wright Investment Company, Kansas City, Mo., and "Some of the Important Factors in the Development and Transmission of Natural Gas," by Mr. C. L. Bullock, superintendent of the Wichita Natural Gas Company.

On the last day of the convention papers on the following subjects will be discussed: "The Design and Construction of High-Tension Distributing Systems," by Mr. G. W. Saathoff, Empire District Company, Joplin, Mo.; "Irrigating Kansas Lands," by Mr. H. B. Walker, state irrigation engineer, Manhattan; "Determining Operating Costs of Power Installations," by Mr. C. A. Fees, Kansas Gas & Electric Company, Wichita, and a talk on "The Education of the Central-Station Staff in Kansas," by Mr. P. F. Walker, dean of the school of engineering, Kansas University, Lawrence.

The secretary and treasurer of the association is Mr. Ivor Thomas, 237 South Main Street, Wichita, Kan.

## Destruction of Utility Plant in Conflagration at Hot Springs, Ark.

The public utilities of Hot Springs, Ark., suffered a severe loss Friday, Sept. 5, when nearly one-third of the city—fifty-five blocks—was destroyed by fire. The Citizens Electric Company's power plant burned soon after the fire started, throwing the city into darkness and shutting down the traction service on account of lack of power.

Describing the extent of the damage done, Mr. S. F. Dillon, general manager of the company, reports by telegraph: "All generating units were destroyed, but boilers and accessories can be made serviceable. We have engineers here on the ground and hope to restore temporary service within two weeks. All poles and wires were destroyed throughout the burned district, and the overhead trolley system was more or less damaged for a distance of a mile. The fire originated in a gale blowing about 50 miles an hour, and no human efforts could control it."

Every effort is now being made to rush electrical equipment to Hot Springs for the early resumption of service. The Federal Light & Traction Company, 60 Broadway, New York, owns the Citizens' Electric Company, the Consumers' Gas Company, the Hot Springs Street Railway Company and the Hot Springs Water Company, having acquired these properties in March, 1913.

The fire started in a negro's shack on Church Street, four blocks east of the government hospital. The utility power plant was in flames within two hours after the fire

rted, but General Manager Dillon and his assistants naged to save the records of the company, which were in e general offices adjoining the station. Great bravery as displayed by the plant engineers, who remained in e station to operate the electric service for the pumps livering the water supply from the distant reservoir. ese men left only when the fire was upon them, but rtunately escaped without much injury.

The auxiliary steam pumps at the water-works, 2 miles stant, had meanwhile been put in service, and there was delay in supplying water for the fire lines. Though no in had fallen for several weeks, the reserve capacity of e company's reservoirs was sufficient to maintain excelit pressure during the fire. This was the only thing at saved the rest of the city from destruction. Dynating was also resorted to to prevent the spread of the mes. This saved the government bath-houses, the Eastan, Arlington, Majestic and other large hotels, as well as e business section along upper Central Avenue. A part the latter section of the city was, however, burned early March of this year, and the section destroyed last week d previously been devastated by the fire of 1906, alough the electric plant was not injured at that time.

A hurried survey of the power-house ruins showed that e 1250-kw turbine set could be rewound, but the smaller its, of 450 kw and 500 kw respectively, appear to be tal losses. The motor-generator set and rotary converter ill have to be replaced by new equipment. One condenser n soon be put into operating condition, but the other ill be a loss. Most of the piping was destroyed. Two the Stirling boilers can be repaired and utilized again.

Traction service was resumed in the city by means of o gasoline motor buses. Besides this, Mr. W. A. Haller, ief engineer of the Federal company, and Mr. Dillon tched mules to the lighter street cars, so that the best ssible service under the circumstances is now being given. r. Dillon also rigged up a temporary power line from e of the larger hotel plants to the newspaper offices, and e papers went to press twelve hours after the fire, miss-g but one edition.

Before the fire was out at Hot Springs the New York fice of the Federal Light & Traction Company had beme a scene of intense activity. The executive, engineerg and purchasing departments began immediate prepations to rush new equipment to the stricken city at the rliest possible moment. The manufacturing companies ere called upon to aid. Telegrams were sent to all parts the country tracing turbines and other equipment, either w or second-hand, that could be bought and rushed to ot Springs. The manufacturing companies were not able supply all needs from their factory stocks but generously ded in this outside search. From Maine to California d Florida to Washington the telegraphic search is being ade at the time this edition goes to press.

When it is considered that the whole city of Hot Springs without electricity, some of it even without telephone rvice, and that the early resumption of its commercial fe, the protection of the city and the dismissal of the ldiers now patrolling the streets are all dependent upon e Citizens' Electric Company's obtaining electrical equipent, and getting it quick, the reader will readily perceive e necessity of getting the apparatus on the ground and rected at the earliest possible moment.

It is now the belief that a new central station will be ilt on another site about a mile from the former plant. he old station occupied valuable space in the business ction of the city which will now be more desirable for siness purposes.

Rush orders have been placed for 3 miles of messenger ire, 2.5 miles of trolley wire and 3.5 miles of No. 0000 eder wire. The express companies are co-operating with e city of Hot Springs, the federal and state governments d the utility company in facilitating shipments.

Mr. C. C. Chappelle, vice-president and general manager of the Federal Light & Traction Company, has personal charge of the rebuilding of the power plant, and Mr. W. A. Haller, chief engineer and general superintendent, is now at the scene of the disaster. Mr. George J. Gauthier, general construction superintendent, is assistant in active charge of the two score of linemen and others now engaged in the work of rebuilding. Mr. Lee Skipwith, of the company's New York office, has charge of the purchase of the new equipment.

## Multiple Ornamental Flame-Arc Installation at Boston

The accompanying photograph shows the first application in the United States of the multiple ornamental inclosed flame-arc lamp, the installation being on the exterior of the Huntington Avenue Theater, in the Back Bay district of Boston, Mass. Eight lamps are in service, having




HUNTINGTON AVENUE THEATER, BOSTON, MASS., AT NIGHT, ILLUMINATED WITH INCLOSED FLAME-ARC LAMPS

been furnished by the General Electric Company's Lynn factory. Each is a 6.6-amp lamp equipped with yellow-flame carbons and operated in multiple with its fellows on a 113-volt, direct-current circuit. The lamps are spaced about 12 ft. apart horizontally and 15 ft. apart vertically and are installed on Lundin brackets of the ornamental type, the arc being carried about 3 ft. out from the wall and inclosed in a 16-in. globe. The lower row is about 35 ft. above the sidewalk. In an early issue the details of the lamp will be described.

## Convention of Northwest Electric Association

On Sept. 3, 4 and 5 the Northwest Electric Light & Power Association held its sixth annual convention on the roof garden of the Washington Hotel, Seattle, Wash. The sessions were afterward declared to have been the most interesting and instructive ever held by the Northwest

association, and the large attendance present included delegates from Washington, Oregon, Idaho, Montana and British Columbia. A wide range of electrical topics was touched by the program, which was made up of three addresses and twelve papers.

In opening the convention, President W. J. Grambs, Seattle, referred to the subjects of labor, adequate compensation for employees, regulation by public service commissions, public education, and the methods and work of public service companies necessary to avoid unjust attacks. "It is only through education that we can stop the unjust criticism and confiscation of our utilities and acquaint the public with the fact that we are not indifferent to public opinion, and that we are simply co-operative institutions of officials, workers, investors and the public. The public must be taught to know that we are not ravenous creatures, taking its wealth from it unjustly, but that we stand for a square deal and an upright public policy," said Mr. Grambs.

"We must no longer be silent, but must be heard loud and often in reply to politicians and demagogues on the other side of the question. We have another duty to perform, if we wish to overcome adverse public criticism, and that is to do our work so well that the kicker will run out of ammunition. All complaints should be immediately remedied, if possible, immediately acknowledged, carefully investigated, and never pigeonholed, because there is usually a basis of truth in every complaint."

Mr. E. G. Robinson, manager of the Jim Creek Water, Light and Power Company, of Arlington, Wash., opened the afternoon session with a paper on "The Management and Operation of an Electric-Light Plant in a Small Town." Mr. Robinson's remarks included the recital of many sober and funny incidents which had come within the range of his work as manager of small-town properties, and aroused the greatest interest.

"Some Operating Problems" was the title of the next paper, by Mr. J. B. Fisken, superintendent Washington Water Power Company, Spokane, Wash., who outlined the relation of the operating department to other divisions of a given company and described in detail practical schemes of organization for such operating departments.

In his paper, "The Tireless Farmer—Results from Ruralizing Electricity," Mr. J. E. Davidson, general manager Pacific Power & Light Company, Portland, Ore., told in a comprehensive way of the uses of electricity in rural districts and advised methods to be employed by companies desiring to extend their lines for this class of business.

"The Regulation of Public Service Utilities," the paper by Mr. George A. Lee, outlined the benefits and dangers of regulating utilities, pointing to the advantages of state over municipal regulation and urging the enactment of further legislation to extend the scope of the state commission's power.

Mr. Norwood W. Brockett, Seattle, Wash., secretary of the Northwest association, followed with an administrative paper, entitled "Recent and Proposed Legislation Affecting Public Utilities." Acts of legislatures of the Pacific Northwest States concerning public utilities were discussed at length and the workings and interpretations of industrial insurance and commission acts were treated.

A paper entitled "Mechanical Devices in the Accounting Department," by Mr. Y. M. White, treasurer Washington Water Power Company, Spokane, Wash., described numerous appliances for office use, with their money-saving possibilities.

Mr. Henry L. Gray, former chief engineer of the Public Service Commission of Washington, next spoke on "The Valuation of Electric Utilities," discussing informally the methods employed and the benefits to be derived from appraisals, particularly in the case of valuations of smaller companies.

Thursday's session was closed with a paper entitled "Management of a Commercial Department," presented by Mr. A. C. McMicken, sales manager Portland Railway, Light & Power Company, Portland, Ore.

Friday's session was opened with the reading of a technical paper on "The Use of Protective Relays on Transmission Systems," by Mr. S. C. Lindsay, electrical engineer Puget Sound Traction, Light & Power Company, Seattle, Wash. Mr. V. H. Greisser, electrical engineer Washington Water Power Company, Spokane, Wash., followed with his paper entitled "Some Features of the Washington Construction Rules." Mr. W. H. Lines, industrial power engineer Portland Railway, Light & Power Company, Portland, Ore., then read a commercial analysis entitled "The Industrial Application of Electrical Heating."

"Electricity in the Lumber Industry," the paper presented by Mr. A. E. Ransom, manager of the Seattle office of the Coldwell Machinery Company, listed motor applications and specifications for mills and logging uses.

The last paper of the program was read by Mr. O. B. Coldwell, general superintendent Portland Railway, Light & Power Company, Portland, Ore., on "Synchronizing an Electric Light and Power Company's Records and Accounts with the Characteristics of Its Business." Mr. Coldwell's points provoked much interesting discussion.

The entertainment committee, of which Mr. A. A. Miller was chairman, arranged an excellent amusement program for the convention visitors, including several automobile rides, a banquet, a theater party, a picnic and dance, and a boat trip to the Puget Sound Navy Yard.

The annual election held Sept. 5 resulted in the choice of Mr. H. L. Bleecker, vice-president of the Washington Water Power Company, Spokane, Wash., as president of the association. The other officers elected were: Mr. E. G. Robinson, Jim Creek Water, Light & Power Company, Arlington Wash., vice-president for Washington; Mr. Franklin T. Griffith, president Portland Railway, Light & Power Company, vice-president for Oregon, and Mr. John McKissick, of the Northwest Light & Power Company, Wallace, Idaho, vice-president for Idaho. Mr. Norwood W. Brockett, Puget Sound Traction, Railway, Light & Power Company, was re-elected secretary-treasurer, and Messrs. M. C. Osborne, Washington Water Power Company, Spokane, and P. A. Bertrand, Gray's Harbor Light & Power Company, Aberdeen, Wash., were named as additional members of the executive committee.

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## Indianapolis Merger Situation

Following the order of the Public Service Commission o Indiana permitting the merger of the Merchants' Heat & Light Company and the People's Light & Heat Company o Indianapolis, the Indiana Trust Company, as trustee, ha brought suit petitioning the court to vacate the order an asking that the People's company be rehabilitated as going corporation. The plaintiff owns ten shares of stock i the People's Light & Heat Company, on which the commi sion fixed a value of $1,000. It is dissatisfied with this val ation and complains that the action of the commission is i effect an effort to appropriate its property without due pr cess of law. The members of the commission and the tw companies affected are named as defendants.

In the order of the commission, as handed down on Au 27, there were some interesting figures. The People's co pany has issued $300,000 in stock and an equal amount bonds. The gross earnings from Oct. 1, 1912, to May 1, 191 were $94,870 and the net earnings $32,221. The Merchan company has issued $1,250,000 in stock and $2,500,000 bonds. It has been furnishing electrical energy under co tract to the People's company for some time. The price to paid by the Merchants' company for the People's company $525,000 in cash, and for the purpose of raising the mor the former was authorized to issue $325,000 of 5 per c bonds and to increase its capital stock by $250,000. T

nds must net the company at least 89 per cent of par value d the stock must not be sold for less than par. A fee of 52.50 (15 cents on each $100) must be paid into the state asury before the new bonds and stock certificates are ued. It is further provided that in future rate-making duplicated value of property shall not be considered or capitalization as increased by the merger order.

### Personnel of Public Service Commissions

Mr. George L. Myers, assistant secretary Pacific Power Light Company, Portland, Ore., wrote an article re-ntly on the "Personnel of Public Service Commissions," ich was published in the *Managers' Bulletin* issued nthly by the company.

Mr. Myers said in the article that regulation is no longer subject of contention between party leaders or political rties, if it really ever was, and that it is not in any sense partisan question. In its relation to public service cor-rations it is a question concerning which practically all ople take common ground.

Much study and consideration have been given to the ovisions of public utility laws in order to insure effective gulation, and too little study and consideration have been ven to the personnel of public utility commissions. The ad of regulation that is to be had is entirely dependent on the efficiency of the commissioners who do the regu-ing. If there is not an efficient and competent commis-n, there cannot be efficient and proper regulation. It is cessary that commissions be composed of men who can fair and just to the corporations as well as to the public d impartial in their attitude and capable of judging the cts involved in cases with which they have to deal.

If political considerations make possible the appointment regulation of a commissioner, such considerations are ry likely to govern his conduct as a commissioner. It ould be impracticable and undesirable to apply civil rvice rules and regulations because of the nature of the ties performed by a commissioner, but the method of ection should be such that the tenure of office would pend upon merit and service rendered.

# Current News Notes

A Boy, a Kite and a High-Tension Line.—While a venteen-year-old boy of Clinton, Mass., was flying a kite that city Sept. 7, the wire attached to the kite came in ntact with a 6600-volt transmission line. The youth was stantly killed by the shock.

* * *

An Electric Searchlamp Revolver.—A searchlamp re-lver invented by Victor DeMarais, of Chico, Cal., is pro-ded with a miniature electric lamp arranged to light the rget at which the gun is aimed. It is said that the spot projected light thus marks out in advance the point here the bullet will strike when the trigger is pulled. he device is patented and will be marketed by a California mpany.

* * *

Examination for Fire-Alarm and Police-Telegraph ngineer.—An examination for the position of engineer the fire-alarm and police-telegraph system of the city of os Angeles will be held on Sept. 27. Its duties consist in signing, constructing and maintaining an independent e-alarm system for Los Angeles. The salary is $250 per nth. The examination is open to citizens of the United ates who possess the necessary qualifications. Further formation may be had by addressing the Civil Service mmission, 204 Exchange Building, Los Angeles, Cal.

Preventing Corrosion of Iron.—As a part of its investigations relating to efficiency in mining, the United States Bureau of Mines has undertaken to develop a method of preventing the corrosion, by acid water from mines, of iron and steel used in mine equipment. Technical Paper 15—"An Electrolytic Method of Preventing Corrosion of Iron and Steel"—describes experiments in connection with an electrolytic method of preventing corrosion. The results appear to justify the hope that the method may be applied successfully for the protection of iron and steel in the construction of mining equipment, as well as for the protection of structures exposed to the acid waters of streams.

* * *

Pictorial History of Keokuk Development.—A handsomely illustrated historical résumé of the construction work leading up to the completion of the Keokuk water-power plant is contained in Bulletin No. 10, just issued by the Mississippi River Power Company, Keokuk, Ia. Many of the pictures are in three colors, and the text completes the description of the electrical equipment begun in a preceding number. Summarizing the electrical portion of this great development, it is pointed out that the 150,000-hp generating station, the 150-mile, 110,000-volt transmission line of 90,000-hp rating and an extensive system of substations and distribution lines carrying energy to industries in Illinois, Iowa and Missouri have all been constructed and put into operation in less than eighteen months.

* * *

Pittsburgh's Ten-Million-Dollar Smoke Damage.—Mellon Institute, University of Pittsburgh, has issued its report on the Pittsburgh smoke nuisance, placing at $9,944,740 the damage done yearly in that city. This represents a per capita charge of about $20. Innocent suffer with the guilty in paying this tax, for, as estimated by Mr. John O'Conner, economist for the investigation, while the loss to the "smoke-maker" himself, due to imperfect combustion, is but $1,520,000, the cost to individuals in laundry bills amounts to $1,500,000 and that for dry-cleaning to $750,000. The extra cost to stores, wholesale and retail, is estimated at $3,675,000 per year; the extra cost to the household, including painting, renewal of wall-paper, etc., is placed at $2,332,000, and the extra cost to quasi-public buildings (hotels and hospitals) is $167,000.

* * *

Bibliography on Electrical Welding.—The New York Public Library has just published a list of works to be found on its shelves relating to electric welding, compiled by Mr. William B. Gamble, chief of the division of technology. This bibliography is arranged in chronological order. Beginning with probably the earliest record in the library of exhaustive experiments on the melting of metals by electricity—a translation from the Dutch into German and published in Leipzig 1786-88—the list is brought up to the end of 1912 and contains references to articles on the subject of electric welding that have appeared in the English, German and French engineering periodicals, as well as books on the subject. An index of authors, with the dates of their articles, is also given. This excellent compilation will be found of value to all interested in the subject matter.

* * *

The Indiana Electrical Boosters.—The Indiana Electrical Boosters were organized in Indianapolis on Sept. 6 at a picnic held at Germania Park. Plans for such an organization had been under way for some time. An annual picnic will be one of the features of the organization. Preliminary organization was effected and the organization will be completed at the convention of the Indiana Electric Light Association to be held on Sept. 24 and 25 at the Indianapolis Canoe Club. The purpose of the new organization is primarily to bring electrical men of the State together for social purposes. Those behind the movement say that the

electrical men of the State should have organized in a social way a long time ago and that now they will make up for lost time. It is believed that the new organization will work in entire harmony with the Jovian Order. At the coming Indiana convention local Jovians will hold a rejuvenation and joviation which promises to be very successful.

* * *

New Automobile Head-Lamp.—A new automobile headlamp which represents a radical departure from present designs has made its appearance in France. The lamp has the shape of a human eyeball and turns in its socket in exactly the same manner as the eye. Two small clamps controlled by thumb screws from the interior of the car hold the lamp in position in any desired direction, while the handle itself is used in turning the light rays to the side they are needed.

* * *

North and South America to Be Linked by Wireless.—Wireless telegraphy soon will be established between the United States and the South American republics, according to Dr. William Marconi. A fifty-year concession has been granted by the Brazilian government, which will enable the Marconi company to install a wireless-telegraph service between that country and New York. It is predicted that this will be the beginning of a network of communication between South America, the United States and Europe.

* * *

Storm Flood Stops New York Subway.—The worst tie-up by water in the history of the New York subway was experienced Sept. 5, when 3 in. of rain fell in two hours' time. From the overburdened sewers the flood poured down upon the underground tracks, finally obstructing passage of the trains and requiring that power be shut off in certain sections. At Times Square the water stood several feet above the up-town platform. Through traffic in this region was interrupted from midnight until 7 o'clock next morning, inconveniencing the early rush-hour passengers.

* * *

German Wireless System for South Pacific.—Germany is reported to be planning the establishment of an independent wireless-telegraph system among the islands of the South Pacific. A large station is to be built at Samoa with a range of 1870 miles, with stations in New Guinea and Marshall Islands, all interconnected and in direct communication with Europe by means of the Dutch cable from Yap, one of the islands in the Caroline group. Effort is also being made to open wireless communication between Nauen and Togoland, Southwest Africa, and the Cameroons, on the African coast.

* * *

Foreign Commercial Relations.—A concise volume, which contains statistics showing the foreign trade of each country of the world during 1911 compared with the previous year, has just been issued by the United States Bureau of Foreign and Domestic Commerce at Washington. This valuable publication shows the principal articles and their value entering into the trade of each country and the itemization of the imports from and exports to the United States. The statistics were prepared by American consular officers and supplemented by other official data. In addition to trade statistics, the grain crops and mineral output of the chief countries are given, thus presenting in compact form the principal features upon which the commerce and industries of the foreign countries depend. The volume should prove highly valuable for reference purposes, having been revised and brought up to date so far as statistics were available. Copies of the book may be obtained from the Superintendent of Documents, Washington, D. C., for 35 cents each.

## SOCIETY MEETINGS

Nashville Jovians to Have Lunch Club.—A permanent local lunch-club organization has been effected among the Jovians of Nashville, Tenn., Mr. J. P. Brown, superintendent of the Nashville Railway & Light Company, having been elected president, and Mr. J. P. Lawrence, of the Habrick-Lawrence Company, secretary. The initial session was called by Statesmen R. C. Leonard and J. A. Cayce, Jr., of Nashville, and was presided over by Past-Jupiter Oscar C. Turner, of Birmingham, Ala.

* * *

American Electrotherapeutic Association. — The American Electrotherapeutic Association held its twenty-third annual meeting at New York, Sept. 3 to 5, many prominent physicians from this country and abroad being present. Dr. F. B. Granger, Boston, read a paper on "Ionic Medication," and Dr. B. S. Price, New York, discussed electrical methods of treating stubborn diseases. Others who presented papers were Drs. Anthony Bassler, New York, "Electrotherapeutics"; J. A. Rivière, Paris, France, "Treatment of Cancer"; Jean Bergonie, Bordeaux, France, "Inducing Exercise to Cure Rheumatism, etc.," and Dr. George M. McKee, New York, applications of the X-ray.

* * *

Jovian Field Day at Bridgeport, Conn.—On Jovian Day, Sept. 6, the Jovians of Bridgeport, Conn., held a rejuvenation at Rivercliff-on-the-Sound and initiated fifty-two candidates under the direction of Statesman Carl F. Siemon. One hundred and fifty sat down at the shore dinner which followed the ceremonies, and there were speeches by Mayor Wilson of Bridgeport, Reigning Jupiter F. E. Watts of the Jovian Order and Mr. A. N. Palmer. The work of the degree team was highly complimented. Assisting Statesman Siemon were Messrs. James Dunn, George S. Hadley, James W. Morey and A. E. Frost. A number of visiting Jovians from New York and New England attended the outing, which closed with a variety of field sports.

* * *

National Council of Industrial Safety.—The second safety congress of the National Council for Industrial Safety will be held at the Hotel McAlpin, New York City, Sept. 22 to 25, in conjunction with the meeting of the Association of Iron and Steel Electrical Engineers. The second day will be given over to an educational session with Mr. Arthur Williams, of the New York Edison Company, presiding. Among the features of an elaborate program, Dr. John Price Jackson will discuss the Pennsylvania Department of Labor and Industry, of which he is commissioner. Mr. George Westinghouse is also scheduled for an address on the subject of "Manufacturers." For the "safety" dinner of Sept. 24 Mr. Elbert H. Gary will act as toastmaster, and addresses are promised by President Wilson and by Secretary of Labor Wilson.

* * *

Institute of Radio Engineers.—The newly incorporated Institute of Radio Engineers held its first meeting for the present season at Columbia University, New York, Sept. 3. Vice-president Marriott commented on the practical achievements of radio workers during the summer and announced the incorporation of the institute under the laws of New York State. The list of active members now numbers well over 200 and includes many prominent radio engineers in England, Europe, Australia, Africa and South America. An interesting and well-illustrated paper by Hans Rein, of the Lorenz company in Germany, describing the theory and apparatus of the "Multitone" system was read by Dr. Goldsmith and was followed by a long discussion. The next meeting will be held on Oct. 1, and the institute's invitation to attend is extended to all who are interested in radio work. A paper on the new equipment of the American Marconi company will be read.

# Development of Alabama Water Powers

**System of the Alabama Traction, Light & Power Company, Ltd., of Birmingham—Hydroelectric Station on the Coosa River and Steam Station at Gadsden—110,000-Volt Transmission**

THE Alabama Traction, Light & Power Company, Ltd., Birmingham, Ala., owns extensive water-powers in Alabama. It now operates public utilities n several cities, the energy being generated by steam plants nd one water-power plant rated at 1500 kw.

The company has just completed a steam turbo-generator lant of 1250-kva rating at Gadsden, Ala., and has under onstruction a water-power development at Lock 12 on the Coosa River, which will have an ultimate rating of 80,000 va.

The plans of the company contemplate a very extensive evelopment with a network of over 800 miles of high-ension transmission lines, reaching into every part of the State. With the growth and development of the State of Alabama, this system should become one of the greatest n the world, as there are over 500,000 hp available in the ydroelectric sites controlled by the company.

## Present Hydroelectric Development

Lock 12, the site of the present hydraulic development, is situated about 50 miles from Birmingham and 50 miles rom Montgomery, the two most important cities in the State. Montgomery is the capital and is the center of the otton trade, and Birmingham is the "Pittsburgh of the South," with its coal, iron and steel industries. The Lock 2 development involves the erection of a gravity-type dam f cyclopean concrete, nearly 1700 ft. long and 80 ft. high, naking available a head of 68 ft. Forming part of the nain dam is a power house 324 ft. long and 80 ft. wide, vhich is situated on the west bank. The lock for naviga-ion will be built on the east side of the river beyond the nd of the main dam, by cutting a channel through a natural lepression.

Four 17,500-hp vertical, single-runner turbines of I. P. Morris manufacture will be installed at present, leaving space for two future units. These are the largest single-runner units ever built for 70-ft. head, and the spiral casings and draft tubes for the units will be molded directly in the concrete of the power-house sub-structure.

## Generating Apparatus

A single-piece shaft will connect the turbine runners directly to the generators, which will be made by the Westinghouse Electric & Manufacturing Company and are three-phase, 60-cycle, 13,500-kva, 6600-volt, 100-r.p.m. machines. These units are characterized by their simplicity and compactness. They are entirely self-contained. A cast-iron speed ring is first bolted in place above the draft tube, and to this is bolted a cast-iron foundation ring, which extends up to the generator-floor level. The generator is placed directly on this ring, so that all the load is transmitted directly to the solid foundations through the foundation and speed rings. This will make the erection of the units very simple, as once the speed ring is properly set all the rest of the apparatus is bound to line up. Another feature is the placing of the thrust bearing, which takes the entire weight of the revolving parts and the hydraulic thrust above the generator. It is supported by a very massive bridge bolted to the generator frame. The bearings are of the Kingsbury type, which have been operating so successfully in recent installations. Direct-connected exciters are used and are carried on an extension of the shaft directly above the Kingsbury bearings. The exciters are rated at 150 kw at 250 volts. The turbine governors will be made by the Lombard Governor Company and are of the same type as those installed in the Mississippi River Company's plant at Keokuk.

The generators are connected in "Y" with the neutral brought out. Eight thermocouple exploring coils are installed in each generator.

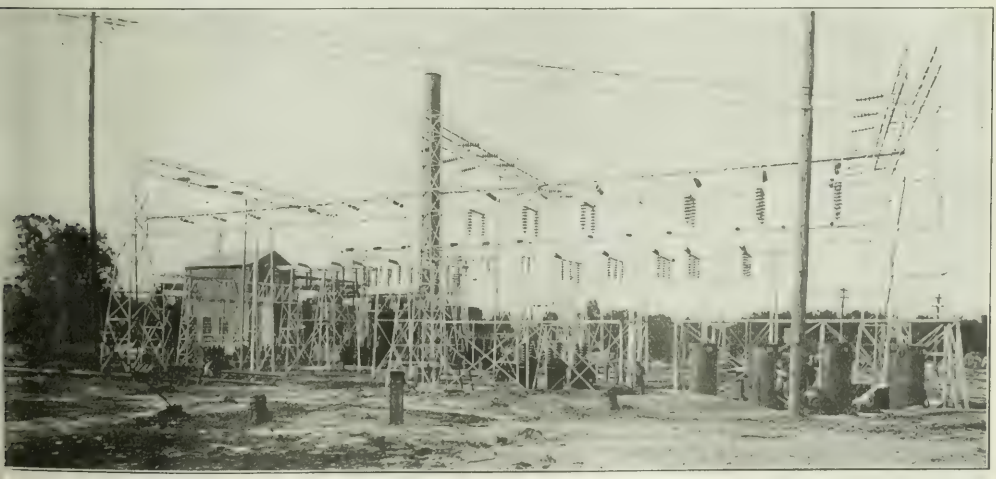


FIG. 1—GADSDEN OUTDOOR SUBSTATION FROM THE SOUTH

### Switching and Control

The switching and control of the station are extremely simple, yet flexible. Each unit may be connected by an oil switch, either directly to its own bank of transformers or to the 6600-volt transfer bus.

The high-tension switches are of the indoor type and will be located on an upper floor of the power house above the main generators.

brought to the switchboard, the armatures being connected through a double-pole, double-throw switch to the generator field. All switches and switchboards will be of the General Electric Company's make. The aluminum-cell electrolytic lightning arresters will be placed on the roof.

At present two 110,000-volt double-circuit transmission lines are being built. One goes directly to the Birmingham substation, a distance of 50 miles, and the other crosses

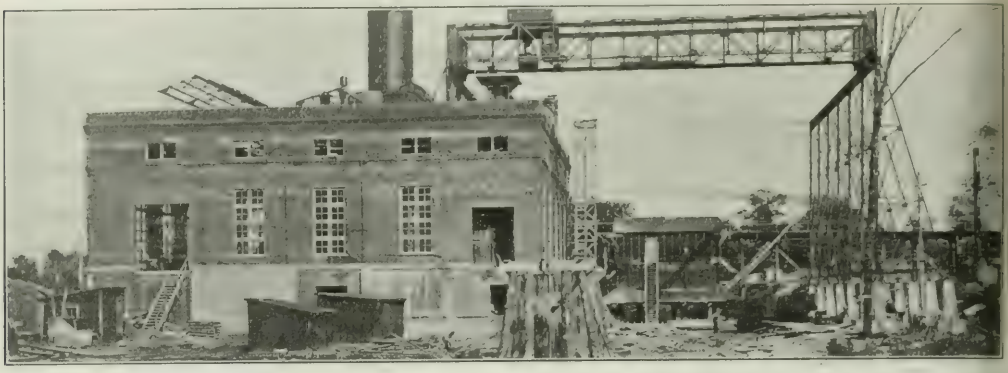


FIG. 2—GADSDEN STEAM PLANT FROM THE WEST

Each bank of transformers consists of three single-phase, oil-insulated, water-cooled, 60-cycle, 4500-kva, 6600-volt to 110,000-volt transformers, connected in delta on the low-tension side and in Y on the high-tension side. Four banks will be installed at present, one for each generator.

The transformers may be connected on the low-tension side, either directly to a generator or to the transfer bus, and on the high-tension side to either an outgoing 110-kilovolt line or to a 110-kilovolt transfer bus. This permits

the river and goes to Gadsden, via Sylacauga, Talladega, Jackson Shoals (where the 1500-kw water-power plant is situated) and Anniston, tying into the steam plant at Gadsden.

### Transmission Line Details

Each circuit will be of 00 copper seven-strand conductor, with 55,000 lb. tensile strength. Six-disk Thomas or Ohio Brass suspension insulators will be used with seven-disk

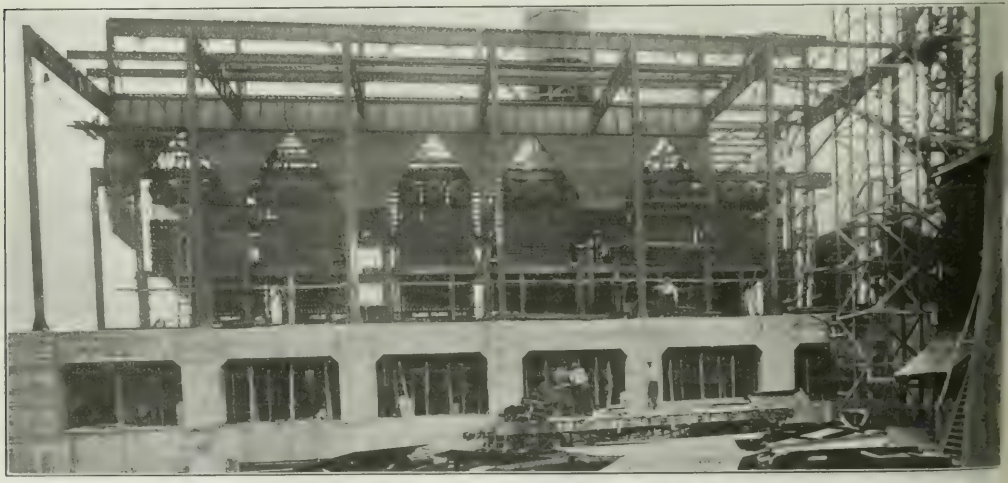


FIG. 3—BOILER EQUIPMENT IN GADSDEN STEAM STATION

putting any machine on any transformer bank and line.

A complete water-cooling system will be installed for the transformers, also an oil storage and an oil filtering and drying outfit.

Each generator has its individual regulator. One motor-generator exciter of 150-kw rating will be installed for emergency service, and it can be connected to any generator. Nothing but the exciter shunt-field leads is

strain insulators at the strain towers. These six-disk units will withstand 350,000 volts dry and 255,000 volts wet before they flash over, and they are designed always to flash over before puncturing. The mechanical strength test is a tension of 5000 lb. applied in line with the axis of the insulator, and the insulators when they are tested to destruction must have a strength that will not fail under less than 10,000 lb. pull.

### Transmission Towers

The towers are manufactured by the American Bridge ompany. The standard tower on the Birmingham line, nown as the "A" tower, weighs 4400 lb. and is 68 ft. high. carries two ground wires and has 10-ft. vertical spacing etween conductors. The middle cross-arm is extended 2 . beyond the upper and lower cross-arms to avoid any ossibility of trouble due to the lines coming together when

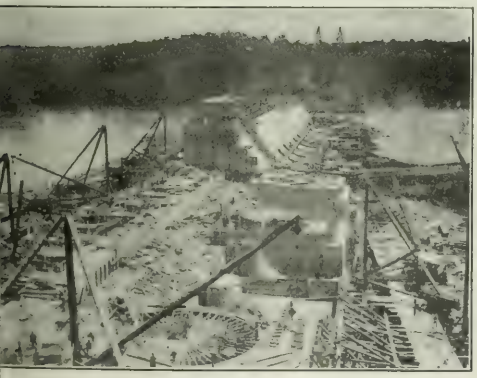


G. 4—GADSDEN STEAM PLANT, HORIZONTAL TURBINE UNIT NO. 1

ey unload sleet or ice unequally. These towers, which re designed for normal spans of 700 ft. with 1200 ft. aximum, are built with an all-metal footing 2.5 ft. square, t 7 ft. in the ground, so that no concrete will be used. he base of the towers is 17 ft. square.

For the line to Gadsden two types of towers are used. he standard tower, called the "C" tower, weighs 3500 lb., 65 ft. high and has the same spacing of arms as the "A" wer. It also carries two ground wires. The normal pacing for these towers is 600 ft. and the maximum allow- ble span is 900 ft.; the base is 16 ft. square.

The strain towers, "B," weigh 4500 lb. and have a base 7 ft. square, otherwise they are of the same general type s the "C" tower. The "B" towers are used at all angles ver 3 deg. and up to 35 deg. When on a tangent "B"



G. 5—CONSTRUCTION WORK IN PROGRESS ON THE DAM AT LOCK 12

wers will be spaced every 2½ miles and the lines strained p at that point. The minimum clearance of conductors ove the ground is 25 ft. on all lines. The right-of-way r transmission lines is 100 ft. in width.

Uninterrupted service being the first criterion, careful udy was given to the telephone system, and it was finally cided to install the telephone lines on a separate creosoted le line 10 ft. from the edge of the right-of-way. Twenty-five-foot poles are used with a single cross-arm, and No. 8 hard-drawn copper is used throughout. The telephone poles are spaced 175 ft. apart and the line is transposed at every fifth pole. The insulators used are of porcelain and were designed for 6600 volts.

### Lightning Protection

The territory in which the company operates is subject to very severe lightning storms, and particular attention had been paid to protecting both the 110,000-volt and the 22,000-volt lines. The transmission voltage was fixed at 110,000 volts after a careful investigation of the present and future market. With this voltage energy can easily be transmitted as far north as Nashville and Chattanooga, Tenn., as far west as Memphis, Tenn., and Meridian, Miss., east to the state line, and south to Mobile, Ala., and Pensacola, Fla. New Orleans is about 300 miles away, and would call for a spiral boosting station, or else a 150,000-volt line running direct from one of the company's future plants.

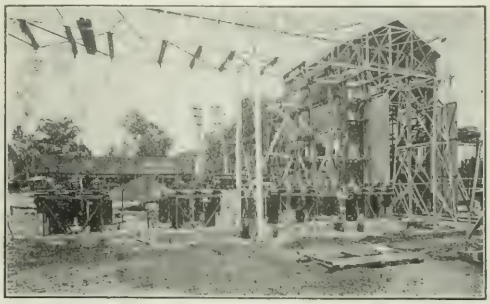


FIG. 6—SUBSTATION LIGHTNING ARRESTERS AND TRANSFORMER REPAIR HOUSE

Local distribution will be by 22,000-volt lines. The single-circuit lines consist of creosoted long-leaf yellow-pine poles, 12-lb. treatment, with wishbone type metal cross-arms and pin-type insulators. The double-circuit lines will be built on either poles or flexible towers of the Archbold-Brady type. Both pole and tower lines will carry a ground wire. A tension of 22,000 volts was chosen, because the bulk of the load will be widely scattered.



FIG. 7.—DOWNSTREAM VIEW OF SPILLWAY, STREAM-CONTROL CULVERTS OPEN, LOCK 12

### Gadsden Steam Plant

The Gadsden steam plant is situated on the bank of the Coosa River about 2 miles from the city of Gadsden. The

installation consists of two 6250-kva General Electric horizontal turbo generators, with Worthington condensers. Condensing water is taken through an intake, from the Coosa River. The boiler plant consists of six 600-hp Babcock & Wilcox boilers with Murphy mechanical stokers. Coal is dumped from a trestle into the coal-storage yard alongside the boiler house. From here it will be handled



FIG. 8—GADSDEN OUTDOOR SUBSTATION TRANSFORMERS

by a traveling crane with 110-ft. span, using a 1-ton bucket, and dumped in the hopper above the boilers. Storage for 9000 tons is provided.

The generators are wound for 2300 volts and the voltage will be stepped up by two banks of three-winding transformers to either 22,000 volts for the local distribution system or 110,000 volts for the high-tension transmission. The transformers are single-phase, 2100-kva units of the outdoor type as are also the oil switches.

### Outdoor Substation

The outdoor substation is situated about 400 ft. distant from the power house. All control switches and switchboards are placed in the main power house, and the 2300-volt cables from the generators are carried underground from the power house to the transformers.

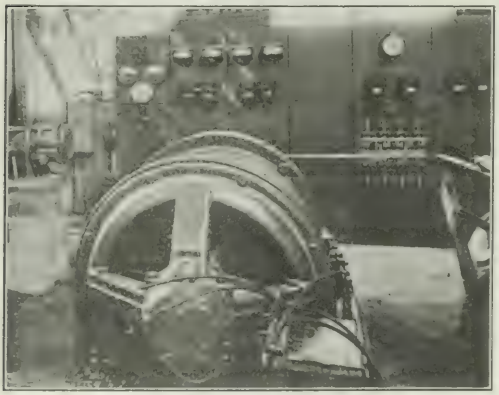


FIG. 9—GADSDEN STEAM MOTOR, GENERATOR, EXCITER AND AUXILIARIES

The substation is out of the ordinary, in that it takes care of four 110,000-volt transmission lines, steps up the generating voltage of the 10,000-kw station to either 22,000 volts or 110,000 volts and also steps down the 110,000-volt transmission tension to 22,000 volts.

The steam plant which has just gone into operation will serve to build up the load for the water-power plant, after which it will be used as a reserve plant. Judging from river gagings taken over a period of fourteen years, the steam plant will increase the permissible sale of primary, 50 per cent load-factor power from the hydroelectric plant by 20,000 kw and will operate for only about 5 per cent of the time.

All 110,000-volt substations will be of the outdoor type and will be standardized as to size and type on 3000, 6000 or 10,000-kva rating. A small building will be put up to house the meters and control apparatus. A spare transformer will be carried in stations of 10,000 kva or larger. Smaller stations will have the transformers connected in delta, so that in case of trouble with one transformer they can be operated in open delta. All transformers will be single-phase. The transmission line will be sectionalized at every transformer station, or about every 25 miles, so that trouble on the company's lines can be quickly located and repaired.

The Alabama Traction, Light & Power Company, Ltd., is incorporated under the laws of Canada, with its main office in Montreal. The securities of the company are

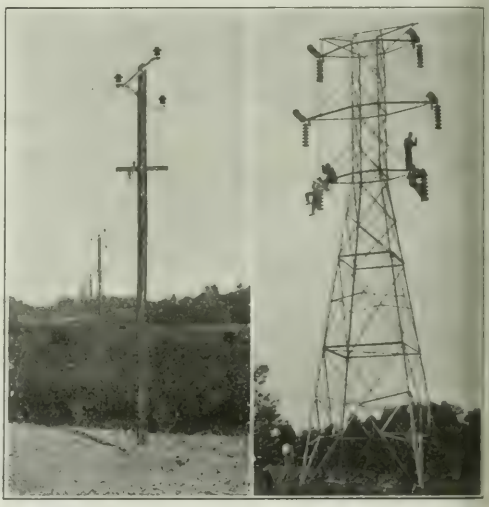


FIG. 10—22,000-VOLT POLE LINE, SYLACAUGA-ALEXANDER CITY TRANSMISSION LINE

FIG. 11—LINEMEN PULLING UP CONDUCTORS ON TOWER, LOCK 12, ANNISTON LINE

largely held in England by the clients of Sperling & Company, bankers, of London, but there are also large stock holdings in New York and Alabama. The operations in Alabama are being conducted by three subsidiary companies owned by the Traction company—the Alabama Power Company, the Alabama Power Development Company and the Alabama Interstate Power Company.

The engineering staff of the company is headed by Mr E. A. Yates as chief engineer, who has as his associates Mr. E. L. Sayers, as assistant chief engineer, Mr. W. E Mitchell, as electrical engineer, and Mr. O. G. Thurlow as designing engineer. Mr. James Mitchell, of London and New York, is president, but the active management of the companies is in charge of Mr. W. Winans Freeman, vice president and general manager.

The other officers and department heads of the Alabama Company are: Mr. M. Webb Offut, assistant to the vice president and general manager; Mr. F. S. Ruth, secretary and treasurer; Mr. Wiley Alford, assistant secretary and treasurer; Mr. Thomas W. Martin, general counsel Mr. J. C. Halstead, manager land department, and Mr. E. Centter, Jr., puchasing agent.

# Commission Control of Public Utilities*

**The chairman of the Wisconsin commission points out ways by which that body has brought about better franchise conditions, improved service and scientific rates—A careful and moderate discussion of the modern practice of regulation**

As plants can neither be constructed nor operated except by virtue of a grant from the municipality or state, it is vital both to the owners of such plants and the public that the rights of each and the corresponding duties of the other in respect to the public functions of the public utility be clearly defined and maintained in a spirit of fairness and justice to both parties. These obligations have generally been prescribed in the franchises granted by the municipalities as state agencies, or by the state itself, conferring upon the grantees the right to construct, maintain and operate such plants. But as the term of a franchise must of necessity be for a long period in order to induce capital to invest in the enterprise, experience has demonstrated that it has been impossible to fix terms and conditions of the franchise satisfactorily to meet unforeseen and unforeseeable exigencies which arise in the progress of time from many causes.

### Changes in the Arts

No one can prophesy the changes in the arts embraced in public utility services, the developments and necessities of the communities served or the requirements of the utilities to perform their functions under changed conditions. In the last few years enormous increases in cost of material and labor which enter into and become part of the cost of the service which the public utility is obliged to furnish are an element that has not always been counterbalanced by the economies resulting from new inventions and increased business, and unless the charges for the service could be increased in such event it would result, in case of the weaker utility, either in an impairment of the quality of the service or in financial embarrassment of the corporation or individual rendering the service.

As an illustration of another burden that is often cast upon a utility and which may not be anticipated when the franchise is granted, we may refer to the advancement in the art of telephony, which within a very few years has been little less than marvelous. Costly telephone equipments have been scrapped and entire systems reconstructed to meet the public requirement for the best service. The art of generating electric current has also advanced with such rapid strides that the expensive electric equipment of a few years ago is to-day found in the scrap pile, having no other value than that of junk. In other utilities the changes have not been so marked and equipment has become more or less standardized, but who can tell what a quarter of a century may bring forth in any of the arts or sciences?

Under the circumstances it is not at all strange that all attempts rigidly to prescribe in detail the obligations of the public utility to the public and vice versa during the life of a franchise have generally met with signal failure. To meet existing conditions, attempts have frequently been made to change the terms of the franchise. This has often resulted in engendering animosity between the public authorities and the management of public service corporations. The negotiations have not always been free from the suspicion that improper methods have been employed to induce those representing the public in the transactions to consent to terms and conditions detrimental to public interest. As a result such public service corporations become a factor in local politics, and questions involving the most important interests of both the public and the corporations have become issues in local political campaigns. Such issues often involve economic laws and sound business principles which cannot be determined by the votes of an uninformed electorate. These unnecessary conflicts between the public and those rendering public services are the cause of more corruption in municipal government than anything else.

Students of economic science have for many years been endeavoring to devise a limited franchise which would be adequate during the term therof to meet the requirements of the public as well as those of the public service corporations, but they have found it impossible to frame a model franchise of any character based upon sound economic principles which could either be limited in time or could prescribe definitely the charges to be exacted or the quality of the service to be rendered during the life of the franchise. If a franchise is to be limited in time, provision must be made for its amortization. Ths compels the public not only to pay a fair return upon the investment during the life of the franchise but also to provide a sinking fund which, with the scrap value of the plant at the termination of the franchise, is equivalent to the original investment. Others have advised the adoption of franchises for long periods of years, reserving to the municipal councils the right to fix rates and establish standards of service at definite intervals or from time to time at the will of the councils. The general experience under franchises of this character has not been such as to warrant their commendation. The expenditure of large sums of money by some of the larger cities to ascertain all the essential facts necessary for intelligent and lawful action on the part of common councils invested with power to establish rates has been more frequently wasted than profitable, as the facts thus acquired have generally been ignored and action taken which was either prompted by prejudice or based upon political consideration.

From an economic standpoint, an unlimited franchise with the provision that the municipality may revoke it at any time upon condition that it acquire the plant by paying to the company the reasonable value thereof is generally regarded by those who have given the subject exhaustive study and consideration as the best kind of franchise. The necessity of the service in all probability will not terminate with or prior to the time of the expiration of the limited franchise. It must be obvious to all who have given the subject any serious consideration that an indeterminate franchise containing the provision that the rates and services shall at all times be subject to revision by an impartial and independent tribunal will result in the greatest good to the public as well as to the investors in such enterprises. It will eliminate all friction between the community served and the agency serving it. Naturally such a policy would be opposed by the average municipal politician who rides into office either as a champion or an opponent of the public utility which usually constitutes a factor in municipal politics.

*From an address delivered by Mr. John H. Roemer, chairman of the Railroad Commission of Wisconsin, at the Association Island meeting, Sept. 4, 1913.

### The Indeterminate Permit

It was with a view of placing public utilities upon a sound economic basis and eliminating all unnecessary friction between the public and such concerns due to causes arising from ignorance of the economic status of public utilities and their moral and legal relations to the public that the Wisconsin public utilities law was framed and enacted. That public utilities are virtually monopolies by nature and must be dealt with as such in any just and comprehensive system of state regulation is the fundamental economic principle upon which the law was constructed. Without protection of such monopolies only a limited and inadequate supervision of their affairs by public authorities can be morally justified. At the very foundation of the Wisconsin system lies a uniform indeterminate franchise, denominated "an indeterminate permit," which gives the corporation a legally protected monopoly. It can never be deprived of its property unless the municipality determines to acquire the same, and then just compensation must be paid therefor, which is fixed and determined by the commission.

### Valuation of Plants

Every element of value, both tangible and intangible, is to be considered in reaching a result, excepting only franchise values, which are necessarily excluded by the general policy of the law. The object to be attained is the fair value of the property as a going concern. This, in the contemplation of the statutes, is the proper capitalization upon which returns must be allowed.

The elements usually available for consideration are the original cost of construction, the amount expended in permanent improvements and extensions, the reproduction cost and the same less depreciation, and the going value. In arriving at a fair and equitable appraisement of the physical structure the commission has considered, as more or less controlling, the reproductive cost based on the average prices of material and labor for the five years immediately preceding the time of appraisement. The results thus attained have been so obviously just and equitable that the muicipalities and the utilities generally have acquiesced therein. Nevertheless, for the sake of comparison and illumination of the subject, the reproductive cost based on current prices also is considered. The commission has never confined itself to any one basis to the exclusion of others in reaching a conclusion. Every factor bearing upon the subject is carefully weighed and such importance given to it as the situation in the light of all the circumstances demands. While a form of universal application might be desirable, yet, from the very nature of the undertaking, such is impossible. In the last analysis enlightened judgment and conscience must be applied to the facts in hand if a just determination is to result

### Classifications of Accounts

The uniform classifications of accounts have now been in effect for over three years. In addition to the utilities operating under them in Wisconsin numerous companies in other states as well as in other countries have voluntarily adopted the prescribed accounts with little modification. One of the features of these accounts, in which the classification differs from similar prescribed classifications in other parts of the country, and concerning which it was submitted at first to much criticism, is that it endeavors to serve as a basis for ascertaining the cost of service. Although it is self-evident that no business of the character involved in public utility service can be successfully conducted without an accurate knowledge of the cost of rendering the service in which the utility is engaged, it was surprising to learn that while the best conducted privately owned utilities had in a measure recognized the importance of such information and had somewhat imperfectly attempted to ascertain the same, the majority of the managers of municipal plants had generally been wholly oblivious to the necessity of any such knowledge.

### Municipal Plant Accounting

This lack of efficiency on the part of the managements of municipal plants has been due partly to various causes, many of them beyond the control of the municipal utility plant The first of these is the question of organization and responsibility. A part of the public function or department of city government is frequently administered by a superintendent, board of public works, engineer, board of commissioners or committee of the common council, and it is frequently difficult to ascertain just where the duties of these individual city officials begin and end. The matter of rotation in office seriously interferes with continued efficent management.

Accounts pertaining to municipal plants were often meregd with other accounts of municipalities, and even where separation was made the accounting was so crude and inaccurate that it was impossible to ascertain therefrom even approximately the cost of any class of service.

The local authorities in control of municipal utilities were at first slow to respond to the demands of the commission, except in the most progressive communities. In some instances it appeared that those in charge of such plants were apprehensive that proper methods of accounting might result in disclosures reflecting upon the capacity or integrity of the management. In other instances there seemed to be no one in the organization of employees capable of keeping a set of books intelligently. This was particularly true where the management changed with the municipal administration. However, in practically every community where the management was intrusted to a non-partisan board whose personnel was more or less permanent there was no difficulty in securing hearty cooperation in putting into effect the prescribed system of accounting. At the present time, practically every utility within the State, whether municipally or privately owned, is now keeping its accounts according to the system prescribed by the commission.

As the various plants are classified according to size, comparison in results of operation between plants in the same class has proved of inestimable value to the managements of all plants, either publicly or privately owned. By studying the accounts of the various plants the commission is enabled to become familiar with the details of operation of each plant and to point out to the management economies that may be adopted and improvements that may be made in the conduct of the business.

### Regulation of Service

To detect violations of the rules relating to service, the inspectors of the commission are constantly traveling through the State making secret inspections. These rules differ materially from those in vogue in other states and countries. They place the responsibility for the character or the quality of the service primarily upon the utility, which is requred to test its own meters and make various other specific tests of the quality of the service prescribed in the rules and regulations, and also to keep a record of the results of all such tests, which must be kept open for public inspection. While the accuracy of meters is an essential element in the economic use of both gas and electricity, the maintenance of adequate pressures is more essential to the efficient use of either. Consequently, general systematic surveys of gas pressures and electric voltages by means of recording instruments are made. The electric inspectors take continuous records of voltage over the distribution systems, calibrate the companies' standard instruments and supervise the testing of consumers' meters and the renewal of incandescent lamps.

When the general survey of the service in the State was first made it was found that few of the plants were able

to comply with the prescribed standards without making alterations and improvements. Hundreds of thousands of dollars were spent by the different utilities in order to bring their equipment to the point where compliance with the rules of service was possible. Many of the managers of the municipal plants were reluctant to make the necessary changes in order to improve the quality of their service; nevertheless, through persistent importuning and threats of prosecution on the part of the commission, the necessary changes are being made gradually and additional equipment installed where necessary.

At the time that systematic inspection was undertaken only about fifteen of the 250 electric plants in the State, serving some 15,000 consumers, were giving reasonably satisfactory voltage. In order to comply with the requirements of the rules of service, about forty plants had to be generally overhauled and practically reconstructed. In the remaining plants it was necessary to install governors, automatic voltage regulators and additional transformers, and also to make extensions and changes in the structure of the plants and distribution systems. Some of this work has not yet been completed and it may be stated that about 50,000 consumers of electric current out of a total of 75,000 are now receiving satisfactory electric service as measured by the prescribed standard. In this connection it must be borne in mind that the state regulation of voltage is new and that work similar to this in scope has never before been attempted. There is as a result of the improvement of service, according to the computation of the engineers of the commission, a money saving of at least $75,000 annually to electric consumers.

### Action on Rates

At the time that administration of the law was first undertaken it was found that there were few public utilities in the State which did not have in effect a large number of discriminatory rates. While all had established schedules of rates, the departures from such schedules were numerous. Free and reduced rates were given to favored persons. Many thousands of such discriminations were in existence. While the practice of discriminating between patrons in the matter of rates and service had become general, as is usually the case where there is no independent tribunal provided by law charged with the special duty of enforcing the obligations of public utilities to the public, it was difficult for the utilities, in many instances, to wipe out the discriminations of their own accord. These had often been forced upon the utility by those having more or less influence in the community and who were in a position to harass the utility through the common council and otherwise unless they were favored as patrons. Such influences were not entirely unlike those which, a few years ago, often compelled railway companies to indulge in similar practices. By a general order, the commisssion compelled every utility in the State to eliminate discrimination of all kinds and charge in every case the regular schedule rates.

As rates made by the commission are based upon the cost of service, the commission has in each instance where a schedule of rates has been challenged worked out a scientific schedule which classified the services according to the cost thereof. The result of this has been most gratifying. Business has extended and the returns to the public utility increased. As an illustration, one of the largest public service corporations in the State, operating both a gas and an electric plant, valued at approximately $1,000,000, was obliged in a rate case to put into effect a scientific schedule of rates which provided a reduction of the maximum rates heretofore in effect but so classified the service that the consumers in each class were paying for the services rendered rates based upon the cost of the service to the utility. The company estimated that the new schedule of rates would operate to reduce its net revenue approximately $30,000 per annum. Much to the surprise of the management, the business at once began to develop, and as a result of the expansion thereof within less than two years the management voluntarily applied to the commission for authority to make a further reduction of rates. This is but one of the many instances of the character that might be called to your attention.

In order to facilitate work along lines of establishing scientific schedules of rates, the commission has published the rates, rules and regulations of all the utilities in the State, and by comparison and by the use of hypothetical plans has demonstrated what are reasonable rates, rules and regulations. In a number of cases small utilities have asked the commission to revise their entire schedule of rates. In fact, utilities often come to the commission asking that a schedule of rates be provided which will develop their business. Generally the managements of the utilities carefully study the decisions of the commission, and they are often thereby able to adjust their schedules of rates upon the principles which govern the commission in its actions.

Perhaps the larger number of utilities in the State are today operating upon schedules which are more or less scientific and based in a measure upon the cost of the various services rendered. It is gratifying to know that such utilities as have established such schedules of rates have been able to extend their business greatly, increase their operating revenues and their net incomes, and reduce the cost of the service to the consumers.

### Rate of Return

Inquiry is often made by those interested in utilities outside of the State of Wisconsin as to the rate of return that is allowed to a utility in Wisconsin. In reply to this it may be said that the commission has never established and does not intend to establish any fixed rate of return.

### State Regulation Preferable

Intelligent regulation of public utilities requires engineering, accounting and statistical skill of a high order. Those intrusted with the work of investigation and study of the various subjects presented for consideration must have scientific knowledge in the respective branches or departments of utility management and operation. With a competent staff of experts in the different lines of service, engaged constantly in examining plants throughout the State, it is possible for the regulating board to bring to the solution of every problem arising a breadth of vision and experience that is invaluaole both to the public and to the utility.

No regulation can be effective which is not based upon accurate information and which is not actuated by a sense of justice and equity. In the light of the past, it must be conceded that an independent tribunal, free from local influences and prejudices and assisted by a corps of trained experts, is better qualified to regulate efficiently public service corporations and individuals engaged in public services than any municipal council or local tribunal. In few instances would it be possible for municipalities to maintain the necessary organization of competent assistants to deal intelligently with the problems involved in the regulation of public utilities. The cost of such an organization would be prohibitive to most municipalities. In central control there is therefore not only efficiency but also economy. One body can serve all municipalities as well as one municipality and serve them better.

After five years of administration of the Wisconsin law, the results obtained from its operation have been generally satisfactory. Our experience indicates that a comprehensive system of regulation such as provided by our law is not only advantageous to the general interests of the public but is of benefit as well to the business interests of the utilities.

# Financial Needs of the Electrical Industry*

**A significant statement and original analysis of recent growth and future capital requirements—The present status of electrical securities before the investing public—How to acquire and hold public confidence**

By Frank A. Vanderlip

Four hundred million dollars a year, $8,000,000 a week, of fresh capital can profitably be used in the development of the electrical industry in the United States during the next five years. What the calls for new capital might reasonably be expected to reach after five years no one can predict with accuracy, but I believe it is a conservative estimate to say that the intelligent development of the industry as a whole will readily absorb $400,000,000 per annum for the next five years, if that amount is available.

In making such an estimate, one does not need to draw on one's imagination. There is no need to picture broadening fields of application, new methods of production and distribution, nor new uses for energy. A survey of what has been going on about us comes near enough to being a fairy tale. Little more is needed than a grasp of present-day statistics, compared with those of five or ten years ago, to give the basis for such an estimate.

We have seen the cost of construction and equipment of all central stations increase in the five years from 1902 to 1907 from $500,000,000 to well over $1,000,000,000, making an increase of 117 per cent in that five-year period. We have seen the output in that time go from 2,500,000,000 to nearly 6,000,000,000 kw-hr., making an increase of more than 133 per cent. The five years from 1902 to 1907 is the last period for which we have complete statistics for the whole country. The government is now collecting the figures for the five-year period ending with last year. In doing that schedules have been sent to 7000 stations and power plants, compared with 4750 in 1907—and it has been estimated that the cost of construction and equipment of central electrical stations will show an aggregate in 1912 of $2,000,000,000, as against $1,096,000,000 five years ago. Here, then, has been a requirement in five years for central station work alone of $900,000,000, or, roundly, $180,000,000 a year, as against a similar requirement in the preceding five-year period of $100,000,000 a year of new capital.

When we think what is certain to be done in the way of electrification of steam railroad terminals and heavy mountain grades, when we reflect on the larger use of electrical energy for industrial power, in agricultural uses, and in the continued growth of necessary interurban lines, we do not need to look further into the possible development of the industry to see a requirement for $400,000,000 a year of new capital.

That means an $8,000,000 new capital issue every week for the next five years. It is such a capital requirement that you gentlemen are facing, and which must be successfully met if your energies are to have an adequate field of display. Can you get it?

### Capital Needs in All Fields

It seems to me that there is no more interesting question that can be proposed to those interested in the electrical industry. When the matter is put so concretely as a new $8,000,000 capital issue every week for five years, the size of your financial problem can be readily grasped. To get a full appreciation of the difficulties, you may well glance outside of your own field, however, and note that there will mature within that five-year period well over $1,000,000,000 of steam railroad securities. We may well note, too, that railroad development in the last five years called for from $2,500,000,000 to $3,000,000,000 of new capital, and I would say that there is every reason to expect at least as great demands, in addition to the refunding operations in the next five years. The railroads, then, in five years will need, say, $4,000,000,000 for refunding and fresh capital. States and municipalities, should they take no more new capital in the next five years than they have in the last five, will absorb in the neighborhood of $1,500,000,000 more, so with the $2,000,000,000 your industry will need, there should be provided between now and the end of 1918 between $7,000,000,000 and $8,000,000,000 for these three purposes alone, to say nothing of general industrial and other needs.

These are bewildering figures. They sound more like astronomical mathematics than totals of round, hard-earned dollars. The raising of these sums, however, is the practical problem that financiers have directly before them.

Financiers must count on two elements over which they have no control if they are successfully to accomplish the gigantic task. One factor is the size of the possible investment fund itself—the question of whether or not there can be made available a total amount of capital for fresh investment that will meet the demand which can be clearly foreseen in these three directions alone—that of general transportation, the production and application of electrical energy, and municipal capital expenditures.

The second factor is whether or not the outlook in these fields of investment is such that the elements of adequate return and ultimate safety will satisfy the owners of capital and lead them to direct such a vast stream of new investment into these fields.

At this time I will not attempt to go into the first factor—the size of the possible investment fund. That would require a world-wide survey of the growth of wealth and an examination of the effect of modern legislative tendencies; it would need an examination of the drain which the vastly increased rate of taxation here and abroad is putting upon capital; of the terrific wastes of militarism, that cancer which is eating into the financial life of Europe at such an alarming pace, and of the other phases of government expenditure, national, state and municipal, which are absorbing such vast totals of capital into public and largely non-productive uses. It would necessitate taking note of the tendency toward individual extravagance, a tendency that is world-wide and which is cutting into the investment fund to a startling degree.

### The Electrical Outlook

Passing entirely this important side of the subject, making no examination as to whether or not the investment fund can possibly be large enough to meet the demands that can be clearly foreseen, let us take up only the narrow question of whether or not the outlook in the field of electrical industry is such that there is promise of adequate return and ultimate safety sufficient to warrant an expectation that $400,000,000 a year of fresh capital will flow into the electrical public utility field.

In spite of the vast proportions that the electrical industry has already reached, the huge total of capital investment which it represents, the substantial standardization of the

*An address delivered by the president of the National City Bank of New York at the Association Island meeting Sept. 5, 1913.

usiness, the complete social and industrial necessity which our work has created and met, electrical securities are still egarded by the general investor, the capitalist, as occuying a new and only moderately seasoned and tried field or investment.

### The Investor in Electrical Securities

Among ten average investors in corporate securities, perhaps not over one, certainly not over two, have as yet invested at all in electrical securities. I think it is conservative to say that among individual investors certainly not over 20 per cent in numbers have yet recognized that securities issued by electrical corporations have come within a range which will permit investors conservatively to employ heir funds in that field. It is not easy for you, perhaps, o realize how very recently it is that the whole field of our business has reached a point where an investor might airly feel that he was not entering a field of experimentaon, that the art was sufficiently advanced and standardized o make it reasonably sure that some brilliant inventor ould not upset all financial calculations, that the most p-to-date establishment might not be turned into scrap by dvances made in the science long before the investor had ade important inroads on the coupon sheet of his bond. s that feeling of insecurity passed and the business beame more nearly standardized, there then came to be emasized difficulties in regard to franchises, until the very hrase "public service corporation" carried with it to the vestor's mind unpleasant pictures of difficulties with oards of aldermen, of threatened charters, expiring franise rights, new forms of taxation, state-fixed rates, and rofit divisions with municipalities before undreamed of.

### Investors Fear Politics

Four out of five investors at the present time have their inds closed against any investment in securities of elecical corporations, and that is true largely because they ear the effect of present political conditions and tendencies. n investor who has such a fear may not be marching in ep to the so-called new freedom; perhaps he does not ecognize fully the force of the principles advocated in our ew progressive politics. But remember he still controls s own capital; remember that it is his individual decision at determines in what field that capital will be invested. he problem that the banker has to face is to convince vestors holding such views that capital issues of this type e attractive, and when you ask bankers to convince ough investors of this so that they will absorb $8,000,000 week of new capital issues, you are outlining a large task. The time has now come, in my opinion, when no man ith capital to invest in corporate securities, if he has a de re for return that is any larger than government obligaons will pay, can longer hold back from the study of public ility investments. The experimental inventive stage is ast. The business has a background that has now become oad enough so that one can make valuable comparisons nd sound deductions. It has ceased to be a business of nly small units, and the tendency is markedly in the rection of great capital issues which shall have at all nes a broad market. The dangers from a prejudiced, unise or unfair vote by a municipality or a board of alderen are being greatly lessened by the newly organized pubce service commissions, and these same bodies, recognizing e monopoly character of the business, are guarding it om useless and venal competition, as they are also guardg the investor from too free capital issues by the optiistic developer or the enthusiastic promoter.

We are a long way from having either uniform or satisctory administration of public service commissions, it is ue. This word commission has a sound of wisdom, exrience and justice about it, but after all commissions are tt composed of men, and sometimes of very poorly uipped even if honestly intentioned men. All this takes into the question of government itself; but I think no one will deny that the securities of public service corporations are sounder and their future more secure, on the whole, because of the tendency to place the affairs of these corporations under the control of public service commissions.

### Meet Proper Public Demands

If I may be permitted to say so, I believe the highest duty that you men who are managing great public service corporations owe to the business in which you are engaged, the greatest service which you can perform for the future development of this field, lies in the clear recognition by you of the true public service character of this business and in meeting honestly, intelligently and freely the proper demands that the public makes upon you.

Your dream is of great central stations that will supply energy to vast communities, and from which will radiate trunk lines that will become as necessary in the lives of communities as are lines of transportation, that will produce electricity which will become almost as essential to our every-day life as the blood in our arteries. That dream is fast becoming a reality, and it is right and proper that the public should hold over those who create such a situation a wise and just control. In the degree in which you recognize and meet this right of the public will you get fair treatment in return.

The public is by no means all-wise, when it is not well informed, nor is it always just. You can cite many instances, in your own field, of injustice and of unwise forms and methods of control, but I believe you will find back of every injustice which you have received at the hands of the public some measure of injustice, or unfairness, or lack of sincerity and frankness, on your own part in dealing with the public.

This business you are in requires qualities of statesmanship as well as inventive faculties, technical skill and business acumen. It requires clean-cut recognition on your part that you are creating a condition of affairs wherein the business in which you are engaged becomes of vital necessity in the life of the community, and you cannot and ought not to expect the community to fail to safeguard itself.

The measure in which you recognize the justice of the public's rights, the activity and skill with which you educate the public so that it can make wise decisions, the extent to which you refrain from unfairness or rapacity, and thus give ground for greater unfairness and rapacity in the public's dealings with you, will, to a large extent, be the measure by which capital will come to recognize the security which this form of investment offers.

### Hold to High Standards

Those of you who keep in mind most clearly that any deviation from the highest standards on your part in dealing with the public is apt to lead to unfair retaliation and unjust regulation by the public of the business in which you are engaged will find that you are creating about your properties an atmosphere which will encourage the investment of fresh capital. Nor will it be enough for you to be fair and just. You must be both patient and energetic in educating the public, in giving them information which will permit them to form wise conclusions, to make sound laws and to recognize the tremendous importance of both high character and broad intelligence in the men who are appointed to positions on public service commissions.

The field is new. The unavoidable mistakes even at the hands of wise men will be many. In the end those mistakes will react on the development of the community itself, and if the voters can be brought intelligently to recognize this, there will be a strong force of public opinion to compel the appointment of properly qualified men to these positions of far-reaching influence.

Not only must you throw all the force you can in the direction of securing properly qualified men on the commissions, but you must more broadly inform the public, so

that the commissions will have back of them wise laws, framed by men who intelligently comprehend the new and intricate problems which your development of the industry has raised.

To-day one of the greatest difficulties that the financial world encounters with public service commissions is on the ground of delay. Sometimes commissions fail to recognize the necessity for prompt action. Frequently they are so burdened and overladen with matters requiring their judgment that it takes months, or even runs into years, before decisions are rendered. Those charged with the duty of financing public service corporations have perhaps more ground for just complaint over commission delays than against the character of decisions after they are made. The commissioners themselves are by no means to blame for these delays. Not infrequently an impossible task is given to them to perform. I believe if the public understood this it would not be difficult to obtain laws which would permit the appointment of extra commissioners, or assistant commissioners, or in some manner to subdivide the work so that public business might be promptly cared for.

If, on the whole, the industry can look forward to fair and intelligent treatment at the hands of voters, municipal authorities and state commissions, it is reasonable from other points of view to anticipate that capital will be found to supply the needs for the development of the next five years, not to look further ahead than that. Nothing in connection with the business is more obvious than that the tendency is toward large units, large corporations and large issues of a single type of security. That all tends directly toward an absolute essential if we are to have a market for public utility securities as broad as the present market for railroad securities. There must be large issues, large enough to warrant the most careful investigation by issuing houses, large enough to make a market that investors can buy and sell in readily, and large enough so that there will be many minds centered on the operating facts back of that security, making the market price of that security represent the combined judgment of many investors, rather than merely the price placed on the security by an issuing house.

The investor wants large issues, but not at the price of over-capitalization. There has been much progress in the last few years in the direction of large issues, which has been brought about through the formation of holding companies that control a number of individual plants. In the creation of these holding companies there has frequently been a tendency toward over-capitalization, toward the building of one corporation on the junior securities of another, and even on the consolidation of holding companies and the creation of another type of security still further away from a primary lien. That tendency should be halted. There is quite enough imagination inherent in the business itself, without letting the imagination of the promoter come into play in creating issues with remote liens.

### Principles for Holding Companies

The holding company theory, I believe, is admirable. It scatters the risk; it affords intelligent supervision and engineering; it makes possible cheaper purchasing of supplies; it gives a broader market and a lower cost of capital—but the relation of total capital to total income involves principles that a holding company can no more transgress with impunity than can the original corporation.

If the investor turns from these large considerations, involving the relation of the properties to public opinion and civic control, and the relation of capitalization to reproductive property values and to earnings, and looks at the technical side of the business in the present state of the development of the science, at the outlook for broader uses, for more economical production, and at the growing necessity of society for the product which you furnish, then indeed there will be seen ground for the most optimistic view.

As I look back on my boyhood days I think perhaps the keenest hours of pleasure that I can remember were when I was deep in Jules Verne's "Twenty Thousand Leagues Under the Sea" or "The Mysterious Island." I have recently had a pleasure almost akin to that in reading from government reports some statistical abstracts setting forth the course of electrical development, and in studying the report of the committee on progress of the National Electric Light Association. That report of the committee on progress comes as near being a true fairy tale as I know of in current literature. It makes me envious of you men who are engaged in a field that has in it such possibilities—such certainties, one may better say, for the report deals with accomplishments rather than expectations.

### Imagination in the Electrical Industry

Diversity factors, off-peak loads, the concentration of central stations, the opening of new fields for the use of energy, and the more complete filling of old ones, makes reading that fires one's imagination. The making of two blades of grass grow where one grew before becomes commonplace by the side of your accomplishments in cheapening the production of electric energy either by water-power conservation or central-station consolidation. When you add to that the economies of diversified load and open up the fields that low-priced current and off-peak loads make possible, you have created a business situation where there is as much need and opportunity for sound imagination as has ever existed in business life—imagination, not mere dreaming, but imagination that means the correlation and new application of known facts. Sound imagination here has unlimited play, and you need it all through your organization and down to every subordinate who comes in any real contact with the problems of labor and the practical affairs of life. As great rivers have affected population or railroad trunk lines have defined development, so will these distributing lines, carrying cheap electricity, affect our future growth.

The nation owes the greatest credit to those among you who have seen this clearly and who are contributing in the largest measure toward a fuller realization of all the possibilities. The man who conceived a 40,000-hp generator is as much entitled to honors at the hands of our government as the men who built the steamship *Imperator* were entitled to be decorated by their government.

### The Reduced Cost of Electric Living

You are selling one of the few commodities that have gone down in price, while the cost of nearly everything else that enters into our life has gone up. I note that in seven years in which the cost of living is calculated as having advanced 37 per cent the average cost of electricity has gone down 17 per cent. You are in the one line of business where the theory of consolidation seems to be fully accepted by everyone who intelligently understands the factors. Elsewhere in business there is a tendency on the part of the public to break up large organizations, but in your field the monopolistic nature of the business is recognized and there is the strongest tendency toward consolidation, and you are demonstrating, in consolidation, the greatest economies.

I note that forty-nine central stations in Illinois have been closed up and that four are doing the work better I read that 400 central stations in New York State might better give way to forty, or even to ten. I see it demonstrated that what was originally your main business, the furnishing of electric light, is now but incidental, and I am told that the economies of diversified load are so large that the great steam railroads will undoubtedly be able to buy power from central stations having that diversified load factor more cheaply than they can produce it from their own central stations, however large their requirements may become. The diversity of load-factor which permits the serving of the countless needs of a great community from

a central station, and which leads to organization on such a scale that the highest intelligence can be afforded for every detail of supervision and engineering, is the direction in which we are obviously and rightly moving.

An independent municipal lighting plant is either an indictment of the intelligence of the community where it is located, an indication of its failure properly to supervise and control the corporation operating there, or a criticism of the severest character against the management of the private companies. The government might as well undertake the organization of transportation lines solely for service in connection with the post office to carry the mails as for a municipality to undertake economically to produce electricity solely for street lighting.

The interesting statistics of your business show far more rapid increase in gross earnings than is shown by the railroads of the country, great as that increase has been. What is still better, in the face of a rapidly decreasing price at which energy is sold, net earnings show a greater percentage of increase than gross, while the tendency with railroads is distinctly in the opposite direction.

### Electricity in Industries

No phase of electrical statistics strikes me as being more interesting than the growth of the use of electric power in our industries. In ten years the horse-power of electric motors in use increased from less than 500,000 to nearly 5,000,000, until to-day about a quarter of the primary power used in the industries of the United States is furnished by electric motors. The most casual study of that development indicates that as yet it is but getting well under way, and that there are as striking advances to be made in the next few years as have been made in the last half dozen.

The statistics of the last five-year period, on the average cost of installations per kilowatt capacity, bear impressive testimony to technical progress, showing as they do marked and steady decline in the cost of installation and the consequent cheapening of product. To a layman it would seem that no field offered more attractive possibilities on the technical side than further improvement in long-distance transmission which will still further broaden the field of operation of a central station and tend toward larger units and economical consolidations.

To-day a quarter of the total industrial power utilized in the United States is electrical. I am told that competent authorities believe that fully 85 per cent of the total industrial power can eventually be economically taken over by central electric power stations. This means an addition of more than 10,000,000 hp with the present volume of industry and an expenditure in central-station construction of $1,875,000,000 for the production of that amount of electricity.

Those of you who are close to and an intimate part of the astonishing development of the electrical business find these, and a hundred other interesting facts that might be stated, but the commonplaces of your every-day business. They are such sound and substantial facts that you perhaps marvel that four out of every five investors in corporate securities have never bought an obligation of a public utility corporation. You can see how it is possible soon to be furnishing 15,000,000 hp instead of 5,000,000 hp to the industries of the country. You can see how it is inevitable that great central stations will produce electricity so cheaply that all the energy that is required for wide communities will soon be coming from single central stations.

### Investors Want Fair Public Treatment

On the other hand, I can see that, with a little more time for investors to become convinced that a public-service corporation is not another name for a target against which to level unfair state and municipal enactments, we may have four out of five investors buying such securities, rather than refraining from doing so.

In the mind of the investor, the outlook for fair public treatment of public-service corporations is the most important single factor in directing investment of capital toward or away from the electrical field.

I firmly believe that this matter of fair public treatment lies largely in your own hands. If you will do so as well with that as you are doing with the technical side of the business, the $400,000,000 a year of fresh capital which you need will be forthcoming.

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## Analysis of Cost of Electric Drive in a Foundry

In recommending the installation of electric motors from the central-station standpoint it is often desirable to consider group drive as an entering wedge, leaving individual drive for later investment after the consumer has become thoroughly acquainted with the convenience and economy of electric service. In the ensuing paragraphs are given the data of a cost analysis in a modern foundry for which a motor-service survey was made by the local central station. The table gives the list of tools and motors required to operate them.

DATA ON TOOLS AND MOTORS

| | | |
|---|---|---|
| Five polishing jacks<br>One 50-lb. trip-hammer<br>One shear<br>One blower | Shaft speed 300 r.p.m.<br>One 23-in. pulley | 5-hp motor<br>1700 r.p.m.<br>4-in. x 4-in. pulley |
| Two 7-in. stones<br>125 r.p.m.<br>30-in. pulley | Shaft:<br>One 30-in. pulley<br>One 12-in. pulley | 10-hp motor<br>1710 r.p.m.<br>6-in. x 5-in pulley |
| Two 75-lb. trip hammers<br>325 r.p.m.<br>13-in. pulley | Shaft:<br>One 12-in. pulley<br>One 7½-in. pulley | 5-hp motor<br>1700 r.p.m.<br>4-in. x 4-in. pulley |
| Three 16-in. lathes<br>One 18-in. lathe<br>One 24-in. lathe<br>One 12 in. lathe<br>Two speed lathes<br>One 20-in. upright drill<br>One sensitive drill<br>Two shapers<br>One planer<br>One milling machine | Shaft<br>125 r.p.m.<br>One 22-in. pulley<br>Countershaft:<br>One 30-in. pulley<br>One 8-in. pulley | 7½-hp motor<br>1710 r.pm.<br>6-in. x 5-in. pulley |

The total installation aggregates 27.5 hp of connected load, and the estimated monthly energy consumption is 1328 kw-hr., giving a net bill of $49.17 per month for electricity. The average load is estimated at about 7 hp. The present cost of operating the foundry by steam power is:

| | Per Year |
|---|---|
| 150 tons coal, at $4.75 | $713.00 |
| Engineer, two hours per day, at 25 cents per hour | 150.00 |
| 288,000 gal. water, at 10 cents per 1,000 gal. | 28.80 |
| Oil, waste, etc. | 50.00 |
| Ash removal | 24.00 |
| Taxes, insurance, depreciation, interest and repairs | 135.00 |
| Total ($91.50 per month) | $1,100.80 |

The first cost of motors is as follows:

| | |
|---|---|
| One 5-hp motor | $72.00 |
| One 10-hp motor | 158.00 |
| One 5-hp motor | 72.00 |
| One 7.5 hp motor | 135.00 |
| Total | $437.00 |

With the most liberal allowance for fixed charges and such steam-heating service as may be necessary after electric drive has been installed, there is indicated a decided saving by the use of central-station service.

# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Commercial Methods and Results at Kokomo, Ind.

In shaping the local advertising of the Indiana Railways & Light Company at Kokomo, Ind., advantage is taken of timely newspaper topics to catch and hold the reader's attention for the central-station message which follows. Thus, at the time of a recent sensational escape in the East, a display "ad" gave prominent position to a scare heading into which a commonplace house-wiring exhortation could be read.

The contract agent of the Kokomo company, Mr. O. M. Booher, reports that by such timely advertising and special offers the sale of flatirons in Kokomo, a city of 20,000 inhabitants, has reached a total of 1685. A campaign instituted for gaining 1000 new customers during the year of 1913 is also progressing satisfactorily. A circular dial in the commercial office shows that already more than 500 of these new customers have been added to the company's circuits. As it is a matter of record that more new business is obtained in the latter part of the year than during the first six months, the hopes of the commercial department for a 1000-customer gain will doubtless be fulfilled.

## A Pleasure Car's 82-Mile Country-Road Run

The electric pleasure car shown in the accompanying illustration recently made the round-trip run from Washington, D. C., to Baltimore, Md., and return on a single battery charge. At the time of this trip part of the road had just been heavily oiled by the State Road Commission. This condition materially checked the machine. At one point heavy sand was encountered but the machine, a Detroit Electric, had no difficulty in pulling through it. The car left Washington at 7:40 a. m. and four hours later



ELECTRIC PLEASURE CAR ON WASHINGTON-BALTIMORE RUN

was in the downtown district of Baltimore. The run through Baltimore was over cobblestones. The drive back to Washington occupied an hour longer, as it was necessary, because of road repairs, to return by Hyattsville and the Queen Chapel Road.

The car arrived in Washington in excellent condition and with sufficient energy remaining in its batteries to travel a number of miles further. This car had already been driven 6213 miles with the same equipment.

Not long ago the Washington-Baltimore round-trip run was made by an electric truck of the same manufacture carrying a load of 1200 lb.

## Nickel-Plated and Costly Heating Appliances

Critical comment on the use of nickel-plated finishes for electric-heating devices is contained in the following letter received from the manager of a Middle West central-station company:

"Nickel plate is all right in its place," he writes, "but it is bad policy to make it the chief feature of a heating appliance. The gas people have been a long time at their business and have passed the nickel-plate stage long ago. Their chief effort is to make the toaster, the broiler and the iron do the business, and they make these things inexpensive in order to sell the gas. But the aim of manufacturers of electrical apparatus is to make profits in the sale of their wares, letting the central station do the best it can with the resulting situation. Flatirons are now beginning to be sold at a somewhat reasonable price, but this has been accomplished only because new manufacturers entered the field and forced prices down.

"Taking, for example, an electric stove with two heating plates and an oven with two heating plates, it is manifest that the material and workmanship in such a stove are not so much as in a gas or gasoline stove of the same size. But such gas, gasoline and oil stoves can be bought at about one-third of the price of electric stoves of like capacity. The experimental stage is passed. The heating element is now cheap and reliable, so that in reliable flatirons the elements are guaranteed for all time. We feel that the prices for stoves and all other electric utensils will similarly come down to a par with their competitors' within the next two or three years, and we do not propose to promote the use of electric stoves and utensils until they are on the market at reasonable prices. We would then place a separate watt-hour meter on such services, charging our regular motor rate, which ranges from 5 cents to 2 cents per kw-hr."

## Watt-Hour Meter Testing for Central Stations

By C. W. Ward and H. N. Stroh

The writers have designed and put in use for the Du quesne Light Company, Pittsburgh, a test board or rack i which two or more portable service types of rotating stand ard watt-hour meters may be checked at the same tim against a carefully calibrated laboratory rotating standard

The device reduces to a minimum the labor expense in volved in the weekly checking of a number of portabl standards, yet enables the inspector to maintain a ver high degree of accuracy.

Primarily the rack is a large container built to accomm date the number of rotating standards desired. Westing house standards of the 5-amp to 40-amp, 100-200-volt ty are employed by the Duquesne Light Company, and t rack in use is built for twenty standards. The rack ca of course, be built to accommodate any type of standard

From the accompanying photograph and sketches one n see at a glance the adaptability of the rack and realize hat a time saver it is.

The meter movements as a whole are removed from their ood-carrying cases and their drums and contact fingers e carefully inspected, after which dust and foreign par-cles are blown out with heated compressed air. The com-

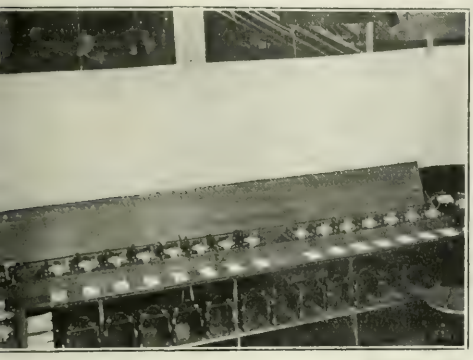


FIG. 1—RACK FOR TESTING WATT-HOUR METERS

ete movements are then inserted in the various compart-ents as shown. These compartments are so designed at the element has as exact a fit as when in its carrying se, being level, sealed from air currents, and with the unt (potential) coils automatically cut into the circuit on e under side of the potential binding posts through the edium of the two springs shown on the left side of each mpartment. These springs make a most positive connec-on and cannot get out of order.

The potential-coil connections are wired up in a special ay to compensate for the drop in voltage when a large mber of the standards are being checked at one time.

The series (current) connections to the standards are ade by short, flexible leads coming up from the rear of e rack, along which run two flat copper buses, each capa-e of carrying 100 amp. From the sketch showing the ar of the rack it will be seen that these strips are split ternately at each meter and that no two adjacent meters e cut in on the same strip or bus. Such an arrangement

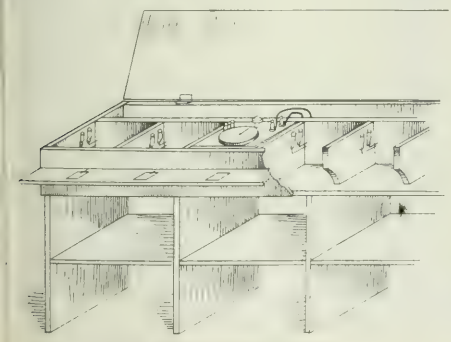


FIG. 2—FRONT VIEW OF RACK

utralizes the effects of any stray fields set up by these ses. The master meter employed as standard is of the gular Westinghouse rotating type with a few special difications insuring greater accuracy and facility of han-ng. These modifications have been worked out in the boratory and have been conceded by meter experts to have nsiderable merit.

Testing includes a check upon each series and shunt instrument winding and the error taken as final in each test is the average of three checks under each condition.

The usual method of returning to zero the pointer of each meter being checked is to employ a switch in the potential circuit of each. This method is slow and unsatisfactory. On this rack the front is hinged so that it drops down with counter-weights, thus exposing the moving element of each standard. The disk is then turned by a light pressure of the finger and the pointer brought exactly to zero at once. The calibration card for each meter is always exposed for entries, being held by a spring clip on a small shelf directly in front of its respective meter. This

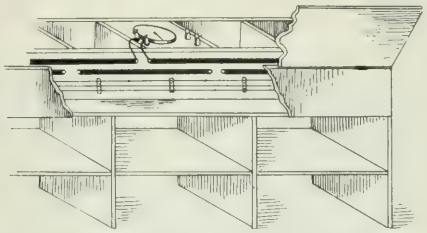


FIG. 3—REAR VIEW OF RACK, SHOWING CURRENT BUSES AND POTENTIAL CIRCUIT

shelf also prevents the warping of the hinged door, which effectively seals each compartment against the influence of air currents. A latch similar to that employed on refrigerators is used to hold this swinging front tightly in place when closed.

Shelves are made underneath each compartment for the storing of the empty meter cases while the elements are under test. A hinged cover fits over the entire top of the rack, which is closed when not in use.

Each series winding is tested at full, half, tenth and twentieth load current and at both voltages, a total of ninety-six tests for each meter. These tests are made on Sunday, all standards being brought in Saturday by the testers. Thus on Monday morning a carefully calibrated standard is ready for each tester for his week's work.

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## Co-operation with the Sales Department

What are the functions of the sales department? Is it limited and circumscribed to the making of contracts and nothing more? "In Detroit we think that its scope is very much broader," explained Miss Sarah M. Sheridan, sales manager of the Edison Illuminating Company of Detroit, in a paper delivered before a recent convention of the sales managers of Edison illuminating companies held at Association Island, N. Y. An abstract of the paper follows:

In the central-station business no sale can be considered as a closed transaction. The company in selling its commodity is performing a service which it aims to make continuing to each customer. The appointment of the sales manager as special agent of the company carries authority to make and sign the company's contracts for the sale of electric energy; to make adjustments, settlements and cancellations of such contracts, and to procure by lease or purchase easements and rights-of-way for the electric lines of the company.

This implies that the department shall not only find a market for the company's output and constantly increase that output by securing new customers and finding new uses but shall also settle all complaints, disputes and claims concerning service or charges. In fact, the Detroit department disposes of all complaints whatsoever in the first instance.

### The Fundamentals of Courtesy and Fair Dealing

An advertised expression of a courteous and fair-dealing policy makes little impression on the general sentiment of a community. But such a policy lived up to year in and year out in all relations with individual members of the same community builds up for a company a public good-will that is invaluable. The courtesy of the sales department expressed to the public through its salesmen who are securing business is of little value in creating favorable public sentiment if the construction department, for instance, in order to keep down costs, disregards the same public in setting its poles without thought of public convenience, or ruthlessly sacrifices trees to facilitate its own work, or if an underground department persistently tears up and keeps open streets without regard or provision for the public use thereof.

Such contradictory methods can only result in the charge against the company of hypocrisy. If the company is not going to be consistent in all of its dealings, it would be far better that the sales department should not profess a policy of courtesy and fair dealing. We writhe under the charge that the company is particularly gracious when securing a contract and indifferent and arbitrary when the customer is looking for a favor.

### Departments' Relations to the Organization

In an organization of many departments each department is apt to consider itself the mainspring of the organization. From the salesman's point of view the sales department is the most important, hence the salesman interprets co-operation to be that the other departments shall do as the sales department wishes and directs. At the same time the production department, feeling its value, knows well that the sales department would be of no use without something to sell. The construction department concludes that without its work none of the others could operate, and it probably joins in with the sentiment that the sales department does not really amount to much any way, because the public must have service and if the sales department did not seek the customers the customers would perforce come to the company.

Time was when the construction department would turn back an order involving an extension of lines with the notation "Business not worth the cost of extension." The construction department did not know, as the sales department believed, that the very shabby building involved was the beginning of a prosperous industry; nor did the firm name represent to the construction department, as it did to the sales department, honest, intelligent men who were bound to succeed. The construction department, because not constantly reminded in its daily dealings with the public, had forgotten that an inherent factor in the company's existence is that "the company *must* meet all reasonable demands of its public." The same department more recently was unable to see why its schedule of work for several days should be disarranged in order to give service in twenty-four hours to a plant where the steam engine had broken down. The work involved the construction of three blocks of primary line, the hanging of a heavy transformer and the securing of crossing waivers from two railroads. The construction department did not appreciate that such a demonstration of the company's ability to serve would gain a good customer and displace a steam plant that the sales department had been endeavoring for three years to shut down.

### Mutual Understanding Between Staffs

If the sales department has authority to insist that work shall be done, and done promptly, even though it does not meet the approval of the construction department, the public is served. But this is not enough. Satisfactory co-operation is not attained by mere authority. Mutual understanding is needed. The understanding that now exists in the Detroit company between these departments was a matter of slow growth. Frequent conferences between the heads, and very frequent telling of the construction chief and his foremen of what the sales department hoped to accomplish in its work, have helped greatly. Authority, within certain limits, given to the sales department to decide without reference to the general manager as to whether or not an extension shall be made inspired some belief in the sales department.

But understanding, real co-operation from the construction department came after two assistant superintendents had been detailed to report jointly to both the sales department and the superintendent of construction. One of these men is responsible for the maintenance of motor-service lines and transformers and is in close touch with the motor-service salesmen and the customers they are dealing with. The other superintends service connections made on sales department orders, and on call of the sales department makes directly for it estimates of cost of extensions. Reporting thus to the sales department and absorbing its spirit of "increasing business" gives him a commercial point of view that he would not acquire as an operating foreman.

### Responsibilities of the Sales Department

That these two departments now work remarkably well together does not mean that the sales department itself has not had to learn a few things. We know that it serves neither good service nor economy to insist on rushing a piece of work merely to make a spectacular showing to some customer, and we know that every time we break into the regular progress of the work by asking for emergency service we are not only increasing the expense but we are delaying service to other customers. We know that if we are to get the best service we must give the construction department early notice of work to be done. Our salesmen secure their contracts as early as possible. If there is delay in signing the contract, the construction department is notified in advance that a rush order will come in later for the given piece of work.

### Allowing Customers Credit Standing

In the matter of credits the sales department also wears the scars of battle. The credit department, being closely allied with accounting, has a tendency to set up precise rulings that are sometimes difficult to enforce when the human factor is introduced. We must agree that when a man fails to pay his bills it is foolish to allow further charges to accrue. But while recognizing these rules as reasonable in general, we meet serious difficulty if they are applied without discretion. We have found that many a man whose past record would not entitle him to credit has started afresh and been a profitable customer. According to credit-department ethics, a poor record of payment of bills does not entitle a customer to a fresh start without security; but sometimes this same security would be the deciding factor as to whether or not the customer shall use our service. A credit department, because it is not in immediate touch with the outside conditions, does not sense the possibility of success or failure in an enterprise as the sales department does.

In Detroit the sales department has the authority of deciding the initial credit of a customer, but it never, no matter how tempting the business, extends credit to one who has previously made unnecessary trouble or shown a disposition to be dishonest. This solution has not only obviated the friction between these departments, but the sales staff has succeeded where the credit men failed in collecting doubtful and stubborn accounts, besides still holding the business and good-will of the customer.

### Absorption of Meter-Installation Staff

The Detroit sales department long ago absorbed the meter-installation department solely in order that its idea of prompt service might be met, and it has never since had

ason to doubt the wisdom of the absorption. The meter vision is just as thoroughly imbued with the spirit of od and prompt public service as is the sales department oper.

The department that primarily meets the public, it ems, must make its contact as broad as possible and ould be the truest and most complete expression of the mpany's policy and ability. To be such an expression it ust understand the desires and difficulties of all the other partments. It must speak with one voice, not with many ices. And in taking to itself this business of direct deal- g with the public the sales department has realized that hile it may be "the voice of the company," it must, like e good ship *Dimbula,* speak as one voice for every part the ship.

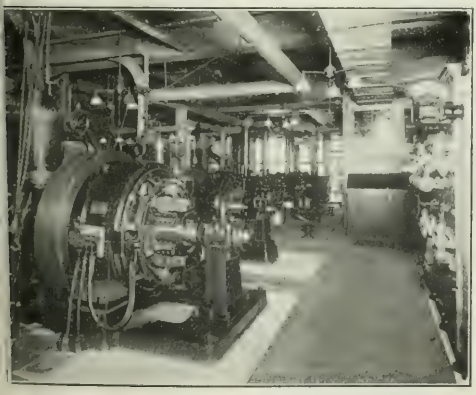
### Saving Soles with Electric Irons

The young woman who has charge of window displays for Louisville central station recently utilized a couple of irs of women's shoes as an effective argument for electric ons. On one side of the window she placed an old-style diron and below it a well-worn pair of women's boots, s down at the heel and in dire need of resoling. In con- ast, on the other side of the display was the cleanly and ining electric iron, accompanied by a trim pair of shoes hich bespoke the ease and convenience of electric service. o the many women who passed the window this mute dis- ay offered its own feminine appeal.

### Central-Station Service for Brooklyn (N. Y.) Post Office

A contract recently taken by the Edison Electric Il- minating Company of Brooklyn, N. Y., possesses more an customary significance in that it indicates very clearly e marked trend of the times toward central-station ser- ce. The contract was made with the government for the clusive supply of light, heat and motor service for the rooklyn post office, in which a private plant had been erated for many years.

The equipment replaced consists of two 50-kw and one -kw generator, directly connected to standard upright tomatic engines; two 12-in. by 20-in. duplex steam-driven



INDIVIDUAL PLANT OF BROOKLYN POST OFFICE

at compressors, and one 14-in. by 18-in. duplex air com- pressor.

he Brooklyn post office building itself covers nearly an ire city block.

egotiations preliminary to signing this contract covered a period of more than one year. Tests made during that time convinced the Treasury Department, which has juris- diction in the matter, that it was more economical in Brook- lyn to purchase electric energy for lighting, motor service and steam, than to generate it.

# Illumination and Wiring

### Night Illumination of Swimming Pool

The excellent night illumination of the Delmar swimming pool in Delmar Garden, St. Louis, as planned and carried out by the Electric Company of Missouri, is illustrated here- with. The St. Louis "white way" lamp, which has met



ILLUMINATION OF SWIMMING POOL

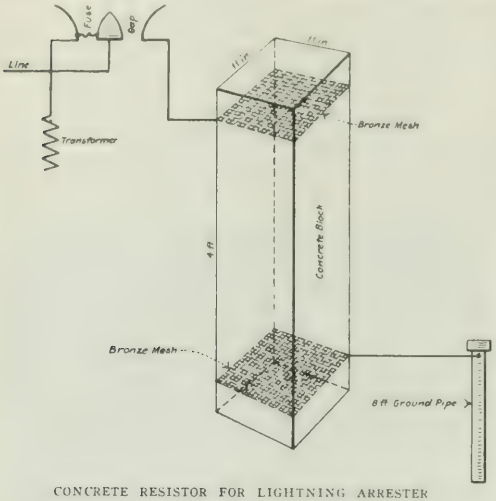
with much success at the hands of the electric-service men of that city, is used with good effect. Five cables suspended over the pool each support five 500-watt tungsten lamps, as shown. The tower in the center of the basin supports two additional lamps of the same size attached to a cross-arm. One-quarter-inch standard guy wire is used for the sus- pension cables. The cable-suspended lamps are spaced at equidistant intervals, and the lamps may be lowered easily for renewals. However, the present installation was made in May, and no renewals had been necessary up to Aug. 20. No. 8 wire is used for the lamp circuits, which are fed from three No. 4 secondaries.

Before the present system was installed both flame-arc lamps and tungsten clusters were installed to light this pool, but it is reported that the single-unit "white way" lamps now in use have given results more satisfactory to the proprietors of the resort. As this swimming pool is very popular during the summer, the "white way" lamps have received a great deal of attention, and much favorable comment upon them has been heard.

### Concrete Resistors for Lightning Arresters

Concrete resistors for lightning-arrester service which are in general use on the 11,000-volt and 22,000-volt systems of a Georgia central-station company are illustrated in the accompanying sketch. Into a solid concrete block measur- ing approximately 4 ft. long and 1 ft. on a side are cast two squares of bronze or copper mesh, one near each end. The block is then stood upright at the point of installation, being set a few inches into the earth to insure it against accidental overturning. To the upper-mesh electrode is connected the tap from the middle member of the double horn-gap, the circuit through to the transformer or other station apparatus being completed by a piece of copper-

wire fuse, as shown. The lower-mesh electrode embedded in the block is similarly connected to a couple of 8-ft. ground pipes or ground rods driven deep into the soil. While the circuits are also adequately protected on the low-tension side, the fuse shown is especially provided for




CONCRETE RESISTOR FOR LIGHTNING ARRESTER

protection to the high-tension line. The copper-wire link used is designed to give four times the full-load carrying capacity, and each lineman carries in his pocket notebook a table of sizes suitable for the various installation ratings at both 11,000 volts and 22,000 volts.

## Wiring of the Continental and Commercial Bank Building

Nearly all the interior conduits for the Continental and Commercial National Bank Building in Chicago have now been installed. Since the publication of the article describing the electrical wiring and illumination of this large building in the *Electrical World* of July 26 last, the rating of the feeder cables for the tenants has been materially increased, and it may be of interest to give the sizes of cables as finally decided upon. There are four main wire shafts, which may be designated as shafts A, B, C and D.

In shaft A, for tenants, there will be three 900,000-circ. mil cables incased in three 2-in. conduits, supplying the seventeenth, eighteenth, nineteenth and twentieth floors; three 900,000-circ. mil cables in 2-in. conduits supplying the floors from the twelfth to the sixteenth inclusive; three 1,000,000-circ. mil cables in the same size conduit, supplying the sixth to the eleventh floors, inclusive. The second, fourth and fifth floors will be supplied by three 650,000-circ. mil cables in three 2-in. conduits. The space from the sub-basement to the third mezzanine floor will be supplied by means of three 350,000-circ. mil cables in three 1.25-in. conduits.

The building-service feeders in shaft A, from the sub-basement to the third mezzanine floor, will consist of three No. 4 wires in one 1.25-in. conduit, in addition to three 400,000-circ. mil cables feeding into all floors from the second to the penthouse on the roof and incased in three 1.25-in. conduits.

The tenants' feeders in shaft B will be as follows: Supplying floors from the seventeenth to the roof, three 900,000-circ. mil feeders in three 2-in. conduits; supplying floors from the twelfth to the sixteenth inclusive, three 900,000-circ. mil feeders in three 2-in. conduits; supplying floors from the sixth to the eleventh inclusive, three 850,000-circ. mil cables placed in three 2-in. conduits; supplying the second, fourth and fifth floors, three 600,000-circ. mil feeders in three 1.25-in. conduits; supplying floors from the sub-basement to the third mezzanine, three 450,000-circ. mil cables in three 1.5-in. conduits.

In shaft B for public uses there will be three No. 4 wires in one 1.25-in. conduit, feeding into floors from the sub-basement to the third mezzanine floor. In addition there will be three 550,000-circ. mil cables in three 1.5-in. conduits, feeding into all floors from the second floor to the roof.

Tenants' feeders in shaft C will consist of three 900,000-circ. mil cables in three 2-in. conduits, supplying the seventeenth and upper floors; three 900,000-circ. mil cables in three 2-in. conduits, supplying the twelfth to the sixteenth floor inclusive; three 1,000,000-circ. mil cables incased in three 2-in. conduits, supplying the sixth to the eleventh floor inclusive; three 650,000-circ. mil cables in three 2-in. conduits, supplying the second, fourth and fifth floors. For the tenants in the portion of the building served by this shaft from the sub-basement to the third mezzanine floor there will be three 450,000-circ. mil cables in three 1.5-in. conduits.

Building service in shaft C will be supplied by three No. 2 wires in one 1.5-in. conduit, feeding floors from the sub-basement to the third mezzanine floor, in addition to three 450,000-circ. mil cables in three 1.5-in. conduits, feeding the second floor and floors above to the roof.

In shaft D the tenants' service will be supplied by three 900,000-circ. mil cables in three 2-in. conduits, supplying the seventeenth floor and floors above; three 1,000,000-circ. mil cables in three 2-in. conduits, supplying the twelfth to the sixteenth floor inclusive; three 1,000,000-circ. mil cables in three 2-in. conduits, supplying the sixth to the eleventh floor inclusive; three 750,000-circ. mil cables in three 2-in. conduits, supplying the second, fourth and fifth floors; three 450,000-circ. mil cables in three 1.5-in. conduits, supplying space from the sub-basement to the third mezzanine floor.

The public wiring in shaft D will consist of three No. 2 wires in one 1.5-in. conduit, supplying the space from the sub-basement to the third mezzanine floor, and three 450,000-circ. mil cables in three 1.5-in. conduits, supplying all floors from the second floor to the penthouse on the roof.

In addition to this wiring there will be two 500,000-circ mil cables in two 1.5-in. conduits, supplying the fans in the attic on the twenty-first floor. On the fourteenth floor there are two elevator distributing panels, and for each of these there will be two 1,400,000-circ. mil feeders in two 2.5-in. conduits. In the penthouse on the roof there are also two elevator distributing panels. One of these will be supplied by two 1,400,000-circ. mil cables in two 2.5-in conduits, and the other by two 1,500,000-circ. mil feeders in two 2.5-in. conduits. The private elevator panel on the seventh floor will be supplied by two No. 0000 cables in one 2-in. conduit. On the sixth floor there are two panels controlling dumb-waiters, and each of these is supplied from two No. 4 wires in a 1.25-in. conduit.

## Montgomery's 400 Electric Signs

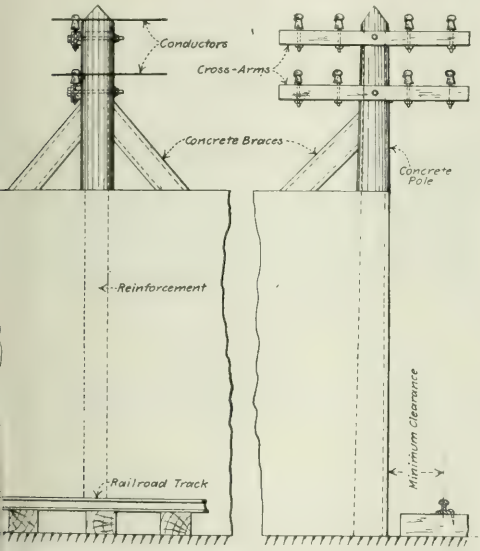
Four hundred electric signs are in operation on the street and buildings of Montgomery, Ala., representing a connected load of about 550 kw. Most of the lamps are 2 watt carbons, so that in all more than 20,000 sign-lamps a in service, averaging about fifty lamps per sign. Montgomery's population is locally estimated at about 45,00 The Montgomery Light & Water Power Company and t Montgomery Light & Traction Company both offer lo rates for sign and display lighting in that city.

## Concrete Poles Integral with Building to Save Space

At the No. 3 plant of the Aluminum Company of America t Niagara Falls, N. Y., the problem of conserving real state has been solved in one instance by resorting to a ovel type of overhead-line construction. The motor- ervice wires reach the mill over a pole line and from the orner of the low concrete building which adjoins the main actory are carried by concrete poles constructed integral ith the building.

As shown in the illustration herewith, the reinforcing xtends up the wall of the building and continues to a point ear the top of the pole. Braces of reinforced concrete are et on three sides of the poles at an angle of about 45 deg. he poles extend about 10 ft. above the roof, giving ample learance between the wires on the lower cross-arm and the oof.

This arrangement has the further advantage of allowing




DE AND END VIEW OF CONCRETE POLES BUILT INTEGRAL WITH FACTORY

e spur track which is shown beside the wall to be placed oser to the factory than would have been possible if ooden poles had been set in the earth near the building. nus in loading and unloading cars the distance between fe car door and the sill of the factory entrance is reduced a few inches.

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## Recent Telephone Patents

### Telephone Time System

Mr. W. Pothen, of Murdock, Minn., has invented an ar- ngement whereby the hours may be struck on the tele- one bells of all idle stations of an exchange. The strik- ig part of a clock controls the connections.

### New Apparatus

The prepayment coin-operated telephone has brought out sne criticism on the ground that in cases of emergency the day in finding a coin may be prohibitive. To obviate such alifficulty Mr. A. U. Gerber, of Chicago, has invented an emergency call attachment for such coin devices. An emergency button is provided which not only initiates a call vhout requiring a coin to be deposited but each such emergency use is registered upon a counter, and when the prescribed number of calls has been made the device locks itself against further use.

Mr. E. H. Martin, of Webster City, Ia., is the inventor of a message register which is contained within the shell of the ordinary receiver. A spring furnishes the motive

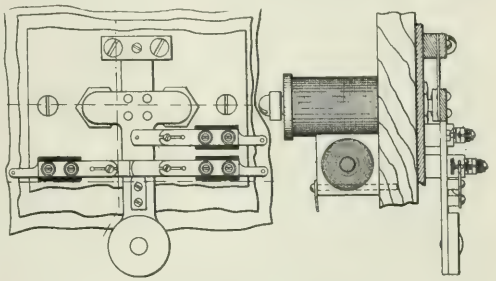


FIG. 1—POLE CHANGER

power and the spring must be kept wound or the receiver circuit will be open. A push-button serves to release the counter mechanism, the counter figures appearing through a window in the receiver casing.

Mr. A. H. Weiss, of Chicago, has obtained a patent on a pole changer for harmonic operation. This patent has been assigned to the Kellogg Switchboard & Supply Company. The main features are in the detailed design. A spring reed, properly weighted, constitutes the moving part. This reed carries a contact which controls the energy supply to the operating magnets in the field of which its armature is exposed. The main pole-changing contacts are placed on either side of the reed and are driven by a contact finger secured to it. The spring members are made very light but their motions are limited by auxiliary stiff members associated with them. Fig. 1 shows the arrangement.

Mr. P. T. Hudson, of Everton, Mo., has patented a circuit-breaker for protection from abnormal currents. Included in the circuit is a coil the magnetic field from which acts upon contact springs in such a manner that if the field becomes too strong the sensitive apparatus is disconnected, the line being grounded through the coil. This condition is maintained until the field weakens, at which time everything becomes normal. The illustration (Fig. 2) shows a neat method of combining the key mounting and key execution plate in one piece. This mounting is made in a long strip, as many sets of key springs and handles being mounted as desired.

Mr. C. A. Bals, of Chicago, has obtained a patent for a circuit system the feature of which seems to be the preven-

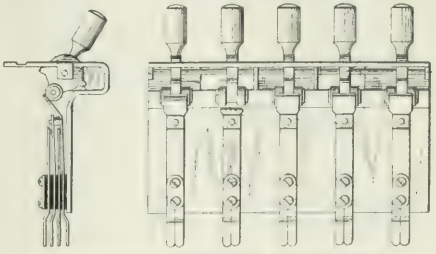


FIG. 2—KEY CONSTRUCTION AND SUPPORT

tion of listening on the part of the operator. A control relay is arranged so that if both parties to a conversation are on the line the relay is de-energized, thereby cutting off the operator's circuit. If two cords are used, the combined resistance is low enough to permit the action of a second relay, which also cuts off the operator's set.

A second patent granted to Mr. Bals, which like the preceding one is assigned to the Corwin Telephone Manufacturing Company, relates to a mutual arrangement of two related exchanges such as a central station and a private branch exchange. The patent covers a means for disconnecting one battery circuit when the exchanges are connected together so that one battery may serve both.

The invention of Mr. A. M. Beeler, of Seattle, Wash., refers to a group of party-line telephones for which a mutual busy signal is desired. He provides special mountings to be clamped to the telephone instrument so that a miniature lamp will glow upon each subscriber set if any one set of the group is in use. The switch hook in its up position closes the lamp contact.

In some systems signaling the exchange depends upon a momentary contact during transmission of the hook lever from top to bottom of its throw. Mr. A. C. Reid, of Genoa, Ill., has designed a set of contacts for a desk telephone with this point particularly in view. The temporary contacts are equipped with a latch device which causes distinctive action and records the direction of motion of the hook. This patent has been assigned to the Cracraft Leich Electric Company.

# Letters to the Editors

## Strength of Transmission Towers

*To the Editors of the Electrical World:*

SIRS:—Referring to the article by Mr. K. Nogami in your issue of Aug. 9 and to Mr. J. B. Leeper's comments thereon, Aug. 30, the writer extends to Mr. Leeper a hearty welcome into the ranks of those who are periodically protesting against certain practices in the design of transmission structures. There are two very common faults in tower design, and they are closely related. One is the optimistic (or fatalistic?) assumption of a totally erroneous safety factor, and the other the use of compression members having an improper ratio of $l/r$. As stated by Mr. Leeper, the critical condition is that of the compression members. He might perhaps have claimed with accuracy that no such structure has ever failed in its tension members, whereas the writer has in mind several failures in compression. It would tend toward a more accurate general understanding of the matter if those designers who are not perhaps structural experts would consider the ultimate strength of steel as being 20,000 lb. instead of 60,000 lb. per sq. in. If this condition is assumed, subsequent statements in regard to the factor of safety will have some basis of fact.

In the particular member under discussion—a 4-in. by 4-in. by 0.75-in. angle—the value of $l/r$ for a length of 13 ft. is 202, an excessive amount for a main compression member. In order to show more clearly the effect of this factor, the approximate breaking strengths of several members of different size and length are given in the accompanying table.

TABLE I—DATA ON BREAKING STRENGTHS

| Section | Area, Sq. In. | Length, Ft. | $l/r$ | Breaking Strength, Lb. per Sq. In. | Total Breaking Strength, Lb. |
|---|---|---|---|---|---|
| 4-in. by 4-in. by ¾-in. angle.... | 5.44 | 13 | 202 | 12,000 | 65,200 |
| 5-in. by 5-in. by ⅞-in. angle... | 5.31 | 13 | 159 | 16,000 | 85,000 |
| 6-in. by 6-in. by ⅞-in. angle... | 5.06 | 13 | 131 | 20,000 | 101,200 |

From the table it is evident that a 6-in. by 6-in. by 7/16-in. angle having a much smaller value of $l/r$ would have been stiffer, stronger and lighter than the section used and would therefore have been a better and more economical member. It may further be noted that the 4-in. by 4-in. by 0.75-in. angle member has a minus factor of safety instead of 3.4.

In general it may be stated that many towers of the windmill type, as well as certain types of frames and poles, are faulty in the design of their compression members. This condition is chargeable to competitive bidding and the prevalence of the custom of expending most of the available appropriation on the power house, leaving the line to work out its own salvation.

There has been some attempt upon the part of purchasers to protect themselves as it were from their own ignorance by making a full-size test of a tower. To the writer's mind this is a confession in avoidance, as it should not be necessary for a competent engineer to test a statically determinate structure, and in addition the result is not an absolute guarantee of the performance of the subsequently erected towers. A long slender unsupported angle is not well adapted to withstand compression, and any injury in handling which produces a slight bend will greatly reduce the theoretical strength.

Lest the writer be accused of undue alarm as to the prevalence of this practice, he gives a table of sections from the last design illustrated in your columns.

TABLE II—DATA ON SECTIONS

| | Area, Sq. In. | Approximate Length, Ft. | $l/r$ |
|---|---|---|---|
| 2½-in. by 2½-in. by ⅜-in. angle | 1.01 | 11 | 236 |
| 2-in. by 2-in. by ⅜-in. angle... | 0.72 | 7 | 210 |
| 2-in. by 1½-in. by ⅛-in. angle. | 0.63 | 10 | 375 |

In all seriousness, is it not about time for the transmission line to receive some fraction of the careful and expert attention now given unquestioningly to the other portions of a transmission installation?

It would appear self-evident that the pole or tower line which carries the product of the power house to the customer, and which is neither under cover nor under constant supervision, is an extremely important factor in maintaining uninterrupted service.

*New York.* R. D. COOMBS.

## A New Notion in Ventilation

*To the Editors of the Electrical World:*

SIRS:—It appears from the editorial entitled "A New Notion in Ventilation" in your issue of Aug. 9 that the true status of ozone in ventilation is beginning to be appreciated. It has substantially been established that the only dangers of vitiated air are due to excess of heat and moisture and to odors. The latter arise from respiration and surface excreta of those present and are due to organic impurities, which, while probably not poisonous in the ordinary acceptation of the term, nevertheless constitute an important factor in the unsuitability of stale air. They cause shallow breathing, anorexia and general lowering of the vitality, with consequent loss of efficiency. Ozone has been shown capable of chemically metamorphosing these odors, and thus its use is both logical and hygienic.

The liability to nitrous-oxide formation in commercial types of ozonators has been greatly exaggerated. One of the worst offenders in this respect, a machine which I examined recently, gave a concentration of only 24 parts of nitrous acid in 100,000,000 volumes of air, so that a person would inhale approximately 2.7 milligrams in twenty-four hours. It is needless to point out that this transcends even homeopathic dilutions and the physiological effect is scarcely even conjectural. Properly constructed ozone generators give amounts of nitrogen oxide which are at most infinitely smaller than those found in the atmosphere after thunderstorms.

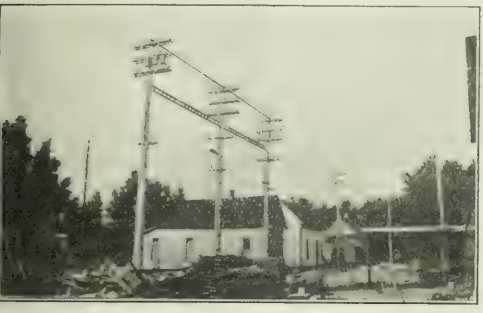
*Bloomfield, N. J.* MILTON W. FRANKLIN.

# Field of the Operating Engineer

**A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers**

## Iron-Pipe Construction in Distribution Rack

The general rehabilitation which is now taking place at he plant of the Elwood (Ind.) Electric Light Company has been extended to include the distribution rack which carries he outgoing lines for local lighting and motor service.



DISTRIBUTION RACK MADE OF IRON PIPE

The feature of this rack reconstruction has been the use of -in. iron pipes with porcelain insulators fastened between hem by means of bolts, giving to the finished structure a neat appearance combined with a degree of stability and endurance not possible to obtain by the use of wooden supports. Wires are brought out from the insulators in the wall of the station to the two lower pipes and are there dead-ended. Jumper wires are thence run to the insulators suspended from the pipe above and after making a right-ngle turn at this point are taken to the lead which they are o supply.

Throughout the installation white, brown, blue and yellow nsulators have been used to distinguish respectively primary ircuits, secondary circuits, arc-lamp circuits and grounded ires so that a man working on the rack has little trouble n distinguishing the several classes of lines.

## Cleaning of Oil Fuel

By R. T. Strohm

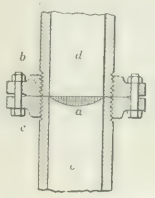
The greater number of burners for oil fuel are constructed with small orifices through which the oil is sprayed. therefore becomes necessary to take proper precautions o prevent the burners from becoming clogged by particles f sand or other foreign matter. The dirt found in the oil ay be in the crude oil as it comes from the well, or it ay find its way in during the subsequent transportation nd handling of the oil. Oil wells are driven through rata of various earthy materials to pierce the oil-bearing nds, and as a consequence the crude oil issuing from a ell contains more or less sand. If the crude oil is used rectly as a boiler fuel, it must be strained; otherwise the rticles of sand will clog the burners and render them ratic in their operation. The heavier and more viscous e oil, the more easily will it hold and carry with it partiles of sand and dirt.

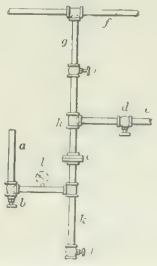
A common method of separating dirt held in suspension in liquids of smaller specific gravity is that of sedimentation or settling. Thus, if oil fuel containing dirt is run into storage reservoirs or settling tanks and there allowed to remain undisturbed for some time, much of the heavier sediment will fall to the bottom by reason of its own greater density. The cleaned oil may then be drawn off at the top. However, this method involves storage of the oil for a time, with the consequent expense of tanks and pumping machinery; moreover, if the oil is very heavy and viscous, it is by no means certain that the settling method will result in thorough cleaning. It is therefore a wise precaution to use strainers in the piping system that conveys the oil to the burners.

Even the heat treatment or partial distillation that results in the formation of fuel oil cannot be relied on to produce a clean oil; so, where fuel oil is used, strainers should be installed. They not only prevent clogging, but they also lessen the wear on the burner tips due to the erosive effect of grit.

The material of which the strainer is made may be wire netting, gauze or perforated metal. In any case, the meshes or openings should be only about half as wide as the smallest passage or orifice in the burner. Brass wire gauze is the material commonly used, although good strong mosquito netting may be bent into shape to form a strainer. On account of the comparatively large openings in mosquito netting, it should be used only in connection with burners that have no minute orifices, as, for example, the Best burner.

The simplest form of strainer, shown in Fig. 1, consists of a circular piece of wire gauze *a* held between a pair of pipe flanges *b* and *c;* but the simplicity and cheapness of this form are its only commendable features. The oil flowing from the pipe *d* to the pipe *e* on its way to the burners will deposit the sand and dirt on the gauze, and sooner or later the latter will become choked, because it has so small an area. In this condition it will seriously obstruct the flow of oil; therefore, a strainer of this kind



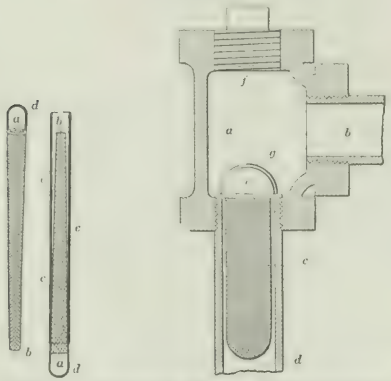




FIGS. 1 AND 2—SINGLE OIL STRAINER AND PIPE CONNECTIONS FOR STRAINER

would have to be cleaned frequently. Each cleaning would necessitate opening up the joint at the flanges, so that the gauze could be taken out, and before this could be done it would be necessary to shut off the flow of oil. This type of strainer, therefore, is to be avoided in the simple form shown.

The arrangement of piping shown in Fig. 2 does away

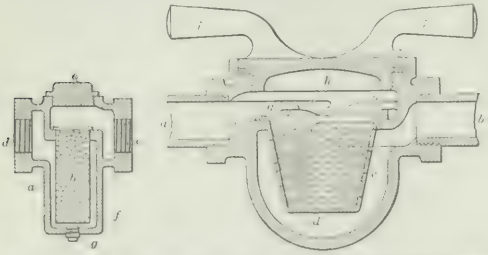
with the objectionable feature of breaking the joint to clean the strainer. The oil from the pump flows through the pipe *a* and the valve *b* and passes upward through the wire gauze held between the flanges at *c*, continuing on its way to the burners through the valve *d* and the pipe *e*. The steam line *f* to the burners has a branch *g* that is joined by the tee *h* to the oil line and is fitted with a valve *i*.



FIGS. 3 AND 4—WIRE-GAUZE STRAINER AND T FITTING USED FOR STRAINER

Below the strainer the oil pipe is extended and fitted with a valve *j*. When the burners are working, the valves *i* and *j* are closed and the valves *b* and *d* are open. When the strainer becomes clogged and requires cleaning, the valves *b* and *d* are closed and a bucket is placed under the valve *j*, which is then opened. Finally, the valve *i* is slowly opened, admitting live steam above the strainer, and this steam, rushing downward through the gauze, will clean it and blow out all the dirt collected beneath it. The valves are then set again for normal working. The valve *i* must be tight or condensed steam will leak into the oil and cause the burners to sputter. The nipples should be fairly long, to form a trap for water and dirt. A pressure gage, shown dotted at *l*, may be attached to the oil pipe on the pump side of the strainer. An abnormal rise of pressure shown on it will indicate that the strainer is clogged and in need of cleaning.

The requirements of a good oil strainer are that it shall stop and hold the solid foreign matter entrained with the oil; that it shall have ample straining surface, so that cleaning may not be required too frequently, and that it shall be constructed and installed so that the cleaning may be quickly and easily done.



FIGS. 5 AND 6—PERFORATED METAL OIL STRAINER AND BASKET STRAINER FOR RAPID WORK

The strainer shown in Fig. 3 is made of wire gauze bent into the form of a conical frustum, with the large end *a* open and the small end *b* closed. This form is inserted in the open end of the suction pipe *c* leading to the oil pump and provides a large area through which the oil may pass on its way to the pump. An advantage of having the strainer at this point is that it removes much of the grit that would otherwise cause wear of the pump barrel and plunger. The large end *a* is made slightly larger than the diameter of the suction pipe. The strainer is simply pressed into place in the pipe and is held there by friction and by the suction effect of the pump. A bail or loop *d* is fastened to the large end so that the strainer may easily be withdrawn when it must be cleaned. The tapering form allows ample space around the strainer, as at *e*, for the oil after it has passed through the gauze.

A T fitting may be used to form a simple and inexpensive strainer, as shown in Fig. 4. The fitting *a* is inserted at a right-angled turn in the oil piping, and the oil, entering through the pipe *b*, passes through the strainer *c* and flows away through the pipe *d*. The strainer is cylindrical in shape and hangs in the pipe *d*, being supported by a ring *e* that rests on the upper end of the pipe. When the strainer requires cleaning, the plug *f* is removed and the strainer is lifted out by the bail *g*.

The type of strainer shown in Fig. 5 consists of a special casting *a* that is installed in the oil line and that contains the perforated metal cylinder *b* by which the actual straining is done. The oil enters at *c* and flows out at *d*. The cylinder *b* may easily be removed after the plug *e* is unscrewed; but, as in the case of the strainers previously shown, the flow of oil must be shut off during the cleaning operation. In order to reduce the period of stoppage to a minimum, it is advisable to have more than one perforated cylinder, so that a clean one can be inserted as soon as the dirty one is removed. Any dirt that passes through the strainer and settles in the bottom of the chamber *f* may be taken out through the hole closed by the plug *g*.

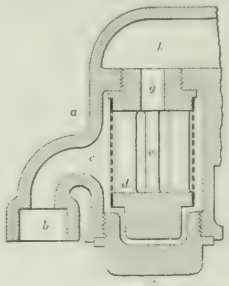


FIG. 7—KOERTING TYPE OF OIL STRAINER

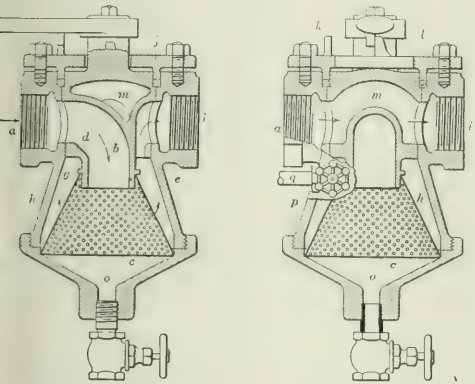
Rapidity in cleaning is the chief feature of the basket strainer shown in Fig. 6. The device is installed in a horizontal section of the oil-pipe line, and the oil flows through from *a* to *b*, being thus forced to pass through the strainer *c*, which consists of a metal basket closed at the bottom, perforated on the sides with large holes, and lined with closely fitting wire gauze *d*. The gauze does the straining and the metal basket simply holds the gauze and prevents it from being torn. If the gauze were not supported and it became clogged, the resistance it would offer to the passage of the oil might cause it to be torn. The basket has a rim that rests on the seat *e* and the inclined ribs *f* on the rim are locked firmly under the lugs *g* by giving the basket a part of a turn. The screw-down cover *h* has a pair of handles *i* by which it may be unscrewed quickly and lifted off, after which the basket is given a twist to unlock it and is then removed. Packing under the flange of the cover prevents leakage of oil.

Sometimes the strainer is located in the same casting with the burner, as in the Koerting type, shown in Fig. 7. The casting *a*, of which only a part is shown, contains a pair of burners, each of which is supplied with oil from a

il inlet *b* through a perforated metal strainer *c*. The trainer is cylindrical and fits snugly over a cylindrical hol- ow cage *d* that has several long slots *e* in the sides. The age is screwed into the casting *a*, being inserted through ie opening made by removing the plug *f*. The oil from ie inlet *b* surrounds the strainer, passes through it and the lots to the interior of the cage, and then flows through the pening *g* to the chamber *h*, which leads to the burner. As ach strainer serves its own burner and the two are sepa- ate, it is possible to shut down one burner and remove its trainer without affecting the operation of the other burner. )n restarting after inserting a clean strainer, the burner iat remained working will ignite the fresh spray of fuel rom the other burner. This arrangement enables the trainers to be cleaned without completely interrupting the peration of the burners.

Of course, the same object could be accomplished by in- talling a pair of strainers of any type, with the valves and iping so arranged that while one was out of service for leaning or repair, the oil could be sent through the other.

A special type of strainer is illustrated in Figs. 8 and 9, vhich show two different positions of the same device. 'orresponding parts in both views are therefore marked ith the same reference letters. The important feature of iis strainer is that it can be cleaned without taking it



FIGS. 8 AND 9—TWO VIEWS OF STRAINER ARRANGED FOR CLEANING WITHOUT REMOVAL

part and without interrupting the flow of oil. Fig. 8 ows a section of the strainer in its normal working posi- on. The oil flows in at *a* and is directed downward by ie curved passage *b* into the interior of the conical per- rated strainer *c*. The passage *b* is formed in a tapering ug *d* that fits closely in the body *e* of the device, and this ug may be rotated by means of the handle *f*. The rainer *c* is held down firmly by the collar *g* on the lower id of the plug. The oil, after passing through the cone to the surrounding chamber *h*, flows upward and out at *i*. he plug is held in place by the pressure of the plate *j* olted to the body *e*, and packing is inserted at the joint to revent leakage of oil. The handle *f* has on its under side lug that comes against one or the other of the lugs *k* and set 90 deg. apart on the plate *j*. These limit the rotation f the handle, and consequently of the plug, to a quarter- rn.

When the strainer becomes so dirty as to require clean- g, the handle *f* is given a quarter-turn, which brings the ug into the position shown in Fig. 9. There is a second assage *m* at right angles to the passage *b*, and when the ug is turned the oil flows directly from the inlet to the itlet, without passing through the strainer. Next, the ow-out valve *n* at the bottom of the chamber *o* is opened, after a bucket is set under it. Then the valve *p* is opened, admitting live steam to the chamber *h* from the supply pipe *q*. The steam rushes through the cone in a direction opposite to that in which the oil flows and loosens the dirt, which falls to the bottom of the chamber *o*. It is then blown out through the valve. By the use of this strainer there is no interruption of the oil supply and unstrained oil is sent to the burners only during the brief time required to blow out the dirt. The handle *f* is then swung back to its first position and the strainer resumes its normal working.

## Plant Extensions at Amesbury, Mass.

The Amesbury (Mass.) Electric Light Company has recently acquired rights in connection with the supply of electricity to a considerable summer population in the Salisbury Beach district and has purchased and enlarged the existing distribution system in that locality, which was formerly operated by several associates controlling an old steam plant. Negotiations have been under way for the sale of electricity to the municipal lighting plant in the town of Merrimac and the shutting down of the latter, and in the company's immediate territory many contracts have been secured for lighting and power service. The company is increasing the capacity of its generating plant by the addition of a 1000-kw steam-turbine unit with the necessary boiler capacity, condensing equipment and auxiliary apparatus. The estimated cost of the new work, based on bids received and previous experience in the enlargement of the plant, is as follows:

ESTIMATED COST OF ENLARGING STATION AT AMESBURY, MASS., 1913, BY 1000 KW

| | |
|---|---|
| Extension of power plant building | $9,122 |
| Kellogg radial brick stack: height, 150 ft.; diameter at top, 6 ft. | 3,585 |
| Stack foundation | 840 |
| Piling, excavation, etc. | 400 |
| Turbine foundation, 10 ft. x 20 ft. x 14 ft. | 1,200 |
| Boiler foundation, 19 ft. x 26 ft. x 11 ft. | 1,300 |
| Excavation for suction piping, 2000 cu. yd. at 50 cents | 1,000 |
| Two 400-hp water-tube boilers, Babcock & Wilcox | 9,781 |
| Brickwork | 1,500 |
| Two superheaters | 2,214 |
| Two Taylor stokers | 6,150 |
| Boiler flue | 800 |
| Coal-handling cars and track | 1,200 |
| One 1000-kw horizontal Curtis turbine, 60 cycles, 2300 volts | 13,200 |
| One Westinghouse Le Blanc No. 8 condenser, capacity 20,500 lb. steam per hour, 28 in. vacuum turbo pumps, 70 deg. water | 3,225 |
| Piping | 3,000 |
| Feed pumps, heater, etc. | 800 |
| Pipe covering | 1,000 |
| Turbo-alternator switchboard | 500 |
| Erecting and wiring board and turbine | 500 |
| Incidentals, 10 per cent | 6,132 |
| Total | $67,449 |

The municipal generating plant at Merrimac is located in the town pumping station, but the installation will probably be shut down soon in view of the lower cost of central-station service.

## Supporting Vertical Feeders

In supporting vertical feeders on interior construction what distance between feeder supports is accepted as good practice? M. E. T.

Conductors in vertical conduit risers must be supported within the conduit system in accordance with the following rules, taken from the National Electrical Code: Nos. 14 to 0, every 100 ft.; Nos. 00 to 0000, every 80 ft.; No. 0000 to 350,000-circ. mil, every 60 ft.; 350,000-circ. mil to 500,000-circ. mil, every 50 ft.; 500,000-circ. mil to 750,000-circ. mil, every 40 ft.; 750,000-circ. mil, every 35 ft.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*Mercury-Arc Rectifier.*—HARRY F. PERKINS.—A fully illustrated article on a recent form of iron tube which is used in place of glass in the development of the rectifier for high power, and which has been reduced by the General Electric Company to an extremely simple and stable state. A rectifier of the three-phase, three-arm type is shown in Fig. 1, and the wiring connections in Fig. 2. A bank of three delta-connected standard transformers step the line potential of 2200 volts, 60 cycles, down to 236 volts, which is applied to compensators connected in Y to give a neutral point, which is the negative side of the direct-current circuit. The compensators also allow of voltage variation by means of taps. Close voltage regulation may be obtained by varying the tap connection one phase at a time. The slight unbalancing of phases thus produced does not affect the rectifier in the least. Each battery being charged has a standard charging rheostat in series which gives the desired individual control. This gives to the rectifier all the regulation qualities of a direct-current generator, without the rheostat losses. Very fine regulation can be obtained by using a standard induction regulator. A comparison is made between the efficiency of a motor-generator set and a rectifier. The latter maintains its efficiency at all loads and is free from loss when no current is taken. With rectifiers for higher voltages an efficiency of 97 per cent can be obtained. A set of oscillographs is given showing the wave-forms of the original and the rectified emfs and currents. The method of starting the rectifier is discussed, together with the necessity of ionization for starting. In the case of rectifiers supplying variable loads where the current may be off for short periods, as, for instance, when carrying a railway load, the carrying-over of the arc is accomplished by supplying the starting anode from a separate direct-current source, or by inserting two small auxiliary anodes which can form part of a separate rectifier circuit supplied by an additional coil from the main transformer, or by a separate small transformer. This auxiliary rectifier can be designed to consume a minimum current at low voltage and can thus be made self-sustaining with but small loss. In rectifiers carrying a steady load this carrying-over can be done to best advantage by placing in the direct-current circuit an air-gap reactance.

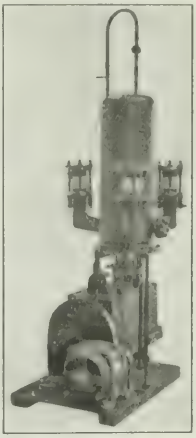
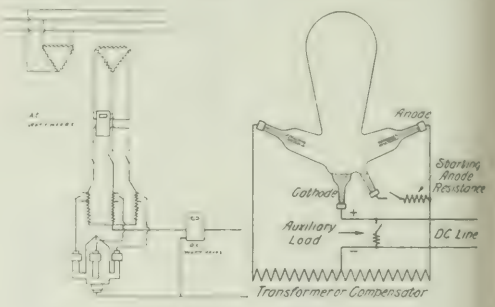


FIG. 1—THREE-PHASE THREE-ARM TYPE OF RECTIFIER

The main arc flows in one direction only when the cathode is excited and when the potential at the anode is positive with respect to the cathode, but no current will flow without excitation until a potential is reached that will cause a Geissler discharge, for the vacuum in these tubes is of a very high degree and it ordinarily would take several thousand volts to cause a discharge without a cathode spot. This is one reason why the current does not flow in both directions. Upon examination of the diagram (Fig. 3) it will be seen that current flows only in one-half of the transformer winding at a time, and the potential of the direct-current load is that of one-half of the average, not the effective (square root of the mean square) transformer voltage, minus the arc drop. As the




FIGS. 2 AND 3—DIAGRAMS OF CONNECTIONS

cathode is only separated from the working anode by the arc drop, we have practically all the potential of the transformer applied between the cathode and the idle anode, which is now negative with respect to the cathode. Many hundreds of these tubes are now in commercial service on circuits carrying over 10,000 volts. A particular application is found in their use for charging electric automobiles.—*Metall. and Chem. Eng'ing.* September, 1913.

*Electrolytic Iron Sheets for Dynamo-Electric Machinery.*—E. von Mauthner criticises the article of M. Breslauer (recently abstracted in the *Digest*) in which the use of pure electrolytic iron was claimed to be very promising for the construction of dynamo-electric machinery and transformers. Breslauer replies to this criticism.—*Elek. Zeit.* Aug. 14, 1913.

### Lamps and Lighting

*Deposit Upon the Poles of Metallic Arcs.*—W. G. DUFFIELD.—An account of experiments with copper arcs, iron arcs, silver arcs, etc., concerning the peculiar tree-like growth which sometimes appears on one or the other electrode. For instance, in experiments with the copper arcs under favorable conditions of current strength and arc length, delicate tree-like structures rapidly grew from the negative pole in the direction of the anode, eventually bridging the gap and possibly assisting in the passage of the current. From the experiments made with arcs of different metals and under different conditions the author summarizes the outstanding features of these metallic growths as follows: their preference for the cathode, their formation upon a third electrode if it is of a potential sufficiently high and especially if it be negatively charged, their preference for a pointed electrode, their derivation from the material of either the anode or cathode, but chiefly from the latter in their organic form—tree-like, etc.—which is different for different metals, the rapidity of their development as the approach the anode and when an outburst of vapor occurs. The origin of these peculiar growths is discussed at co

iderable length by the author.—*Philos. Magazine,* August, 913.

*Automobile Lighting.*—JOSEF LOEWY.—An illustrated escription of various systems of electric automobile light-ng.—*Elek. u. Masch* (Vienna), July 27, 1913.

*Railway Station Lighting.*—Illustrated notes on modern ailway station lighting in Germany, with special reference o the use of metallic-filament lamps.—London *Electrician,* ug. 15, 1913.

### Generation, Transmission and Distribution

*Electric Power in Coal Mines.*—S. F. SOPWITH.—A aper in abstract read before the South Staffordshire and Varwickshire Institute of Mining Engineers on the elec-rification of the Cannock Chase colliery. The generating lant consists of three direct-coupled steam alternators, two eing of 200-kw and one of 500-kw capacity. Three-phase urrents are generated at 3000 volts and 50 cycles. The otal cost of power station and transmission lines is 106,000. The total number of kilowatt-hours produced uring the first half year was 337,000 and the total cost er kilowatt-hour was 1.974 cents. The advantages de-ived from the adoption of electricity are summarized as ollows: (1) The colliery consumption has been reduced y at least 1¼ per cent, say 6875 tons. (2) Some twenty-ve horses have been dispensed with underground. (3) A reat reduction in labor has resulted from the substitution f mechanical for horse haulage. (4) The Lancashire oilers no longer required (owing to the conversion of team to electric power) are being utilized at other pits to upersede old egg-ended boilers, thereby reducing labor nd consumption. (5) The energy is available under-round for further extensions in the way of auxiliary aulage, coal cutting, etc., and for lighting up important tations, which, if not actually economical, is more con-enient and safer. The actual total annual saving repre-ents about 18½ per cent interest on the capital outlay.—ondon *Electrician,* Aug. 8, 1913.

*Upper Silesia.*—BÜGGELN.—An account of a recent ex-ursion of a party of electrical engineers through the indus-rial district of Upper Silesia in Germany. Notes are given n the use of electric winding in mines, electric operation of olling mills, and on the Chorzow and Zaborse power sta-ions of the Upper Silesia electricity works. They generate hree-phase currents at 6000 volts which are transmitted in nderground cables. For the low-tension networks over-ead wires are used. The generating capacity of the two ations is 57,600 kw. The connections have increased from 1,649 kw in 1911 to 45,455 kw in 1912; the kilowatt-hours old have increased from 100,081 to 126,240. The extended se of reinforced concrete is mentioned.—*Elek. Zeit.,* Aug. 1913.

### Traction

*Stray Currents from Railroads.*—JOHANNES RAUTEN-RANTZ.—An illustrated article on the problem of stray cur-nts from railroads and the German regulations concerning em. The author describes the methods of Haber for easuring the voltages in the earth and the density of earth rrents, Hering's method of measuring the current in e pipes, methods of measuring the resistance of the track id of the rail joints, and finally discusses means for avoid-g damage due to earth currents.—*Elec. u. Masch.* Vienna), Aug. 10, 1913.

### Installations, Systems and Appliances

*Holland.*—J. A. SCHONTEN.—A map showing the location the central stations in Holland. The most important ansmission systems are Bloemendaal (763,000 kw-hr. sold 1911), Leiden (1,471,000 kw-hr.), Staatsminen (6,378,-00 kw-hr.) and Hengelo-Enschede (2,800,000 kw-hr.). he largest electric railway is the line from Rotterdam to he Hague and Scheveningen, which has its own power lant.—*Elek. Zeit.,* Aug. 7, 1913.

*Electric Heating.*—H. O. SWOBODA.—The concluding article of his serial on efficiency and cost of electric heating. A long table is given stating the rating of various commercial electric-heating devices.—*Elec. Journal,* July, 1913.

### Wires, Wiring and Conduits

*Calculation of Lines.*—A. BLONDEL.—An article illustrated by numerous diagrams on the rapid calculation of overhead lines from a mechanical viewpoint. The author gives a résumé of the graphical methods which have been developed by him formerly and of the principles which have more recently led him to the development of the "logarithmic diagram." He finally makes some remarks on the method of Semenza. The article is to be concluded. —*La Lumière Elec.,* Aug. 9, 1913.

### Electrophysics and Magnetism

*Delta Rays.*—H. A. BUMSTEAD.—An account of an experimental investigation. When aplha rays fall upon a metal electrons are emitted with velocities varying continuously from a very small value to more than $2.7 \times 10^9$ cm per second, which corresponds to a potential difference of 2000 volts. It is proposed to include under the name "delta rays" all the electrons which owe their origin to the direct action of the alpha rays—the swifter ones as well as the slower ones previously known. Evidence is given for the view that, in addition to the delta rays, positive ions are also produced when alpha rays impinge upon a metal in a very high vacuum. These ions appear to come from the layer of absorbed gas upon the metal. By maintaining the vacuum for several days the current carried by these ions may be reduced to a small value—from 5 to 10 per cent of that carried by the alpha rays themselves. The present experiments do not determine whether or not these ions leave the plate with an appreciable velocity in the absence of an electric field, but there is some evidence that the velocity is, at all events, small. When the swifter delta rays fall upon a solid it emits electrons of slow speed which, in the present paper, are referred to as tertiary electrons. Their number is considerably greater than the delta rays which produce them. The existence of the tertiary electrons makes it difficult to determine with accuracy the distribution in velocity of the delta rays. A large number of tertiary electrons come from the source of delta rays itself, and their presence in the beam of delta rays makes it impossible to draw valid conclusions as to the true number of delta electrons of slow speed (less than 10 or 20 volts). The distribution in velocity of the delta rays between 20 and 1200 volts has been determined. —*Philos. Magazine,* August, 1913.

### Electrochemistry and Batteries

*Carborundum Refractories.*—F. J. TONE.—An article pointing out that carborundum is a material unique among refractories owing to the following distinguishing physical properties: High softening or decomposition point, high thermal conductvity, low coefficient of expansion, hardness of mechanical strength, resistance to acids and other chemical agents, comparatively low density. Carborundum refractories are now available in two different forms, one containing a vitrified or ceramic binder, the other consisting entirely of carborundum. The latter type is absolutely unattacked by acids and is inert to the influence of practically all other chemical agents. It is, however, extremely expensive to produce, and its use is limited to those places where the ordinary brand of carborundum refractory is not suitable. The vitrified carborundum refractory has, owing to its lower cost of production, a much wider application to the refractory industry. It consists of suitably chosen carborundum grains bonded with a special form of refractory clay, mixtures of grits and methods of molding being employed to insure a very dense body of low porosity.—*Metall. and Chem. Eng'ing,* September, 1913.

### Units, Measurements, and Instruments

*Testing Cable Networks.*—B. Andran.—In an article on exhibits at the recent annual exhibition of the French Physical Society mention is made of the difficulty of testing a cable network, since double the normal voltage is required for these tests. If alternating current is used for testing, the transformer giving double the normal voltage must have a rather high capacity in order to charge at each alteration the condenser formed by the cable. Delon and Picou have described methods of testing based on the use of direct current which are more convenient. On the other hand, André Leaute has devised a rather simple method in which alternating current is used. If a circuit (Fig. 4) comprises a self-induction $L$ with resistance $R$ and a capac-

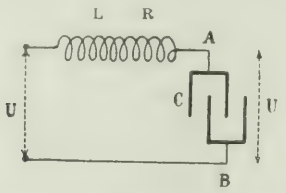



Fig. 4—Circuit for testing cable networks

ity $C$ and if an emf $U$ is impressed on the circuit, then the emf $U_1$ between the terminals $A$ and $B$ of the condenser $C$ will increase with increasing inductance $L$ and will become a maximum if $(2\pi n)^2LC=1$ and this maximum of $U_1$ will be $2\pi n\ LU/R$. If $2\pi n\ L/R$ is made equal to 2 or greater than 2, this method (condition of resonance) gives the desired voltage for testing. The two conductors of the cable under test, or each of them and the armature, form a condenser, and if between the conductor and the source of testing current a self-induction cord of correct dimensions is inserted, the desired testing voltage is obtained in the cable. The advantages accruing from the utilization of this method are discussed at considerable length.—*La Lumière Elec.*, July 26, 1913.

*Watt-Hour Meters.*—T. T. Fitch.—An abstract of a paper from the Bureau of Standards. This paper gives the results of numerous tests on six makes of American direct-current watt-hour meters. The discussion is given under three headings: performance data; details of construction; effect of friction losses. With respect to performance data, the load curve is shown to be a curve which when the ordinary adjustment of the meter is correct at 10 per cent and full load results in the meter being fast between 10 per cent and full load and slow at overloads. The meters showed a variation of from 1 to 8 per cent for a variation of voltage from 84 to 116 per cent of the normal. For three-wire meters the two current elements were found to differ from equality by from 0.4 to 4 per cent. The range of starting-coil adjustment at 10 per cent load varied from 4 to 22 per cent in rate of the meter for different makers. The range of the magnet adjustment varied from 35 to 155 per cent in change of the meter rate for the different makers. The meters were affected by short-circuit on 220 volts, as shown by changes in the rate of from 0 to 34 per cent. The back emf in the commutator meters at full load ranged from 0.07 to 0.19 volt and was about — 0.1 per cent per deg. C., except for one meter which gave 0.25 per cent. The friction torques due to the bearings, the brushes, the gearing and the air were measured. The friction torques, with the exception of the air friction torque, are curvilinear functions of the speed. Finally the load curve of the commutator meter is analyzed and its curvature shown to depend on the back emf, the variation in the friction torque and the change in rate caused by heating of the series coils. The discussion has not been extended to the mercury-type meter in such a complete form as is the case with other types.—*Journal Franklin Inst.*, August, 1913.

*Instrument Exhibition.*—B. Andran.—The conclusion of his illustrated description of exhibits at the recent exhibition of the French Physical Society. The Soulier rectifier, methods of testing networks, wireless telegraph apparatus and the high-speed Pollag-Virag printing telegraph are dealt with.—*La Lumière Elec.*, July 26, 1913.

### Telegraphy, Telephony and Signals

*Submarine Telephone Cables.*—Béla Gati.—In the Thompson system of telephone-line construction with induction coils in shunt the induction coils are made of a high ohmic resistance. In contradistinction to this the author investigates a cable with induction coils in shunt if the resistance is comparatively low and compares this system with the Pupin system of induction coils in series and the Krarup system of continuous loading.—*La Lumière Elec.*, July 26, 1913.

### Miscellaneous

*Exhibition.*—Max Gruhn.—An illustrated article on electric exhibits at the International Architects' Exhibition in Leipzig, with special reference to lighting.—*Elek. Zeit.*, Aug. 14, 1913.

# Book Review

Practical Alternating Currents and Alternating-Current Testing. By Charles F. Smith. Fifth edition. Manchester, England: The Scientific Publishing Company. 398 pages, 258 illus. and tables. Price, 6 shillings.

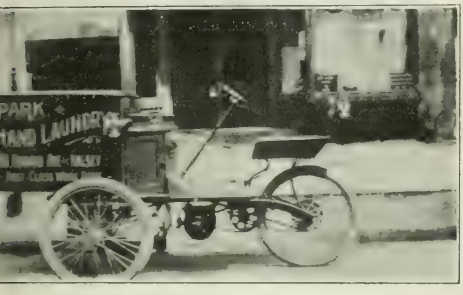
Apart from the fact that the method of presentation renders this book of special interest to students and others engaged in laboratory or testing work, it is eminently a textbook dealing with the principles of alternating-current working. The language is simple and precise; higher mathematics has been avoided, and the opening chapters render the attainment of the more difficult subjects gradual and progressive. The ground covered includes general principles and the proper understanding of reactance, impedance, power-factor and capacity. Then follow transformers, alternators and synchronous motors, rotary converters and induction motors, both polyphase and single-phase. The sine-wave assumption is, of course, made, and vector diagrams are used freely. A short chapter is devoted to the consideration of the root-mean-square, or virtual, value of an alternating quantity, and the relation between this value and the power in the circuit is discussed. The effects produced by waves differing appreciably from the sinusoïdal form are, however, not considered in much detail, even in the chapter on capacity. It is not here suggested that the difficult question, "What is an equivalent sine wave?" should be completely answered in a treatise of this kind, but perhaps the reader might have been guided a little farther in this direction. The existence of Chapter XIII (the last), treating solely of the composition of voltage waves, has not been overlooked; but this does little more than explain the action of the oscillograph and some of the processes by which waves can be analyzed into their component parts. There is a beauty and fascination about harmonic analysis which may well outweigh its tediousness; but in these days of economy of time, and quick returns, one is tempted to ask whether the ends attained by harmonic analysis are worth attaining. If the main object is to arrive at the root-mean-square (effective) value of a complex wave, as Mr. Smith would seem to indicate by the conclusion of the chapter under discussion, then it cannot be denied that the end does not justify the means. The author is to be congratulated on the appearance of this fifth edition of one of the best books treating of alternating currents.

# New Apparatus and Appliances

**An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers**

## Battery-Driven Three-Wheeled Vehicle

The battery-driven three-wheeled vehicle which is shown ewith has been in operation collecting and delivering a laundry in Brooklyn, N. Y., for a period of six nths. When loaded to its capacity (200 lb.) a speed of niles an hour can be maintained. The distance which

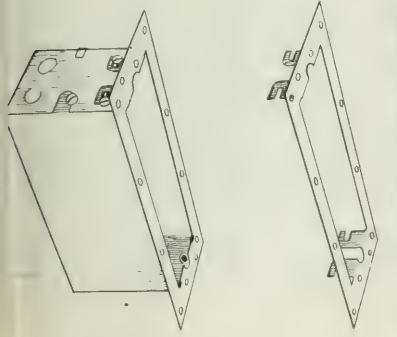


BATTERY-DRIVEN THREE-WHEELED VEHICLE

vehicle has been able to make on one charge while ployed in the laundry business has averaged between 25 es and 30 miles. All charging was done by means of a rcury-arc rectifier, and it is stated by the maker that with s apparatus the cost of one charge was estimated to be ut 16 cents with the energy costing 6 cents per kw-hr. O. E. Huebner, who designed and built the vehicle, has ired that the total running cost per mile is about 4 cents.

## Supporting Plate for Switch-Box Installation

n article of interest to electrical contractors has been ught out by the Flush Plate & Appliance Company, Inc., Binghamton, N. Y., in the shape of a supporting switch-



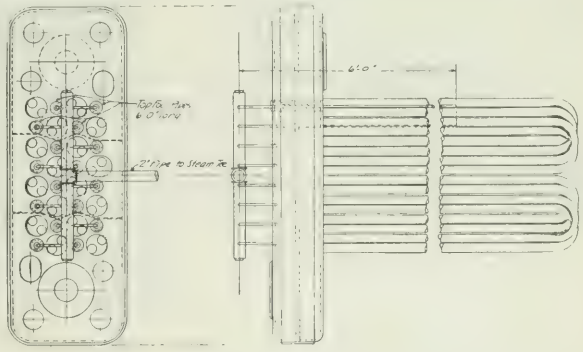
SUPPORTING SWITCH-BOX PLATE

o plate, a sketch of which is here shown. This plate is ta ped from 18-gage galvanized sheet iron (14-gage in h larger sizes for gang boxes) and is designed to serve as a flexible support for the installation of the switch box. Flexibility in only one direction is desired—namely, laterally—and this is gained by means of the slotted lugs near each end of the plate. No up-and-down or in-and-out movement of the box is possible when attached to the plate, and these motions are not ordinarily desired. The plate is tacked or screwed to the lath or furring strips on the wall and forms a substantial support on all sides of the box face, besides offering a ready gage for the plastering around the same, with which it is flush. The brass or nickel-plated switch plate rests on this supporting plate and is fastened to it through the four corner holes.

Plates of similar design are made for gang boxes, but only on order, the stock carried being simply of the standard single-box type. These plates have been approved by the Department of Water Supply, Gas & Electricity of New York City, the New York Board of Fire Underwriters and the National Board of Fire Underwriters. They are marketed ten plates to the box and ten boxes to the standard package.

## Steam Soot Blower for Superheaters

Soot on superheater tubes interposes additional resistance to heat conduction and its removal increases the efficiency of the superheating system. A mechanical soot blower applied to a superheater manufactured by the Heine Safety Boiler Company, St. Louis, Mo., for the purpose of periodically freeing tubes from soot is shown in the accompanying diagram. Steam nozzles are inserted through hollow stay-bolts used in the construction of the headers and are arranged to discharge steam at high velocity over the tubes. One group of tubes at the top of the superheater may be seen extending nearly to the extreme end of the tubes, while the remaining steam nozzles extend only a short distance within the hollow stay-bolts. The nozzles are all connected by suitable piping and a manifold.

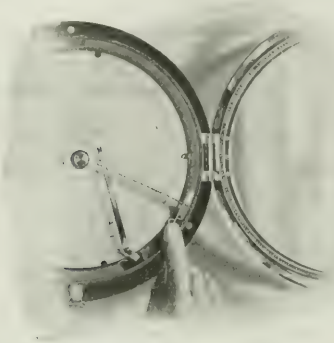


STEAM SOOT BLOWER FOR SUPERHEATERS

It is stated that tests have demonstrated that it is possible to effect a saving of from 5 per cent to 10 per cent of the fuel by blowing the soot from the superheater tubes.

## Pen Lifter for Recording Instruments

The Industrial Instrument Company, of Foxboro, Mass., has just perfected a new attachment for its recorders. This attachment is called an automatic release pen lifter and can be attached to any Foxboro improved recorders. The device consists of a german-silver strip mounted on a special holder, which is inserted under the screw head which

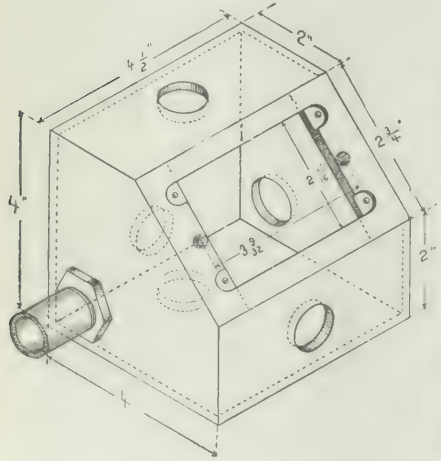


PEN LIFTER FOR RECORDING INSTRUMENTS

holds the chart disk. A slight pressure on a small lever brings the strip up against the pen arm and lifts the pen from the chart. Friction holds it in the raised position, thus giving the operator free use of both hands for removing the used chart and supplying a new one. When the door is closed the pen arm is automatically released and the pen returns to its marking position on the chart. This automatic feature makes it impossible for the operator to forget and leave the instrument out of commission.

## Receptacle of Junction Box for Location at 90-Deg. Angles

The metal junction box shown in the accompanying illustration is intended for use at intersections of walls and



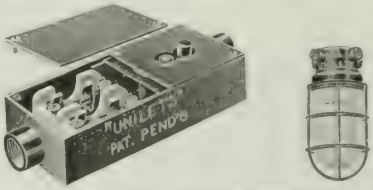

METAL JUNCTION BOX

floors. When used as a junction only a blank flush steel plate is used instead of the flush switch or receptacle plate. The steel plate has four lugs with machine screws which rest in the four depressions shown in the face of the box

The right-hand and left-hand sides of the box are of sufficient area to allow drilling for conduits as large as 2 in. in diameter if desired. Vertical or lateral conduits up to 1 in. in diameter may be applied at the top and front surfaces. The device may be furnished in black enamel or galvanized to match attendant piping. These boxes are made in single sizes only and are drilled to order by their maker, the Fancleve Specialty Company, Boston, Mass.

## Conduit Fittings

The two conduit fittings which are illustrated herewith are manufactured by the Appleton Electric Company, of Chicago, Ill. Fig. 1 shows a combination cut-out and dou-

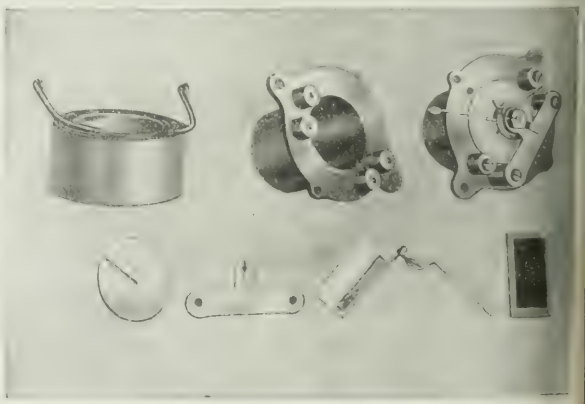



FIGS. 1 AND 2—CONDUIT FITTINGS

ble-throw push-button switch which has been designed for operation on 250-volt circuits. It is claimed that this device is particularly adapted for use on machines which are operated by individual motors. In Fig. 2 is shown a so-called "vapor-proof unilet," which is said to be of value where it is necessary to install lamps out of doors or in places where they will be subject to dampness.

## Combination Ammeter and Voltmeter

A combination ammeter and voltmeter which will operate on either alternating current or direct current has been recently put on the market by the Kermel Apparatus Company, Cambridge, Mass. The instrument is provided with a single moving element which is acted upon independently by shunt and series coils. Separate scales are placed upon the face of the instrument for reading amperes and volts, and in some of the instruments two ranges of voltage and



INSTRUMENT PARTS DISASSEMBLED

one for current are provided. This arrangement makes the one meter available for use as six separate instruments. The total weight of the meter is 3.5 lb., and the inclosing walnut case is 6 in. wide by 6 in. long by 3 in. deep.

## Electric Water Sterilizer

An electric water sterilizer which has been patented by Electric Water Sterilizing Company, of Scottdale, Pa., composed of three principal parts—an electrode box, a agulation chamber and two filter cylinders. The general rangement of the apparatus is shown in the accompany- illustration. The electrode box consists of a series of re-iron plates, separated by marginal insulating gaskets. rough each of these plates, inside of the gaskets, and at ernating ends of the successive plates, is a series of es. The water is passed successively between the sev- l plates and over the entire plate surface. Electrical nnections are so arranged that this entire series of water ns is in the circuit at the same time, the voltage between tes being regulated by the number of plates in a series. e current consumed for a plate 10 in. by 10 in. square h city water, treated at a rate of about 400 gal. an hour, only 0.5 amp at 110 volts.

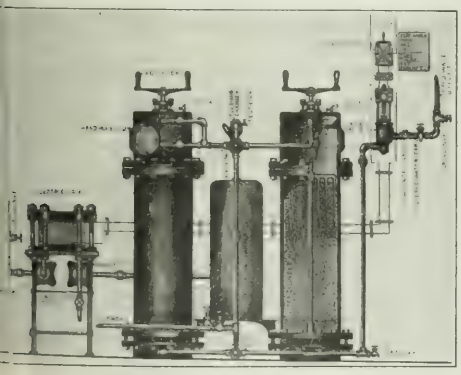
After leaving the electrode box the water passes into the agulation chamber, where the heavier filth and dirt set- s to the bottom, thus preventing the too frequent filling of the filter beds.

From the coagulation chamber the water passes through upper part of a four-way valve to the first filter cylin- , down through the filter bed, up through a three-way ve, into the lower section of a four-way valve, and from re flows into the second filter cylinder. The effluent m the second filter bed flows up to a contact valve, ich opens, allowing the water to pass, at the same time king an electrical contact directly from the switch on wall to the electrode box.

The filter cylinder is arranged so that the flocculent coag- nt can pass in on top of the filter bed without being ken up by a strainer of any sort used to retain the rtz when flushing. The upper outlet is above a strainer l when the machine is being flushed the inlet check closes l the water flushing the machine passes upward through auze strainer, which is supported between the inlet and let pipe in the head cylinder. It is impossible to treat ter in this type of apparatus with alternating current, in places where alternating current only is available a verting device is employed.

This direct-current sterilizing machine, it is claimed, will move color from the water, destroying and removing all etable matter and pathogenic germs, and will leave the er bright, pure and sparkling.

By the double-throw, double-pole hand switch on the



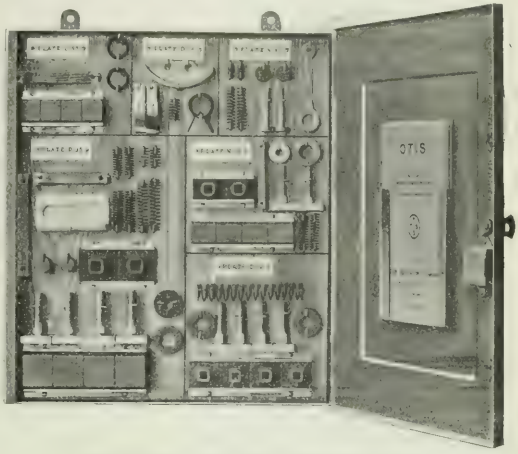
ELECTRIC WATER STERILIZER

ra the energy supplied to the machine is reversed in olarity every day. This reversal cleans the plates auto- matically and the debris can be flushed into the sewer by reverse on the electrode box.

## Elevator Controller Parts Cabinets

In order to facilitate repair service in the event of breakdowns on elevator controllers a useful device known as a controller parts cabinet has been designed for the convenience of engineers and all who are responsible for elevator maintenance.

This equipment consists of a compact steel box which




CABINET FOR ELEVATOR CONTROLLER PARTS

contains the essential parts of the type of controller furnished with the elevator machine installed. By hanging it in the engine room, the engineer may, on short notice, replace a worn part of the controller and, by referring to the catalog on the inside of the cabinet cover, order immediately a new part to replace the part removed, keeping the cabinet complete for repair work at all times.

At present these cabinets are being manufactured for direct-current controllers only and are furnished for the more familiar types of controllers used with Otis standard drum and traction machines of all voltages. The cabinets are manufactured by the Otis Elevator Company, Eleventh Avenue and Twenty-sixth Street, New York City.

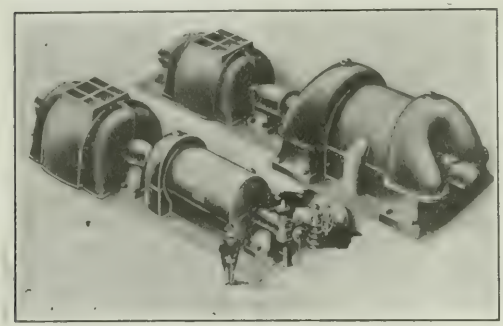
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## A 30,000-kw Double-Unit Steam-Turbine Generator Set

The Interborough Rapid Transit Company of New York placed recently with the Westinghouse Machine Company an order for three immense turbo-generator sets, the design of which promises to bring out some new phases of both manufacturing and operating practice. With generating equipment of this capacity—namely, 30,000 kw—these manufacturers claim that after that of reliability of operation the most desirable characteristic is very high efficiency, and that in order to obtain this a large capital expenditure is warranted, since the apparatus is apt to be operated at a high load-factor a large part of the time that it is in operation.

It is conceded that it lies within the range of possibility to build such a set as a single unit operating at either 750 r. p. m. or 1500 r. p. m., but it is claimed that in the case of a machine designed for the lower speed the proportions would be so gigantic as to carry the problem beyond the pale of usual engineering experience, while if the higher speed is contemplated the turbine-blade velocities will rise to a value greater than is at present considered advisable. Moreover, either of these supposed types would involve the use of a combination of impulse and reaction elements

in the turbine, and it is claimed that the highest efficiency is not to be obtained with the former element. To meet these difficulties and the other important consideration that the speed is high and the volume small at the entering point, while at the point where the steam leaves the turbine its speed is relatively low and its volume correspondingly large, it was proposed to build the sets in two units, one generator being driven at 1500 r. p. m. by a high-pressure turbine the exhaust from which would be used in a low-pressure turbine driving the other generator. The accompanying picture gives an idea of the approximate size, shape and arrangement of each of these double-unit sets



30,000-KW DOUBLE UNIT STEAM-TURBINE SET

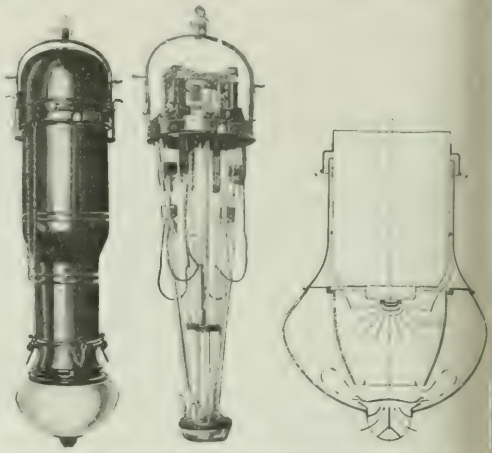
where installed. The blade speeds involved in this design are low, and each turbine element is of exceedingly simple mechanical construction, involving no unusual engineering problems and thoroughly fulfilling the first desideratum of absolute reliability.

The scheme of employing two turbine elements and having the steam pass serially through them is not new. A number of such units of from 1000-kw to 2000-kw rating were built by the Westinghouse Machine Company in 1901. This construction has again come to the front in the case of the English-built Parsons turbine ordered recently by the Commonwealth Edison Company of Chicago. It is new, however, to employ high-pressure and low-pressure elements driving separate generators, each at a different synchronous speed.

The steam supply for these units will carry 120 deg. superheat, and a vacuum of 29 in. will be required for operation. Under these conditions it is claimed by the manufacturer that the steam consumption of each of them will be approximately the same as that for one of the Parsons sets operating on 200 deg. superheat and with 29.2-in. vacuum, conditions much more favorable than can be obtained for the Interborough installation.

## Improved Differentially Wound Long-Burning Flaming-Arc Lamp

A long-burning flaming-arc lamp which is said to possess many improved features in design and operation has recently been brought out by the Koerting & Mathieson Company, New York City. This lamp, which is known as the "Excello-duplex" lamp, is provided with a double gravity feed, the mechanism for which is to be seen in Fig. 1 at the top of the lamp. As the operating pair of electrodes are burned and descend a mechanical trip is automatically raised, so that when the extremity of the first pair of electrodes is reached the second pair is brought into the circuit without any interval of darkness or interruption of the lamp. One of the pairs of electrodes is always locked to preclude the possibility of both sets of electrodes burning at once. A double electrode chamber at the arcing points prevents the inactive electrodes from becoming sooted during the operation of the first pair. However, should the inactive electrodes be carelessly left in such a position that they will become sooted they will be automatically cleaned, as they are fed together by a rubbing action induced by eccentrically mounted pulleys controlling the feed. In case



FIGS. 1, 2 AND 3—EXTERNAL AND SECTIONAL VIEWS OF LAMP

the electrodes become jammed the lamp will be automatically cut out of the circuit and a resistor will be inserted to protect the individual lamp and at the same time keep the series in operation.

One of the illustrations herewith (Fig. 3) shows the path of the air which circulates about the arc. Air is admitted through the small baffle plates of the ash tray shown in the bottom of the globe and follows the paths designated by the arrows. In passing through the narrow chamber above the globes the heated air carrying the products of the electrodes' combustion is cooled and caused to deposit the burned material upon the surfaces of the passage. In cleaning the lamp the trimmer lowers the globes and wipes this surface with a cloth.

The photometric curves herewith show the effect of using clear globes and prismatic globes. The prismatic globes flatten out the curve so that the illumination under the lamp is not so great, but in the area between lamps brighter light is afforded.

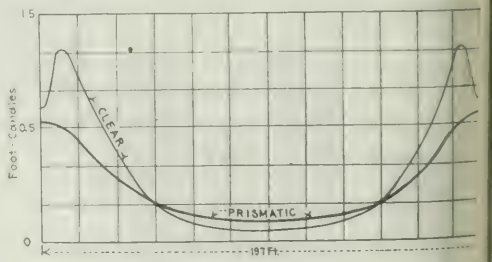



FIG. 4—LIGHT DISTRIBUTION CURVES OF TWO RANGES

The lamp is designed for operation on either alternating current or direct-current circuits and requires a current of 10 amp. With no auxiliary inductance in the circuit the power-factor of the lamp is said to be 0.83 and the power consumption 382 watts. With an inductor added power factors as high as 0.98 have been obtained with a consumption of 313 watts.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Pyrene Company Secures Additional Distributing Medium.**—The Pyrene Manufacturing Company of New York has recently made arrangements to sell its products to the electrical trade through the Western Electric Company, which will act as a distributer of Pyrene fire extinguishers, liquid and brackets, through its twenty-five branches in this country.

**Electro-Galvanizing Plant Opening in Brooklyn, N. Y.**—The Metal Treating & Equipment Company, Inc., of New York, is opening a plant at 834 Humboldt Street, Brooklyn, where it will do job galvanizing work by its improved "standard process" of electro-galvanizing. This factory is expected to be ready for work about the middle of the present month.

**Electricity Supply for the Kansas City Union Station.**—It is reported that the new union station now under construction at Kansas City, Mo., is to have a generating station of its own to supply electricity for lighting and power purposes. Owing to recent strikes the work on the station is now five weeks behind, and it is thought that it will not be completed before next summer.

**Headquarters for Diesel Engine Catalogs.**—In the Aug. 23 issue of the *Electrical World* a short note appeared describing the latest catalog issued by the Usines Carels Frères, of Ghent, Belgium, on their line of Diesel engines. Mr. W. R. Haynie, of 30 Church Street, New York, American representative of the above concern, informs us that he is prepared to furnish copies of this booklet to interested parties.

**Boston Contractor Busy.**—The contract for the complete electrical equipment of the proposed Commonwealth Pier at Boston, Mass., has been awarded to Edwin C. Lewis, Inc., of the same city. This concern is at present occupied in the installation of similar equipment in the American College for Girls at Constantinople, Turkey, and it has recently been awarded the contract for electrical work in the United States Custom House and the State Mutual Building, both in Boston.

**Prices and Catalogs Desired on Electrical Supplies.**—The Electric Supply Company has recently been incorporated, with offices at 21 East Fourth Street, Tulsa, Okla. The secretary, treasurer and general manager of the company is R. C. Steuve, formerly sales engineer in the Cincinnati (Ohio) office of the Allis-Chalmers Manufacturing Company. Mr. Steuve informs us that he would be pleased to receive from the several manufacturers of electrical supplies, catalogs and quotations on the same.

**Rate Question in Indianapolis.**—The Public Service Commission of Indiana has been petitioned by residents in the northwestern part of Indianapolis to cause the Indianapolis Light & Heat Company and the Merchants' Heat & Light Company to readjust their rates. Some of the people living in that portion of the city say that they pay more than customers in other sections at a greater distance from the generating plants. Discrimination is also alleged between tenants in office buildings receiving like service.

**Hickey & Schneider Plan New Factory.**—Hickey & Schneider, of 227 Fulton Street, New York, have just completed shipment to the Utah Power & Light Company of a large order of splicing sleeves. The South Carolina Development Company also bought recently a number of large line-disconnecting switches. The manufacturers report that at present their factory is very busy making their various line and power-house specialties and that they are negotiating for land on which they expect to build a new plant.

**Few Important Devices Presented for Inspection.**—From the Underwriters' Laboratories, 135 William Street, New York, it is learned that their volume of business is normal but that in the way of new apparatus presented for investigation and testing there is little or nothing of wide interest and general applicability coming to their attention at present. A number of special devices of limited interest have been received, the general inspection service offered by the Laboratories is being fully employed, and its label sales are large.

**Exports of Duncan Apparatus Large.**—The Duncan Electric Manufacturing Company, of Lafayette, Ind., reports that while its meters and transformers have enjoyed an extensive sale in the United States during the past two years, its export trade has amounted to over 25 per cent of its total sales. The company has just completed the construction of a four-story addition to its plant and is now contemplating the building of a five-story fireproof factory structure, which will occupy a quarter of a block of ground area.

**New Showroom Opened.**—Following the opening of an uptown office at 71 West Twenty-third Street by the Gleason Tiebout Glass Company, a short time ago, it was decided to establish, at the same address and in connection with the office, a showroom for the exhibition of its various lines of lighting glassware. This has been done, and in addition to some of the older styles there are on view at present examples of the Camia, Beaux Arts and Taglio designs that are claimed by the company to be the latest word along these lines.

**Kodak Company Increasing Generating Equipment.**—The Eastman Kodak Company, of Rochester, N. Y., has recently purchased for its Kodak Park Works a 1000-kw low-pressure steam turbine, connected through a Westinghouse floating-pinion reduction gear to a 250-volt slow-speed, direct-current generator. This equipment was supplied by the Westinghouse Machine Company, which furnished also a 5000-sq. ft. surface condenser, with motor-driven circulating, air and condensate pumps. A cooling tower will be used in connection with the condenser.

**Arc Lamps Said to Be Doomed.**—In reply to a query as to what is being done in the arc-lamp business to meet the imminent appearance of an incandescent lamp with a specific consumption of ½ watt per candle, a prominent Middle West manufacturer and dealer states that, in his opinion, it is very doubtful whether there will be any improvement in arc lamps which will give them consideration except for exterior illumination. He thinks that for interior illumination they are doomed, but there is a feeling in some quarters that the possibilities of this form of lamp are not nearly realized at the present time, and that, when the subject receives a little more concentrated attention, large improvements are not only possible but probable.

**Instruction in Selling Electricity.**—The Chicago Central Station Institute, which has been giving instruction to students in the commercial end of the electric-service business, has opened a night class to accommodate applicants unable to attend the day classes. The school is supported by the Insull companies having headquarters in Chicago, and the night classes will be of particular benefit to the present employees of those companies. Sessions will be held on Monday, Wednesday and Friday of each week from 7 to 10 p. m. The full course for the night-class students will cover eighteen months, and the tuition will be $100 for the course, the same as for the day classes. Mr. Fred R. Jenkins is the manager of the institute, which has its office and recitation rooms at 112 West Adams Street.

**Predicts Large Future for Electrical Industry.**—As reported more fully elsewhere in this issue, a remarkably optimistic statement was made by Frank A. Vanderlip, president of the National City Bank, of New York, at an

informal gathering of leading electrical interests, on Sept. 2-6, at Association Island, Lake Ontario. In his opinion an investment averaging $8,000,000 a week for five years, or over $2,000,000,000, could be profitably used in the electrical industry in this country, during that period, for its development along the lines of transportation, and agricultural and industrial power.

**Indiana Utility Contemplating Large Addition to Generating Equipment.**—The Merchants' Heat & Light Company, of Indianapolis, Ind., in its electrical department is continuing its efforts to secure the business of large consumers. The company's principal generating station is located at West Washington Street near the White River, Indianapolis. According to E. Darrow, general manager, the company is getting ready to install a new 10,000-kva turbine unit in this station and the order for this equipment will be placed within the next thirty days. He states that new water-tube boilers of 4000-hp capacity will also be required.

**Steel Company Decides on Underground Distributing System.**—The Pittsburgh Crucible Steel Company, of Midland, Pa., recently extended its plant and installed electric service therein, the distributing system being laid underground in fiber conduit supplied by the H. W. Johns-Manville Company, of New York. It is stated that an overhead system was at first contemplated, but that, while the matter was still undecided, reports were received by the engineers that particularly heavy damage to such lines had been done by a severe storm in the vicinity of Pittsburgh, and that this news caused them to decide upon the underground system of distribution. This installation required about 100,000 ft. of the fiber conduit, which was laid in concrete by one man and a helper at very low cost.

**Hollow Glass Column Illumination Planned.**—The Lighting Studios Company, 16 East Thirty-third Street, New York, which supplied the distinctive lighting effect at the Carle'n Terrace Restaurant, at Broadway and 100th Street in that city, reports that it has been authorized to prepare designs for similar installations at the Winter Garden Music Hall, 1646 Broadway; the Hotel Endicott, Columbus Avenue and Eighty-first Street, and at several of the Marcus Loew theaters, all in New York City. In addition to these special installations, the company is devoting considerable time to the development of a line of standard lighting units, largely of the semi-indirect type, and among the latest and most popular of these is its sanitary dustproof unit for hospital service, in which the company's Doric moonstone hemisphere is used together with a cover of clear glass.

**Mica Prices Expected to Drop Slightly.**—Meirowsky Brothers, mica importers, of 146 Liberty Street, New York, in a recent interview stated to one of the representatives of the *Electrical World* that there is at present a slightly downward tendency in mica prices, although the volume of business continues good. This concern is at this time supplying a considerable amount of split and punched mica for use in the making of condensers, moving-picture films and various electrical appliances, the manufacturing processes being completed by it, thus saving the customer the necessity of providing special machinery and labor for this work. This business is stated by the firm to be growing in popularity and gradually replacing the older trade in raw mica. In addition to its business in the above lines, the concern handles built-up sheet mica in various thicknesses, and also a certain amount of formed mica for insulating purposes.

**Business Increased by Publicity.**—The Commercial Electrical Supply Company, of St. Louis, Mo., has, in addition to its jobbing business, a repair and exchange department for electrical apparatus of all kinds. A piece of used apparatus brought to the company may be taken by it in exchange, or bought outright and sent to the company's shop, to be thoroughly overhauled and repaired by a corps of expert repair men. This work includes the rewinding of coils, the rebuilding of commutators, renewal of bearings and various other repairs, and after the machines are overhauled they are sold or exchanged again for others, with a guarantee of satisfactory operation. This is a branch of activity in which the jobbing houses do not generally engage, and it was started by this concern on a small basis. A weekly stock report was issued to its salesmen in addition to the publication of a list of apparatus in its monthly net price sheet. The business grew so rapidly, however, that the company decided to issue a booklet devoted to the description of this end of its service and it reports that in the month following the appearance of this booklet, "The Motor Mart," on Aug. 1, an increase of over 100 per cent in the business of this department was experienced.

**Tariff Bill Passes the Senate.**—On the afternoon of Sept. 9 the final vote on the tariff revision bill was taken in the Senate and the measure won by a vote of 44 to 37, the margin of seven being two more than the Democratic margin of control in that branch of Congress. The bill was returned to the House of Representatives on the following day, and action will be taken within the next two weeks on the 300 or more amendments made in the Simmons measure to the original bill prepared by Chairman Underwood of the ways and means committee of the House. It is expected that several of the larger reductions made by the Senate will be compromised and that the bill will be signed, in all probability, by about Sept. 25. In the June 28 issue of the *Electrical World* there appeared a discussion of the principal changes made by the Senate in those items of particular interest to the electrical industry, and, as far as can be learned at present, there is little likelihood that any of these items will be further changed. The most important changes made by the Senate in the bill as a whole are those concerning the income-tax feature and the free list and it is probable that these two matters will furnish the principal ground for discussion in the committee of conference, in which each house has an equal voice.

**Copper Stocks Reach Low-Record Figures.**—At the end of January of the present year the stock of marketable copper of all kinds on hand at all points in the United States had reached the comparatively high figure of 123,198,332 lb. Since that time there has been a rapid decrease in these stocks until, at the end of August, the figures on this item reached the low record of 38,314,037 lb., a drop of over 6,000,000 lb. from the lowest previous mark since statistics have been kept by the Copper Producers' Association. Every month since January (with the exception of July, when there was a small increase) has produced a further decrease in the copper stocks, and the rate of decrease has been so rapid that, if continued for three months more, it would produce an entire depletion of these reserve stocks. Comparison of the figures on production and total deliveries will give some idea of the causes for this reduction of stocks. Since January the delivery has exceeded the production each month excepting July, when the two items were approximately equal. Labor and other troubles at some of the larger mines and refineries have held up production in its several steps during this period, and unusual activity in some of the industries which use the metal extensively has, at the same time, caused a drain on the sources of supply, considerably heavier than normal. The average monthly domestic delivery since January has been in the neighborhood of 71,000,000 lb., somewhat over the normal average, and the average export delivery in the same period has been close to 75,000,000 lb. per month, a large increase over the normal figures. From these statistics it is apparent that the present reserve stocks would serve to meet the volume of deliveries for only about one week's time if production should cease. With this small margin there is anxiety felt in some quarters, where it is feared that the present situation will develop into a runaway market with prices soaring above 20 cents per lb. It is generally felt that for some time to come the copper situation will be strained, since there is small prospect of a material reduction in demand, and it is estimated that no extensive increase in production can be looked for until 1915 when the Inspiration development begins to produce. Reports state that the tension is somewhat relieved at the Lake mines and that some of the men have returned to work, but it is also understood that large numbers of them have left to seek employment in other fields, which, with the inevitable disorganization following the recent troubles, will serve to curtail production there for many months. When it is taken into consideration that the total reserve stocks of the world are also at present very low, so that relief for the domestic situation is hardly to be expected from abroad, it is apparent that all parties interested should act with extreme caution and co-operate to prevent a crisis which would bring good to neither producer nor consumer.

# Corporate and Financial

**Increase in Galveston-Houston Electric Company Dividend.**—A semi-annual dividend of 3 per cent, declared on ie common stock and payable on Sept. 15, is an increase a the rate. The last semi-annual dividend was at the rate f 5 per cent per annum, while the one before that was t the rate of 4 per cent per annum. For several years reviously the rate of dividend on the common stock was per cent per annum.

**Electric Company of America Dissolving.**—A special ieeting of the stockholders of the Electric Company of merica will be held in Philadelphia on Oct. 7 for the purose of dissolving the corporation. If this action is approved, the outstanding stock will receive 140 per cent in merican Gas & Electric 5's and a distribution of the oney remaining in the treasury after the expenses of the issolution proceedings are met.

**Issue of Notes by the Appalachian Power Company.**— t is proposed to authorize an issue of $3,000,000 of 7 per ent collateral trust notes maturing on Sept. 1, 1918. Of his amount $2,500,000 notes have been sold. The balance re reserved to retire an equal amount of notes due on Nov. 20, 1914. The notes will be secured by the deposit f $3,000,000 of second mortgage 6 per cent bonds and 550,000 of first mortgage bonds.

**Plans of the Texas Public Service Company.**—The Texas ublic Service Company, which was formed in Texas re- ently for the purpose of acquiring public utilities in that tate, has purchased and now owns lighting and ice plants n Bay City, Gilmer, Mount Pleasant and Vernon, Tex. he properties are now being rehabilitated. It is expected hat the company will acquire a number of additional utility roperties in the State. The present amount of capital ock is $500,000, divided into $125,000 preferred stock and 375,000 common stock. There has also been authorized n issue of $500,000 bonds, of which $375,000 have been old. The Albert Emanuel Company, of Dayton, Ohio, hich controls and operates a number of companies in ther states, is interested in the Texas Public Service ompany.

**Commonwealth Edison May Be an 8 Per Cent Stock.**— hicago newspapers assert that it has been virtually deter- ined by the directors of the Commonwealth Edison Com- any to pay dividends on the stock at the rate of 8 per cent, stead of 7 per cent, as at present, beginning in November. is said that this projected increase, to which reference as made in the *Electrical World* of Aug. 2, has been under onsideration for nearly a year. Perhaps if the money arket had not been so "tight" the directors would have oted the increase several months ago. This rumored in- ease in the dividend rate, together with the recently an- ounced 10 per cent stock dividend and the decision to issue 5 per cent of new capital at par, is thought to account for he recent rise in the price of the stock on the Chicago ock Exchange. The stock was quoted on Sept. 3 at 8½.

**Electrical Improvements in the New York Subway.**— he annual report of the Interborough Rapid Transit Com- any of New York for the fiscal year ended June 30, 1913, fers to various electrical improvements. In outlining the lans for new subway and elevated construction, it says hat additional power requirements for the proposed ex- nsions can be secured at a minimum cost through the stallation of new high-pressure turbo-generator units in e company's present main Fifty-ninth and Seventy-fourth reet power houses. Among the additions, betterments nd improvements authorized during the year were the uipment of 651 subway cars with storage battery emer- ncy lighting devices; the installation of railings around taries in the subway division substations so as to pre- nt accidents to employees, the installation of an emer- ncy power connection between the Fifty-ninth Street and e Ninety-sixth Street power houses, the substitution of ro 300-kw steam-driven turbo-exciter sets for the present 00-amp storage battery used for exciting current at the fty-ninth Street power plant, and the painting of ceilings seventy-nine cars white in order to improve the appear- ce and provide better lighting reflection. Among the improvements made in the subway division that were charged to current earnings were the equipment of 276 cars with tungsten lamps, the installation of two battery-charging plants for maintaining emergency lights and the painting of ceilings of seventy-nine cars white.

**Financial Plans of the Mississippi River Power Company.**—Following the completion of the construction period and the inauguration of its operating period, the question is being asked as to what plans are being made for the payment of dividends on the outstanding $6,000,000 of preferred stock of the Mississippi River Power Company. This issue was made at 80 in the form of receipts, exchangeable on July 1, 1913, for permanent certificates. Up to this time dividends have been paid on this stock at 6 per cent on the paid-in value and charged against construction cost, but from now on they will have to be paid out of income. After Jan. 1, 1915, this stock becomes cumulative. The interest charges which have to come out before dividends are on $19,000,000 of 5 per cent first mortgage bonds and $2,500,000 of 6 per cent notes, maturing Jan. 24, 1914. This interest amounts to about $1,125,000, or nearly $325,000 less than the estimated net earnings of the company for the year ended June 30, 1914. This excess represents about 5 per cent on the outstanding preferred stock, and while it is not likely that the full 6 per cent dividend will be paid until after Jan. 1, 1915, the company will probably continue the present dividend until then, as it may do out of its earnings. The company is now selling more than 80,000 hp, and has, with present development, 120,000 hp available, which is ultimately to be increased to 200,000 hp. For the development of the additional 80,000 hp about $6,000,000 has already been expended, so that when it becomes necessary to add to the present development the installation of the additional equipment will not be an expensive operation for the company.

## Statement of the Copper Producers' Association for August

The stocks of copper on hand on August 31 were the lowest ever reached in the history of the association. The figures on production and consumption during last month are as follows:

| | August, pounds | | July, pounds | |
|---|---|---|---|---|
| Stocks on hand in the United States on first of month | | 53,594,945 | | 52,904,606 |
| Production | | 131,632,362 | | 138,074,602 |
| | | 185,227,307 | | 190,979,208 |
| Domestic deliveries | 73,649,801 | | 58,904,192 | |
| Foreign deliveries | 73,263,469 | | 78,480,071 | |
| | | 146,913,270 | | 137,348,263 |
| Stocks on hand at end of month | | 38,314,037 | | 53,594,945 |

### NEW YORK METAL MARKET PRICES

| | Sept. 2 | | Sept. 9 | |
|---|---|---|---|---|
| | Bid. | Asked. | Bid. | Asked. |
| Copper: | | | | |
| Standard, spot* | | | 15.50 | to 16.37½ |
| | Selling Prices | | Selling Prices | |
| | £ s d | | £ s d | |
| London, standard, spot* | 71 12 6 | | 73 5 0 | |
| Prime Lake | | 16.25 | 16.75 | to 16.87½ |
| Electrolytic | 16.12½ | to 16.25 | 16.66 | to 16.70 |
| Casting | 15.87½ | to 16.00 | 16.40 | to 16.50 |
| Copper wire base | 17.00 | to 17.25 | 17.75 | to 18.00 |
| Lead | | 4.75 | | 4.75 |
| Nickel | 40.00 | to 45.00 | 40.00 | to 45.00 |
| Sheet zinc, f. o. b. smelter | | 8.00 | | 8.00 |
| Spelter, spot | | 5.90 | | 5.90 |
| Tin, spot* | 42.00 | to 43.25 | 42.40 | to 42.75 |
| Aluminum | | | | |
| Prompt delivery | 21.50 | to 22.50 | 21.50 | to 22.50 |
| Future | 20.00 | to 21.00 | 20.00 | to 21.00 |

### *OLD METALS

| | | |
|---|---|---|
| Heavy copper and wire | 14.50 | 14.75 |
| Brass, heavy | 9.25 | 9.25 |
| Brass, light | 8.25 | 8.25 |
| Lead, heavy | 4.65 | 4.65 |
| Zinc, scrap | 4.62½ | 4.75 |

### *COPPER EXPORTS

| | |
|---|---|
| Total tons to Sept. 1 | 9243 |

*From daily transactions on the New York Metal Exchange.

## Business Notes

**The C & C Electric & Manufacturing Company,** of Garwood, N. J., has recently appointed T. E. Jewell manager of its New England office at 120 Milk Street, Boston, Mass.

**The Triumph Electric Company,** of Cincinnati, Ohio, announces that W. W. Van Ausdall has been appointed sales engineer in charge of its special reversing planer motor department.

**Staege-Bennett & Dewey.**—Staege & Bennett, engineers, and Charles E. Dewey, architect, on Aug. 1 became copartners under the firm name Staege-Bennett & Dewey, Watertown, N. Y.

**D. C. & Wm. B. Jackson.**—Mr. Edward L. Moreland has been appointed manager of the Boston office of D. C. & Wm. B. Jackson, which was moved recently from 84 State Street to the Garden Building, 248 Boylston Street.

**The Fred W. Nason Company,** of 39 Cortlandt Street, New York, has just been appointed sales agent for the territory including New York, New Jersey, Pennsylvania, Delaware and Maryland, to handle the product of the Barnes & Kobert Manufacturing Company, of New Haven, Conn., maker of a full line of strain insulators, guy clamps, cable racks and brackets, and pressed-steel insulator pins.

## New Industrial Companies

**The National Electric Sign & Construction Company,** of Mansfield, Ohio, has been chartered with a capital stock of $50,000. The incorporators are E. P. Robbins and others.

**The Storage Battery Company of America,** of Chicago, Ill., has been incorporated with a capital stock of $30,000 by Harry A. Bioscat, William H. Smith and Noah Divilbisa, 806 Asen Building, Chicago, Ill. The company proposes to manufacture electrical supplies.

**The Imperial Gas & Electric Fixture Company,** of Camden, N. J., has been incorporated with a capital stock of $25,000 for the purpose of manufacturing gas and electric fixtures. The incorporators are: S. W. Collin, H. Schwartz, of Riverton, and W. Wilkinson, of Collingswood.

**The Chanoler Company,** of Newark, N. J., has been incorporated with a capital stock of $25,000 to manufacture mechanical inventions and as model makers, machinists, etc. The incorporators are G. C. Hirst, E. L. Hirst, of Montclair, N. J., and E. P. Hirst, of Philadelphia, Pa.

**The Peterson Electric Company,** of Wheeling, W. Va., has been incorporated by Hugo Peterson, Joseph A. Armstrong, of Wheeling, W. Va.; Harry Brandfass, of Warwood, W. Va., and L. Wayt, of Bridgeport, Ohio. The company is capitalized at $10,000 and proposes to deal in electrical heating apparatus, power appliances, electrical supplies, hardware, etc.

## Trade Publications

**Electric Vibrators.**—A recent pamphlet of the Shelton Electric Company, 4 East Forty-second Street, New York, is devoted to Shelton vibrators, therapeutic appliances and massage apparatus for physicians.

**Laundry Machinery.**—The Conlon electric washer is fully described and illustrated in a booklet published by the Conlon Electric Washer Company, 312 North May Street, Chicago. Its ease of operation, its economy, simplicity and efficiency are pointed out.

**Wires.**—A thirty-two-page pamphlet has recently been issued by the American Insulated Wire & Cable Company, Chicago, which contains data and price lists on its bare and insulated wires. A tabulated statement is printed showing the monthly average of copper from 1883 to 1913.

**Instruments.**—Bulletin No. 175 of the Bristol Company, Waterbury, Conn., refers to electric resistance thermometers, model 162. Electric pyrometers are discussed in Bulletin No. 176. In Bulletin No. 178 wet and dry bulb recording thermometers are illustrated and described.

**Telephones.**—The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., has recently issued a folder in which are illustrated and described various types of "Central Energy" telphone equipment. Wall telephones, desk telephones and combination telephones are shown.

**Testing Set.**—A full-sized representation of the Type S portable Wheatstone-bridge-testing set manufactured by the Leeds & Northrup Company, Philadelphia, is being sent out by the company in the form of a large double cardboard folder. The galvanometer is of the company's new interchangeable type.

**Lighting Units for Hospitals.**—A sanitary dustproof lighting unit, designed by the Lighting Studios Company, 16 East Thirty-third Street, New York, is made the subject of a four-page leaflet. These units are especially designed for use in hospitals and are adapted also to other installations where a similar kind of lighting is required. The unit is said to be free from glare and to be dustproof.

**Lamps for Photographic Purposes.**—Bulletin No. 49, issued by the Cooper Hewitt Electric Company, Eighth and Grand Streets, Hoboken, N. J., gives information regarding the Cooper Hewitt lamp for photographic purposes. This lamp is used for many photographic processes, as a substitute for daylight. Brief descriptions of the various outfits are accompanied by miniature illustrations of the apparatus.

**Motors.**—The Peerless Electric Company, Warren, Ohio, in Bulletin No. 35 sets forth the general characteristics of its single-phase alternating-current motors in fractional horse-powers. These motors are of the induction type, with rotating secondary member. The motors are of the squirrel-cage type, steel-laminated, with copper conductors securely riveted to copper end-rings, soldered to insure perfect contact and ground to size.

**Electric Welding Apparatus.**—The C & C Electric & Manufacturing Company in its Bulletin 513 C gives a complete description of its new multiple-unit arc-welding outfit. With this apparatus several operators can work from the same machine and use either graphite or metallic electrodes and perform all kinds of welding operations by means of the electric arc. Tables, curves and test data are given, together with numerous interesting photographs showing the wide variety of welding repairs made with this outfit.

**Wiring Specialties.**—Catalog No. 16, which has just been published by the Arrow Electric Company, Hartford, Conn., contains ninety-six pages, in which are illustrated and described the company's numerous wiring specialties. Many new devices made since the last catalog was issued necessitated doubling the number of pages of the older one. The material has been so arranged as to afford ready reference to any particular device. The pamphlet is of standard size, punched for convenience in inserting in a binder, is well printed and has an attractive cover.

**Motors, Controllers, etc.**—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has added to its periodical bulletins a number on the following subjects: crane controllers for slip-ring motors, float switches for alternating-current motors, magnetic disk brakes, heavy-duty starters with no-voltage release, index and general description of self-starting speed regulators, double-pole float switches, floor stop devices and manually operated starting compensators for alternating-current motors. Some of these bulletins take the place of others formerly printed on the subject.

**Condensers for Wireless Work.**—The Dublier Electrical Syndicate, Ltd., of 96, 98 Leadenhall Street, London, E. C., in a new illustrated circular describes its improved form of condensers for work in wireless telegraphy. Owing to the unique construction of these condensers it is declared that they occupy only one-tenth the space and weigh but one-tenth as much as other high-tension condensers of similar capacity. They are also said to be more efficient and to be free from brush discharge or leakage. A number of these condensers have already been furnished for pressures up to 30,000 volts. A 0.006-microfarad condenser for 30,000 volts working pressure will withstand a breakdown test of 75,000 volts, and in physical dimensions it measures only 18 cm by 15.5 cm by 8.5 cm.

# Personal Mention

**Mr. Henry F. Black** has been appointed superintendent of the Dallas City (Ill.) Electric Company.

**Mr. J. G. Cronin** has been appointed superintendent of the municipal light and water plant at Perry, Okla.

**Mr. Henry D. Jackson,** consulting engineer, Boston, will sail on Sept. 20 for Bermuda for a three months' trip for rest and recreation.

**Mr. J. W. Lillienthal,** of San Francisco, has been elected successor to Mr. Patrick Calhoun as president of the United Railroads of San Francisco.

**Mr. R. H. Henderson,** formerly manager of works of the Westinghouse Lamp Company, Bloomfield, N. J., has resigned his position to engage in other work.

**Mr. Albert M. Chambers,** of the Electric Properties Company, New York, has been elected president of the Northern Colorado Power Company, succeeding Mr. W. J. Barker, Denver, resigned.

**Mr. Thomas A. Edison** has returned to his laboratory at East Orange, N. J., following a motor trip through New England. Mr. Edison is reported to have benefited from his vacation in both health and weight.

**Prof. R. W. Sorensen,** of the department of electrical engineering, Throop Polytechnic Institute, Pasadena, Cal., has been appointed supervising engineer for the Pacific Light & Power Company at its Big Creek generating station.

**Mr. H. U. Wallace** has been re-elected vice-president and general manager of the Northern Colorado Power Company and will assume complete charge of the operations of the company, whose headquarters were recently moved to Boulder, Col.

**Mr. Webster W. Benjamin** has resigned his position as electrical engineer with the Sunnyside Mines Company at Eureka, Col., to become electrical engineer and master mechanic for the Ozark Smelting & Mining Company, Magdalena, N. M.

**Mr. O. W. Rector,** who for two years has been general superintendent of the gas department of the George Carson property at Washington, Ia., has severed his connection to take the position of general superintendent of the People's Gas & Electric Company of Mason City, Ia., which is now owned by the United Light & Railway Company.

**Mr. R. G. Black,** formerly superintendent of the Toronto Electric Light Company, has been appointed a member of the Toronto Hydroelectric Commission to fill a long-standing vacancy caused by the resignation of Mr. H. L. Drayton, an account of whose appointment to the chairmanship of the Dominion Railway Board appeared on page 865 of our issue dated April 26, 1913.

**Mr. Justus Eck,** of London, England president of the Koerting & Mathieson Company, will sail for America on the *Majestic*, Oct. 1. Throughout England and Australia Mr. Eck is known as an authority on illumination, and on his many trips he has delivered lectures on this subject the information contained in which was gathered from all quarters of the globe.

**Mr. J. F. Martin,** who for the past year has been manager of the new-business department of the United Light & Railway Company, at Iowa City, Ia., has been transferred to the People's Gas & Electric Company at Mason City to assume similar duties. Mr. Martin was formerly connected with the Milwaukee Electric Railway & Light Company at Kenosha, Wis.

**Mr. Frank S. Washburn,** of Nashville, Tenn., president of the American Cyanamid Company, has been elected president of the Alabama Power Company. Mr. Washburn is also president of the Goodman Manufacturing Company, of Chicago, and consulting engineer of the Crescent Coal & Coke Company, of Nashville, besides his connections with other industrial and banking institutions.

**Mr. Edward W. Doty,** of Cleveland, Ohio, has been appointed a member of the Ohio State Public Utilities Commission, the other two members of which are Messrs. Oliver P. Hughes, chairman, and Judge W. L. Dechant. Mr. Doty was a member of the 1911 constitutional convention and also served on the commission which framed Cleveland's recent progressive city charter.

**Mr. William B. McKinley,** president of the Illinois Traction System, Peoria, Ill., which operates a number of electric-lighting properties in the Middle West, had a farewell dinner tendered him at the Country Club at Peoria recently by Mr. Frederick H. Smith and Mr. H. E. Chubback, vice-president executive of the Illinois Traction System. Mr. McKinley will shortly sail from Seattle for Japan on a tour of the world originally planned two years ago.

**Mr. George Smith,** until recently a construction engineer connected with the Fort Wayne Electric Works, has been appointed general superintendent of the municipal electric service of the city of Fort Wayne, Ind. Mr. Smith had charge of the installation of the Fort Wayne municipal plant at the time the present plant was placed in operation. He also had charge of the work of rehabilitating the Fort Wayne municipal plant at the time of the disastrous flood of last March.

**Mr. John W. Hancock,** general manager of the Roanoke (Va.) Railway & Electric Company, has been chosen general manager of the Lynchburg (Va.) Traction & Light Company and its subsidiaries. Mr. Hancock will continue to supervise the Roanoke property, dividing his time between Lynchburg and Roanoke. Mr. Hancock was born in Franklin County, Va., and has lived in Roanoke since 1890. He entered the service of the Roanoke Street Railway Company in April, 1895, and was appointed general manager when it was reorganized and expanded early in 1900. He is also president of the Public Service Association of Virginia, the Mill Mountain Incline, Inc., Roanoke, and the Little Tunnel Water Power Company, and is a vice-president of the Roanoke Chamber of Commerce.

**Mr. H. L. Bleecker,** who was elected president of the Northwest Electric Light & Power Association at its Seattle (Wash.) convention, Sept. 5, is the second vice-president of the Washington Water Power Company, of Spokane, Wash. He was born at Belleville, Ontario, in 1873, his parents being citizens of the United States. In his early childhood the family moved to Los Angeles, Cal., where the son's education was obtained in the public schools. At the age of nineteen Mr. Bleecker entered the employ of the old Los Angeles Cable Railway Company, being first connected with the legal department. About two years later he was admitted to practice in the courts of California. In 1900 he took up his residence in Spokane, Wash., and became affiliated with the Washington Water Power Company, acting in the capacity of the general manager's clerk. He was later promoted to be assistant secretary, then secretary, and finally to the position of second vice-president, which he now holds.



H. L. BLEECKER

# Obituary

**Clifford L. Pullen,** who died of acute indigestion in the St. James Hotel, Philadelphia, Sept. 5, was prominent in the promotion plans of the Youghiogheny Water & Electric Power Company, New York, which is developing hydro-electric plants on the Youghiogheny River near Friendsville, Md. Mr. Pullen was fifty years of age and resided at West Hampton, L. I.

**Charles A. Sterling,** who was a vice-president of the Public Service Corporation of New Jersey, Newark, N. J., from 1903 until the time of his retirement from active business five years ago, is dead. He became connected with the Public Service Corporation following the absorption of the Orange & Passaic Valley Electric Railway, of which he had been president. Mr. Sterling was seventy years old.

# Construction

## New England

MONTPELIER, VT.—The capital stock of the Montpelier & Barre Lt. & Pwr. Co. has been increased from $2,100,000 to $2,310,000.

MONTPELIER, VT.—The Consol. Lig. Co., of Montpelier, has leased the property of Morse & Almon, of Montpelier, consisting of two power plants on Main River in Moretown, and a steam power plant in this city, transmission lines to and distribution systems in the towns of Moretown, Westfield, Northfield and Montpelier.

BOSTON, MASS.—The contract for electrical equipment, including lighting, power and transmission for the new Commonwealth Pier, has been awarded to Edwin C. Lewis, Inc., 121 Federal Street, Boston, electrical engineer and contractor.

PLYMOUTH, MASS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 9 for construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches, of the United States post office at Plymouth, Mass. Drawings and specifications may be obtained at the above office or from the custodian of site at Plymouth. O. Wenderoth is supervising architect.

SPRINGFIELD, MASS.—The advisability of establishing an electric power plant in the proposed new High School of Commerce is being considered by Alderman George H. McClean, of the city property committee, H. L. Dorman, schoolhouse agent, and Edwin J. Parlett, of Kirkham & Parlett, architects for the school. The cost of the proposed building is estimated at $600,000.

NEWPORT, R. I.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 4 for furnishing and installing boilers, heaters, centrifugal pumps, turbines, coal conveyor and piping connections, underground piping systems for distribution of steam, hot and cold water, a sewer, electrical conduits and brick chimney for the naval hospital, Newport, R. I. The cost of the work is estimated at $40,000. Plans and specifications may be obtained on application to the bureau. H. R. Stanford is chief of bureau.

## Middle Atlantic

BINGHAMTON, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until Sept. 22, for the reconstruction of electric-lighting system, steam and exhaust piping at Binghamton State Hospital, Binghamton. Separate proposals will be required for the following branches of the work: Engines, generators, steam piping, switchboards and electric work. Drawings and specifications may be seen and blank form of proposals obtained at the Binghamton State Hospital, Binghamton, and at the office of Lewis F. Pilcher, state architect, Capitol, Albany. Plans and specifications may be secured at the office of the state architect. J. H. B. Hanify is secretary of the State Hospital Commission.

BROOKLYN, N. Y.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 23 for furnishing at the navy yard, Brooklyn, the following supplies: 5733—fiber conduit, etc., vitrified clay duct, electric cable, transformers, watt-hour meters, end bells; Schedule 5734—cast-iron and galvanized pipe and fittings, gate valves, fire hydrants; Schedule 5316—rotor shafts, etc.; Schedule 5823—submarine thermometers, water gages, cartridge fuses. Applications for proposals should designate the schedules desired by number. Blank proposals will be furnished upon application to the navy pay office, New York, or to the bureau. J. T. Cowie is paymaster general, U. S. N.

CHATHAM, N. Y.—The Board of Trustees is investigating the matter of installing an electric plant to furnish electricity for pumping water and for street lighting in Chatham. Gas-producer or oil-burning engines are being considered for motive power. As yet no decisive steps have been taken or engineer engaged. George E. Burrows is village clerk.

COHOES, N. Y.—The Public Service Commission has granted the Cohoes Co. permission to exercise its rights and privileges under a franchise granted by the State to construct a hydroelectric plant upon lands in the bed of the Mohawk River at Cohoes. The company proposes to generate electricity for use of the factories and mills in Cohoes now using water-power. The New York office of the company is at 2 Rector Street.

CORNING, N. Y.—The Corning Lt. & Pwr. Corpn. expects to purchase a 400-hp return tubular boiler for gas plant. J. H. Doherty is general manager.

CROTON FALLS, N. Y.—George Juengst & Sons, owners of the local electric-light plant, expect to purchase within the next four months one 175-kw, three-phase, 60-cycle, 2300-volt vertical generator and switchboard complete with instruments.

ELMIRA, N. Y.—The Elmira Wtr., Lt. & R. R. Co. expects to purchase within the next two months switching equipment, including switches and protective devices and material for distribution system, including poles, towers, lightning arresters, insulators, distribution cable [illegible] conduits, hand holes and lamp posts. Also electrical appliances, including heating and cooking apparatus. L. H. Hill is general manager.

LOCKPORT, N. Y.—The Lockport Lt., Ht. & Pwr. Co. has just closed a contract with the city of Lockport for street lighting for a period of three years, beginning Sept. 9. The contract calls for 741 tungsten magnetite arc lamps at $54 each per year with all-night and every night service. C. M. Kaltenbaser is manager.

LYONS, N. Y.—The Village Board is considering a proposition to adopt a new street lighting system. It is proposed to install ornamental standards carrying cluster lamps in the business district and to erect single lamps in the parks and residence sections, to cost $5,015 per year. Under the present contract it costs the village $7,000 per year to light the streets. If the proposed plan is adopted, the location of the lamps will be changed.

NASSAU, N. Y.—At an election held recently the proposition to install an electric-street-lighting system to replace the present kerosene lamps now in use was carried.

NEW YORK, N. Y.—Bids will be received by the Public Service Commission, First District, 154 Nassau Street, New York, until Oct. 2, for construction of section No. 2 of routes Nos. 4 and 38, Seventh Avenue-Lexington Avenue rapid transit railroad of New York City, a four-track subsurface railroad under Greenwich Street, West Broadway and Varick Street, borough of Manhattan, between a point in Greenwich Street about 70 ft. south of Vesey Street and a point about 100 ft. south of Beach Street. Form of contract, plans and specifications may be obtained from the Public Service Commission.

NEW YORK, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until Sept. 22, for construction, heating, plumbing and electrical work for the nurses' home at Manhattan State Hospital, Ward's Island, N. Y. Separate bids will be required for each division of the work and no combination of bids will be considered. Drawings and specifications may be consulted and blank forms of proposals obtained at the Manhattan State Hospital, Ward's Island, and at the office of the State Hospital Commission, 1 Madison Avenue, New York City. Complete sets of plans and specifications may be obtained upon application to Lewis F. Pilcher, state architect, Capitol, Albany.

OSSINING, N. Y.—Bids will be received by John B. Riley, superintendent of State Prisons, Capitol, Albany, until Sept. 30 for boilers, steam apparatus and piping for new power plant and electric feeder system for Sing Sing Prison, Ossining. Drawings and specifications may be consulted and blank forms of proposals obtained at Sing Sing Prison, Ossining, and at the office of Lewis F. Pilcher, state architect, Capitol, Albany.

SCHENECTADY, N. Y.—The Board of Contract and Supply, it is reported, have rejected all bids for electric wiring of three new schools; new bids will be asked for. The cost of wiring the three buildings is estimated at $15,000.

KITTANNING, PA.—The Borough Council has engaged F. G. Ross, civil engineer, of Pittsburgh, to prepare plans and estimates for the installation of a municipal electric-light plant and water-works system.

PATTON, PA.—The Penn Central Lt. & Pwr. Co., of Altoona, which recently took over the management of the George S. Good El. Lt. Co., of Patton, will make improvements to the system and service. Energy for operating the system will be supplied by the 45,000-volt transmission line from the power stations at Warrior Ridge and Williamsburg. E. B. Greene, of Altoona, is general manager of the Penn company.

PECKVILLE, PA.—The managers of the municipal electric-light plant of Blakely Borough expect to install within the next 30 days one 450-hp Harrisburg four-valve engine directly connected to a 300-kw General Electric two-phase, 60-cycle, 2300-volt, alternating-current generator; also to purchase one 15-kw, 125-volt exciter, four-panel switchboard, three voltmeters, four ammeters, voltage separators, paralleling instrument, etc. Material has been purchased for the erection of 1½ miles of distribution lines, including a 60-kva transformer, and it is expected to duplicate the same within the next three months. Thomas F. Grogan is superintendent.

PHILADELPHIA, PA.—The merger of six electric companies chartered to operate in the vicinity of Philadelphia along the lines of the Philadelphia & Western Railway, under the name of the Interborough El. Lt. & Pwr. Co., has been approved by the State Department. The company is capitalized at $30,000 and the main offices will be in Philadelphia. The companies taken over are the Milbourne, Cooperstown, Ithan, Guelph, Gladwine and Interborough. Thomas Newhall, of the railway company, is president.

PITTSBURGH, PA.—Arrangements have been made by the Armstrong Cork Co., of Pittsburgh, for an extension of its power plant on Twenty-fourth Street, to cost about $38,000.

POTTSVILLE, PA.—The Eastern Pennsylvania Lt., Ht. & Pwr. Co. announces its intention of adding 10 more companies to its list, all of which are expected to be chartered in September. Some of the companies will be located in Girardville, Gilberton, Ryan, West Mahanoy and Butler Townships in Columbia County. The incorporators are: W. B. Rockwell, general manager of the Eastern Pennsylvania Ry. Co.; Ira C. Walborn, superintendent, and Van Dusen Rickert, treasurer of the Pottsville Edison El. Illg. Co.

GLEN GARDNER, N. J.—Bids will be received at the office of the New Jersey Sanatorium for Tuberculous Diseases, Glen Gardner, N. J., until Oct. 7, as follows: (1) For construction and equipment of a power plant; (2) for construction of Tuberculosis Pavilion for the New Jersey San-

orium for Tuberculous Diseases, in accordance with plans and specifications on file in the office of the commissioner of charities and correction, tate House, Trenton. Separate bids to be submitted for each division. or further information address Joseph P. Byers, commissioner of charies and correction, State House, Tenton, or Dr. Samuel B. English, uperintendent, Glen Gardner.

BALTIMORE, MD.—Extensive improvements, it is reported, will e made to the power plant of the Consol. Gas, El. Lt. & Pwr. Co. at Vestport, involving an expenditure of $500,000. The work will include construction of boiler house with complete equipment for coal-handling apparatus, stokers, pumps and heaters; the stacks are to be 50 ft. high and 20 ft. in diameter (inside). The first installation is to onsist of six 1000-hp boilers equipped with automatic stokers.

ROCKVILLE, W. VA.—Preliminary plans have been prepared by the ydro-Electric Co., of West Virginia, for the construction of a large ydro-electric plant and dam near Big Sandy Creek, near Rockville. The am will be of concrete, 200 ft. high and 1600 ft. long; the power house 0 ft. by 100 ft. and will have a generating capacity of 65,000 kw. The ost of the plant is estimated at $5,000,000. Work will begin next spring rovided the plans are approved by the state officials.

WILLIAMSON, W. VA.—The Williamson Lt. & Ice Co. expects to nstall an additional 35-ton motor-driven ice machine. O. B. Welch is ice-president and general manager.

COVINGTON, VA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches, of the United States post office at Covington, Va. Drawings and specifications may be obtained from the custodian of site at ovington, Va., or from the above office. O. Wenderoth is supervising architect.

## North Central

CLEVELAND, OHIO.—Bids will be received at the office of the ecretary of the director of public service, 204 City Hall, Cleveland, ntil Sept. 18 for furnishing luminous-arc lamps and equipment for the lunicipal Electric Light Department of Cleveland, in accordance with ans and specifications, which may be obtained at the office of the ngineer of construction, 419 City Hall. W. J. Springborn is director f public service and W. H. Kirby secretary.

ORRVILLE, OHIO.—At a special election held Aug. 26 the proposiion to issue $40,000 in bonds for the installation of a municipal elecic-light plant was carried. Frank B. Rae, Engineers' Building, Cleveand, Ohio, is engineer.

RAVENNA, OHIO.—The city of Ravenna is planning to install new umping machinery, at a cost of about $32,000. The equipment will clude a turbo-generator, with a rating of from 200 kw to 300 kw, two otor-driven centrifugal pumps, having a capacity of 3,000,000 gal., one ndensing and feed-water pump and 7000 ft. of transmission line. Bids erefor will be received about Nov. 1. W. H. Linton is director of ublic service.

CATLETTSBURG, KY.—The Carpenter El. Lt. & Pwr. Co., of Catlettsburg, has sold its property to the Ohio Valley El. Co., of Benwood, . Va. This gives the Ohio company possession of all the electric ower plants between Guyandotte, W. Va., and Hanging Rock, Ohio.

HARRODSBURG, KY.—Bids will be received by the town of Harrisburg until Nov. 1 for following equipment for the municipal electric-ght plant: One 200-hp tubular boiler complete with setting and equipped th Detroit stokers, one duplex feed pump for 400-hp boilers, one 200-kw, 0-volt direct-current generator and engine, directly connected; also 00 lb. 0000 weather-proof wire and 2000 lb. 0 wire.

LAKELAND, KY.—The electric light and power plant at the Central ylum for the Insane at Lakeland was recently destroyed by fire, causg a loss of about $12,000.

LOUISVILLE, KY.—The ornamental lighting system recently authorzed by the Board of Park Commissioners for installation of ornamental mps in the parks and along the boulevards is to be extended on the stern Parkway several miles west from Cherokee Park and designed mately to connect Cherokee and Shawnee Parks. The cost of the tem is estimated at $3,000 per year. The Louisville Gas & El. Co. ll erect the standards and maintain the service.

INDIANAPOLIS, IND.—Arrangements are being made by the American Creosoting Co. for the construction of a power plant at its new tory at Sherman Drive and the Belt Railway. The equipment of proposed plant will include four boilers with a rating of 150 hp ch, equipped with automatic stokers. A smokestack 148 ft. high and ft. in diameter (brick and metal construction) will be erected.

JEFFERSONVILLE, IND.—The contract for street lighting is reported to have been awarded to Owen L. Carr, of Rushville. Mr. Carr, is understood, will erect a plant here.

GALESBURG, ILL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 17 for conduit and wiring, lighting fixtures, plumbing, etc., in the United States post office at Galesburg, in accordance with specifications and drawings, copies of which may be secured at the above office or at the office of the custodian at Galesburg. O. Wenderoth is supervising architect.

GRAND RIDGE, ILL.—The local plant of the Northern Illinois Pub. Ser. Co. was destroyed by fire on Sept. 2, causing a loss of about $5,000. At present the town is without electrical service.

STERLING, ILL.—The Rock River Lt. & Pwr. Co. is reported to have purchased the power rights of the Sterling Hydraulic Co. in the government dam here. It is understood that the Rock River company will begin work at once developing the power. The cost of the improvements is estimated at about $200,000.

TAMAROA, ILL.—Bonds to the amount of $6,500 have been voted for the installation of a municipal electric-light system in Tamaroa. The contract for the construction of the plant has been awarded to Thomas Russell, of Du Quoin.

GRAND RAPIDS, WIS.—The Grand Rapids El. Co. expects to purchase within the next 12 months a new street-lighting system. The city has voted to purchase the plant of the Grand Rapids El. Co. and has started the necessary proceedings. M. N. Weeks is manager.

LAKE MILLS, WIS.—Within the next 10 or 15 days the municipal electric-light and water plant will be connected with the Kilbourne dam power plant. B. C. Engsberg is superintendent.

PORTAGE, WIS.—At an election held recently bonds were voted for the installation of a municipal electric-light plant.

FAIRMONT, MINN.—The Board of Electric Light and Water Commissioners expects to erect within the next two months a new structural steel building, 84 ft. by 80 ft. over the present building, for the municipal water and light plant for which material has been purchased. Contracts have been received for new generating equipment.

GRACEVILLE, MINN.—At an election held recently the proposition to sell the municipal electric-light plant to the Otter Tail Pwr. Co., of Fergus Falls, and to grant the latter a franchise to operate a plant in the village, was carried.

LAKE PARK, MINN.—The village of Lake Park has engaged J. F. Druar, of the Oscar Claussen Engineering Co., Commercial Building, St. Paul, as consulting engineer to prepare plans and specifications for a direct-current lighting system, consisting of pole line and wiring, oil engine and generator, building with future installation of battery system. Bids for the above will be awarded Sept. 16. Plans may be seen at the office of the village recorder, Lake Park, or at the office of the consulting engineer, Commercial Building, St. Paul. The cost of the plant is estimated at $10,000.

NEW ULM, MINN.—Contracts have been awarded by the City Council for addition to power station and new equipment for the municipal electric-light plant as follows: For addition to building to Otto Tappe, of New Ulm, at $1,740; for machinery, including 312-kva generator and engine (directly connected), switchboard, extensions, wiring, etc., 150-hp boiler and accessories, etc., to the Union Machine Co., of St. Paul, for $13,721, and smokestack to the Webber Chimney Co., for $2,390. The Oscar Engineering Co., Commercial Building, St. Paul, has charge of the engineering work.

RED LAKE FALLS, MINN.—Bids will be received at the office of the Board of Education, Independent School District No. 15, Red Lake Falls, until Sept. 22 for plumbing, heating, ventilating and electrical work of a 16-room school building. Copies of plans and specifications may be obtained from E. F. Broomhall, architect, 710 Alworth Building, Duluth, upon deposit of $15, which will be refunded upon return of same. Copies of plans will be on file in the Builders' Exchange of Duluth, at the office of the board and at the office of the architect. M. M. Watson is president of the board and I. Lemieux secretary.

ST. CLOUD, MINN.—The Public Ser. Co., of St. Cloud, expects to purchase within the next six months a 500-kw turbine engine directly connected to a 2300-volt, three-phase, 60-cycle generator. The company would like to secure good second-hand machines.

CEDAR FALLS, IA.—Within the next six months the town of Cedar Falls expects to erect a power house for proposed municipal electric-light plant and to purchase within from one to six months material for distribution system, including poles, transformers, arresters, wire, meters, insulators, poles and hardware; also steam pipes. Contracts have been awarded for engines, boilers and generators. C. H. Streeter is city engineer.

MAQUOKETA, IA.—Application has been made to the City Council by F. J. Cross, of Cedar Rapids, for a franchise to construct and operate an electric-light plant in Maquoketa. Mr. Cross, it is said, has secured a franchise in Anamosa and proposes to operate electric-light systems in Maquoketa and Anamosa and in the villages between these towns.

AVA, MO.—A franchise has been granted to J. W. Pettit & Co. to construct and operate an electric-light plant here. Power for operating the system will be secured at the old Wilson Mill, about 5 miles east of Ava. The cost of the plant is estimated at about $10,000.

CAPE GIRARDEAU, MO.—The Missouri Public Utilities Co., of Cape Girardeau, has applied to the State Public Service Commission for permission to purchase the light and power plant at Dexter, owned by Benjamin F. Eichholtz, and the public utility plants in Chaffee.

CLARENCE, MO.—The managers of the municipal electric plant expect to purchase within the next year a new engine directly connected to alternator. D. McIntire is superintendent.

KANSAS CITY, MO.—The Kansas City Terminal Co. has awarded the contract for construction of power house to the Fogel Construction

Co. The building will be 93 ft. by 196 ft., three stories high, and will furnish light, heat, power and air to the new union station and terminals. The cost of the power house exclusive of machinery is estimated at $180,000. John V. Hanna is chief engineer.

LOUISIANA, MO.—The Louisiana Lt., Pwr. & Trac Co. expects to purchase within the next six months one 125-hp boiler and a 250-kw generating unit, consisting of an engine and generator. F. E. Murray is general manager.

MARCELINE, MO.—Within the next two months the managers expect to erect an addition to the municipal electric-light plant. New equipment has already been purchased, including two boilers, one feed-water heater, two Corliss engines and one boiler-feed pump from the Murray Iron Works Co., Burlington, Ia. L. A. Nickell is superintendent.

PLEASANT HILL, MO.—Application has been made to the Public Service Commission by Edward H. Crow, of St. Louis, for permission to purchase the property of the Reader Lt., Ice & Fuel Co., of Pleasant Hill, and for approval of contract with the city of Pleasant Hill to furnish street-lighting to that city. Mr. Crow proposes to organize a new company with a capital stock of $40,000 and to issue bonds to the amount of $35,000.

ALEXANDER, N. D.—Plans are being considered for the installation of an electric-light system in Alexander.

JAMESTOWN, N. D.—The contract for construction of a power house for the insane hospital at Jamestown has been awarded to J. W. Curren, of Valley City. The power plant will furnish electricity for lamps and motors and heat for all the buildings of the hospital, and will cost about $56,000.

LA MOURE, N. D.—The franchise granted to I. I. Bennett, of Sioux Falls, for the installation of an electric-light plant has been sold to M. A. Erickson, of Cashton, Wis.

DAVID CITY, NEB.—At an election held Aug. 30 the proposition to purchase the local electric-light plant, owned by the heirs of James Bell, at $7,000 was carried. Improvements will be made to the plant.

HARVARD, NEB.—The Harvard El. Co. expects to purchase a 35-kw, 220-volt direct-current generator within the next six months. A. W. Person is manager.

LOUISVILLE, NEB.—The Continental Gas & El. Corpn., of Cleveland, Ohio, has secured a 50-year franchise in the town of Louisville and is erecting a high-tension transmission line from Plattsmouth to Louisville. This line is a continuation of the distribution system which the company is building west from its Red Oak (Ia.) property, serving some 15 communities between Red Oak and Plattsmouth. An electrical distribution system is being built, including a street-lighting system, in Louisville. All contracts for materials have been let. Abbott & Eaton, Schofield Building, Cleveland, Ohio, are engineers in charge of the work.

RULO, NEB.—We are informed that the city of Rulo will not install an electric plant but will connect up with a transmission line. G. E. Johnson, of Falls City, Neb., is engineer in charge.

HOISINGTON, KAN.—Investigations are being made by the city officials with a view of building a power plant to operate the municipal water-works system and also possibly to install a municipal electric-lighting system.

KANOPOLIS, KAN.—Bids will be received by the city of Kanopolis until Oct. 6 for construction of water-works, complete, and alternating-current electric-light plant equipment. The equipment to be either steam-driven or oil-driven. Plans and specifications are on file at the office of the city clerk, Kanopolis, or at the office of Henrici, Kent & Lowry, engineers, 715 Reserve Bank Building, Kansas City, Mo. A deposit of $3 will be required for plans, to be refunded upon return of same. Bids may be submitted on any portion of the work.

LEBANON, KAN.—Rollins & Westover, consulting engineers, Midland Building, Kansas City, Mo., have been engaged to prepare plans for the installation of an electric-lighting system in Lebanon. Bonds to the amount of $18,000 have been voted for the plant.

TOPEKA, KAN.—We are informed that the power plant to be built in Topeka by the Atchison, Topeka & Santa Fe Ry. Co. will be constructed by the company's own force, material for same being ordered by M. J. Collins, general purchasing agent. R. A. Rutledge is chief engineer.

## Southern States

CONCORD, N. C.—The Board of Electric Light Commissioners expects to erect within the next three months 1 mile of three-phase, 2300-volt transmission line and to purchase 25 lightning arresters. L. A. Fisher is superintendent.

MACON, GA.—The Board of Water Commissioners has signed a two-year contract with the Central Georgia Pwr. Co., of Macon, to operate the new 1,000,000-gal. pump at Tufts Springs pumping station.

CHIPLEY, FLA.—The Chipley Lt. & Pwr. Co. is building a power plant to furnish electrical service here. The equipment of the plant will consist of two 75-hp boilers, one 125-hp, four-valve Ball engine directly connected to a General Electric 75-kva, 60-cycle, 2300-volt generator. The street-lighting system will consist of 75 150-watt tungsten lamps. The company expects to purchase meters. E. M. Hale is engineer in charge.

GAINESVILLE, FLA.—The City Council has authorized an ordinance prepared to be presented at the next meeting of the Council for the installation of an ornamental street-lighting system in the business district.

MIDDLESBORO, TENN.—Investigations, it is reported, are being made by New York parties with the view of installing an electric plant for the purpose of furnishing energy to the coal mines in this district; also to build electric railways to adjacent mines and towns.

MOUNT PLEASANT, TENN.—The Mount Pleasant El. Co. expects to purchase within the next three months one double-ply leather belt for dynamo (18 in. by 100 ft.), one 66-in. by 16-ft. return tubular boiler (125-lb. pressure), both second-hand; also within the next six months ten 2200-volt lightning arresters and pole tape. E. N. Cunningham is lessee.

PULASKI, TENN.—The electric light committee has decided to purchase within the next few months a 125-hp oil engine and a 12[illegible]-kva, three-phase, 60-cycle, 2300-volt generator and exciter (directly connected), motor and pump for unloading fuel oil from tank cars and for handling cooling water; also wire and fixtures for series tungsten street-lighting system. L. P. Thornburg is superintendent.

SHELBYVILLE, TENN.—The Duck River Pwr. Co., of Shelbyville, expects to put in operation within the next two or three weeks its new hydro-electric plant on Duck River, 5 miles from here. The equipment includes two new 44-in. Trump waterwheels, developing about 300 hp, equipped with Woodward governors, and a 200-kva General Electric alternator. The company has a three-phase transmission line into town. Several extensions have been made to its distribution lines this summer and several motor contracts taken, one of which is for pumping the city water.

SOUTH PITTSBURG, TENN.—The South Pittsburg Lt. & Pwr. Co., it is reported, is making improvements in its system in anticipation of receiving energy from one of the hydroelectric plants now being completed in this State.

ANNISTON, ALA.—The Alabama Pwr. Co. is building a substation in Anniston near the plant of the Anniston Foundry and Machine Works, to cost from $125,000 to $200,000. The equipment will include three 2000-kva transformers. Energy will be received from the Jackson Shoals plant, the Gadsden steam plant and from Lock 12 on the Coosa River. Part of the station is already in operation.

HUNTSVILLE, ALA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 24 for a conduit and wiring system and lighting fixtures at the United States court house and post office at Huntsville, Ala., in accordance with plans and specifications copies of which may be obtained at the above office or at the office of the custodian at Huntsville. O. Wenderoth is supervising architect.

JACKSON, MISS.—Bids will be received by the Mayor and Councilmen of the city of Jackson until Sept. 24 for the construction of two pumping stations and a mechanical filtration plant as follows: Contract 1, for constructing river intake, low lift station and main station; (2) constructing filtration plant complete with all equipment and appurtenances; (3) furnishing approximately 195 tons of 24-in. cast-iron pipe and specials; (4) furnishing five valves (6-in. to 30-in.); (5) furnishing and installing two 200-hp water-tube boilers, feed-water heater, feed pumps and steam piping complete; (5 A, B, C, D) furnishing and installing boilers and furnishing separately the heater, pumps and piping above mentioned in contract 5; (5 E) erecting heater, pumps and piping; (6) furnishing and installing one 4,000,000-gal. (per day) pumping engine and hand traveling crane; (7) one radial brick chimney (8) moving from the existing station and installing in the new station two pumping engines and one boiler, together with all appurtenances and connecting piping; (9) furnishing and installing two motor-driven centrifugal pumps complete with piping, starting apparatus and wiring; also two motor-driven sump pumps; (10) furnishing and installing two 75-kw generators with switchboard and wiring and 2000 ft. of transmission line. Forms of proposals and specifications may be obtained upon application to Massena L. Culley, city engineer. Plans for pumping station may be secured from the city engineer upon deposit of $8; complete plans for a deposit of $15. Each proposal must be made on the proposal form. George W. Fuller, 170 Broadway, New York, N. Y., is consulting engineer.

HOT SPRINGS, ARK.—In the recent fire all the generating units of the electric-light and street-railway companies of Hot Springs were destroyed, but the boilers can be made serviceable. Temporary service is expected within two weeks. The electric pole line and wire system throughout the burned district was destroyed by fire and the overhead trolley system damaged for 1 mile. S. E. Dillon is general manager of both companies.

CHECOTAH, OKLA.—The Checotah Wtr., Lt. & Ice Co. will build a modern steam laundry plant on the plant grounds, to be operated in connection with the other properties. L. B. Griffing is secretary and treasurer.

BRENHAM, TEX.—The Brenham Compress Oil & Mfg. Co. expects to purchase some electric ranges and current supplies. James C. Kennedy is secretary.

DALLAS, TEX.—The Texas Pwr. & Lt. Co., of Dallas, is extending transmission lines to cotton gins and other industrial plants in rth Texas.

DALLAS, TEX.—The Standard-Tilton Milling Co., of St. Louis, Mo., s awarded contracts for the erection of a plant, including flour mill, in elevator, power house, warehouse and storage building, to cost ut $300,000. The plant will have a capacity of 2500 barrels of ur and 600 barrels of cornmeal. The mill and elevator buildings, the ter to have a capacity of 300,000 bushels, will be erected by the Donald Engineering Co., of Chicago, Ill.; the machinery will be rnished by the Barnard A. Leas Machinery Co., of Moline. The ver house will be equipped with a Diesel engine.

DENTON, TEX.—Within the next 12 months the managers of the nicipal electric-light plant expect to purchase one electric generating t and boiler, two carloads of poles, transformers and lightning arrest- and one tub transformer. W. J. Grady is superintendent.

LINDALE, TEX.—The installation of an electric-light plant in Lin- e is under consideration. J. D. Nance, of Dallas, and others are erested in the project.

PALESTINE, TEX.—The electric plant of the Texas Pwr. & Lt. Co., Palestine, was recently damaged by fire, causing a loss of about $30,000

## Pacific States

EATONVILLE, WASH.—Bids wil be received by the city clerk, Eaton- e, until Sept. 26 for construction of a hydroelectric power plant in ac- dance with plans prepared by the Evans-Dickson Co., 734 Commerce eet, Tacoma, Wash.

EPHRATA, WASH.—Application has been made to the City Council William F. Scheffel and Thomas J. Smith for a 25-year franchise to nish electricity for lamps and motors in Ephrata; also water for nestic and fire purposes. They have appropriated water rights of the rflow and springs of Beasley Canyon for the purpose of storing water irrigating purposes in the Ephrata Valley and generating electrical rgy.

MOUNT VERNON, WASH.—The Pacific Northwest Trac. Co., of unt Vernon, it is reported, contemplates erecting a transmission line from Allen via Avon and the Olympia Marsh district to West Mount rnon. The company is controlled by the Stone & Webster Manage- nt Association, of Boston, Mass.

TACOMA, WASH.—The Puget Sound El. Co. is contemplating level- its tracks and installing a block signal system on the interurban s between Tacoma and Seattle, involving an expenditure of about ,000.

TACOMA, WASH.—Bids will be received by the board of directors of oma School District No. 10 until Sept. 24 for the installation of er plant and heating plant for the Lincoln Park High School building accordance with plans and specifications prepared by Heath & Gove, hitects, and Leigh Allen, engineer, National Realty Building, Tacoma. arate bids must be submitted for each plant. Alfred Lister is secretary.

TACOLT, WASH.—The Northern Clarke County Lt. & Pwr. Co., of olt, expcts to purchase within the next six months a vertical engine in. by 12-in. cylinder), also a boiler for use during peak load.

GOLD HILL, ORE.—The substation of the California-Oregon Pwr. in Gold Hill was destroyed recently by fire, causing a loss of about 00. The station, it is understood, will be rebuilt and a new trans- mer installed.

LEBANON, ORE.—The Santiam Pwr. Co., it is reported, contem es the development of the water-power of the falls at Waterloo. wer developed at the plant will be used to operate the Lebanon paper

PORTLAND, ORE.—Plans have been filed by the Northwestern El. for the erection of an eight-story steel building at Tenth and Wash- ton Streets, to cost $750,000. The central station of the new heat- plant now being installed will be located in the basement of this ding.

HERIDAN, ORE.—Improvements, it is reported, will be made to the ht of the Sheridan Lt. & Pwr. Co., including the installation of an itional boiler, etc.

OVINA, CAL.—The Home Tel. Co. has received permission from State Railroad Commission to issue $90,000 in bonds, the proceeds e used for discharging indebtedness and for making improvements.

AKE TAHOE, CAL.—The Stone & Webster Engineering Corpn. of on, Mass., is reported to have been given permission by the United es government to construct a dam across the outlet of Lake Tahoe. proposed dam will be 125 ft. wide, with a waterway 109 ft. long and t. deep, and will cost about $40,000.

AN FRANCISCO, CAL.—The Board of Harbor Commissioners has oved the recommendation of Jerome Newman, chief engineer of the bor Commissioners, that arrangement be made for electric wiring r lighting of Piers 26, 28, 30 and 32, which are now nearing com- on. The present plans provide for the use of 250-watt tungsten s, to cost about $2,000 per pier. Work on installation of the m, it is understood, will begin at once.

ST. ANTHONY, IDAHO.—Application has been made by the Ashton & St. Anthony Pwr. Co., capitalized at $250,000, to the State Public Service Commission for a certificate of convenience and necessity. The company proposes to build its main power plant on the Snake River, 2 miles west of Ashton.

ANACONDA, MONT.—The Anaconda Copper Mining Co. is planning to install a 10,000-ton electric precipitation plant, at the Washoe smelter.

LARAMIE, WYO.—The Laramie El. Co. expects to purchase within the next 30 days a coal conveyor. A. E. Anderson is superintendent.

DENVER, COL.—The Continental Mines, Pwr. & Reduc. Co., 401 First National Bank Building, Denver, expects to erect within the next few months from 2 to 5 miles of transmission lines and to purchase motors, transformers and switching equipment necessary for above extension; also air compressors. Henry I. Seamann is president and manager.

LA VETA, COL.—The La Veta Lt., Ht. & Pwr. Co. has leased the La Veta Roller Mills and water-power rights for a period of three years and will operate same in connection with the electric-light plant. C. C. Webster is manager.

GALLUP, N. M.—The Gallup El. Lt. Co. has recently put in operation a 200-kw, three-phase, 60-cycle, 2300-volt generating unit, changing the system entirely to alternating current. The old direct-current equipment is being removed to make room for a duplicate alternating-current unit. Kenneth H. Meyers is manager.

## Canada

VANCOUVER, B. C.—The British Columbia El. Ry. Co., of Vancouver, expects to replace the wooden poles with steel towers on its high-tension transmission line extending from Lake Buntzen to Barnet.

VICTORIA, B. C.—Notice has been filed in the office of the water recorder by the British-Pacific Hydro-Electric & Tramways Lt. Co., of Victoria, that application will be made for use of 1000 cu. ft. per second of water of the Nimpkish Creek. The water will be stored in Nimpkish Lake and River by means of a dam to be built about 1 mile from sea and will be used for industrial purposes. G. Gray Donald is agent for the company.

SOURIS, MAN.—Plans are being considered by the Town Council for the installation of a municipal electric-lighting system, to cost about $40,000.

BRANTFORD, ONT.—Contracts have been awarded by the city of Brantford for the erection of a substation in Brantford. The transformers and switching equipment will be purchased by the Hydro-Electric Power Commission of Ontario.

ELORA, ONT.—The cost of installing a complete distribution system for distributing hydroelectric power in Elora is estimated (roughly) by the Hydro-Electric Power Commission at $10,000.

HAMILTON, ONT.—The contract for building the Hydro-Electric Power Commission underground system in Hamilton has been awarded to G. M. Gest, of Montreal, Que., for $177,822.

SAULT STE. MARIE, ONT.—The power plant of the Lake Superior Pwr. Co., of Sault Ste. Marie, was recently struck by lightning, causing much damage to the plant.

TORONTO, ONT.—To meet the demand for additional energy the Hydro-Electric Power Commission of Toronto has found it necessary to build an addition to the transformer station on Strachan Avenue. A permit has been issued calling for the construction of a two-story brick, steel and concrete building, to cost $35,000.

WOODVILLE, ONT.—On Aug. 13 a by-law authorizing the expenditure of $4,000 for the installation of a distribution system was carried.

ST. JEROME, QUE.—The City Council, it is reported, is contemplating improvements to the electric-lighting system, to cost about $24,000.

SHERBROOKE, QUE.—The city has recently acquired the Lomas power right on the Magog River, situated above the present municipal power station. This opens the way for a further development which may be rendered necessary in the near future.

## Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Oct. 6 for furnishing centrifugal pumps, valves, piping, hydraulic operating tables, traveling cranes, air compressors, switchboard complete, with all electrical instruments and equipment, as per circular 796. For further information address Major F. C. Boggs, general purchasing officer.

SALTILLO, COAHUILA, MEX.—The Saltillo El. Lt. & Pwr. Co. expects to erect within the next six months an automatic telephone system in this city, and within the next 18 months a hydroelectric power plant with transmission line 100 miles long; also to purchase within the next six months switchboard equipment for above telephone system, overhead and underground lead-covered multiple telephone cables, having from 25 to 500 pairs of wires, and supplies for electric-light system. A. W. Lilliendahl is president and manager.

# New Incorporations

MONTGOMERY, ALA.—The Alabama Pwr. Co., a consolidation of the Alabama Pwr. Co., the Alabama El. Co., Wetumpka Pwr. Co., Alabama Pwr. & El. Co. and Alabama Pwr. Devel. Co, has been organized, with a capital stock of $20,000,000. John Mitchell, of New York, N. Y., is president.

WILMINGTON, DEL.—The Southwestern Cities El. Co. has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $6,000,000. The incorporators are: H. E. Latter, O. J. Rockrod and E. B. Davis, of Wilmington.

PORTLAND, MAINE.—The Idaho El. Co. has been chartered under the laws of the State of Maine with a capital stock of $12,000,000. The company proposes to generate, transmit and distribute electricity. T. L. Croteau is president and A. A. Richards treasurer, both of Portland.

WELLINGTON, MO.—The Wellington Lt. & Pwr. Co. has been incorporated with a capital stock of $6,000 by Walter J. C. Westerman, W. H. Bremer and H. H. Ness.

NEW YORK, N. Y.—The Elmira Transmission Corpn. has been incorporated with a capital stock of $10,000 for the purpose of carrying on an electrical power business, etc. The incorporators are: F. G. Robinson, 825 West 179th Street, Henry Morgan, 44 East Eighty-first Street, and G. H. Olney, 59 East Ninety-first Street, New York City.

TULLAHOMA, TENN.—The Tennessee Utilities Co. has been incorporated by G. M. Whitson, President, and L. E. Womack, secretary. The company is capitalized at $25,000 and proposes to build a hydroelectric power plant on Elk River in Franklin County. Present plans provide for the development of about 20,000 hp.

KERENS, TEX.—The Kerens Lt. & Pwr. Co. has been chartered with a capital stock of $15,000 by S. E. Bergstrom, R. H. Daniel, W. T. Stockton and others.

SEATTLE, WASH.—The Lake Forest Lt., Wtr. & Pwr. Co. has been incorporated with a capital stock of $10,000 by A. H. Reid, E. Soelberg and others.

MOUNT HOPE, W. VA.—The Mount Hope Pwr. Co. has been incorporated with a capital stock of $25,000 by John Faulkner, B. Rurvitz, T. L. Feazel and others.

ALMOND, WIS.—The Almond El. Co. has been incorporated with a capital stock of $10,000 by William Brunker, Oscar Culver, S. E. Ralph and A. A. Lepper.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED SEPT. 2, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,071,710. LIGHTNING ARRESTER; E. E. F. Creighton, Schenectady, N. Y. App. filed Dec. 22, 1906. Multi-gap type of high potential.

1,071,737. SWITCH; G. W. Hart, West Hartford, Conn. App. filed July 7, 1910. Remote-controlled switch closed by a solenoid.

1,071,769. CIRCUIT CONTROLLER; H. McCready, Wilkinsburg, Pa. App. filed March 29, 1911. Railway signal relay.

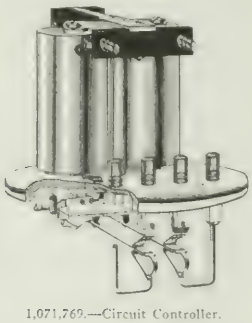
1,071,770. MOTOR-CONTROL SYSTEM; R. H. McLain, Schenectady, N. Y. App. filed Nov. 25, 1912. Series-field protection for Ward-Leonard system.

1,071,778. SYSTEM OF MOTOR CONTROL; W. Naumann, Berlin, Germany. App. filed June 10, 1908. For hoisting motors.

1,071,807. ELECTRICAL INTERLOCKING MECHANISM; J. L. Schureman, Chicago, Ill. App. filed Aug. 21, 1908. Starting device with rotary shaft-carrying crank.

1,071,819. COMBINED TYPEWRITER AND TELEGRAPH TRANSMITTER; H. H. Steele, Marcellus, N. Y. App. filed May 11, 1908. Attachment for an ordinary typewriter.

1,071,838. MAGNETIC SEPARATOR; J. Weatherby, New Cumberland, Pa. App. filed Jan. 11, 1912. Fixed and rotary pole pieces.



1,071,769.—Circuit Controller.

1,071,839. ORE CONCENTRATOR; J. Weatherby, New Cumberland, Pa. App. filed Aug. 1, 1912. Magnetic separator for pulsating or shaking separating tables.

1,071,840. MOTOR CONTROL; M. A. Whiting, Schenectady, N. Y. App. filed Oct. 19, 1911. Retarder for motor-operated winches, etc.

1,071,843. RESISTANCE GRID; H. J. Wiegand, Milwaukee, Wis. App. filed June 6, 1910. Insulating reinforcing frame.

1,071,844. REINFORCED-GRID RESISTANCE; H. J. Wiegand, Milwaukee, Wis. App. filed May 25, 1911. U-shaped strip for convoluted grid.

1,071,871. FUSE PLUG; R. C. Bronson, Chicago, Ill. App. filed May 9, 1912. Successive strips.

1,071,884. AUTOMATICALLY OPERATED ELECTRIC SIGNALS FOR RAILWAYS; W. H. Cook, Denver, Col. App. filed July 18, 1910. Locking device for a semaphore.

1,071,886. ELECTROMAGNETIC SWITCH; A. S. Cubitt, Rugby, England. App. filed May 16, 1910. Dash-pot for timed delayed actions.

1,071,905. ELECTROMAGNETIC DEVICE; M. F. Geer and R. C. Leake, Rochester, N. Y. App. filed Oct. 26, 1911. Armature support for electric bell.

1,071,920. DYNAMO-ELECTRIC MACHINE; A. Hill, Warminster, Eng. App. filed Feb. 28, 1911. Self-regulating auxiliary brush type.

1,071,975. ORE CONCENTRATOR; J. Weatherby, New Cumberland, Pa. App. filed Jan. 4, 1913. Concentrated fields with pulsating table.

1,071,978. DEVICE FOR REMOVING HAIRS; J. E. White, Rochester, N. Y. App. filed April 11, 1912. Tweezers with electric terminals.

1,072,009. SECTIONAL BOX; J. Keefe, Boston, Mass. App. filed Oct. 17, 1910. Screwless outlet box with interlocking corners.

1,072,014. TROLLEY STAND AND POLE; A. C. Kudla, Meriden, Conn. App. filed March 7, 1913. Pivoted vertical pole.

1,072,030. RAIL-CIRCUIT-CLOSING CONTACT; F. Prochaska, Charlottenburg, Germany. App. filed June 17, 1909. Mercury type with heavy top plate.

1,072,036. ARMATURE WINDING FOR ELECTRICAL MACHINES WITH COMMUTATORS; R. Richter, Charlottenburg, Germany. App. filed Aug. 7, 1906. Non-inductive resistance and active conductor coils.

1,072,042. TRANSFORMER CONNECTION; K. Schmidt, Berlin, Germany. App. filed Aug. 25, 1911. The number of turns of the various groups of winding forms a geometrical series.

1,072,074. PUSH-BUTTON SYSTEM; W. Baxter, Jr., Jersey City, N. J. App. filed Nov. 19, 1908. For preventing sparking of elevator switches.

1,072,083. MOTOR-CONTROLLING SYSTEM; E. R. Craichoff, East Orange, N. J. App. filed May 18, 1905. Single push-button automatically controlled elevator.

1,072,091. PROCESS FOR PROTECTING IRON SURFACES FROM CORROSION; S. O. Cowper-Coles, Westminster, London, Eng. App. filed Nov. 23, 1912. Electrode deposition of pure iron and then zinc.

1,072,120. ARMATURE FOR MAGNETO INDUCTION MACHINES; G. Honold, Stuttgart, Germany. App. filed Oct. 4, 1909. The coils are inserted after winding.

1,072,132. ACCELERATING DEVICE FOR ALTERNATING-CURRENT MOTORS; W. D. Lugg, Ville-du-Bois, Belgium, N. J. App. filed Jan. 7, 1911. Opposed windings for accelerating in proportion to the speed.

1,072,154. CULINARY APPARATUS; E. J. Covington, Los Angeles, Cal. App. filed Nov. 8, 1911. Coffee percolator for use in a cup.

1,072,170. ELECTRIC-COOKING DEVICE; C. E. Sargent, Chicago, Ill. App. filed May 20, 1911. "Fireless" type.

1,072,177. CIRCUIT-BREAKER FOR ELECTRIC CIRCUITS; F. L. Sessions, Columbus, Ohio. App. filed Feb. 25, 1904. Delayed action with carbon terminals.

1,072,178. CIRCUIT-BREAKER; F. L. Sessions, Columbus, Ohio. App. filed Oct. 9, 1905. Adjustable magnetic tripping device with indicator.

1,072,205. PRODUCTION OF LEAD OXIDES; O. W. Brown and R. Nees, Bloomington, Ind. App. filed Sept. 9, 1912. It is heated between 325 deg. and 440 deg. C.; for storage-battery plates.

1,072,224. SWITCH HANDLE; G. W. Goodridge, Bridgeport, Conn. App. filed Dec. 1, 1911. Metal shell.

1,072,227. ELECTRIC HEATER; F. J. Holmes, Chicago, Ill. App. filed May 24, 1909. Mechanical construction of curling tongs.

1,072,228. ARMATURE FOR MAGNETO INDUCTION MACHINE; G. Honold, Stuttgart, Germany. App. filed Oct. 4, 1909. A bobbin for receiving a previously wound coil.

1,072,252. TROLLEY POLE AND BRAKE CONTROL; J. E. Pyle, Logan, W. Va. App. filed Jan. 12, 1912. Pneumatic operation.

1,072,271. ELECTRIC-LAMP SOCKET; G. B. Thomas, Bridgeport, Conn. App. filed Feb. 23, 1912. Pull-switch insulation.

1,072,[illegible]. STARTER APPARATUS AND SYSTEM FOR AUTOMOBILE VEHICLES; R. Varley, Englewood, N. J. App. filed Nov. 14, 1911. Automatic disconnection of the starting motor and engine.

1,072,383. ELECTRIC TRAIN-CONTROLLED SYSTEM FOR RAILWAYS; F. T. Jones, Baltimore, Md. App. filed July 5, 1910. Block system for signaling and setting brakes.

1,072,400. AUTOMATIC BATTERY CUT-OUT FOR TELEPHONE CIRCUITS; A. R. Nelson, Janesville, Cal. App. filed May 8, 1912. Sub-station interlock for party-line.

# Electrical World

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**Convention of Lighting Companies**

The four-day session of the Association of Edison Illuminating Companies at Cooperstown, N. Y., last week was remarkable in many respects. The attendance was greater than ever before, so that the family atmosphere which has always hovered about Edison conventions was rather attenuated. It is regrettable that the organization continues to hold its deliberations behind closed doors, because so much that is excellent is brought out and the papers are always of such a high order that the industry really loses valuable experiences that should be disseminated for the good of all. The Edison association is small so far as numbers go, seventy-three companies, we believe; but it wields an immense influence in the industry. One need not marvel at this when it is considered that these companies are located in the great marts and that they dominate in output of energy and in purchasing power. Their problems are the big and weighty ones of the industry, so that smaller central-station companies cannot hope to follow in the footsteps of the Edison companies in general matters of policy. However, the latest engineering information on lamps, meters, generating apparatus and distribution and transmission circuits is brought out at their sessions, which are, by and large, the best of the industry, and this information, gathered oftentimes at no small expense, is of just as great value to the thousands of companies not in the Edison association. Some day, we hope, the guiding hands in the Association of Edison Illuminating Companies will be touched by the spirit of broad co-operation and will spread what information they can for the benefit of the entire central-station industry. Competition no longer exists in the lighting field, and there is nothing that partakes of the nature of a star-chamber proceeding in the doings of the Edison Association. Is it wise, then, to suffer from the reflection which secret sessions give rise?

**Our Electrical Customers Abroad**

Our highest hopes as to the development of electrical export trade have been realized in the figures given out recently as to the business of the year ended June 30. The statistical returns for June were very satisfactory, showing a gain from $1,783,102 to $2,314,732. For the whole year the total was $26,772,816, as compared with $20,169,362 in 1912 and $18,727,455 in 1911. It will be conceded that this shows a remarkable advance in electrical export trade, over which one might well become enthusiastic if it were not that the full measure of opportunity in this direction is far from being realized. As pointed out previously, the electrical industry is entitled to be credited with other items of an electrical nature, such as electric locomotives, or wire drawn and insulated for electrical purposes solely; but our main contention is correct, that swell the present figures as we may, the total is far below what it ought to be. There is, however, a recognition by manufacturers of the fact that a vast market exists abroad for our apparatus, and that American electrical goods find favor even under the adverse conditions that exist in many places owing to duties, lack of commercial connections, insistence on short credit here, and other features involved in holding old territory or opening up new. We can only regret once more that the present method of compiling these statistics in the United States Bureau of Foreign and Domestic Commerce prevents us from noting just where the goods do go, and in what volume. Such information is obviously of the highest value; but when out of nearly $27,000,000 of apparatus over $17,000,000 is lumped together as "all other," and no destination is given in the returns for any of it, helpful criticism or suggestion, based on such data, becomes practically impossible. The old statistics were extremely useful in showing exactly what the principal fields of consumption were and how they were varying from time to time.

**The Failure of "Home Rule"**

The failure of an effort, made principally by city officials of Seattle and Spokane, to obtain legislation at the last session of the Washington Legislature that would take away the regulative powers of the Public Service Commission over the utilities in those cities was discussed by Mr. Norwood W. Brockett in his paper before the Northwest Electric Light & Power Association. The same kind of an effort, made largely by officials of the city of Chicago, received the same treatment at the hands of the last Illinois Legislature. These movements attracted some unwarranted public sympathy because of the ease with which the politicians were able to attract a following when they raised the specious cry of "home rule." The local politicians had their chance at a "home rule" policy for public utilities during many years preceding the development of the modern practice of state regulation and they did not make it an effective or a safe policy. With a good law and able, fair-minded commissioners state regulation will yield the utmost in reasonable results to the public as well as to the companies. A state commission is, or should be, removed far enough from the controversy between a city and a corporation to judge without prejudice the merits of an issue between them. Control by a state commission has the approval of the general public, and both the public authorities and the companies should try in every way so

to meet the conditions of the new method that its efficiency will be a recognized factor in the security of our form of government. If the strength of state regulation is diluted or dissipated the eventual result will be that the public will show its hand again in public utility affairs in a firmer and less reasonable way.

## The Berlin Meeting of the I. E. C.

The second plenary meeting of the International Electrotechnical Commission, which has just been held at Berlin, has set a very permanent stepping stone in the advance of international electrotechnics. It was also well attended, since twenty-four countries were represented and seventy persons were present. Each of the special international sub-committees which had been working during the interval since the last meeting of the commission, in 1911, at Turin, was able to furnish a definite report on its subject, with the aid of deliberations held during the first three days of the Berlin meeting. In fact, the official plenary meeting, on the last day, became a mere ratification meeting, the report of committees being formally adopted and steps being taken for the continuation of their activities in the future. The results reached in the Berlin meeting are, therefore, in substance the aggregate results of the various sub-committees.

The nomenclature committee, under the chairmanship of Prof. S. P. Thompson, brought in an excellent report on the definitions of a number of technical terms frequently used in electrical engineering. The work of this committee is likely to be considerably extended in the future, since the German and Spanish languages are now admitted by the I. E. C.

The symbols committee, presided over by Dr. Karl Strecker, reported, among other recommendations, a list of thirty-six symbols representing electric and magnetic quantities for international use. This list comprises a number of quantities for which international symbols have never previously been agreed upon. The adopted list is now long enough to satisfy the needs of most electrical engineers for some time, and it is a matter for general and mutual congratulation that so much has been internationally accomplished in this direction. The prime-movers committee, of which Dr. Zoelly was chairman, brought in a report dealing especially with the specifications and nomenclature of hydraulic plants, in connection with electric generators, a field where standardization has been much needed.

Within the last few years the national laboratories of England, France, Germany and the United States have been coming into agreement on the international standardization of annealed copper for electrotechnical purposes. It is true that there was no very serious difference between the values of electrical conductivity taken as standard for copper wires in any of these countries, but there was just enough difference to keep the various national copper-wire tables distinctly apart. The four laboratories have recently come to an agreement on the matter, and Dr. Warburg, the president of the Physikalisch Technisches Reichsanstalt, communicated a report upon the values arrived at, which are also the basis of the new copper wire tables of the American Bureau of Standards. The result should be that all of the copper-wire tables issued hereafter in any country should be consistently in accord, and that a given sample of copper wire, tested in any country, should be found to possess the same percentage of standard conductivity.

The rating committee, under the presidence of Mr. E. Huber, also accomplished a considerable amount of work. Up to the date of the preceding meeting in Turin, very little had been accomplished by the I. E. C. in this direction, mainly because the way had first to be prepared by standardizing terms and methods of procedure. After a good deal of discussion, the rating committee adopted the fundamental principle of limiting the output of a dynamo-electric machine at a definite maximum permissible temperature, that of its hottest spot. Since the hottest spot in the armature of a machine is ordinarily at some part of the working conductor on the inside of the insulation, it is not practicable, at present, to measure this hottest-spot temperature, and reference has to be made to the highest accessible temperature, which is at some spot on the outside of the insulation, by allowing for a conventional drop of temperature in the insulating covering. Several of these maximum accessible temperatures were definitely adopted, such as 90 deg. C. for impregnated cotton insulation on machines up to an emf of 4 kv, the value recommended at the last A. I. E. E. midwinter convention in New York.

In order, however, to fix upon the international rating of a machine for continuous service, as the output which will finally raise the temperature of the machine to the accepted limit at the hottest accessible point, it becomes necessary to establish a conventional room temperature, or ambient temperature of reference. Thus, with 90 deg. C. as the maximum accessible limit, if the conventional reference ambient temperature were taken as 40 deg. C., the international rating of the machine would be the output that would ultimately raise its temperature by 50 deg. C. whereas if the reference temperature were 30 deg. C., the international rating would be the output that would ultimately raise its temperature by 60 deg. C. It is clear that the lower the reference ambient temperature is taken, the larger becomes the corresponding temperature rise and the consequent international rating. In cases, however, where a machine is set to operate at a temperature higher than the assumed international reference temperature, the available output becomes less than the international rating, or the machine has to be temporarily derated, and the user must be cautioned against exacting the international rating load. On the other hand, when the machine works at a temperature below the international reference temperature the load on the machine may be safely increased above that of the international rating.

It was found impossible at Berlin to reach an international consensus of opinion as to what the reference ambient temperature should be. The large majority of the delegates appeared to be in favor of 40 deg. C., as recommended at the A. I. E. E. midwinter convention, but two countries held out for 35 deg. C. Since 40 deg. C. is a common summer ambient temperature in many roo

where machines have to be operated, it is clear that such machines would not have to be derated, or reduced in load, if the accepted reference temperature were 40 deg. C., but would have to be derated if the reference temperature were 35 deg. C. The whole question of reference temperature, and the international rating dependent thereon, was therefore referred back to the national committees for further consideration, with a view to taking the matter up again in 1915.

President C. O. Mailloux, of the American national committee, extended the invitation to hold a meeting of the A. E. C. and an International Electrical Congress at San Francisco in 1915 and, with his linguistic talents, greatly aided the technical sessions of the commission over which he presided. The invitation, originally communicated by President Dunn for the A. I. E. E. in 1911 at Turin, was cordially received, and we may all hope that a large and representative delegation of electrical engineers, from many parts of the world, will convene at San Francisco two years hence. It was unfortunate that President Budde, of the I. E. C., was prevented by indisposition from presiding in Berlin, but the German reception committee did all in its power to make the session a memorable one.

## The Return Must Attract Capital

In a paper read before the Northwest Electric Light & Power Association, mentioned in last week's issue, Mr. George A. Lee quoted the "chairman of a certain Public Service Commission in one of the Mississippi Valley States" as saying that "in no event should capital invested in public service properties be entitled to a greater net return than 2 per cent." Mr. Lee replied that the courts and the commissions had held almost universally that any net return under 6 per cent was unreasonable, confiscatory and unconstitutional. To this the commissioner naïvely retorted that the courts and commissions were wrong.

The name of the commissioner who thus revealed unfitness for his responsible office is unknown to us. That he lacks worldly experience, business judgment and the necessary fairmindedness to pass upon questions affecting public utility companies is clear. If he had ever enjoyed the benefit of banking experience, he would have known that a lender obtains all the interest he can get consistent with the protection of his principal, and that a return of 2 per cent is not enough to tempt a lender to take the risks of fixed investment in a public utility plant. If he had been a borrower, even on the best collateral, he would have looked in vain for a capitalist who would accept 2 per cent on a long-term loan. If he had been a silent, unidentified investor, he would know that a 2 per cent rate would not attract his capital into public utility stocks or bonds. If he has any appreciation of the facts we have indicated, his absolute disregard of them is amazing and he indicates that he has not that open mind with which he ought to approach issues raised before him as arbitrator. If the commissioner is merely inexperienced or was talking for effect, both the corporations and the public whose interests he should equally protect have a painful task before them to inculcate in him those elemental notions of business and just public policy which are so indispensable to a public service commissioner. The public will not be served by idle talk of a rate of return which will not induce capitalists to provide the facilities that the public wants.

## The Patent Situation

The address recently delivered before the American Bar Association by Mr. F. P. Fish, of Boston, is well worth careful reading by all who are interested in the movement for patent reform, whether or not they agree with his views. Regardless of partisanship, however, Mr. Fish's extended defence of a liberal patent system as one of the essentials to greatness as a nation commands admiration and ought to inspire a sober sense of responsibility in all who approach the question from any angle whatever. The original purpose of our patent system was the promotion of the industrial arts, and to that end a reward was held out to each individual who would make an invention, the reward consisting of the exclusive right to the application of the idea for a limited period, in return for making a complete public disclosure of it. The original intent was clearly that the inventor should have the reward for his work, but it has finally come to pass that the reward as a rule is obtained by others, at least in great measure, and the cases where the inventor reaps a fair share of the profit are exceptional. This is perhaps the most serious indictment of our patent system as it stands to-day. Another important aspect is the relation of the system to the upbuilding and control of monopolies. The second phase is the one which undoubtedly lies behind the present efforts to pass legislation in Congress more than any abstract desire to restore inventors to a plane of substantial security in their rights under the original intent of the law.

The desirability of striking through the patent law at evils resulting from monopoly may be debatable, but it would seem sound nevertheless to lay down the precept that a wholly adequate reward may be conferred upon a patentee without bestowing upon him immunity from the anti-trust law. The Oldfield proposal for compulsory license is obviously a stroke at the evils which would result from monopoly or substantial monopoly of all the leading or controlling patents of any given art. By some it is held that all situations of such a character, so far as they may be against sound public policy, are reachable through the present anti-trust law, although it remains for the Supreme Court to confirm this opinion. While no one supposes that the suppression of patented inventions has been going on in any extensive wholesale fashion, nevertheless it is one of the immediate tendencies which flow from monopoly of any art. But the question as to whether or not the public may be injured by such suppression is exceedingly complex, and undoubtedly there are cases and circumstances in which suppression is a valuable asset to an inventor. The circumstances, the purposes, the effects, of suppression are all to be taken into account, and the interests of all parties carefully weighed in the light of the facts, before it is possible to say whether suppression is accompanied by a harmful tendency or produces beneficial results.

# The News of the Week

**Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.**

## X-Rays as Light

*By Cablegram*

At the Birmingham meeting of the British Association for the Advancement of Science, Sept. 10 to 17, Dr. C. G. Barkla announced that he had established the fact that X-rays are the most extreme of the rays of light in the ultra-violet end of the spectrum. The velocity is the same as that of "light" within the range of experimental error. The spectral distribution was found to be uniform like fluorescence, and the absorption was found to follow a definite law for all substances. Dr. J. J. Thomson claimed that this discovery is among the greatest of the present generation. Dr. Ernest Rutherford remarked that the discovery has been confirmed by experiments with radio-active materials. Dr. W. Bragg estimated the wave-lengths of the rays to be less than one-thousandth of that of the ultra-violet light heretofore recognized as such.

## Program of Indiana Convention

Owing to the fact that the Public Service Commission of Indiana has come into existence since the last convention of the Indiana Electric Light Association this year's meeting of the association will be of unusual interest. The convention will be held in Indianapolis at the new Canoe Club on Sept. 24 and 25, although meetings of the committees on local arrangement and finance will take place at the Claypool Hotel at 2 p.m. on Sept. 23. President J. W. Robb, of Clinton, Ind., will deliver the opening address at the forenoon session of Sept. 24, and Mr. J. V. Zartman, the secretary-treasurer, will make his report. An address of welcome will be made by Hon. Samuel L. Ralston. Mr. Thomas Duncan, chairman of the Public Service Commission of Indiana, will deliver an address, as will Mr. James L. Clark, of the same commission. Mr. Halford Erickson, a member of the Railroad Commission of Wisconsin, is also down for an address.

Papers are scheduled as follows: "Physical Valuation," Mr. H. H. Crowell, Grand Rapids, Mich.; "Practice Before Commissions," Mr. H. Wherry, New York; "Rates," Mr. F. A. Newton, Jackson, Mich.; "Electric Heating," Mr. J. S. Staudt, Purdue University; "Problems of Insurance," Mr. L. T. Block, St. Louis. There will be an accounting session in charge of Mr. Fred L. Dennis, of South Bend, and for the evening of Sept. 24 a banquet is scheduled, to be followed by a vaudeville entertainment.

## Pittsburgh I. E. S. Convention Arrangements

The general convention committee of the Illuminating Engineering Society has issued an unusually attractive souvenir program in connection with the seventh annual convention to be held at Pittsburgh, Pa., from Sept. 22 to 25. There will be both morning and afternoon technical sessions on Monday, Sept. 22, and Thursday, Sept. 25. On Tuesday and Wednesday there will be only one session, in the morning, the afternoon on Tuesday being devoted to a trip to the works of the Westinghouse Electric & Manufacturing Company, and Wednesday afternoon being given over to baseball, tennis and golf. On Monday evening the reception and ball will be held at the Schenley Hotel. On Tuesday evening a lecture on the evolution of illumination will be delivered in the Allegheny County Soldiers' Memorial Hall, followed by a demonstration of the lighting effects in the auditorium. A banquet will be given at the Schenley Hotel on Wednesday evening. A theater party at the Grand Opera House has been arranged for Thursday evening. Both the banquet and the theater party will be complimentary to the visiting ladies. Numerous entertainment features, including visits to places of interest around Pittsburgh, have been provided for the ladies attending the convention.

Lists of the papers to be read and discussed at the convention were given on page 269 of our issue dated Aug. 9, and page 168, July 26.

Special trains will be run from Chicago and New York. The Chicago train will leave the La Salle Street station over the Lake Shore on Sunday, Sept. 21, at 8:20 p. m., arriving at Pittsburgh at 7:40 on Monday morning. The New York train will leave the Pennsylvania station on Sunday at 10:04 a. m., reaching Philadelphia at 11:57 a. m., Harrisburg at 2:35 p. m., and Pittsburgh at 8:50 p. m. on Sunday.

## Convention of I. and S. Electrical Engineers

For the seventh annual convention of the Association of Iron and Steel Electrical Engineers, to be held at the Hotel McAlpin, New York, from Sept. 22 to 27, the tentative program includes the following papers:

"The Selection and Operation of Carbon Brushes," by Mr. W. P. Boynton; "Alternating-Current and Direct-Current Magnetic Control," by Mr. M. A. Whiting; "Herringbone Gears for Steel Mills," by Mr. P. C. Day; "Direct-Current Turbo-Generators," by Mr. H. A. Rapelye; "Recent Developments in Switching Devices for Power Circuits," by Mr. T. G. Mahoney; "Design and Use of Lifting Magnets," by Mr. B. E. Fernow, Jr.; "Mercury-Vapor Quartz Lamp and Its Applications," by a representative of the Illuminating Engineering Society; "A Progress Report on Illumination," by Messrs. Ward Harrison and H. H. Magdsick; "Present Status of Electric Drive for Main Rolls," by Mr. Brent Wiley; "Questions on Motor Drives for Main Rolls," by Mr. E. Friedlander; "Variable-Speed Drives for Main Rolls of Steel Mills," by Mr. K. A Pauly, and "Notes on the Present Status of Electric Furnaces," by Mr. Wilfred Sykes.

Two standardization meetings will be held on Friday, Sept. 26, one in the morning at 10 o'clock, at which Mr. F. D. Egan, chairman, will present reports of the standardization committee, which will include general specifications for (a) electric cranes, (b) power transformers and (c) automatic control, and another in the afternoon, at which will be discussed general specifications for (d) alternating-current direct-connected generators, (e) large alternating-current motors for roll-drives, and (f) motor generators.

In conjunction with the association's convention the second safety congress of the National Council for Industrial Safety will hold meetings, as mentioned in our issue of Sept. 13, page 526.

## Pennsylvania Electric Association Convention

*By Telegram*

The sixth annual convention of the Pennsylvania Electric Association, state branch of the National Electric Light Association, opened at the Water Gap House, Delaware Water Gap, Pa., on Sept. 16 with a registered attendance of 298. The first session was given over to routine work and the address of the president, Mr. Van Dusen Rickert, of Pottsville. Mr. Rickert referred to the national progress of the industry and to the tendency toward centralization. Absorption, he said, will become more marked because with it goes stability of construction, operation organization and capitalization. Pennsylvania during the year had to meet the new thought of the people in regard to the control of public service corporations of all kinds. The legislation passed during the session just closed, he said, was vital to the lighting industry, and he contended that it was the duty of the companies to comply with the requirements. It should be the province of the association to see that the rulings be made plain and clear to the members.

Referring to the national body, Mr. Rickert expressed the opinion that its value will be found along lines other than those drawn at present. The state associations, because of commission regulation, must do the work as yet neither understood nor contemplated, and the national association must become the clearing house for the work of all the state associations. It will devolve on the national body to legislate and advise about matters brought to it from smaller self-governing integral parts which will send representatives to a central convention. The time will come, Mr. Rickert said, when conventions of the national body along present lines will be things of the past and a greater, broader National Electric Light Association will result. He suggested that papers for state meetings be chosen through competition so that merit may be encouraged. Mr. Rickert also suggested that the vital work of the association be compressed into two sessions so that those whose time is precious may leave without losing much of great value.

The features of Wednesday's sessions were the speeches of Mr. J. M. Wakeman, of the Society for Electrical Development, who outlined the aims and purposes of the organization, stating that its membership is now 575, of which 250 are central-station companies; Mr. J. B. McCall, president of the national association and also of the Philadelphia Electric Company, and Mr. Frederic W. Fleitz, a well-known attorney of Scranton. Mr. McCall briefly outlined the work of the national body, paying a tribute to the work of the state sections in cementing the relations of the various companies locally and making for closer and better understanding. He asked that the loyalty and support of the Pennsylvania Electric Association to the parent organization be continued. Tracing the early development of the industry, he said that the lessons learned from mistakes of the past might be divided into several classes, namely, financial, operating and business promoting. The errors made in the way of hastily or unduly considered investments, capitalization, etc., are errors likely to occur in the acts of the pioneers of any industry. The financiers look with grave doubt upon the industry as capable of profitable venture, and conditions of the industry are such that practically no economical basis can be found to justify the claim that larger investments would be justified by even comparatively small profits. Government authorities in almost every community have given little heed to the work which is being done which constantly adds to the value of the franchises and the convenience of the public served. It soon became apparent that the business was a practical monopoly and that duplication of stations and apparatus did not bring about the competition much desired and possible in ordinary industries, but resulted in combinations which in the main necessitated capitalizations that prevented both the stockholders and the public for some years from participating in the profits which would have been theirs from the start, had it not been for the mistaken idea of the benefits of competition, this being the promise invariably made as a lure to the free gift of franchises. Mr. McCall maintained that this era and these methods, for which the industry was not primarily responsible, did more than the attitude of the management toward the customer to bring about governmental regulation, and he felt satisfied that such regulation as to rates and service, coupled with protection to the industry and of just consideration of the rights of both parties, is acceptable and desirable to all parties concerned. The position of corporation managers has not been antagonistic to the law. They did not fear the passage of laws regulating their relations with the public, but they did fear the interpretations of such laws. It will depend on the companies how liberal that interpretation will be.

Mr. McCall referred at some length to the speech of Mr. Vanderlip at Association Island a short time ago, which was printed in abstract in these columns last week, as offering much of comfort to central-station managers. He said that only one out of every five investors seeks public utility securities, but that the bankers believe securities under governmental control are better than others.

The mistakes of engineering, Mr. McCall said, were due to the fact that the industry was meeting absolutely new conditions almost daily. The lesson to be learned is so to manage properties as to provide the surplus which will enable the company to make promptly the replacements that improvements in efficiencies render desirable. However, engineers must realize that there is a point where the colossal waste brought about by the early discarding of apparatus still useful will balance the economies expected from the newer apparatus. More mistakes have been made, however, and more lessons learned by past experience in the business-getting side of the industry. Lighting loads were looked upon as the most important and motor loads as by-products in the past, whereas now the lighting load is secondary to the motor load. The development of the business in a well-rounded manner was neglected chiefly because there were no commercial or business-getting departments and the engineering end overshadowed everything else. It soon became apparent that the industry would have to adopt the keen, aggressive business-getting and business-holding methods which had become almost a science in many other lines of trade. The lesson was a hard one to learn, but the industry profited by it. Recent statistics show an investment in electric supply companies not excluding electric railways of $2,500,000,000, which is more than the total capitalization of any one manufacturing industry in the country, excepting iron and steel. The combined capital of the central stations in the country has increased by 400 per cent during the past decade, and this has been accompanied by a 417 per cent increase in primary horse-power of installation in generating stations, indicating that the increase in capital is not merely an increased issue of stock. While the income from commercial lighting has increased by 226 per cent in ten years, the income from industrial motor circuits has increased 764 per cent. Mr. McCall closed with a reference to the great welfare work of the industry as a whole.

Mr. Fleitz spoke on utility regulation and gave some account of his work for the Pennsylvania Electric Association in guiding legislation in the recent utility bill enacted in Pennsylvania. The whole trend of modern life, he said, is away from individualism and toward collective community action, and this is bound to increase each year until many of the services now performed by individuals will be done, and done much better and cheaper, by a utility. This development and progress of public utility service has brought before the courts and the bar of that higher tribunal, public opinion, problems more in-

tricate and complex than any of those that confronted mankind fifty years ago, and one of the greatest of these is the question of regulation.

Mr. Fleitz believes that regulation of all public utilities has come to stay, and that the quicker the men at the head of the great public utilities realize this and accept it as one of the things with which they must deal the better it will be for the interests which they serve. He also believes that the sooner the public generally comes to understand that competition between public utilities is an economic fallacy which works out badly for both the utility and its customers the better the public interest will be served. The Supreme Court of the United States, in the case of Knoxville versus the Water Company, 212 U. S., handed down the opinion that:

"Regulation of utilities which perform their duties under conditions of necessary monopoly will occur with greater and greater frequency as time goes on. It is a delicate and dangerous function and ought to be exercised with a keen sense of justice on the part of the regulating body, met by a frank disclosure on the part of the utility to be regulated.

"The courts ought not to bear the whole burden of saving property from confiscation, though they will not be found wanting when the proof is clear. The legislatures and subordinate bodies, to whom the legislative power has been delegated, ought to do their part.

"Our social system rests largely upon the sanctity of private property, and that state or community which seeks to invade such rights will soon discover its error in the disaster which follows. The slight benefit to the consumer gained from a reduction in the rates charged by utilities is as nothing compared with his share in the ruin which would be brought about by denying to private property its just reward, thus unsettling values and destroying confidence. On the other hand, the utilities to be regulated will find it to their lasting interest to furnish freely the information upon which a just regulation can be based."

Mr. Fleitz said that the court here predicates the rate of regulation upon the natural monopoly of the business. There are, broadly speaking, three kinds of monopoly—artificial monopoly, produced by men and interests acting in combination and creating the so-called trusts; natural monopoly, being mainly utilities whose prior occupancy of the district precludes competition, and legal monopoly, created by law by the granting of patents or exclusive franchises. The grasping avarice and unreasonable conduct of many of the possessors of these monopolies in the very near past has created a public opinion antagonistic to the last degree against all monopolies irrespective of their merits, and indeed against almost all public utilities, without regard to the fairness of their management, until a situation has arisen which makes regulation and its protecting power as necessary to the utility as to the public which it serves.

Public opinion, he continued, when once formed is the most potent factor in the making and shaping of legislation and its interpretation by the courts. Legislators, jurors and judges are human, and they imbibe, are influenced by and are controlled by the opinions held by those with whom they associate. If regulation by properly constituted commissions will bring about, as it should, a better public opinion of the utilities which serve mankind, then regulation will prove a boon to the whole public-service world. When the public comes to realize, as it must, through the information disseminated by the commission, that the interests of the utilities and of itself are mutual, and that neither can prosper at the expense of the other, that the money invested in the great corporations is the money of the people generally, the present antagonism will give way to a more harmonious relationship between the two.

Mr. Fleitz also referred to the recent address of Mr. Frank A. Vanderlip, in which Mr. Vanderlip had estimated that to develop the electrical industry in the United States, so that it might keep pace with the increased demands made upon it, there would be required no less than $80,000,000 per week for five years, or $2,000,000,000 in all. The railroads during the same period will require $4,000,000,000 for refunding their debts and for fresh capital, while the cities and municipalities will absorb in their operations at least $1,500,000,000 more. In other words between now and the end of the year 1918 there will be needed for these three purposes between seven and eight billions of dollars, to say nothing of the enormous sums which will at the same time be needed for general industries and other things.

Capital is the most timid thing in the world, and has reason to be. It cannot be induced to enter a field where it will be constantly harassed by hostile forces. According to the speaker, men prominent in the management of utilities feel that regulation is interference with property rights. If the utility were purely a private business, they would be entirely right. The property itself is private, but the use to which it is put is public and the function of proper legal regulation is as much to preserve private property as it is to protect public right. The duty of the state to protect one is as sacred as its right to protect the other, and governmental power ought not to, and never can be, invoked to interfere with the control and management of private property. But it can and should be strong enough to see that the public use shall be fairly and equitably supplied. The great end to be sought by regulation is to see that private enterprises shall be left wholly free and unhampered to do their duty to the public with efficiency and fairness.

It ought to be generally understood and universally accepted among men that utilities are real necessities of mankind, that they are here to serve the needs of the people in a reasonable and businesslike way, and that they cannot do it, nor obtain the money to finance themselves, unless they are treated with fairness and reason, and established in public confidence. They cannot give good service unless generous opportunities and support are granted to them, and under proper and reasonable regulation they can be made quickly responsive to public sentiment and will give better service than any politically controlled, municipally owned utility in the world.

Speaking of the Pennsylvania utility bill and the commissioners appointed, Mr. Fleitz said he was satisfied that the Governor had acted wisely in the selection of the personnel and that they will prove to be reasonable, fair and impartial arbiters between the utility and the public, to the end that properly managed utilities shall prosper and the public shall participate in the benefits of that prosperity.

Abstracts of the papers read at the Delaware Water Gap convention, together with reports of the discussions they provoked, will be presented in a later issue.

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## Convention of Association of Edison Illuminating Companies

Some of the features of the thirty-fourth convention of the Association of Edison Illuminating Companies held at Cooperstown, N. Y., Sept. 8 to 12 inclusive were reported in these columns last week. Inasmuch as the Edison association meets in executive session, very little of what transpires reaches the general electrical public except what is released for publication. No discussion is ever released, because it is claimed the object of free and frank interchange of experience would be defeated by publicity.

The papers were arranged in groups. Those of the first session comprised chiefly committee reports and the president's address. The second session, held on the evening of Sept. 9 and presided over by Mr. C. L. Edgar, of Boston, was devoted to welfare work. Wednesday morning's session, the most important of all, was given over to a dis-

ssion of the lamp question, with Mr. Samuel Insull, of icago, in the chair. The afternoon session was taken with reports and some papers dealing with rotary con-rters and load-factors. High-potential topics were dis-ssed at the session on the morning of Sept. 11, and in the ening an address on the model public utility bill was livered by Mr. E. W. Burdett, of Boston, who presided, eceded by a paper on the proper bases for valuations of blic utility properties for purposes of rate making by of. D. C. Jackson. The seventh and final session, which s held on the morning of Sept. 12, was presided over by r. Louis A. Ferguson, of Chicago, and was devoted to discussion of important steam matters.

A feature of the session on Thursday morning was the dress of Prof. Elihu Thomson on "The Nature of Wire-s Transmission." The speaker gave a very simple and id account of wireless transmission, beginning with nsmission by wire and showing that as the frequency d voltage increase the copper conductor becomes more d more ineffective until at the enormous frequencies and ltages used in wireless transmission it can be dispensed th altogether. He said that the industry need never fear at wireless would ever supplant the present system for nsmitting electrical energy.

At the Friday morning session Mr. S. E. Doane, of eveland, delivered an address on European practice to ke the smallest possible customers profitable. Mr. ane told of the cheap wiring which obtains in Germany d Italy and the exceptionally small returns from certain sses of customers. The latter are of the poorer work-g classes, and although the rate per kilowatt-year is very gh, the income per customer in Milan is as small as 36 nts a month. Flat rates with a limiting circuit-breaker vice prevail on such circuits. It was pointed out, how-er, that the class of building differs materially from that this country and that the wiring does not meet the nerican standard. Most of the buildings are of stone nstruction in Europe, so that the wiring creates no eater fire hazard than that which it would cause if it re placed in an iron safe.

### Election of Officers

At the final session officers were re-elected as follows: esident, Mr. Arthur Williams, of the New York Edison mpany; vice-president, Mr. William Chandler, of the ison Sault Electric Company, Sault Ste. Marie, Mich.; retary, Mr. George C. Holberton, of the Pacific Gas & ctric Company, San Francisco, Cal.; treasurer, Mr. uis A. Ferguson, of the Commonwealth Edison Com-y, Chicago, Ill.; executive committee, the officers above d Messrs. Charles L. Edgar, of the Edison Electric Illu-nating Company of Boston; W. W. Freeman, of the Ala-ma Traction, Light & Power Company, Ltd., Birming-m, Ala.; Samuel Insull, of the Commonwealth Edison mpany, Chicago, Ill.; John W. Lieb, Jr., of the New rk Edison Company, and Joseph B. McCall, of the Phila-lphia Electric Company.

### Entertainment Features

From the reception on the evening of Sept. 8 to the close the convention entertainment features were provided the ladies morning, afternoon and evening and for the ntlemen during the hours when no sessions were sched-ed. The chief entertainment feature consisted of a udeville by professional talent in a huge tent on the el green on Sept. 10, followed by an exhibition of Edi-n educational and kinetoscopic pictures. A very pleasant nction was made of the distribution of prizes about mid-ght of Sept. 11, General George H. Harries, of Louis-le, officiating.

Following are abstracts of papers released in addition to papers which were published in last week's issue of the *Electrical World*:

### High-Potential Disturbances

The report of the committee on high-potential disturbances, of which Mr. L. L. Elden, of the Edison Electric Illuminating Company of Boston, is chairman, dealt largely with subjects intimately connected with the elmination and prevention of failures of supply. Consideration was also given to various developments of protective apparatus which promise to meet most serious conditions. A step forward in this direction has been accomplished through the design of high-voltage generators of large ratings which eliminate the necessity for auto or step-up transformers in generating plants having pressures up to 15,000 volts. Practical applications of current-limiting reactors afford the most reliable evidence of their value, and the committee presented convincing testimony of their efficiency. There have been substantial developments in relay protective apparatus during the past two years, and a number of devices and methods of application are now available. These schemes, some of which are described in detail in the report, include the use of pilot-wire systems, split-conductor transmission lines, and devices for protection from lightning or accidental grounds and failure of generators, in all of which overhead and reverse power relays are employed to operate suitable switching devices to effect the disconnection of lines and apparatus when necessary.

No marked improvements in switching devices have been noted during the year, although experience with the reactor type of oil switch shows that the addition of reactance materially increases the ability of oil switches to break heavy currents. The committee again referred to earlier recommendations covering the rating of cables and emphasized the desirability of studying the possibilities of increasing the current-carrying capacity of certain classes of cables through recognition of temperature conditions. The committee also maintained that cable manufacturers should use every effort to improve the quality of all classes of cables, particularly those used for transmission service.

The success which has attended the construction of an experimental section of high-tension underground structure for transmission purposes justifies the hope that the present limitations of underground potentials will be removed through the successful development of some construction permitting operation at the higher voltages. The scheme described by the committee involves the use of standard iron pipe as the container, in which are assembled insulators so disposed around the pipe and so displaced laterally in it as to provide an independent support for each of the three-phase conductors and also allow the free passage of oil which is used as the fluid dielectric. According to the committee, the manufacturers are continuing to improve and modify lightning arresters to meet observed conditions. Extended experiments are now in progress on several important systems to determine if possible the conditions under which lightning arresters should be installed on distribution circuits to obtain the maximum protection and the greatest freedom from interruptions.

Improvements in the quality of porcelain used for insulating material may be anticipated as the result of most valuable research work on the methods and results obtained under present manufacturing conditions. Improvements of this character cannot fail to increase the reliability of overhead systems through the introduction of a larger factor of safety in insulating materials as has been the case in generating apparatus where mica has been more generally adopted for insulation. Reports of further progress in the improvement of 60-cycle rotary converters and their successful application to commercial service in situations previously considered as prohibitive will undoubtedly be of interest to operating companies having use for such apparatus. The committee also gave attention to the use of storage batteries for the protection of alternating-current systems and a study of a proposed installation described in the report bears evidence as to the feas-

ibility of the scheme. Whether it is advisable, necessary or warranted in any location must, of course, be determined by those interested in the supply of service.

### Load-Factor

The Consolidated Gas, Electric Light & Power Company of Baltimore succeeded in increasing its load-factor from 23 per cent in 1907 to over 50 per cent in 1912 and expects to improve this figure materially in the future. Mr. A. S. Loizeaux, after briefly examining the meaning and use of the term "load-factor," explained the methods used in obtaining this result. Four requisites for improving the load-factor of central-station companies were given as follows: (1) Prospective business in industrial or other motor load; (2) rates properly designed to attract business of high load-factor; (3) an adequate industrial engineering department; (4) adequate plant and equipment and facilities for special service to supply customers satisfactorily. When a contract has been obtained for electric service of large bulk it is generally necessary for the electric company's engineers to serve the customer in planning the distribution system, purchasing motors and equipment and installing the same. This service has been rendered at Baltimore in every large installation obtained, the company even going so far as to design and construct substations for customers and operate them until the customers were prepared to take over the installations. Work of this kind is done at actual cost, including overhead charges, and enables the customer to obtain a more satisfactory and economical installation than he otherwise could. A frequent means of obtaining desirable business is the ability to supply electricity during breakdown of a private installation. According to Mr. Loizeaux, several instances have occurred where energy was supplied within twenty-four hours of such breakdown, and the experience with electric service thus obtained induced the making of contracts with the electric company for permanent service.

### Industrial Electric Heating

A superficial examination of figures on the relative cost of heat as obtained from various sources shows that electricity for this purpose is hopelessly expensive, and in a paper by Mr. T. King, of the Consolidated Gas, Electric Light & Power Company of Baltimore, the three disadvantages of high cost, difficulty of obtaining thoroughly reliable heating elements of long life and unfamiliarity of the public are considered in connection with the eight advantages of control of the atmosphere surrounding substance heated, temperature attainable, portability, ease of thermal insulation, cleanliness, adaptability of automatic control, adaptation to intermittent work, and reduction of fire hazard. According to the author, there are hundreds of industrial processes where the advantages of electric heating outweigh the cost and where the processes cannot attain perfect results or truest economy until electric heating is applied. It is therefore the manifest duty of the central station diligently to seek out processes where electricity is truly the best source of heat and carefully to refrain from any attempts to apply electricity to processes for which it is not particularly adapted. It is also incumbent upon the central station to encourage the development of reliable, efficient devices and to educate and enlighten the public on their uses. The author expatiated on the advantages of electricity for heating purposes but offered no information on the industrial processes in which electric heating is essential to the process or to true economy.

### Circuit Protection

Mr. Paul M. Lincoln, of the Westinghouse Electric & Manufacturing Company, in his paper dealt with the general subject of protection against short-circuits, tracing the development of the various measures that have been used and proposing certain modifications of existing practices that seemed to him to be logical. He regarded circuit protection from two viewpoints, namely, protection to the apparatus and protection to the service, the latter being regarded by operators as being of more importance than the former. He said that the conditions which led to the use of reactors in generator leads were the prevention of damage to generator windings and the necessity of easing up on the then existing types of circuit-breakers, both of which conditions led to a protection of apparatus rather than a protection of service. Modern improvements both in the bracing of generator windings and in the enlargement of circuit-breaker capacity have removed these limitations so that the two main reasons which led to the adoption of reactors in generator leads have disappeared. According to Mr. Lincoln, reactors have an important function in the protection of service entirely apart from the use to which they were originally put in the protection of apparatus, and to fulfil this function properly they should be used on feeder circuits and in very important plants to sectionalize busbars rather than in the generator leads. He described in detail the method of bracing used in recent 60-cycle generators of approximately 20,000-kva rating which enabled the generator windings to withstand any short-circuit shock. A description was also given of a reactor type of circuit-breaker whose chief characteristic is that it divides the opposing forces into two or more sections and then ruptures them in detail. The first break is shunted by a suitable reactor which reduces the current to such a point that the second break can then interrupt the circuit without difficulty. The two breaks are carried by the same mechanism and the reactor forms a part of the circuit-breaker itself. So far as the manufacturing company can judge at present, station ratings will have to exceed anything yet proposed before it will be necessary to resort to more than two breaks in order to secure successful operation.

### Electric Drive in Selected Industries

Mr. R. H. Tillman, of the Consolidated Gas, Electric Light & Power Company of Baltimore, Md., presented a paper dealing with the engineering features and manufacturing processes in three classes of business, together with operating data of each plant. Direct-current and alternating-current ice-cream plants were described, as were a glass-bottle plant electrically equipped with special reference to the type of air compressor and motor drive, and the manufacture of acids and fertilizer by electricity. In general the paper showed how necessary it is for the central-station representatives to familiarize themselves not only with the engineering features but with the actual manufacturing processes of modern industries as well.

### Apparatus for Catching Cinders

As is well known, when coal is burned small particles of unconsumed carbon, dust and ash are carried away from the fuel bed and a portion of the so-called cinders is drawn up the stack and thrown out into the atmosphere. This creates not a smoke nuisance but a cinder nuisance, to correct which much time and money have been spent. Messrs. C. B. Grady and E. B. Ricketts described the latest apparatus for catching cinders which is at present being installed in the stations of the New York Edison Company. A movable damper located just beyond the boiler outlet deflects the products of combustion in a downward direction in the flue. At the bottom of the flue is a water tank in which is maintained about 1.5 ft. of water. The water is constrained to flow over a gutter and down the inside face of the damper into the tank. About 75 gal. of water per minute per boiler is thus circulated, and about 8 gal per minute per boiler is added to make up for evaporation, etc. The gases leaving the boiler are deflected downward by a baffle plate and then pass down through a wedge-shaped duct, one side of which is formed by the movable damper and the other side by one of the sides of the flue. The duct is of uniformly decreasing cross-section and is

en at the lower end so that the direction of flow of the ases as they leave the duct is substantially vertical. In ssing through the cinder catcher the gases are fanned t so that they leave the bottom of the catcher through a ng narrow slot. The water level at the bottom of the e is kept constant and at a comparatively short distance om the bottom of the movable damper. The water flow- g over the edge of the gutter forms a sheet on the mper and a diminutive waterfall at the bottom. The nders are either caught by coming in contact with the eet of water on the movable damper or are projected to the water in the bottom of the flue by the compara- ely high velocity that they have attained. This velocity attained partly by the increase in the velocity of the s current in which the cinders are suspended and partly gravity. It is estimated that the cinders are projected ward the surface of the water with a velocity of about ft. per second. The movable damper can be raised or wered from the boiler-room floor through suitable echanism, according to the load on the boilers. The nder catcher does not reduce the boiler capacity materi- ly. Results of a number of tests are said to show an erage efficiency of 95 per cent.

### Steam Turbines and Auxiliaries

According to the committee on steam turbines, of which r. J. P. Sparrow, of the New York Edison Company, as chairman, there has been no radical change in the sign of steam-turbine units or auxiliaries during the ar. The present trend of turbine design from the manu- cturers' point of view was presented in communications om the General Electric Company and the Westinghouse achine Company which formed part of the report. A ry complete description of the large horizontal turbine t purchased abroad by the Commonwealth Edison Com- ny of Chicago was also given as an appendix. The end view of the Commonwealth Edison Company has been obtain the best possible over-all plant efficiency, and hile the general arrangement of boilers, economizers, rbines and auxiliary machinery presents no radical de- rture from accepted practice, it embodies a complete- ss of detail which is new, at least in American practice. s to turbine auxiliaries, the committee says that continued mand for more efficient apparatus has been met by in- eased effort on the part of the manufacturers. Geared paratus is looked on with growing favor since it enables e purchaser to secure the highest efficiency in the driven paratus with the correct turbine speeds for minimum eam consumption. Many practical and efficient gearing vices are now on the market. The general opinion seems be that the simple rigidly mounted gearing is fully as tisfactory for pump and blower service as the more com- icated and costly floating pinion type, the only advan- ge of the latter being a better distribution of tooth pres- res and possibly less noise. The development of con- nsers has not kept pace with that of the prime movers, d the committee in its report gave three appendices by ominent manufacturers on this subject. In addition, the mmittee itself made an elaborate investigation of con- nser tubes under salt-water conditions. It pointed out at local galvanic action and not electrolytic action of ray outside currents is the cause of condenser-tube de- rioration. Tube troubles were classified in three groups— lit or cracked tubes, caused by improper mill treatment; tted tubes, a failure common to coarse-grained material, d dezincification, resulting in brittle tubes. While it is possible to draw definite conclusions from the results of e many experiments and investigations under way, the mmittee states that it seems reasonable to conclude that ers may protect themselves by requiring manufacturers furnish (1) mechanically perfect tubes free from sliv- s and blisters, (2) tubes of uniform hardness, and (3) bes of uniform grain size in cross-section.

According to the General Electric Company, the present trend in the design of Curtis turbines of 10,000 kw and over is in the direction of higher speeds and a greater number of stages. At present horizontal turbines of from 20,000 kw to 30,000 kw are under construction. Although it appears possible to build machines of somewhat greater output along the lines of existing designs, any great increase in size would necessitate lower speeds, which in turn involves difficulty in obtaining suitable material and in shipping the large parts. In the light of present knowledge, it appears undesirable to build turbine-driven generators for pressures higher than 13,200 volts. Extreme voltages invariably result in higher temperatures due to thicker insulation and to the heating effect of the static potential strains.

The Westinghouse Machine Company is building turbines ranging in maximum continuous rating from 15,000 kw to 25,000 kw. The machines are designed for expanding to high vacuum, the whole expansion being carried out within a single cylinder. An innovation has been made in the case of some important machines of 30,000-kw rating lately contracted for. In these machines the expansion is carried out in two separate turbine elements, the one being compounded with the other and each driving a separate generator, the regulating mechanism controlling the admission of steam to the high-pressure element only. During the year a number of geared units have been shipped, driving direct-current generators. The most notable of these are the gears installed at the Cleveland (Ohio) Electric Illuminating Company's plant. The turbines operate at 1800 r.p.m., and the generators which are 3750-kw, 275-volt machines operate at 180 r.p.m., the ratio of the reduction gears being ten to one.

### Electric Vehicles

The desirability of building up a large vehicle-charging load is generally admitted, but there is some difference of opinion as to the means central-station companies should adopt in fostering the business. The committee on electric vehicles, of which Mr. G. H. Jones, of the Commonwealth Edison Company of Chicago, was chairman, expressed the opinion that the purely technical phases of the business can be left in the hands of the Electric Vehicle Association of America and the American Institute of Electrical Engineers, while central-station companies should concern themselves with matters of general policy and in giving unbiased advice on many points likely to arise. Central stations can help to bring about the general use of electric vehicles by maintaining public garages, by using electric trucks themselves, by making special rates for energy, by maintaining experts to give operating instructions, by supplying forms for operating records, by helping to sell vehicles and by advertising. One class of work seems to devolve more particularly on the central station and that is the education of the public in regard to the proper use of the vehicles. By this is meant not merely boosting and advertising but supplying such data relating to the actual performance of electric vehicles as will convince the public of the economy of using them and such operating instructions as the owner of the electric vehicle should have. Reliable data are lacking, especially information of the energy consumption per mile or per ton-mile. Such data are also necessary for the protection of the central station, otherwise dissatisfaction results. Salesmen are not over-cautious as to claims, and the owner feels that the central-station company is overcharging him if the energy used per ton-mile is greater than what he was led to expect. The committee recommended that member companies undertake in a systematic way to collect data from a sufficient number of each type of electric vehicle for which they are furnishing energy so that they may have information which will be representative of the several types of vehicles being operated.

## Berlin Meeting of the I. E. C.

With delegates and representatives from twenty two countries, the International Electrotechnical Commission opened its sessions in Berlin Germany, on Monday, Sept. 1, with certain committee work preliminary to the plenary meetings beginning on Wednesday. On Sept. 3 Colonel R. E. B. Crompton, the honorary secretary, called the delegates to order and announced that, because of the illness of Dr. E. A. Budde, Dr. E. Warburg, director of the Reichsanstalt, had consented to take the chair. The secretary felicitated the commission on the work that had been accomplished and on the significant fact that national committees had been formed in twenty-two countries with several others soon to come. He then introduced Dr. Lewald, representative of the imperial cabinet, who welcomed the commission in the name of the imperial and Prussian governments.

Dr. Warburg then took the chair and the formal meeting opened. Secretary Le Maistre read a report on the upbuilding of the commission and the nature of its deliberations and work, following which Dr. Warburg extended an invitation to the delegates to visit the Reichsanstalt, the oldest of the world's national laboratories.

Mr. Alexander Siemens then nominated as president of the working sessions Mr. C. O. Mailloux, who was elected by acclamation and accepted in a graceful speech. Colonel Crompton then moved to transmit through Dr. O. F. T. Lewald a telegram of congratuation to the Kaiser on the occasion of his jubilee year, and the proposition was unanimously indorsed. This ended the formalities of the opening and the morning session.

In the afternon when the commission got down to serious business, the first matter considered was the report on the international specification for copper, based on the work of the four national laboratories. All mooted points on this subject had happily been cleared up in committee and the report was unanimously accepted. It will be remembered that this report places the resistance of the meter length sq. cm area standard annealed copper at 1/58 ohm at 20 deg. C. The only point in the report which provided any discussion of moment was a proposal to fix a standard minimum conductivity for "commercial" copper, whatever that may be. As the figure proposed was too low for line copper and needlessly high for commutator and terminal copper, the suggestion was dropped out of sight rather promptly.

Dr. S. P. Thompson then presented the report of the committee on nomenclature, which was unanimously accepted as a whole. Dr. Zoelly brought up the report of the committee on prime movers, which in turn was accepted unanimously. In these committees work had progressed very harmoniously. The latter committee had confined its attention to the matters pertaining to water-powers already published in a bulletin, and several suggestions relating to steam matters were passed over for consideration at the next meeting of the special committees. Perhaps the most important matter brought up was the need of specifications for safety in pipe lines, and arrangements were made for the exchange of ideas and data to gather material for consideration at the next meeting.

The report of the rating committee, which was really due at this session, was held over to obtain agreement on disputed points if possible. A rather serious clash had come with respect to limits of heating, and in particular over the temperature of the ambient air to be taken as standard. The maximum temperatures to be allowed at the hottest spots created comparatively little trouble, and the allowances below these for the measured temperatures were also agreed upon after considerable discussion, the basis being taken at a maximum temperature of 100 deg. C. and a measured temperature of 90 deg. C. for ordinary cotton or fibrous material impregnated with insulating material. At 40 deg. for the ambient air this means 50 deg. rise of temperature, but several of the more northern nations, in particular the Germans and Scandinavians, were holding out for a lower temperature than 40 deg. in the beginning, a figure as low as 30 deg. being mentioned. This would mean a rise of 60 deg., which might be suitable enough for cold climates. Apparatus thus standardized in warmer climates would, unless re-rated, certainly reach a temperature above the maximum allowed. It was at this point that there was a deadlock in the discussions.

The committee on symbols had difficulties also. As everybody knows, the letters commonly used in different countries for the same things vary, and there was mutual and stubborn opposition to change; then too the proposal to call the unit in the past known as mho by the name of "siemens" aroused opposition, chiefly on the ground of needless change, and altogether the proceedings were reported as taking a somewhat lively turn. A reception and supper to the delegates by the most cordial German hosts softened the asperities of much discussion and wound up the day's proceedings cheerfully.

On Thursday morning, when the commission was brought into action by President Mailloux, the first questions raised were those that had been touched upon just before closing the previous afternoon regarding the information of the special committees and especially the representation upon them of countries not included in the committees at Turin. There had been several direct requests for representation, and while evidently all countries could not come in without making unwieldly committees, the justice of some additions was evident. An amicable adjustment was made by adding representatives of Russia and Austria to the rating committee, of Norway and Denmark to the committee on symbols, and of Sweden, Russia and Denmark to the committee on prime movers.

A prolonged discussion followed the reading of the rating report, Germany taking the lead in a demand for higher rating than would correspond to an ambient temperature of 40 deg. The German delegate explained very properly that a small machine, of say 5 kw, rated at 40 deg. could not well be changed to an odd rating for sale in Norway and consequently would have to be sold on a basis which would make it needlessly expensive. As he did not volunteer information as to what he would propose to do in selling the same machine on German rating in, for instance, Egypt, where on that rating it would go to extra high temperature, the argument seemed inconclusive. At the beginning of the afternoon session the report of the committee on symbols was accepted in its entirety. The most notable thing was the adoption of the "siemens" to replace the cast-off mho.

When the rating question came up again the American delegates, supported by the British and various others, stood squarely for 40 deg. as the ambient temperature, while the Germans, supported by the Scandinavians, held just as determinedly for 35 deg. at most. After a deadlock was quite certain the committee retired for another quarter hour of fruitless discussion and came back to report disagreement. Then followed a long period of debate and suggestions of compromise which got nowhere. Ultimately those parts of the report which did not deal with ambient temperature were accepted, and the bone of contention was referred back to the national committees for discussion and report within a year. Practically therefore the vital question of settling an international rating is postponed until the meeting two years hence in San Francisco.

The plenary meeting took place on Friday morning, with Mr. Alexander Siemens as presiding officer. The minutes of the presiding meetings were read and the reports there accepted were duly ratified. A telegram from the Kaiser through his private secretary conveyed his thanks and best wishes. Invitations were then the order of the day. The Spanish delegates invited the special committees to

meet next in Madrid. The invitation from the Panama-Pacific Exposition, already duly acknowledged, was formally accepted and Mr. Mailloux explained the work of organization begun for the International Electrical Congress. The Russian delegate extended a cordial invitation to meet in St. Petersburg in 1917, which was received with applause and placed in course for future action. The formation of the International Commission on Illumination received due announcement from Mr. Carter, and after some friendly words from the delegates from South America, now for the first time in conference, the second plenary session of the International Electrotechnical Commission came to an end. Mr. Maurice Le Blanc was elected president of the commission for the ensuing year.

The American delegation consisted of Messrs. C. O. Mailloux, Louis Bell, H. M. Hobart and A. E. Kennelly.

## Mr. Fish on Patents and Industrial Conditions

At the recent meeting of the American Bar Association held at Montreal, Canada, a notable paper was presented by Mr. F. P. Fish, of Boston, entitled "Letters Patent in Relation to Modern Industrial Conditions," which contained many features of interest to our readers.

Mr. Fish claimed that the present period in the industrial history of our country is a critical one. For more than 100 years industrial progress has been the nation's aim and ideal, but now public sentiment, which once regarded business capacity and foresight as the most admirable of all qualities, has undergone a change. The country's extraordinary industrial development is possibly not ideal in character nor in its relations to society, but the present state of opinion has been due in some measure to criticism which was lacking in appreciation of the difficulties and complexities of the situation. Prevailing business methods are the subject of attack, and numerous features of industrial organization which are most characteristic of modern conditions are regarded with suspicion. But whatever may be the views of those who are free from mental bias in respect to the propriety of a protective tariff, the regulation of corporations and the reform of business methods, whatever may be the popular feeling as to the distribution of wealth that arises from our present social and industrial institutions, the questions as to the value and importance of a patent system and the spirit in which it ought to be organized and administered should be regarded as entirely independent of all such considerations.

No one doubts that industrial prosperity is essential to the welfare of a community, and if it is clear that a liberal patent system is essential to industrial development, all must favor it, whatever side they may take in the acute controversies of the day. No form of reward so fits the achievement, is so productive of advantage to the community and is attended by so few disadvantages as the grant to an inventor of a monopoly of his invention for a limited time. While many other forms of reward have been suggested (such suggestions were made at the convention which adopted the national constitution), they have nowhere been adopted as part of the machinery of society. Everywhere some form of exclusive control for a limited time has been recognized as the best method.

The encouragement of patent protection does not alone stimulate the inventor to intellectual effort; it excites to strenuous effort a long line of intermediaries, capitalists, investors, business administrators, licensees and users who work with or under the patent and whose co-operation is vitally necessary that the invention may not be confined to a paper description but may actually get into use. The ultimate consumers get their advantage from the invention, even during the term of the patent, in lowered cost, added facilities, increased comfort and greater convenience.

This form of reward for invention is strictly automatic and comes only to those who meet a public need and give the community something it desires and will use. Practically every civilized nation in the world now has a patent system, although Switzerland had none until 1888, when, finding that there was no stimulus to invention or industrial progress, the lead of more progressive nations was followed. Holland in 1869 abolished her patent law, undoubtedly in the hope that domestic industry would be thus stimulated, but found the reverse to be true and more than a generation later re-established the patent system.

Nowhere can it be worth while to invent unless there is opportunity for utilizing inventions as made. An adequate patent system gives to the inventor, who as a rule never could himself do anything with his invention, something that is tangible and of value, which he can transfer, in whole or in part, to the business enterprises which alone can make the invention of value to the community. Inventors and business men who develop inventions and introduce them to the service of man, to exactly the same degree and for the same reason, are stimulated by the protection afforded by a patent to efforts which they would never otherwise make. Each class would be helpless without the other. It is only when both are encouraged and protected, as they are by the grant of a patent, that the progress of the useful arts is promoted. Even if the invention meets a real demand, there is frequently the opportunity and occasion for the expenditure of a vast amount of money and of the greatest intelligence and energy on the part of those who are introducing it into use before commercial success can be attained, and always there is the chance of utter failure.

Very few inventions are the result of a happy thought which comes without cost or expense and is complete and perfect at conception. Most of them spring first from a clear recognition of the given problem or opportunity, requiring exact knowledge and trained judgment, and then require the intellectual effort to find a solution. Next comes experimentation, attended so frequently by failure, and lastly realization of the goal after much patient expenditure of money and time.

If the industrial workers of a nation are discouraged from inventing, they are likely to stagnate—they lack the training and the right habits of mind. On the other hand, when stimulated to invent, there is developed also the capacity or instinct to make mechanical improvements not amounting to invention but of great value in the arts. Such improvements are by-products of the inventive habit.

The patent system of the United States, which has existed for nearly 125 years, has in the past been the subject of attack only once, in the late seventies. Congress at that time took no action. Now, again, it is the object of attack, in connection with the so-called Oldfield bill, although the attack is not supported by any public demand for a change in the fundamental law. There is, however, a widespread conviction that reforms are needed in the procedure of both the Patent Office and the courts.

The American patent system differs from the English system, which alone preceded it, and from most others in two important respects: First, a patent here is granted only to the first inventor himself, whereas in England the reward goes to him who first introduces the invention into the realm, whether he originated it himself or found it in some other country; second, the patentee and those with whom he elects to share his right in working his patent have absolute and exclusive control of the invention for the statutory period. The patentee may attach to a license any conditions, as laid down in the National Harrow case,* "not definitely illegal," except so far as the Sanatogen case† denies him the right to attach a condition to an article which has been sold for the full consideration which the patentee expects to receive.

* Bement versus National Harrow Company, 186 U. S., 70.
† Bauer versus O'Donnell, 229 U. S., 1.

It seems obvious that the standards and rules imposed by foreign patent laws as to working inventions and as to the grant of compulsory licenses are and must be purely arbitrary. No man who is inclined to invent or to promote invention can be sure that any particular invention will not be one of a class that is necessarily rendered unprofitable because the law fails to give him a free field for effort during the term of the patent.

The simple provision of the United States patent law that after the grant of his patent the patent owner shall control the invention absolutely for a short but definite term, having no more payments to make and no fear of interference from competitors during the term, gives to our people a far greater stimulus to invention than does the law of any other country.

To-day there are not only a very large number of men struggling with inventive problems or who are on the lookout for the opportunity to invent, but the effort has been systematized to a large extent in accordance with the scientific principles upon which modern business is carried on. With the large enterprises of the country, invention is as much a part of the systematic organization of the business as manufacturing or selling. Highly trained engineers and inventors attack industrial problems as they are presented and work them out in well-equipped laboratories, where not only technical skill but thorough scientific investigation, carried on almost regardless of expense, is applied to their solution. Meantime, individuals are inventing or hoping to invent. They know that nothing is more likely to advance them in wealth and comfort than an invention, the opportunity for which is wide open before them, reward in proportion to the merit of what they may accomplish being almost more certain than in any other field of human endeavor.

The growth and importance of our patent system is indicated by the following statistics. There were filed in the Patent Office 41,980 applications in 1900, 54,971 in 1905, 64,629 in 1910, and 70,976 in 1912. The number of patents issued was 993 in 1850, 4778 in 1860, 13,947 in 1880, 26,499 in 1900, and 35,930 in 1910. The number of patents issued in the principal countries of the world is given in the accompanying table.

PATENTS ISSUED IN LEADING COUNTRIES OF THE WORLD

| | To 1870 Inclusive | 1870 to 1911 | Total |
|---|---|---|---|
| United States | 120,573 | 1,002,478 | 1,123,051 |
| France | 103,934 | 336,964 | 440,898 |
| Great Britain | 53,408 | 371,966 | 425,374 |
| Germany | 9,996 | 238,110 | 248,106 |
| Belgium | 35,044 | 202,456 | 237,500 |
| Canada | 4,081 | 129,609 | 133,690 |
| Italy and Sardinia | 4,723 | 94,175 | 98,898 |
| Austria | None | 64,793 | 64,793 |
| Switzerland | None | 50,197 | 50,197 |
| Spain | None | 44,987 | 44,987 |
| Sweden | 1,629 | 31,734 | 33,363 |
| Russia | 1,464 | 23,528 | 24,992 |

It is clearly far more than a coincidence that the number of patents issued has so largely increased simultaneously with the most extraordinary development in manufactures the world has ever seen.

In 1850 the manufactures of every kind in the United States amounted to $1,019,106,616. In 1880 they had increased only to $5,369,579,191. In 1910 they had attained the enormous total of $20,672,051,870, an amount equal to one-fifth of all the wealth of the United States, six times the total money in circulation, nine times the total gold and silver in circulation, twelve times the total domestic exports, thirteen times the total imports, twenty times as much as what would be required to pay the national debt, and 216 times the value of all the gold produced in the United States.

Between 1905 and 1910 the number of establishments engaged in manufacture increased nearly 25 per cent, from 216,180 to 268,491. The number of employees increased nearly 24 per cent, from 5,981,939 to 7,405,313, and the wages of employees increased nearly 38 per cent. The amount of wages paid in manufacturing industries in the United States in 1910 amounted to nearly two-thirds of the total wealth of the United States in 1850, nearly one and a half times the total money in circulation in 1910, and nearly twice the amount of wages paid out in 1900.

Up to a recent time an enormous amount of free land was open to cultivation. This has now been practically exhausted, and that fact adversely affects our industrial situation. The prevailing popular sentiment of to-day and the new laws and new interpretations of old laws based upon that sentiment require a definite readjustment of business and of business methods in all their relations. The process of readjustment will surely be one of shock to our industries.

Foreign competition is sure to become more serious every year. In our competition with foreigners we are hampered in many ways. In our cost of production we are embarrassed by the high cost of our labor as compared with other countries. We have in the past more than held our own in international competition, chiefly because of our superiority as inventors and in the quick and comprehensive adoption of inventions. If the process of continuous improvement is checked, we shall lose this advantage and there will be no alternative except the destruction of some or many of our most important industries or a reduction in the wages and standard of living of our workmen.

There is no longer room for the striking advances in agricultural machinery, machinery for making fabrics and shoes, electrical and other power apparatus, machinery employed in the production and working of wood and metals and in other great departments of industry that there was a few years ago. Many of the arts are already developed almost to the point of saturation. It is not so easy as it was to find out how they can be improved and to improve them. There should be every possible incentive to seek out and to develop an incessant series of minor improvements which may in the aggregate afford great possibilities of advancement. The latter are of a kind that especially require encouragement, for they do not greatly appeal to the imagination and the direct returns from any one of them are not likely to be large. But agriculture and the production of food products may be revolutionized during the coming century by chemical inventions, and in other fields there is room for many great and important improvements, which cannot be realized unless our patent system affords the requisite encouragement.

The Oldfield bill, which has been reported by the committee on patents to the House of Representatives at Washington, is a most serious attack upon our patent system. It restricts the patent owner in the manufacture, use, sale and license of patented articles and under certain circumstances compels him to license the invention to any person or corporation that requests it. Such a requirement would check invention and the development of inventions, invade the established law of the land and be a national misfortune.

There is little occasion for the revision of our patent law so far as its fundamentals are concerned, but it is far otherwise with respect to procedure in the Patent Office and the courts. It is even doubtful whether the new rules of practice formulated by the Supreme Court will be satisfactory. There is also need for a single court of patent appeals, instead of the nine circuit courts of appeal now existent.

In closing, Mr. Fish stated that he had passed by many phases of the subject, such as the arguments against compulsory license, the charge that patents promote monopoly

an offensive degree, and the proposition that patents e pigeonholed or suppressed. The sole purpose of the per was to emphasize the controlling importance of a eral patent system and express belief that our present v requires no fundamental changes.

## Colorado Convention of the A. E. S.

The twenty-fourth general meeting of the American ectrochemical Society, at Denver, Col., Sept. 9-11, 1913, s probably the most spirited and enjoyable gathering er held by this society. Although the attendance from e Eastern States was somewhat small, the total number delegates registered was 109, of whom 52 were from tes outside of Colorado. The Eastern delegation ar-ed in Denver on two special cars, Monday, Sept. 8, and re received by a committee of representative Denver gineers and business men. A trip by automobile through e parks, over the extensive new boulevards and to Inspi-ion Point ended at the convention headquarters, Hotel irley.

### Tuesday Morning Session

In the opening paper of the Tuesday morning session, titled "Some Aspects of Heat Flow," Dr. E. F. Northrup pposed that thermal-resistance values be stated numer-lly in their ratio to the thermal resistance of a selected ndard. He suggested the adoption of two such stand-ds, one for low-conductivity materials and the other for gh-conductivity materials. Alundum cement, packed and ked under given conditions, was suggested as the first ndard, and copper of 100 per cent electrical conductivity the second standard. The author also described a num-r of methods for measuring thermal resistance suggested electrical analogies.

In the absence of Prof. E. F. Northrup, this paper was d by Mr. C. A. Hansen. It was discussed by Messrs. W. Richards and C. W. Comstock.

In their paper, "The Flow of Heat Through Furnace alls," Messrs. Irving Langmuir, E. Q. Adams and G. S. ikle described mathematical methods of calculating heat w through insulation of various forms and shapes, pre-ting both experimental and theoretical shape factors for rious elementary surfaces, corners, edges, rods, etc. Ex-ples of practical calculations were appended, giving re-ts agreeing closely with experimental values.

This paper was also read by Mr. C. A. Hansen. The cussion which followed was enlivened by a communi-ed discussion from Prof. E. F. Northrup and remarks Messrs. C. A. Hansen, J. W. Richards, F. A. Lidbury d C. W. Comstock.

In his paper, "The Heat Resistivity of Carbon and aphite," Dr. J. W. Richards reported work done by ssrs. J. P. Stokes and A. D. Jamieson in the Lehigh iversity laboratory. These investigations give the heat istivity in thermal ohms or degrees per watt, for Na-nal Carbon Company carbon (202 deg. to 853 deg. C.) abeing 36.8 thermal ohms for a cm cube, and for Acheson aphite (240 deg. to 420 deg.) as 3.69 thermal ohms for a c cube. Practically the same relative values were ob-ned at other temperatures, showing the heat resistivity tio between carbon and graphite below 1000 deg. C. to bat least 10:1.

Mr. Richards' paper was discussed by Messrs. Carl Her-ig (communicated), F. A. Lidbury, C. A. Hansen, C. G. Fink and J. W. Richards.

From an elaborate study of the electrolysis of cyanide sotions Mr. E. F. Kern concluded that the progressive consumption of cyanide noted is the result of oxidation to oxy-cyanide compounds. Peroxidized lead and passive iron anodes were found to be more permanent than metallic anodes of either iron, nickel or lead, all of which pass into solution. Low-current density at both electrodes reduces the cyanide consumption, as does also increasing the alkalinity of the solution, the latter on account of decreasing the resistivity.

The paper prepared by Dr. E. F. Kern was read by Dr. E. P. Schoch. In the discussion which ensued the following men participated: Messrs. E. P. Schoch, G. H. Clevenger, J. W. Richards, F. A. Lidbury and F. C. Frary.

### Wednesday Morning Session

As has been arranged, the Wednesday morning session was held at the University of Colorado in Boulder. During a visit to the laboratories of the school the "Elderkin rectifier," essentially a commutator driven by a synchronous motor, was shown in Evans' electrical laboratory. Owing to the large amount of time consumed in visiting places of interest only two papers were read at this session. They follow in abstract.

From a series of experiments in the electrolysis of aqueous solutions of the simple alkaline cyanides, Messrs. G. H. Clevenger and M. L. Hall concluded that the bulk of the decomposition of cyanide is due to the oxygen liberated at the anode. Formation of calcium carbonate during electrolytic precipitation of gold and silver was explained by the production of alkali carbonate corresponding to the protective alkalinity employed. Investigators were warned against the use of electrolysis with an ore pulp, as this may result in the loss of a large amount of cyanide deposits, besides interfering with extraction by the formation of coatings of calcium carbonate on the ore particles.

A spirited discussion of this paper was indulged in by Messrs. F. A. Lidbury, G. H. Clevenger, F. C. Frary, J. W. Richards, E. P. Schoch and F. W Skirrow.

In a paper entitled "Possible Applications of Electric Furnaces to Western Metallurgy," Messrs. Dorsey A. Lyon and Robert M. Keeney declared that aside from the smelting of iron ores and the manufacture of aluminum and ferro-alloys, electric smelting is still in the experimental stage and will probably never replace existing processes where local conditions are favorable to the latter. In zinc smelting temperatures of 1500 deg. C. are required, so that the electric furnace offers the advantage of giving full temperatures just where needed. Under such conditions, therefore, electric furnaces may enable metallurgists to work out processes of greater efficiency more advantageously than is otherwise possible. The paper included detailed manufacturing data and tables of the cost of electrical energy from various sources and at the principal electrochemical manufacturing centers.

The paper elicited a lively discussion. Among those taking part were Messrs. F. A. J. Fitzgerald (communicated), D. A. Lyon, J. W. Richards, F. A. Lidbury, C. A. Hansen, G. H. Clevenger, J. A. Mathews, E. L. Crosby and L. B. Skinner.

### Thursday's Sessions

"Progress in Electrostatic Ore Dressing" was the title of a paper by Mr. Frank S. Macgregor, who discussed the recent advances made by this method following the construction of the initial plant at Platteville, Wis. The energy required is small, a 3-hp plant being sufficient to operate from one to fifty separators. One attendant will care for a shift exclusive of handling ore. The electrostatic process has already been applied to separating zinc ores, silver, graphite, coal, etc. The paper was discussed briefly by Mr. G. E. Collins.

Mr. S. C. Lind in his paper, "The Transformation of Radiant into Chemical Energy," pointed out that much experimental evidence is now at hand showing electrochemical equivalence in gas reactions occurring under external ionizing agencies. The author suggested the use of the term "ionic-chemical equivalence" in discussing gas reactions and placed at 0.72 gram the theoretical maximum quantity of ozone produceable per hour by one gram of

radium. In the ensuing discussion the following were heard: Messrs. L. C. Frary, L. C. Lind and E. P. Schoch.

In his paper, "The Art of Electric Zinc Smelting," Mr. W. M. Johnson described early experiences with electro-metallurgical processes. Tables of data on recent electric furnace runs were also appended. From the progress at the Hartford (Conn.) plant during the past three years Mr. Johnson predicted that electric zinc-lead smelting will ultimately afford treatment costs as low as $6 per ton of ore, and that the losses, excluding roasting, will be reduced to: Zinc, 40 lb.; lead, 1 lb.; copper, 2 lb.; silver, 0.30 oz., and gold, 0.01 oz. per ton of ore. For the immediate future, however, he suggested multiplying this estimate by two.

Mr. Johnson's paper, which was read by Prof. J. W. Richards, elicited a long and animated discussion in which Messrs. J. W. Richards, Ericson, C. A. Hansen, F. S. McGregor, L. B. Skinner, G. H. Clevenger and J. L. Malm took part.

In his paper, "The Electric Zinc Furnace," Mr. Peter E. Peterson described the series of experimental furnaces built by him, recounting the difficulties overcome and the results obtained. He estimated that a ton of pay charge can be worked at a total cost of $12.67—of which $4.65 is chargeable to electrical energy (1401 kw-hr. at 0.332 cent per kw-hr.) and $1.33 for 9.5 lb. of electrodes at 14 cents per lb. The Rocky Mountain States, he declared, now present great opportunities for the electric-furnace treatment of complex zinc ores. Under its present condition the electric furnace should be a thorough success. With future experience costs will be greatly reduced.

In the short discussion following the presentation of Mr. Peterson's paper Messrs. G. H. Clevenger, L. B. Skinner, Ericson and Snow told of their experiences with the zinc furnace.

As the reading and discussion of these four interesting papers had occupied the greater part of the afternoon the papers which had not previously been read were presented by title and their joint discussion made as short as possible. A brief characterization of each of these papers is given below.

Mr. Arthur J. White's paper on "Simultaneous Determination of Copper and Lead, with the Rotating Anode" contained descriptions of methods of analysis of pure lead and copper, brass, foundry brass, zinc and cadmium, and bismuth and arsenic. The rotating-anode method was found also applicable to other alloys if containing less than 2 per cent of arsenic or bismuth, since the latter act as reducing agents.

In their paper, "Rapid Refining of Copper with a Rotating Cathode," Messrs. C. W. Bennett and C. O. Brown pointed out how current densities of 425 amp per square decimeter may be used in electrolytic deposition provided the cathode be rotated rapidly. Details of mechanical construction of a rotating-cathode cell were given and experiments were reported in which various copper solutions were used. Qualitative tests showed that only very accurate analyses of these deposits would show variation from 100 per cent copper.

"Effect of Light on Decomposition Voltage" was the subject of experiments reported by Mr. Alan Leighton in which he exposed one or both of the platinum electrodes of an electrolytic cell to the light from a mercury-vapor lamp. Illumination of the anode produced no appreciable effect, but illumination of the cathode increased the decomposition voltage. The light also tended to make both the solution and the deposited copper less stable, rendering it even possible to precipitate copper on shaded portions of the cathode but not on the illuminated portion.

Methods of obtaining "solid, thick deposits of lead from lead-acetate solutions" were discussed in detail by Mr. Frank C. Mathers, who insisted that any soluble lead salt will give a dense, coherent electrolytic deposit if the proper additional agents be used. A large number of varied agents were employed in the experiments, ranging through ammonium perchlorate and glue, acetic acid, peptone, extracts from feathers, casein, meat and vegetable extracts, tannin, fatty oils and gums. For electrolytes various strengths of lead nitrate, lead acetate, lead chloride and lead sulphate were employed.

Mr. R. M. Kenney presented a paper on electric smelting of chromium, tungsten, molybdenum and vanadium ores, in which were described practical methods of handling and preparing ferro-chrome, ferro-tungsten, ferro-molybdenum and ferro-vanadium. Theoretical considerations and chemical equations for the transformations were given together with practical data of the commercial method in use, sources of ore, etc.

"The Carnotite Industry" was described by Mr. Siegfried Fisher. Carnotite is a source of uranium and other radio-active elements. While the process of treatment is essentially chemical, electrolytic refining can be advantageously employed in reducing the carnotite.

Mr. O. L. Kowalke reported observations on base-metal thermocouples in a paper in which he compared the nickel-chromium, nickel-iron, nickel-aluminum and iron-manganese couples now marketed by several manufacturers with standard platinum couples, over ranges of temperature between 300 deg. and 1100 deg. C. The author concludes that such base-metal couples give results well within the required accuracy of industrial high-temperature measurements. He recommended, however, that manufacturers exert more care in adopting thermocouples for customers' particular uses and that all such couples be thoroughly annealed before shipment.

"Osmium-Platinum—A New Alloy" was described in a preliminary paper by Mr. F. Zimmermann. These alloys in various proportions, are intended to take the place of iridium-platinum, owing to the growing scarcity of iridium. Osmium-platinum is highly acid-resisting, and its electrical resistance is higher than that of an equivalent iridium-platinum alloy. It has great hardness and tensile strength and may be drawn into wires of the finest size

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## Eastern New York Section, N. E. L. A.

The Eastern New York Section of the National Electric Light Association held its annual meeting at The Sagamore, Lake George, N. Y., Sept. 15. The attractive Adirondack region was scenically at its best for the convention and when not engaged in the sessions the thirty delegates and guests found time to enjoy motor-boat trips, fishing, automobile rides, tennis, putting matches, hydro-aeroplane flights, speed-boat contests and the other diversions afforded.

Mr. Elmer J. West, vice-president of the Adirondack Electrical Power Company, Glens Falls, welcomed the convention to the lake region, recounting in a happy vein the history of the vicinity and comparing the work of the early pioneers with the industrial achievements of the electric industry. After a brief response by Mr. A. T. Thomas, Utica, N. Y., president of the association, the secretary, Mr. R. E. Russell, Schenectady, read his report and also that of the treasurer, Mr. F. W. McRea, of Glens Falls.

### Electric Vehicles in Central-Station Service

Interesting figures of the estimated savings effected by substituting electric vehicles for horse-drawn and gasoline wagons and trucks were next presented by Mr. C. A. Van Dyck, superintendent of the Schenectady Illuminating Company. In addition to its six or eight double and single horse wagons, the Schenectady company formerly operated several gasoline trucks and motor-tricycles, using the data mentioned for setting meters. Without drivers, the daily cost of operating these vehicles was: Two-ton truck, $5.44; 1000-lb. truck, $3.71; one-horse wagon, $1.26;

se line wagon, $2.71; three-wheeled motorcycle, $2.21. Four electric trucks now largely replace this equipment l result in yearly savings ranging from 25 to 35 per t of the investment in the electric machines. The new tery-driven vehicles have been in service since March l have given splendid satisfaction, declared Mr. Van ck.

### Public Confidence in Utilities

"Public Service and Public Opinion" was the subject of address by Mr. William McClellan, New York City, merly engineer for the Public Service Commission of Second District. Every business, declared the speaker, ds public support and the support of public opinion. en monopolies experience a form of competition—the mpetition of disuse"—owing to the fact that the pub- can "get along" without their services. In this sense, rates are competitive since they must be low enough to ract business. Public confidence is a valuable asset, and e which, built up at great expense and effort, may be troyed by a single untoward incident. Honest, straight- ward business methods must invariably be employed by ity corporations, despite the difficulties manufactured those who have personal ends to serve.

Many companies have been so earnestly engaged in the ggle of earning a bare existence that their manage- nts are too preoccupied to be informed on the details operation, rate-making, etc., and while this principle of ediency has been justified in the past, a different policy necessitated by the future, said the speaker. The wide- ead introduction of commissions has changed the view- nt of utility operation, revealing to corporations how it to their own interests to know the value of the proper- s they operate, their running expenses, the provision of per maintenance for best efficiency, and the accumula- n of funds if possible.

Although commissions sometimes enter local situations h limited information of detailed conditions, they ener find, declared Mr. McClellan, discouraging "messes ignorance" on the part of the company officers concern- g their own properties. Such managers are, of course, sy and struggling to pay expenses, and have no time for e fine points, but even in such cases Mr. McClellan commended "house-cleanings" of all doubtful policies and nditions. After a commission has completed such a use-cleaning the company investigated is sometimes ap- lled at the conditions discovered and sometimes dis- uraged, but, added the speaker, it is always interested. nd in few cases has commission regulation done injury the corporation involved. When complaints were re- ived at Albany, Mr. McClellan said he found a mutually tisfactory step toward adjustment to be that of first ferring the complainants directly to some individual of- er in the company concerned. In ninety-nine out of one ndred cases explanation was made and adjustment fected without commission intervention.

### The Manager and the Public

Utility officials should be accessible to the public, urged e speaker. With a cleaned house and nothing to hide, e manager should be able to explain his rate schedules nd to answer satisfactorily the customer's questions. road principles of policy should be fixed, and then the idest possible latitude should be given to employees to terpret these policies, without referring unimportant mat- rs to headquarters. Proper use of the employee as a mpany outpost in the community is another principle tle understood, declared Mr. McClellan. Scattered as ey are throughout the population, such employees can e encouraged to answer questions honestly and frankly nd to create for the company public opinion worth many llars.

Constructive policies are needed, concluded the speaker, th in the administration of individual companies and in the conduct of associations of utility interests. Many successful companies, for example, have representatives attend all meetings of movements for the public welfare. Constructive suggestion in advance will often avoid embarrassing and destructive legislation.

A new alignment and rearrangement is now apparent in the relations of capital, public and operating man, said Mr. McClellan in closing. Heretofore capital has been the dominant factor, and to it the old-fashioned manager looked for orders. The new type of operator has the courage to face his directors and demand adequate service for the public. And only in such a three-stranded partnership, with the operating man representing the interests of both capital and public and seeing that each gets its rightful share, will all three parties receive their just deserts.

### Losses Due to Voltage Drop in Wiring

Continuing the subject of co-operation with the customer, Mr. J. G. Henninger, Cleveland, Ohio, told of the work done by the National Quality Division staff in investigating conditions of customers' lamp voltage, candlepower and illumination. In many cases excessive drops are found between service switch and socket. For a number of industrial plants this average drop was 2.9 volts, indicating a 10 per cent loss of light to the customer and a 4.6 per cent reduction in central-station revenue. For residences the average drop of 3 volts showed 10.8 per cent loss of light and 4.6 per cent reduction in energy sales; while for stores 1.5 per cent drop gave 5.5 per cent light loss and 2.3 per cent energy reduction.

On the country's $300,000,000 annual electric-lighting bill, the saving of this 3.8 per cent loss would amount to about $10,000,000 yearly, suggested Mr. Henninger. In conclusion, he showed that when lamps are being burned at their greatest efficiency, resulting in highest satisfaction and economy for the customer, the central station will be earning its maximum income and the manufacturer will do the greatest renewal business.

### Medals for Resuscitation Heroes

Dr. C. A. Lauffer, medical director Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., followed with a demonstration of the Schaefer method of resuscitation, which he declared to be five times more efficient in filling the lungs, than the more laborious Sylvester method. He urged a more general diffusion of resuscitation knowledge and declared that the moral law makes guilty of contributory manslaughter any bystander who neglects to attempt intelligent resuscitation of a person apparently dead from electric shock.

As a means of distributing resuscitation knowledge, Dr. Lauffer proposed the institution of an N. E. L. A. hero commission to award bronze medals to persons resuscitating victims of electric shock. Each such instance reported could be investigated thoroughly, and the information incidentally obtained would be of the greatest value in accident-prevention work. This medal suggestion received hearty sanction from the convention, and Messrs. A. A. Anderson, Albany; C. S. Van Dyck, Schenectady, and W. A. Buttrick, Glens Falls, were appointed a committee to urge the proposal before the national association.

### Lighting of the Panama Exposition

At the evening session Mr. W. D'A. Ryan, illuminating engineer for the General Electric Company, Schenectady, N. Y., gave an illustrated talk on the illumination effects at the 1915 San Francisco Panama-Pacific International Exposition, for which he is director of illumination. Besides a number of lantern slides, Mr. Ryan exhibited banners and standards to be used for the concealed magnetite lighting of the building exteriors and displayed paintings of the effects when complete. He also showed a number of the cut-glass "Panama jewels," of which 125,000 will be used, weighing 10 tons and costing $60,000. Scintillator effects are to be em-

ployed at San Francisco on an unparalleled scale. Among the display features will be a huge steam locomotive painted in cream and gold and illuminated by projectors while steaming at 60 miles per hour on a rotating turntable. To gain the requisite semblance of power, the locomotive will be made to develop 1000 hp on water-brakes. During his address Mr. Ryan also discussed general illumination subjects, exhibiting various forms of arc lamps and illustrating the effects of proper illumination in lighting statuary and art objects.

ELECTION OF OFFICERS

The report of the nominating committee, made up of Messrs. J. C. Hemmingway, Glens Falls, chairman; M. O. Troy, Schenectady; J. C. G. Bradley, Syracuse; W. J. Reagan, Utica; E. M. Ellsworth, Schenectady; L. Hagood, Schenectady, and P. F. Roohan, Saratoga Springs, was unanimously approved by the convention, and officers declared elected as follows: President, Mr. H. W. Peck, Schenectady; vice-president, Mr. Leon Scherck, Poughkeepsie; secretary, Mr. C. S. Van Dyck, Schenectady; treasurer, Mr. F. W. McRae, Glens Falls; executive committee, Messrs. A. A. Anderson, Albany; A. T. Throop, Utica; O. F. Webster, New York; H. G. Davis, Watertown; L. Hagood, Schenectady, and J. C. Hemmingway, Glens Falls.

## The Electric Vehicle at Boston

Seventy members and guests of the Electric Motor Car Club of Boston assembled at the Boston Edison company's office on Sept. 10 for the first fall meeting of the season, General Superintendent W. H. Atkins of the latter organization being host. At the close of the usual luncheon the membership was increased to a total of 124.

Mr. S. G. Thompson, Public Service Corporation, Newark, N. J., cited the development of electric-truck applications in his territory, which represents an increase of about 1000 per cent in the past two years. At present 304 electric trucks are in service on the company's lines, compared with thirty in 1911, when the electric-vehicle department was organized. There are 206 pleasure cars of the electric type in service. The total advertising expense in this campaign has been under $20,000. The company aims chiefly at electric-truck development on account of its income possibilities. The territory of the Public Service Corporation offers a market for a total of 4000 trucks, which it is estimated would yield a yearly revenue of $1,080,000 at a rate of 3 cents per kw-hr. It is anticipated that this development will be attained within the next fifteen years.

MASSACHUSETTS ELECTRIC VEHICLE REGISTRATION

| | 1912 | 1913 | Gain | Per Cent Gain |
|---|---|---|---|---|
| Pleasure cars | 443 | 562 | 119 | 26.8 |
| Commercial cars | 227 | 389 | 162 | 71.3 |
| Total | 670 | 951 | 281 | 41.9 |

President Baker announced that plans are being made for holding an electric-pleasure-car exhibition in the ball-room of the Copley-Plaza Hotel, Boston, early in November. An effort will be made to class this among the social events of the year in Boston Back Bay circles. It was announced that the Boston Edison company is prepared to extend to dealers in commercial electric cars the use of its Stanhope Street garage as an exhibit space supplementary to the pleasure-car exhibition.

Mr. Frank J. Stone, Boston, reviewed the results of an electric-vehicle advertising campaign in Philadelphia, where there had been an increase in the sale of pleasure cars amounting to 75 per cent in 1911-12, with a publicity expense of about $1,000 per dealer. The total number of cars sold in this period was 128, compared with 74 in the previous year. The advertising was concentrated in a single medium and was well organized in arrangement and scope. Mr. O. G. Draper, Boston, gave the accompanying data as to electric vehicle growth in Massachusetts to Sept. 6, 1913.

He stated that the present registration of electric vehicles in New England totals 1539, of which 970 are pleasure cars and 569 commercial machines.

Before the close of the meeting President Baker announced that the Massachusetts Highway Commission has gone on record in its latest annual report to the effect that horse-drawn vehicles with narrow tires are working far more damage to the roadways than motor trucks, whose broader tires and distributed weights are favorable to lower highway maintenance costs. The next meeting of the club will be on Sept. 24, and a meeting of the New England section of the Electric Vehicle Association of America will be held in Boston near the end of the month.

## Texas Jovians Celebrate at Galveston

Jovian Day was worthily celebrated by Texas Jovians on Sept. 6. Members of the Jovian Order from Houston and Galveston united in a parade, rejuvenation and jovialion held at the latter city, entertaining also a number of visiting Jovians from Dallas and elsewhere. The parade was held in the early evening and was an elaborate and spectacular affair, fittingly examplifying the flourishing condition of the society in its native state. The initiation was held at the Crystal-Majestic Theater. Afterward there was a banquet at Harmony Club Hall, at which Mr. Fred M. Lege, Jr., was toastmaster. Many speeches were delivered. Mr. Max Levy, who arranged the details of the parade, came in for a share of applause, as did Messrs. A. K. Young, T. J. Jackson and others who were prominent in the arrangements.

## Power Development in National Forest

The Secretary of Agriculture has signed a water-power permit granting the right to use for power development certain land within the Lassen National Forest, Cal., to the Sierra Electric Power Company, Oakland, Cal. The water-power project is located on Mill Creek and approximately 25 miles east of the city of Red Bluff, in Tehama County. By means of low dams across the creek the flow is to be diverted into a conduit with a capacity of 300 cu. ft. per second and a total length of more than 16 miles. At the upper end of the pressure pipes a small regulating reservoir is to be built. In the power house—which is to be built of concrete—there will be installed machinery capable of providing a constant output of 22,500 kw. The energy will be transmittted at 110,000 volts.

## Illinois Commission Revises Overhead-Power-Line Crossing Rules

The Illinois Railroad & Warehouse Commission, as the result of fourteen petitions, five coming from the Aurora, Elgin & Chicago Railroad (electric) and nine from the Chicago, Milwaukee & St. Paul Railway (steam), to cross steam railroads overhead with high-tension transmission lines, has decided to revise its rules governing installation of overhead-wire crossings over the rights-of-way of railroad companies to conform to the specification adopted by the joint committee representing the National Electric Light Association and other societies. The Aurora, Elgin & Chicago Railroad, in filing its petitions, said that it has conformed to the specifications adopted by the joint com

itttee for overhead crossings of light and power lines
id provided an overhead clearance of 30 ft. The rules of
e Illinois Railroad & Warehouse Commission provide for
n overhead clearance of 35 ft. On Sept. 4 the companies
terested had a hearing, at the end of which the com-
ission agreed to issue an order for each of the fourteen
ossings if both the petitioners would conform to the joint
ecifications. Furthermore, the commission agreed that
s own rules governing the installation of telegraph, tele-
none and power wires over the right-of-way of railroad
mpanies needed revision. The engineers for the railroad
mmission will begin at once to revise these rules, using
a basis the specifications adopted by the joint committee.

## Wisconsin Commission Shows Milwaukee that Central-Station Energy Is Cheapest

An informal report on the cost of street lighting, sub-
itted by the Railroad Commission of Wisconsin at the
quest of Alderman W. I. Greene, chairman of the City
ouncil committee on street lighting, Milwaukee, shows
at energy purchased from a privately owned company
ill cost $46,873 less per year than if generated by the city.
his report means the end of the project of a municipally
wned plant, which has been advocated by the Socialist
rty.

Expert advice was sought from the commission as the
ntract with The Milwaukee Electric Railway & Light
ompany expired three years ago and the Council ever
nce has been undecided as to whether the city should
nerate its own energy or purchase it. Since the city is
evented by injunction from generating energy except
r its streets and public buildings, Alderman Greene con-
dered that the load-factor would be poor, and solicited
e advice of the commission.

At present the streets are illuminated by 2318 electric
mps, mostly old-style, 3120 gas lamps and 399 naphtha
mps. In one of the boulevard districts within a radius
150 ft. the annual expense for lighting is $210, while
ly 200 ft. away the cost is $45 per year, showing the
nequal distribution of lamps. It is partly for this reason
at the committee on street lighting proposes to rehabili-
te the system.

In a map showing the location of proposed lamps sub-
itted to the commission for use in its investigation 3809
ries magnetite lamps were shown. These were located
practically every street intersection, and where foliage
heavy it was specified that tungsten lamps should be
ed and spaced at more frequent intervals. About nine
onths elapsed before the commission was ready to pre-
nt the final figures on Sept. 15.

The terms under which the estimate was made provide
at all of the old electric street lamps shall be replaced;
out sixty lamps will be installed in a ward which never
id any lamps, and other wards will receive additional
umination. A portion of the lamps will be suspended
er the center of the street intersection and some will
supported on brackets on poles. About 2525 will be
pplied with energy from overhead circuits, and 1284 will
fed from underground circuits. It was estimated that
e privately owned plant could furnish energy at an aver-
e rate of $62.25 per lamp per year, the rate per lamp per
ar on underground circuits being $76, against $55 for
erhead circuits. At these rates it was estimated that the
reets could be lighted at an annual cost of $230,000, or
out $4,000 more than the cost at present for a less effi-
ent system. By an exclusively electric street-lighting
stem the efficiency would be increased about 25 per cent
er the present conditions.

A municipal lighting plant in Milwaukee would cost
out $1,493,758, and the annual operating expense would
about $273,153, or a rate of $75.11 per lamp per year.
The difference between this rate and the one offered by the privately owned plant may be accounted for by the diversity factor under which the latter operates. In place of installing one cable duct for the lighting system, the privately owned plant can use one of the ducts which it has already installed and charge the percentage of the whole duct system to the street-lighting account. Similarly with generating energy, the load-factor is higher than it would be in a municipal plant, which would operate only a portion of the day.

## Public Service Commission News

### Missouri Commission

The Missouri Public Service Commission will call a conference some time in October of representatives of electrical, gas and water companies, to consider rules and standards for service. The Bureau of Standards will send a representative to attend the hearing.

### New Jersey Commission

Under the New Jersey public utility law, the Board of Public Utility Commissioners was authorized to adopt rules and regulations for the determination of the adequacy of service furnished by electric companies.

Tentative rules and regulations were prepared and were considered at a hearing held in the latter part of 1912. A number of matters were brought up which had a bearing on the rules, and subsequent inspection of some of the properties subject to the jurisdiction of the commission showed that material changes would have to be made before the rules should be promulgated. These involved the enlargement of the scope of the rules so as to include all utilities using overhead wires supported by poles.

The tentative rules and regulations have been issued in pamphlet form and will be considered at a hearing to be held by the commission at the State House, Trenton, at 11 o'clock in the morning of Oct. 8. The hearing is called on the question of the adoption of the rules and regulations as they now stand. The commission has requested those who are interested to be present at the hearing and to take such part in the discussion as they may desire. The commission desires to have as full and free discussion of the matter as is possible.

### California Commission

The Railroad Commission of California has denied the application of the Oro Electric Company for permission to furnish electricity in sections of Stockton and San Joaquin County in competition with the Western States Gas & Electric Company.

Upon the receipt of the application the commission decided to allow the Western States Gas & Electric Company ninety days for the installation of certain improvements and to grant the company exclusive rights in this territory if it complied with the conditions. At a hearing held by the commission the Western States company showed that it had complied with the directions of the commission, and the petition of the Oro Electric Company was therefore denied.

### New York Commission

During August the New York Public Service Commission, First District, tested thirteen electric meters. All were found to be accurate within the requirements of the law.

### Indiana Commission

The Public Service Commission has been asked to approve a voluntary lowering of rates by the Merchants' Heat & Light Company and the People's Light & Heat Company of Indianapolis. The companies are controlled by the American Public Utilities Company and they were merged recently under the first order of the commission approving an electrical merger.

# Current News and Notes

Chicago Engineer a Benedict.—Mr. Thomas G. Grier, well known in Chicago electrical circles, was united in marriage to Miss Susie Ingeborg Clark on Sept. 16, 1913, in Boston, Mass. The wedding was one of unusual interest to the electrical industry, the bride being a sister of Mr. Augustus T. Clark, treasurer of the American Circular Loom Company of Boston.

* * *

Illinois Establishes New Coal-Producing Record.—Figures made public by the statistician of the United States Geological Survey show that the production of coal in Illinois in 1912 was 59,885,226 short tons, valued at the mines at $70,294,338. This constitutes a record for the State. Coal is mined in half of the 102 counties, the total coal-formation area of the State is 35,600 square miles.

* * *

Jovian Campaign Time-Limit Extended.—In view of the fact that many enthusiastic Jovians who are assisting the Society for Electrical Development in its membership campaign have reported that a large number of the men in the electrical business were still away on their vacations during the early part of September, the society has decided to extend the time limit in the campaign from Sept. 30 to Oct. 10.

* * *

Examination for Assistant in Laboratory Physics.—On Oct. 8 the United States Civil Service Commission will hold an open competitive examination for laboratory assistant in physics (male) for the Bureau of Standards, Washington, D. C. The salaries range from $900 to $1,200 per annum. Competitors will be examined in advanced general physics and electricity, and education, training and experience will count 50 per cent. Applicants must be between twenty and thirty-five years of age. Form 1312 of the Civil Service Commission gives further particulars.

* * *

New Form of Government for Springfield, Ohio.—The city of Springfield, Ohio (population, about 50,000), has adopted a new charter providing for the commission-form business-manager system of government. Five commissioners elected by the people are to elect a city manager, who will be the administrative head of the city and who need not be a resident at the time of his appointment. Franchises cannot be granted for a longer period than twenty years. The city reserves the right to purchase or lease all utilities. Dayton has adopted a similar charter and Akron has defeated the proposal.

* * *

Combined Mouth and Nose Telephone Transmitter.—For the purpose of transmitting the sounds emitted through the nose as well as the mouth Dr. Jules Glover has developed and patented in France a delicate microphonic transmitter for nose sounds to be used in combination with the standard form of telephone transmitter for mouth sounds. These two transmitters, each adjusted for its special service, vary the current in a common transmitting circuit acting upon a single standard receiver. It is claimed that speech is much more accurately and clearly reproduced by the new arrangement than by the old.

* * *

Electioneering in Chicago N. E. L. A. Section.—A lively campaign is in progress prior to the election of officers of the Commonwealth Edison Company Section of the National Electric Light Association. Two tickets are in the field. One, the "members'" ticket, is headed by Mr. F. J. Arnold, of the engineering department, who is candidate for president of the section; the other, the "popular" ticket, bears the name of Mr. W. C. Berry, of the claim department. Mr. Dana H. Howard, of the advertising department, is the candidate for vice-president on both tickets. The "members'" candidate for secretary is Mr. N. A. Rollins, of the engineering department, and the "popular" candidate for this position is Mr. T. J. Walsh, of the statistical department. Both sides have issued literature and are campaigning in vigorous fashion.

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## SOCIETY MEETINGS

Detroit Industrial Engineering Society.—At the regular semi-monthly meeting of the Industrial Electrical Engineering Society of Detroit, Mich., held Sept. 12 at the Employers' Association Hall, Detroit, Mr. Albert Keith, chief electrician of the Pennsylvania Salt Manufacturing Company, spoke on the subject of "The Manufacture of Caustic Soda and Chlorine from Salt Brine by Electricity."

* * *

Meeting of the Electric Vehicle Association of America.—The regular monthly meeting of the Electric Vehicle Association of America will be held in the Edison Auditorium, 44 West Twenty-seventh Street, New York City, on Tuesday, Sept. 23. "The Value of Power Wagon Operation to the Community" is the title of the paper to be presented by Mr. F. J. Ryan, of *The Commercial Vehicle*.

* * *

Colorado Electric Club.—At the weekly luncheon of the Colorado Electric Club, held at the Albany Hotel, Denver, Sept. 11, Mr. F. B. Fulton, designer of electrical scenery for theatrical productions, addressed the club on the subject of "The Advancement of Electricity for Stage Purposes." At a recent meeting of the board of directors of the Colorado Electric Club it was decided to postpone the club's electric show until some future date.

* * *

Illinois Convention Next Week.—The Illinois State Electric Association will hold its annual convention at the Quincy Hotel, Quincy, Ill., on Sept. 24 and 25. Mr. J. J. Frey, of Hillsboro, is president of the association, and Messrs. H. E. Chubbuck and C. A. Willoughby, of Peoria, are secretary and assistant secretary respectively. Features of the Quincy convention will be a theater party on the night of Sept. 23 for all who arrive on early trains, a trip to the Keokuk water-power plant during the day on Sept. 24, and a smoker-cabaret at the Hotel Quincy on the night of the same day. The business sessions will be held on Sept. 25.

* * *

Rochester Employees' Benevolent Association.—The employees of the Rochester Railway & Light Company have formed an Employees' Benevolent Association whose membership is expected shortly to reach 1000 out of the 1500 employees of the company. Messrs. Victor T. Noonan, secretary of the general safety committee, and Patrick F. O'Neil, foreman, were among the originators of the movement, which has received enthusiastic approval of the company's officials. The employees' association will be administered by officers selected by the employees themselves. Small enrolment and assessment fees have been fixed, and it is expected that the company will later contribute a substantial reserve fund to the organization.

* * *

Officers of Purchasing Agents' Association.—At its annual meeting held on Sept. 11, at Cooperstown, N. Y., in connection with the Association of Edison Illuminating Companies, the Association of Edison Purchasing Agents elected the following officers: President, Mr. William F. Huntley, Buffalo (N. Y.) General Electric Company; first vice-president, Mr. James B. Eaton, Rochester (N. Y.) Railway & Light Company; second vice-president, Mr. John H. Hunt, Pacific Gas & Electric Company, San Francisco, Cal.; treasurer, Mr. Andrew Banks, Consolidated Gas, Electric Light & Power Company, Baltimore, Md., and secretary, Mr. H. Frederic Frasse, Edison Electric Illuminating Company of Brooklyn, N. Y.

# Electrical Equipment of a Department Store

**Lighting and motor service installed in the Filene establishment, Boston—Indirect illumination and special display lighting derived from concealed units**

AMONG the recent additions to the shopping facilities of Boston, the new building of the Filene store, at the intersection of Washington and Summer Streets, the heart of the retail trade district, is a structure of mmanding interest from all the standpoints of architect-l design, efficient merchandising and modern equipment. mpleted but recently at a total cost, exclusive of land, of 225,000, this store illustrates the latest electrical appli-ions in lighting, power and signaling service upon a com-hensive scale adapted to insure the greatest convenience the sale of wearing apparel and accessories.

The building has a ground area 223 ft. long by 149 ft. le and rising 125 ft. above the sidewalk in accordance h the Boston building limitations. It rises to eight ries above the foundations, the latter having been exca-ed to a depth of 53 ft. to provide three additional stories ich are also in regular use. Mezzanine floors are pro-ed on the first six stories above the street, affording ce for department offices, quarters for 2500 employees l various auxiliary uses. The entire covering of the uctural frame is of terra-cotta above the first story, and building is of fireproof construction throughout. The hitects were Messrs. D. H. Burnham & Company, icago, the electrical installation being made by Mr. Harry exander, electrical and contracting engineer, New York.

### Sub-Basement Power Plant

The electrical service of the building is supplied from a ver plant located in the sub-basement. The boiler instal-lation here consists of two 250-hp and two 500-hp Edge Moor horizontal water-tube boilers equipped with Roney mechanical stokers. These stokers are supplied with bitu-minous coal by a 16-in. motor-driven belt conveyor fed from a cross-conveyor, also motor-driven, which runs under five hoppers at the bottom of a reinforced-concrete coal pocket holding 200 tons. Coal is received by gravity from teams discharging at the sidewalk level. Ashes are taken from the furnaces by the fire-room force and dumped into a pit at one end of the boiler room, whence they are hoisted to the street for carting away. The hoist is of the motor-driven bucket type with a capacity of 15 tons per hour. The plant steam pressure is 150 lb. per sq. in. The boiler room, which also contains two electrically driven vacuum pumps used in connection with the steam-heating system, is 80 ft. by 46 ft. in dimensions, its floor being about 14 ft. below the level of the engine room.

The engine room, measuring 100 ft. by 60 ft., contains five direct-connected engine-driven generating units, each consisting of a horizontal single-cylinder Ball engine and a Crocker-Wheeler three-wire, 125/250-volt direct-current generator. Four of the units are rated at 300 kw each, the fifth being a 150-kw machine. The larger engines have 20-in. by 30-in. cylinders, and the small engine measures 16 in. by 20 in., the speeds being 150 and 200 r.p.m. respectively. The total electric generating capacity is 1350 kw, and the approximate total con-nected load is 1155 kw. Of this the connected lighting load represents about 475 kw and the connected



FIG. 1—ILLUMINATION OF RESTAURANT BY DIRECT UNITS INCLOSED IN FROSTED GLOBES

motor load 680 kw. Various heating devices of small demand are included on the lighting circuits. The ventilation of the mechanical plant is cared for by motor-driven fans connected with a duct system which permits frequent changes of air through suitable inlets and outlets.

### Switchboard and Electrical Distribution

The main switchboard, 26.5 ft. long, contains eleven marble panels shown in the accompanying illustration and



FIG. 2—DISTRIBUTION LAYOUT OF SECOND FLOOR

is located opposite the generators at a distance of 6 ft. from the engine-room wall, its ends being inclosed by an open grille protecting the rear of the panels. There are five generator panels, each containing a voltmeter, an ammeter, a field rheostat, a pilot light, a circuit-breaker with equalizer contact, and main and balancing coil double-throw switches. At one end of the board are two lighting switch panels. An intermediate totalizing panel adjoins the generator section, with two watt-hour meters for recording the lighting output. Eleven triple-pole, single-throw lighting feeder switches are installed, the risers being carried upward from the rear of the board through three-wire shafts together with the power feeders. All are in iron conduit and terminate in cut-out cabinets on the various floors as shown in the accompanying reproduction of the feeder sheet.

At the right of the generator section is a totalizing panel

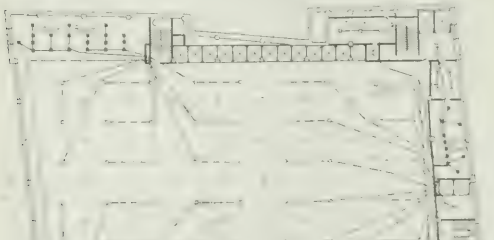


FIG. 3—DISTRIBUTION LAYOUT FOR SALES FLOOR

carrying a watt-hour meter for the motor record and two tie switches for bus service, there being one set of buses for motor service and one set for lighting. Two motor feeder panels are located beyond this totalizing panel, carrying fifteen double-pole single-throw switches controlling a corresponding number of motor-supply circuits. At the top of the switchboard is a ⅛-in. sheet-steel plate to which the conduits are fastened by lock nuts and bushing the cables being carried from the conduit outlets to th switch terminals.

### Installation of Indirect Lighting

The lighting installation was planned with unusual ca and is among the most noteworthy examples of indire illumination lately placed in service. All of the main sal floors, with the exception of the basement, are equipp with indirect reflectors supplied by the National X-Ra Reflector Company, of Chicago. These reflectors are mad of one-piece glass with vertical and spiral corrugation plated with pure silver and protected by means of an elast enamel.

On the first floor are fifty-three bays, each 20 ft. by 22 f in dimensions, the ceiling being 20 ft. high. Each bay equipped with one reflector, containing six 150-watt clea bulb tungsten lamps, giving an energy ratio of about watts per sq. ft. and an illumination of about 5.25 ft candles on the working plane at the counter level. Th distance from the top of the reflector to the ceiling is 60 i The interior of each reflector is fire-glazed, which facilitat cleaning and tends to insure permanence of the illuminatio standard. In general, the interior finish throughout th building is light in color, the usual showcase and counte material being mahogany, except on the second and thir floors where the cases are light gray in tint.

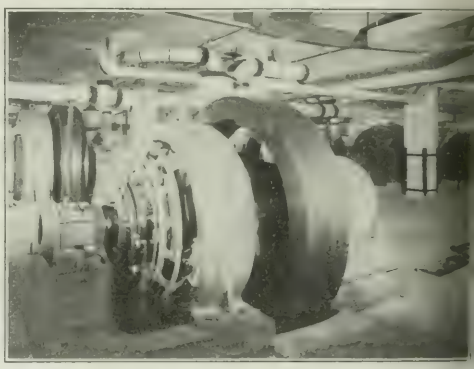


FIG. 4—VIEW IN ENGINE ROOM OF SUB-BASEMENT PLANT

On the first floor are departments displaying men's h and furnishings, women's gloves, hosiery, neckwear, je elry, leather goods and toilet articles, and, as described he after, special illumination is required in addition to general indirect lighting in certain cases. The second fl upon which are carried clothing for men and boys, b furnishings and shoes, has a 14-ft. ceiling, and the spac and equipment of the indirect-lighting units is similar that on the first floor, except that the distance from the of the reflector to the ceiling is 42 in.

The third to sixth floors, inclusive, carry underw garments and feminine furnishings of varied charac These have 14-ft. ceilings and fifty-three 20-ft. by 2 bays per floor, with one outlet per bay. From each o an indirect lighting reflector depends, each reflector taining six 100-watt clear-bulb tungsten lamps, the en requirements being 1.36 watt per sq. ft. and the illum tion at the working plane or counter level 3.5 ft.-can On these floors the distance from the top of the refle or to the ceiling is but 36 in. The seventh and eighth f rs are occupied by general offices, fitting and alteration ro s, the latter floor including a large restaurant for the u of patrons and accommodations for feeding employees u a co-operative basis.

### Special Counter Lighting

The standard method of illuminating counter interiors is metal reflecting troughs at the top and front of each unter immediately under the plate-glass surface, all lamps ing concealed from the eye. The typical counter has a oss-sectional display space 24 in. high and 19 in. deep. ch reflector is equipped with 25-watt tubular tungsten mps installed 24 in. apart on centers, the reflector being pported at intervals of about 6 ft. by metal clips attached the glass. This arrangement is followed regardless of e length of the case. Energy is supplied to the lamps in e counters by wires carried up from the floor at the cor-rs in a ⅜-in. metal conduit run inside the counter. This nduit ends at the top of the counter, the leads being thence n horizontally to the lamp terminals inside the reflector. ne lighting of each group of three counters on the main oor is controlled by snap switches located in a hinged etal box installed flush with the lowest stock shelf built ound the columns.

On the first floor, in the jewelry department, additional ghting is provided to improve the display of polished goods shaded pairs of tubular 25-watt lamps carried in dull-nished metal reflectors at a height of 5 ft. 6 in. above the p of the counter on brackets spaced 6 ft. 6 in. apart hori-ntally. Other examples of special lighting are found un-r certain balconies. where the effect of the main indirect



FIG. 5—TYPICAL SHOW WINDOW LIGHTING

umination is reduced. In a typical collar display case ½ ft. long, 6 ft. 4 in. high and 15 in. deep, placed near an calator under a first-floor balcony, the lighting is pro-ded by five 25-watt tubular lamps spaced 18 in. apart on nters and located in front of a metal reflector of the unter type. This case has a capacity of seven stands, olding 156 collars, and, at the ends, shelves holding thirty oxes of these goods. Little reliance is placed upon ex-rnal lighting in connection with this typical case, the in-rior illumination being adequate for the exhibition of the erchandise contained within. In the hat department, under ne first-floor balcony, four-lamp fixtures are used, contain-ng 25-watt exposed lamps.

On the first-floor balcony there is a manicuring depart-ent containing a number of 18-in. by 30-in. porcelain-pped tables each equipped with a portable fixture con-ected by flexible cord with a wall outlet. Each fixture arries a 25-watt frosted-tip tungsten lamp shielded by a arabolic metal reflector, silver-lined and carried about 9 n. above the table. Similar lighting is provided for the anicuring tables of the main barber shop of the establish-ent.

On the second floor is a children's barber shop, 22 ft. by o ft., the general illumination being provided by four 60-watt lamps with diffusing shades installed in the ceiling at a height of 7 ft. above the floor. Three barber chairs are provided, and in front of these are plate-glass mirrors carried along the entire length of the wall and extending around the room, the walls being finished in white-enameled tile and with tiled floor and white ceiling and beams. Four 25-watt tungsten lamps are installed in front of the chairs to furnish additional special lighting at these points. The

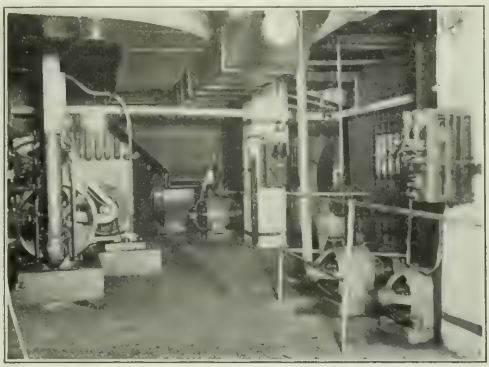


FIG. 6—MOTOR-DRIVEN PUMPS IN BASEMENT

main barber shop, 22 ft. by 43 ft., contains nine chairs, and its general illumination is provided by six 150-watt lamps equipped with prismatic reflectors and carried at a height of 7 ft. above the floor in two rows 10 ft. apart and 15 ft. on centers. Over each of the eight washstands is a 40-watt, frosted-tip lamp supplied with a translucent shade.

The standard showcase is 12 ft. long, 6 ft. high and 3 ft. wide and is illuminated by eight 25-watt tubular tungsten lamps installed 18 in. apart on centers in Frink reflectors. In stepping from the passenger elevators into the main aisle of a typical upper floor where cases of this size are installed this method of lighting at once attracts attention to the contents of the case.

### Direct Illumination in Restaurant

The Filene restaurant, on the eighth floor, has a capacity

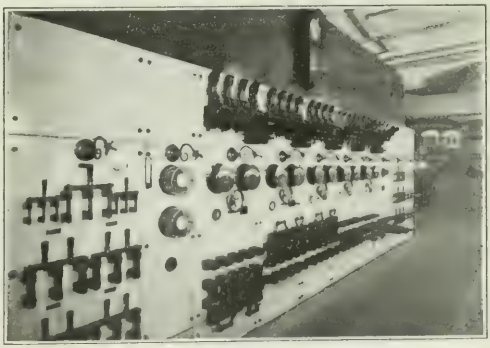


FIG. 7—SWITCHBOARD FOR FILENE BUILDING

of about 600 guests and is the climax of the interior decorative scheme of the building. The restaurant is L-shaped, the main portion, 50 ft. by 90 ft., being located under an ornamental monitor roof, as shown in the accompanying photograph. The remainder occupies a rectangular area under the roof on the Summer Street side of the building. In the case of the restaurant, the architects depended to a

large extent upon natural lighting for the main portion, which is provided with supplementary electric lighting around the under side of the monitor. Ninety 50-watt lamps are installed in translucent spherical globes for this service. The remainder of the restaurant is divided into 19-ft. by 22-ft. bays equipped with direct lighting, four semi-hemispherical Holophane reflectors being provided per bay,



FIG. 8—INDIRECT LIGHTING AND SHOWCASE ILLUMINATION

with two 60-watt lamps per reflector. The ceiling is about 12 ft. high in the case of these bays. Outside the main portion of the restaurant, at the elevator entrance, is an aisle 90 ft. long and about 18 ft. wide, which is illuminated by sixteen similar units installed in two rows parallel to the elevator doors. A waiting space is included in this area, with easy chairs and a magazine table carrying an ornamental alabaster lighting standard whose concealed incandescent units provide a soft and pleasing illumination for readers.

The clinic, which is located on the eighth floor in a corner of the building, consists of a physician's room, men's ward, women's ward and nurses' quarters. Indirect lighting is used in all these, with supplementary direct lighting for closets and other purposes. A view is shown of the physician's room, which is finished in white, and is about 7 ft. by 13 ft. by 12 ft. in dimensions. The general illumination is provided by one 150-watt lamp carried in an X-ray reflector, the bottom of the latter being about 8 ft. above the floor.

Over the consultation table there is a 100-watt frosted-bulb lamp mounted on a swinging pantograph arm at a height of about 4.5 ft. above the floor, with an extra outlet in the corner over a set of platform scales. The women's room, which is L-shaped, 48 ft. by 23 ft. in over-all dimensions, is provided with four indirect fixtures, each containing one 150-watt lamp. The men's room, 20 ft. by 11 ft., with a small supplementary skylight, is provided with one 150-watt indirect unit, and the nurses' room, which has no skylight and is 10 ft. by 11 ft. in dimensions, has one similar fixture.

The stockrooms are in one corner of the building on mezzanine floors and are in general 22 ft. by 70 ft. in dimensions, the usual number of outlets being twenty in each case. According to local requirements, lamps of from 15-watt to 40-watt rating are used in the stockroom general illumination. On the seventh floor, adjoining the fitting room, is a waiting room, 17 ft. by 28 ft. by 12 ft., with easy chairs and a reading table. The lighting here is provided by two indirect fixtures carrying four 150-watt lamps in each case, the bottoms of the bowls being 7 ft. above the floor and hung 7 ft. from each wall on a longitudinal axis. In clothing departments a special arrangement of mirror lighting is used, the installation consisting of a 40-watt lamp 6 ft. 9 in. above the floor on a bracket extending outward from the column for a distance of 15 in., to facilitate the use of folding mirrors which surround the column. The mirrors are 28 in. long by 5 ft. 4 in. high and are of plate glass.

### Systems of Signals

In front of each elevator door are two pilot lamps which indicate the travel of the car. At all exits two 15-watt lamps are installed in a transparency with a red glass suitably marked. Carbon lamps are being substituted for this service on account of their superior life record and on account of the importance of maintaining absolutely continuous operation at these points.

On each selling floor from the basement to the sixth floor inclusive are located two illuminated call-signal boxes, each containing nine signal lamps, numbered from 1 to 9, to summon heads of departments to headquarters when telephone or other business arises. These signal boxes are wired in tiers one above the other in two sets. The numbers are connected in series-parallel on nine circuits for each box, connected back to two banks of wall switches each in the telephone switchboard room of the house and wired back to a suitable cut-out cabinet. Each number is illuminated by a 15-watt lamp with a reflector.

At various points in the store public telephone pay stations are located, the standard booth being 2 ft. 10 in. by 7 ft. in dimensions, finished in light wood and lighted by one 25-watt frosted-tip lamp. Federal tubular sign lamps are used at various points to guide patrons to the different departments and selling sections. The lighting of the basement, which is broken up into a large number of selling

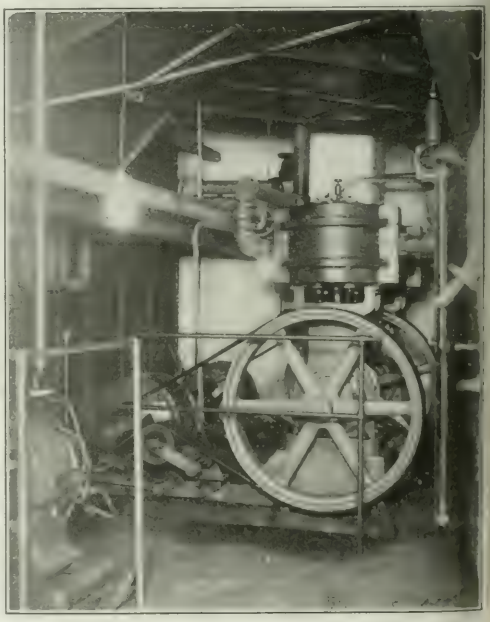


FIG. 9—MOTOR-DRIVEN VACUUM CLEANING MACHINE

spaces separated by glass partitions, is handled mainly by 100-watt open-bulb lamps with reflectors installed in the ceiling, this illumination also serving the basement balcony.

### Arrangement of Show-Window Reflector Units

The show-window lighting on the outside of the store is handled by 40-watt and 60-watt lamps installed in one-piece

lvered-glass reflectors set in troughs in the upper portion f the window and shielded from the eye by their location. he lamps are spaced about 15 in. apart on centers, and a pical window illumination view is shown herewith. Show indows equipped with this style of lighting are also lo- ated in the Summer Street station of the Washington treet tunnel, from which entrances are had to the store rough turnstiles. The entrance lighting is cared for by ie installation of two 40-watt lamps in 12-in. prismatic owls 7 ft. above the floor of each vestibule. On three sides f the building a marquise is run above entrances and is rovided with border lamps of 15-watt rating, spaced 16 in. part, bulls'-eyes being installed in the front of the mar- ise, at the ends and in intermediate positions. Two 25- att lamps are used in each of the latter. Around three des of the building at the eighth floor a strip of 15-watt rder lamps is also installed, 12 in. apart on centers. A tal of 667 outlets are installed in the marquise and border ghting.

### Distribution, Wiring and Outlet

The accompanying table gives the lighting outlets on the rious floors. The wiring arrangements of the second or and the second-floor balcony, which are typical, are own in the accompanying diagrams. In general, the feeds r floor, wall and ceiling outlets are provided by two-wire d three-wire circuits run in metal conduit from three nel boxes located at widely separated points in the build- g, the riser connections being made between the panel xes and the wire shafts previously mentioned. As a rule, ch pair of indirect-lighting units for ceiling suspension



FIG. 10—LIGHTING IN SURGICAL CLINIC

sfed by a three-wire circuit running directly from the nel-box switch to the first unit of the pair, a two-wire extension being made for the second unit. In this way the lighting load is well balanced, each switch for such a cir- it controlling service on each side of the three-wire ntral. No outlet is wired for less than 55 watts demand, al no more than 660 watts is allowed on any tap circuit except for exterior lamps. Fan outlets are wired for 110 watts capacity in each case.

Sizes of all lighting feeders are proportioned on the basis that all circuits provided in cut-out cabinets are loaded up to 85 per cent of the full capacity allowed by the insurance regulations, and the system is designed so that the drop of potential between the service and any cut-out cabinet will



FIG. 11—INDIRECT LIGHTING OF FIRST-FLOOR SALESROOM

not exceed 3 volts, measured across the outside legs of the three-wire system. The wiring is proportioned so that when loaded to its full capacity the drop of potential will not exceed 2 volts between any cut-out cabinet and the most distant outlet on any one circuit. A maximum drop of 1 volt is permitted on sub-feeders. Main lighting feeders pass through the rear wiring compartments of the cut-out cabinets which they supply, and they are supported on porcelain insulators on every floor where they pass through the wiring compartments.

All cables are anchored with strain insulators at their upper terminals and are supported by cable racks inclosed

LIGHTING OUTLETS IN FILENE STORE, BOSTON, MASS.

| Location | No. Outlets | Wattage of Lamps | | | | | | | Kw Connected |
|---|---|---|---|---|---|---|---|---|---|
| | | 150 | 100 | 60 | 50 | 40 | 25 | 15 | |
| Subway show windows | 160 | | | 160 | | | | | 9.6 |
| Basement balcony | 305 | | 233 | 2 | | 30 | 12 | 28 | 27 |
| Sub-basement | 233 | | 11 | 120 | | 5 | 57 | 40 | 12.35 |
| First floor show windows | 370 | | .. | 326 | | 47 | | .. | 21.26 |
| First floor | 1380 | 324 | 10 | 19 | | 112 | 815 | 50 | 80.3 |
| Second floor | 643 | 318 | 14 | 14 | | 42 | 174 | 81 | 57.2 |
| Third floor | 607 | | 321 | 17 | | 33 | 130 | 106 | 41.3 |
| Fourth floor | 853 | | 371 | 10 | | 45 | 322 | 105 | 51.2 |
| Fifth floor | 752 | | 361 | 6 | | 43 | 262 | 80 | 47 |
| Sixth floor | 814 | | 335 | 15 | | 76 | 297 | 91 | 49 |
| Seventh floor | 872 | 157 | 8 | 14 | | 152 | 175 | 266 | 40 |
| Eighth floor | 326 | 51 | 16 | 91 | 90 | 69 | 9 | 10 | 25.7 |
| Border and marquise | 667 | | | | | 241 | 17 | 409 | 16.2 |

in sheet-steel pull boxes at intervals of three or four floors. These cable racks are built up of heavy strap iron hung from an I-beam at the back of the slot in the floor, the cables being supported on porcelain cleats. A cut-out cabinet is provided in each shaft on every floor where the wire shaft opens. The cabinets are made of sheet steel with an interior slate box treated with linseed oil, the slate for the panel being 1 in. thick and for the side linings ¾ in. thick. Cut-outs are of the panelboard type, the connections being made through copper strips which are continuous from one

side of the circuit to the other. Each cabinet is provided with an even number of circuits. On the various selling floors are a number of twenty-five-lamp floor outlets for showcase lighting, and these are connected together by three-wire sub-feeders from the cut-out cabinets connecting a maximum of four to five outlets per sub-feeder.

### Electrically Operated Elevators

The mechanical plant of the store is modern in every detail and provides for heating, ventilation, elevator service, compressed-air supply, vacuum cleaning, pump service and numerous small power applications. Electric drive by individual motors is employed in all departments except the laundry. The elevators include eighteeen Otis electric machines and two hydraulic lifts, the latter serving only the lower portion of the building. There are thirteen electric passenger elevators running between the basement and the eighth floor, each having a live-load capacity of 3000 lb. at a speed of 300 ft. per minute; one passenger elevator and one freight elevator of the same speed and capacity running from the sub-basement to the eighth floor; one freight elevator running from the sub-basement to the eighth floor,

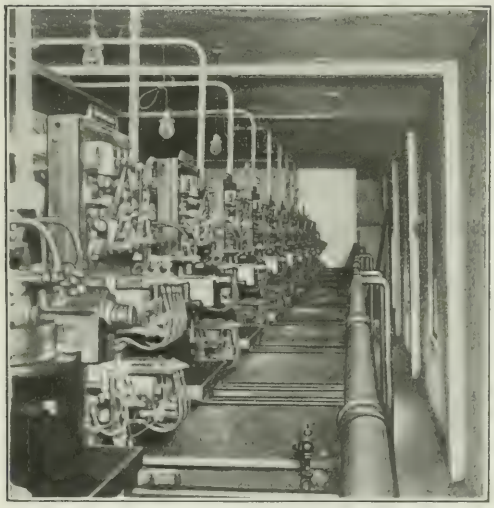


FIG. 12—MOTORS AND CONTROL EQUIPMENT FOR ELEVATORS

and one from the sub-basement to the seventh floor, with a capacity of 4000 lb. at a speed of 250 ft. per minute.

The main battery of thirteen passenger elevators is located in a single row on the north side of the building, the machines being carried on four 12-in. by 3-in. by 5/16-in. channel irons in each case. The channels are bolted together in pairs, being mounted upon channels inbedded in a concrete flooring or deck carried 42 in. above the roof. The battery is 100 ft. long and is illustrated in the accompanying photograph. All the elevator machinery is readily accessible by iron ladders from a passageway running parallel to the deck, and the controllers for each machine are located on slate panels adjacent to the corresponding machines. Water pressure for the operation of the two hydraulic lifts is supplied by a 7-in. by 8-in. Deane vertical triplex single-acting pump driven through a silent chain with a five to one reduction by a 17.5-hp motor. The capacity of this pump is 100 gal. per minute against 150 lb. pressure. The passenger elevator motors are rated at 34 hp each and those of the freight elevators at 40 hp. The Otis double-file cleat-type escalator in service between the first and second floors is designed to deliver 3600 passengers per hour ascending or descending. This escalator is chain-driven at the head end by a 17.5-hp motor. Between the sub-basement and the first-story balcony an automatic tray-type hoist for handling 24-in. by 43-in. by 33-in. baskets is in service, the apparatus being gear-driven by a 7.5-hp motor. The speed of this hoist is 60 ft. per minute.

### Dumbwaiters and Conveyors

Two automatic electric push-button dumbwaiters operate between the seventh floor, basement and second floor, each being driven by a 1-hp motor. The cars are equipped with electric lights which can be seen from the outside through a bull's-eye in the inclosure door, indicating when the car is at a landing. Locking devices are provided so that the ca

### List of Motors in Filene Store, Boston, Mass.

One 27-hp—Supplies fan, mechanical plant, belt drive (34,675 c.f.m.), 210 r.p.m.
One 13-hp—Supplies fan, sub-basement, basement, basement balcony (18,750 c.f.m.), 270 r.p.m.
One 10-hp—Supplies fan for entrances, belt drive (12,000 c.f.m.), 398 r.p.m.
One 30-hp—Supplies fan, sub-basement, basement, basement balcony (32,550 c.f.m.), 252 r.p.m.
Two 7.5-hp—Air compressors, 6-in. by 6-in., 60-lb. pressure chain drive.
One 3-hp—Air compressor, sprinkler dry-pipe system, geared, single-cylinder.
One 5-hp—Sump pump, air-washer overflow, vertical, direct-connected; capacity, 150 gal. per minute against 20-ft. head.
Two 2-hp—Air-washer pumps, 2-in. rotary, direct-connected.
One 5-hp—Air-washer pump, 3-in. rotary, direct-connected.
One 3-hp—Air-washer pump, 2.5-in. rotary, direct-connected.
One 15-hp—Deep-well pump, 2¼-in. by 24-in., well 585 ft. deep, capacity pump 90 gal. per minute.
Two 20-hp—Vacuum cleaning pumps, (six-sweeper), Sanitary Dust Removing Company, belted.
One 3-hp—Ash hoist, capacity 15 tons per hour, gear-driven.
Two 9-hp—Sewage ejectors, capacity of each 250 gal. per minute against 60-ft. head.
One 17.5-hp—Hydraulic pump, 7-in. by 9-in. Deane, vertical, triplex, chain drive, 5:1.
Two 0.5-hp—Vacuum pumps, steam-heating system, belted, capacity of each 6 c.f.m.
One 1-hp—Lamson pneumatic service system, capacity of exhauster 160 c.f.m., 480 r.p.m. (1-lb. vacuum).
Three 2-hp—Package conveyors, 75 ft. per minute, 24-36 in. (length 75 ft. on centers).
One 1-hp—Exhauster fan, shipping-room air duct (1,200 c.f.m.), 350 r.p.m.
One 10-hp—Laundry group drive, two washers, two extractors, 100-in. flat-work ironer, 36-in. body ironer.
One 1-hp—Apple parer and meat chopper, group drive.
One 0.3-hp—Polishing machine (Blakeslee), geared.
One 0.4-hp—Potato peeler (Victor), geared.
One 3-hp—Blakeslee ice cuber, Creasey ice breaker, group drive.
One 2.5-hp—Dish washer, capacity 6000 pieces per hour, three tanks
One 2-hp—Dish washer, capacity 4000 pieces per hour, three tanks.
One 1-hp—Dish washer, capacity 3000 pieces per hour, two tanks.
Fifteen 34-hp—Capacity 3000 lb. live load, speed 300 ft. per minute, Otis elevators.
Two 40-hp—Capacity 4000 lb., speed 250 ft. per minute, Otis elevators
One 17.7-hp—Escalator, up and down, capacity 3600 passengers per hour, each direction, rise 18.5 ft., speed 100 ft. per minute.
One 15-hp—Exhaust fan, sub-basement, etc. (33,500 c.f.m.), 200 r.p.m., direct drive.
One 19-hp—Exhaust fan, mechanical plant (33,700 c.f.m.), 215 r.p.m., direct drive.
One 4-hp—Exhaust fan, from toilets (8550 c.f.m), 295 r.p.m., direct drive.
One 15-hp—Exhaust, sub-basement, etc. (25,510 c.f.m.), 235 r.p.m., direct drive.
One 1.6-hp—Exhaust from kitchen (8000 c.f.m.), 450 r.p.m.
One 2.5-hp—Exhaust fan, kitchen off basement balcony (3000 c.f.m.), 350 r.p.m.
One 5.5-hp—Coal conveyor, 675 r.p.m. motor speed; 16 in. wide; length 14 ft. on centers, 16 degree incline, capacity 15 tons per hour.
One 2.5-hp—Cross coal conveyor, 16 in. wide, length 50 ft. on centers, capacity 15 tons per hour.
One 0.5-hp—Printing press, 11-in. by 17.5-in. jobber.
One 2-hp—Ice-cream freezer, capacity 10 gal., silent chain drive.
Two 0.16-hp—Carbonating machines.
Two 1-hp—Automatic dumbwaiters, capacity 150 lb. each, at 150 ft. per minute.
One 7.5-hp—Automatic hoist, geared, 60 ft. per minute, capacity 24 in. by 43 in. by 33 in. basket.
Twenty-four 0.14-hp—Sewing machines and auxiliary apparatus.

cannot be started if any landing door is open. The ash hoist between the boiler-room ash pit and the street has a capacity of 15 tons per hour and is gear-driven by a 3-hp motor.

A package conveyor installation is in service in the sub-basement to facilitate the classification of parcels for shipment. It consists of a system of canvas and rubber belts receiving packages from the floor above through chutes and carrying them past rows of bins assigned to various localities reached by the delivery service. Three motors of 2-hp rating each are required to drive this equipment, the belts ranging from 24 in. to 36 in. in width and running at a speed of 75 ft. per minute.

### Motor-Driven Fans and Pumps

Motor-driven supply fans are in service for furnishing fresh air to the mechanical plant, sub-basement, basement, basement balcony and the entrances, there being four fans for this work placed in an auxiliary machinery room adjoining the engine room. The capacities of these fans range from 12,000 cu. ft. to 34,675 cu. ft. per minute. All are belt-driven by individual motors varying from 10-hp to 50-hp in rating. The main selling floors are ventilated by natural inflow and outflow. An air-washer installation is provided for the sub-basement, basement balcony and basement, with a duplicate set of centrifugal pumps direct driven by motors, the pumps ranging from 2 in. to 3 in. in size, and the motors from 2 hp to 5 hp. Seven motor-



FIG. 13—MEN'S CLOTHING SHOP ON SECOND FLOOR

driven exhaust fans are in use in the establishment, five rising on the roof, one in a small kitchen off the basement balcony, and one in a vent duct for the shipping department. Motors with automatic starters are in use operating air compressors, a deep-well pump, sewage ejectors and an air-washer overflow pump. Two main compressors are installed, each of the Bury type, with 6-in. by 6-in. cylinders, driven by a 7.5-hp motor in each case and delivering air at 60 lb. pressure per sq. in. A sprinkler system with about 600 International nozzle heads is installed, the sources of water supply being a triple connection with the city's high-pressure mains, three pressure tanks on the roof and four steamer-pipe connections. The show windows are equipped with a dry-pipe system, the air pressure on which is automatically maintained by a vertical single-cylinder compressor driven by a 3-hp motor. Two vacuum cleaning pumps are installed, each driven by a 20-hp belted motor.

### Miscellaneous Motor-Driven Equipment

The laundry contains two washing machines, two extractors, a 100-in. flatwork ironer and a 36-in. body ironer, group-driven by a 10-hp motor. In the alteration department are about two dozen sewing and auxiliary machines, each individually driven by a motor of about 0.15-hp rating, operated from the lighting feeders. Other electrical applications are small motors operating dish washers, a vegetable peeler, an apple parer, a meat chopper, a polisher, an ice cuber and an ice breaker in the culinary department, ice-cream freezers, two soda-water carbonators, a small printing press, two vacuum pumps on the steam-heating system, hair driers, electric heaters, vibrators, electric-bell service, an "Eco" watchman's clock system, thirty-six electric flatirons, portable fans, Lamson pneumatic service, and a 500-mile Marconi radio station located on the roof. The latter

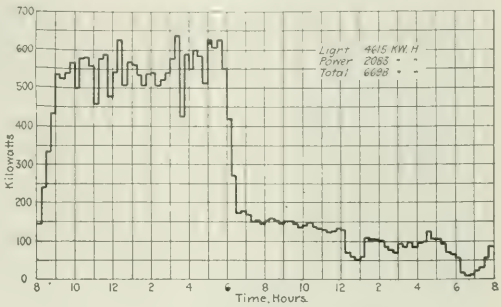



FIG. 14—HOURLY CONSUMPTION OF DEPARTMENT STORE

employs two 120-ft. steel towers, about 250 ft. apart, and a 5-kw motor-generator set. A continuous twenty-four-hour watch is kept in the station, and at intervals bulletins are posted on the first-floor balcony for the benefit of patrons.

The accompanying load curves are representative, Fig. 15 giving the output between 11.30 a. m. and 7 p. m. on Dec. 24, 1912, the day of the heaviest load carried by the plant, and Fig. 14 showing the variation in output from hour to hour for a complete twenty-four-hour run on Monday, Jan. 13, 1913. In the former case the maximum load was 720 kw, occurring at 5 p. m., the lighting output at the time being 480 kw and the power load 240 kw. The motor-service and lighting peaks did not quite overlap, although the readings were taken at the height of the Christmas shopping season. The peak load on Jan. 13 was about 640 kw.

Among those supplying motors for the Filene establishment were the General Electric Company, Diehl Manufacturing Company, Western Electric Company, Jenney Electric Manufacturing Company, and Sprague Electric Com-

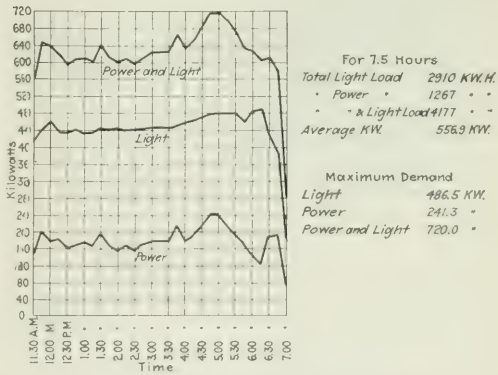



FIG. 15—DAILY LOAD CURVES OF FILENE STORE PLANT

pany; rheostats and motor starters, the Cutler-Hammer Manufacturing Company, the Cutter Company and the Condit Electrical Manufacturing Company; lighting fixtures, the Pettingell-Andrews Company; fans, the B. F. Sturtevant Company. Mr. David A. Chapman, betterment engineer, is mechanical and electrical superintendent of the installation.

# Graphic Solution for Illumination Problems

**Chart for rapid calculation of illumination density from known values of candle-power and of vertical and horizontal distances from the source. By Neville S. Dickinson**

MANY tables have been prepared to reduce the labor and shorten the time involved in the solution of illumination problems. This was the purpose that led to the construction of Illumination Charts 1 and 2, here shown. Fig. 3 illustrates a chart, reduced in size, suitable in scales for interior illuminants, and Fig. 1 shows a chart designed for exterior work. The problem of finding the illumination at any point from a lamp the light distribution curve of which is known, given the elevation of the lamp above the illuminated plane and its horizontal distance from the point in question, can be solved much more rapidly with the aid of these charts than with tables, and with an error not exceeding 5 per cent, and generally not more than 1 per cent, on charts 12 in. by 12 in. or thereabouts. The reverse problem—namely, of determining the various heights and distances at which a given illumination may be obtained—which ordinarily requires the drawing of several illumination curves, can be solved with similar ease.

As an example, suppose it is desired to find the horizontal

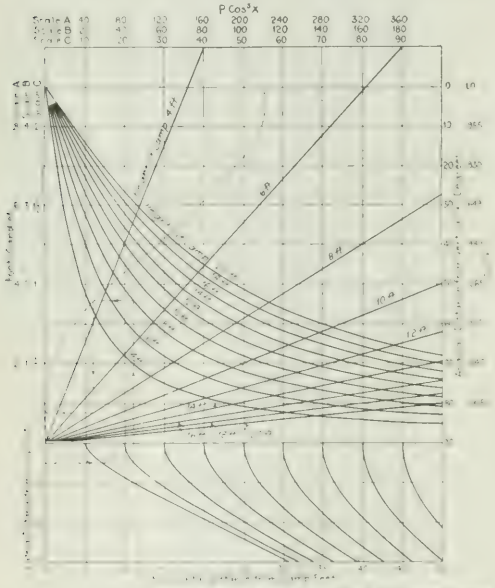


FIG. 1—ILLUMINATION CHART FOR EXTERIOR ILLUMINANTS

NOTE.—The dotted irregular curve is the horizontal illuminat... teristic curve (scale B) of a 100-watt "Mazda" lamp, clear bulb, fitted with an MM 12-in. diffuser, and is shown to illustrate the method of using this chart. The dotted lines show how to proceed in order to find the horizontal illumination from this lamp at a point located 5 ft. laterally and 10 ft. horizontally with respect to the lamp when the latter is at an elevation of 8 ft. (0.37 ft.-candle, scale B). If the illumination at a point on a line immediately below the lamp is required, proceed upward directly from the "horizontal distance from lamp" axis to the correct "height of lamp" curve, etc. Given the illumination, proceed in the reverse order to find the various heights and distances at which it may be obtained. Points for plotting the characteristic curve of a lamp are obtained from its distribution curve by multiplying the candle-power $P$, at various angles ($x$), measured from the vertical, by $\cos^3 x$ when horizontal illumination is desired and by $\cos^2 x$ for normal illumination. Use one of the upper scales and the right-hand scale of degrees for plotting these points and draw a smooth curve through them.

illumination at $C$, Fig. 2, from a 100-watt tungsten lamp located at $E$, with its axis in a vertical position. Ordinarily, the problem would be solved as follows: After having found $AC$, the angle $x$ would be obtained from trigonometric tables or with a slide rule. From the distribution curve of

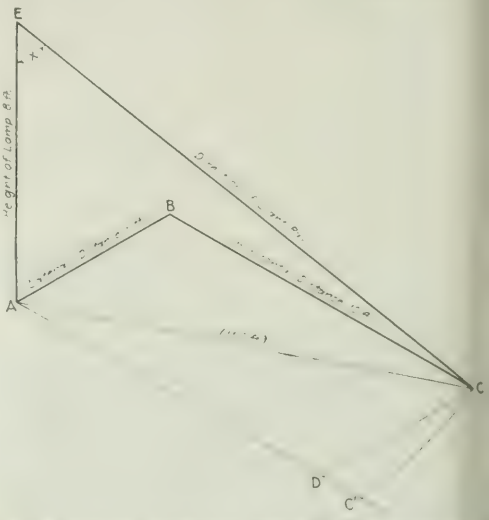



FIG. 2—GRAPHIC METHOD OF FINDING ILLUMINATION AT POINT ON A LINE PASSING DIRECTLY BENEATH A LAMP

the lamp (Fig. 4) the candle-power $P$ at the angular displacement $x$ would be scaled off. It is 122 cp in this case. $EC^2 = 5^2 + 10^2 + 8^2 = 189$. The horizontal illumination then is

$$\beta = \frac{P \cos x}{EC^2} \qquad \frac{122 \times 0.58}{189} = 0.375 \text{ ft.-candle.}$$

On the first chart (Fig. 3) the horiontal characteristic curve, which will be explained shortly, is given in dotted lines, and the method of solving this same problem graphically is shown by the dotted arrowed lines. Thus, referring to Fig. 3, from the 5-ft. point on the "lateral distance from lamp" axis, move horizontally to the curve starting from 10 ft. on the scale of horizontal distances. From this point proceed vertically to the "height of lamp" curve marked "8 ft.," then travel in a horizontal direction to the ... characteristic curve, then vertically downward to the 8-ft. "height of lamp" line, and finally leftward to the foot-candle scales. The answer in this case, scale $B$, is 0.38 ft.-candle as nearly as one may judge, which, therefore, is an error of

$$\frac{0.38 - 0.375}{0.375}$$

or roughly 1.3 per cent.

Looking at the chart, it may be readily seen that had the reverse problem been stated—that is, of locating $C$, given the illumination of 0.375 ft.-candle—one could have done this by merely proceeding on the chart in the reverse order. The illumination of 0.375 ft.-candle, of course, may

obtained at an infinite number of points, but we have in mind a point on *BC*, when the lamp is stationed at a lateral distance of 5 ft. from this line and at an elevation of 8 ft. The problem is naturally indeterminate unless the elevation and lateral distance be so chosen as to limit the result to a single unknown quantity, namely, the horizontal distance of the point from the light source. It is in solving this latter problem (that is, given the illumination to find the various heights and distances at which it may be obtained) that the charts are exceedingly useful, for, as has just been mentioned, it is ordinarily necessary to draw several illumination curves, one for each elevation of lamp it is desired to consider, in order to solve this problem.

To find the illumination at a point on a line passing directly beneath the lamp, say at *D* (Fig. 2), proceed directly upward from the "horizontal distance from lamp" axis. At *D*, according to the chart, the illumination (horizontal) is approximately 0.475 ft.-candle.

With regard to Chart 2 (Fig. 1) it is only necessary to say at this point that a problem similar to the one outlined in connection with Chart 1 is given on it, and that in this case the dotted curve is the normal illumination characteristic curve of a 6.6-amp magnetite-arc lamp.

For reference it will be convenient to write down at once the three equations expressing normal ($\beta_n$), horizontal ($\beta_h$), and vertical ($\beta_v$) illumination at a point in terms of the height of suspension ($H$) of the light source above the illuminated plane, the angular displacement ($x$) of the light ray from the vertical, and its candle-power ($P$). They are

$$\beta_n = \frac{P \cos^3 x}{H^2} \qquad (1)$$

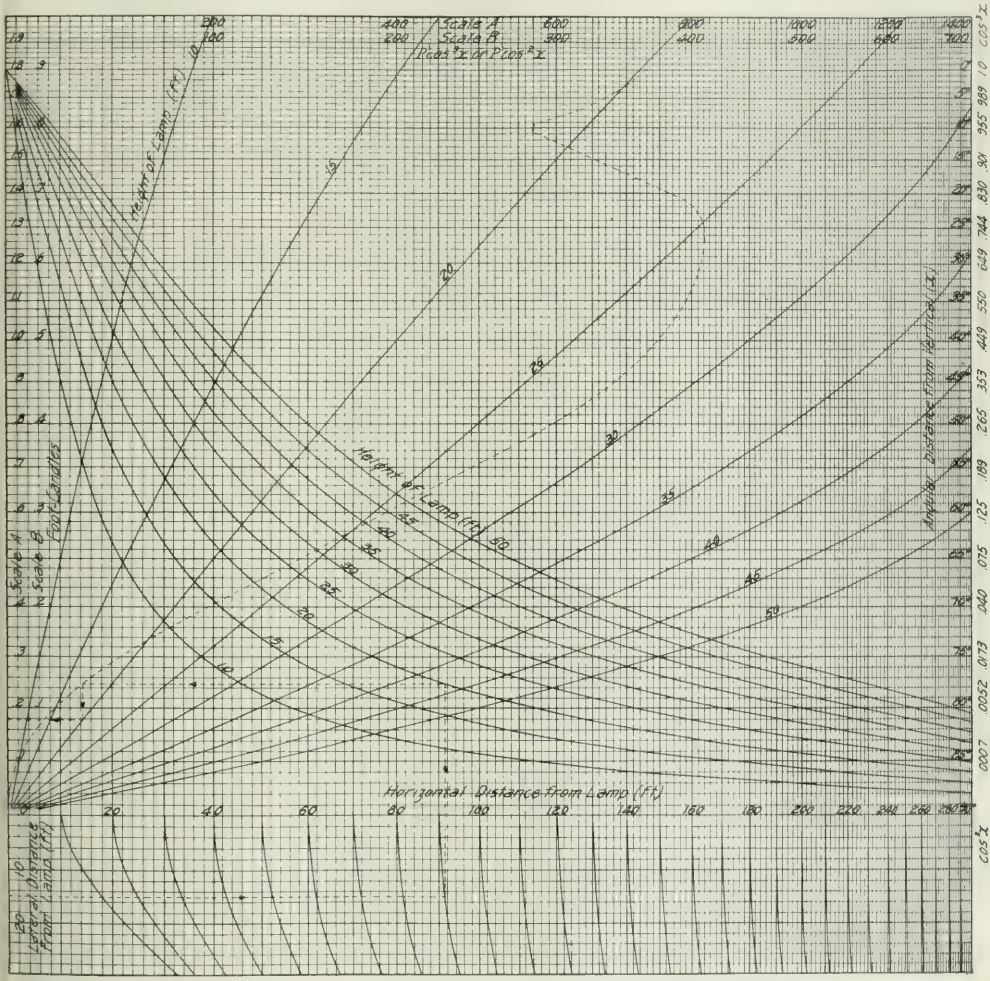



FIG. 3—ILLUMINATION CHART FOR INTERIOR ILLUMINANTS

NOTE—The dotted irregular curve is the normal illumination characteristic curve (scale A) of a 6.6-amp magnetite-arc lamp and is shown to illustrate the method of using this chart. The dotted lines show how to proceed in order to find the normal illumination from this lamp at a point located 15 ft. laterally and 90 ft. horizontally with respect to the lamp when the latter is at an elevation of 20 ft. (0.177 ft.-candle, scale A); if the illumination at a point on a line immediately below the lamp is required, proceed upward directly from the "horizontal distance from lamp" axis to the correct "height of lamp" curve, etc. Given the illumination, proceed in the reverse order to find the various heights and distances at which it may be obtained. Points for plotting a characteristic curve of a lamp are obtained from its distribution curve by multiplying the candle-power, $P$, at various angles ($x$), measured from the vertical position, by $\cos^3 x$ or $\cos x$ when normal or horizontal illumination respectively is desired. Use one of the upper scales and the right-hand scale of degrees for plotting these points and draw a smooth curve through them.

$$\beta_h = \frac{P \cos^3 x}{H^2} \qquad (2)$$

$$\beta_v = \frac{P \cos^2 x \sin x}{H^2} \qquad (3)$$

At present consideration will be given exclusively to equation 2, which is the equation for horizontal illumination. The first point to note about it is that $P$ and $x$ are

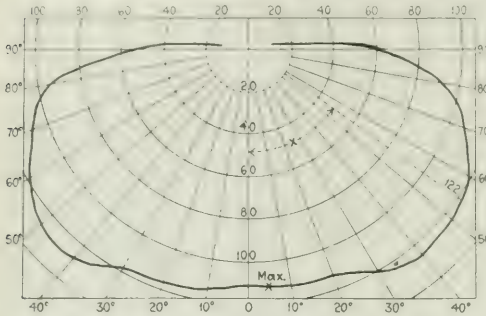



FIG. 4—DISTRIBUTION CURVE OF A 100-WATT TUNGSTEN LAMP, CLEAR BULB, FITTED WITH A DIFFUSER REFLECTOR

related or dependent variables. For example, referring to Fig. 4 it is seen that as the angle $x$ varies so does the candle-power $P$, according to a law which need not here be discussed. It is, therefore, plain that one may multiply the candle-power $P$ at any angular displacement $x$ by $\cos^3 x$ and deal with $(P \cos^3 x)$ values as a single number in equation 2 instead of $P$ and $\cos^3 x$ separately. In addition to having a "distribution curve" of a lamp, one may also have a "horizontal illumination characteristic curve," whose co-ordinates are $P \cos^3 x$ values and angular displacement from the vertical $x$. For the purpose in hand it will be convenient to use rectangular co-ordinates.

A portion of such a curve is given in quadrant 2 of Fig. 6, where the abscissas are $P \cos^3 x$ values and the ordinates are degrees displacement from the vertical. The complete curve is given in Fig. 3. Points for plotting this curve, as has just been indicated, are obtained from the candle-power distribution curve of the lamp, or where available, directly from illumination test records, by multiplying the candle-power values at any angle by the cosine cubed of that angle. For example, from Fig. 4, the cp of the lamp at an angle of 50 deg. is 125; $\cos^3 50$ is 0.265. Hence, $P \cos^3 x = 125 \times 0.265 = 33.1$, which gives the point $A$ on the characteristic curve in Fig. 6. From fifteen to twenty minutes is required to compute the points for such a curve, plot them and draw the curve, when a slide-rule and a French curve are available.

It has already been noted that the intensity of a light ray from a lamp and its angular displacement are related variables; knowing the angular displacement and having the characteristic curve of the lamp plotted, one may readily find the corresponding $P \cos^3 x$ value. But the angular displacement of the light ray which illuminates a particular point depends upon the height of suspension of the lamp and its lateral and horizontal distance from the point. The problem, therefore, now is to provide a means for determining the angular displacement for any height of lamp and lateral and horizontal distance.

Returning to the example illustrated by Fig. 2, the problem is to find the value of the angle $AEC = x$. The first step will be to find $AC$, the hypothenuse of the triangle $ABC$. This is done in quadrant 4, Fig. 6. Thus, $AC = \sqrt{5^2 + 10^2} = 11.2$; which is the value obtained by projecting to the curve in quadrant 4 from the 5-ft. point on the lower vertical scale of lateral distances and thence upward to $B$. The lateral distance of 5 ft. may therefore be considered as adding 1.2 ft. to the horizontal distance from the lamp. This step is so simple as to require no further explanation. Proceeding, it is seen that

$$x = \text{arc tan} \frac{AC}{AE} = \frac{11.2}{8} = 1.40.$$

Therefore, $x = 54$ deg. 35 min., roughly, which is the value obtained by traveling upward from $B$ to $C$ and leftward to $D$ in Fig. 6. The curve in quadrant 1, consequently, expresses the relation, using geometric terms, between an angle $(x)$ of a triangle and the opposite leg, which latter is the horizontal distance from the lamp when the adjacent leg, which is the height of suspension, is constant (8 ft. in this case). It is quite evident that a series of such curves, one for each height of suspension, may be plotted. Points for plotting them are found from the relation just explained. Thus, for the 8-ft. "height of lamp" curve one pair of co-ordinates would be 45 deg. and 8 ft., since the tangent of 45 deg. is 8/8, or 1.

Having found the angular displacement, 54 deg. 35 min. at $D$, Fig. 6, one is in a position to determine the $P \cos^3 x$ value, as explained in an earlier paragraph, by traveling from $D$ to the characteristic curve in quadrant 2 and then downward to $F$ on the left-hand horizontal axis, and it is 24.3. From equation 2 it is seen that the illumination $(\beta_h)$ is obtained by dividing the numerator $P \cos^3 x$ by $H^2$. Therefore the last step will be to provide a way of performing this small operation. The numerator of this equation can readily be found from the quantities generally given in an illumination problem, as has already been explained.

The abscissa in quadrant 3 is $P \cos^3 x$ and for the ordinate a scale of foot-candles $\beta$ will be given. From equation 2 it is evident that $\beta_h$ and $P \cos^3 x$ vary directly, and that if $H$ is constant a straight line passing through zero will denote the relation between these two variables. Such a line is drawn in quadrant 3 for a constant height of suspension of 8 ft. For a complete chart a line for a number of different heights of suspension must be drawn. Continuing the illustrative problem, from $F$ one would travel to $G$ (since the "height of lamp" is 8 ft.), and at $H$ find the illumination to be 0.38 ft.-candle horizontal illumination.

A chart arranged as in Fig. 6, while convenient for explanatory purposes, would occupy considerable space and occasion considerable traveling in working out a problem. Both of these difficulties may be greatly reduced by revolving quadrant 2 about the $Y$ axis through 180 deg. so that it coincides with quadrant 1, and revolving quadrant 3 about the $Y$ axis into quadrant 4 and then about the $X$ axis so that it also coincides with quadrant 1. This plan

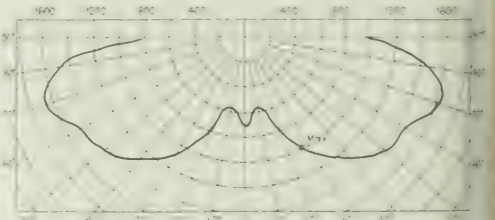
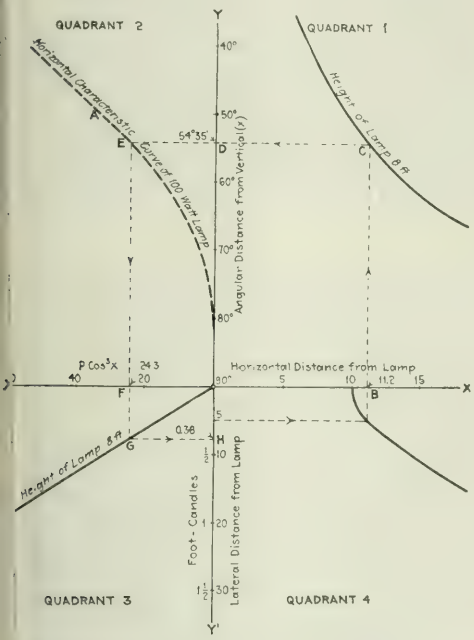


FIG. 5—DISTRIBUTION CURVE OF A MAGNETITE-ARC LAMP EQUIPPED WITH A CLEAR GLOBE AND CONCENTRIC REFLECTOR

will give the arrangement shown in Figs. 1 and 3 and in no way change the relation existing between the various scales. The $P \cos^3 x$ scale will then fall along $OX'$ and the foot-candle scale along $OY$. It will be noted that the $P \cos^3 x$ scale and the scale of angular displacement are intermediate scales and are not necessary in solving a problem. For example, from $C$ one may pass directly to

t stopping to read the degrees at $D$, and from $E$ he may ntinue to $G$, having no need, so far as the solution of a oblem is concerned, to note the $P \cos^3 x$ value at $F$. Ex- pt for the fact that these two scales are needed for plot- ig the characteristic curve of lamps, they might be ased. In the finished chart they are placed on the upper id right-hand margins, where they in no way interfere th the scales in more general use.

So far no mention has been made of equations 1 and 3, r normal and vertical illumination respectively. These uations are similar in form to equation 2 and differ from only in the trigonometric function of $x$ of the numerator. herefore, if normal illumination were desired instead of rizontal, it is plain that the scale which has been re- rred to as the $P \cos^3 x$ scale may represent $P \cos^2 x$ lues, and a normal illumination characteristic curve may plotted, using this scale in conjunction with the "angular stance from the vertical" scale. When using this curve e answers on the foot-candle scale will be foot-candles




IG. 6—GRAPHIC METHOD OF FINDING ILLUMINATION AT A POINT BY MEANS OF QUADRANTS

normal illumination. To obtain the vertical illumination from a lamp, its vertical illumination characteristic curve would be drawn in the same manner, one of the upper scale thus representing ($P \cos^3 x \sin x$) values, and on the foot-candle scale the answer would be vertical illumination, when using this curve. On Chart 1 (Fig. 3) three foot-candle scales are given, namely, $A$, $B$ and $C$, and three corresponding scales $P \cos^3 x$ values are given. Scale $C$ is most convenient for plotting the characteristic curve of small units, that is, of less than 100 cp. For larger units it is necessary to use either scale $A$ or scale $B$. On Chart 2 (Fig. 1) only two scales are given, one suitable for the large-flame arc the luminous-arc lamps, and the other for tungsten and other small units employed for exterior work.

Chart 2 is similar to Chart 1, except for the special cross-section paper. The peculiarity of this paper is that starting from the zero point and proceeding upward, downward and to the right the sections diminish in length according to an arithmetic progression. With this special paper it is possible to obtain a chart reading with accuracy over a wide range; for instance, from 0.01 ft.-candle to 2 ft.-candles and from 1 ft. to 300 ft. horizontal distance, within comparatively moderate limits. It is owing to this special paper that the "height of lamp" lines are curved instead of straight.

An interesting point is the manner of ascertaining the maximum illumination and its location. The characteristic curve on Chart 2 has a very pronounced maximum point, occurring at about 26 deg. from the vertical (see Fig. 5), as may be seen by glancing over to the right-hand scale of degrees (Fig. 1). To determine the value of the maximum illumination, say at 30 ft. elevation, move from the maximum point of the characteristic curve vertically to the 30-ft. "height of lamp" straight line, and then horizontally to the foot-candle scale, where the normal illumination is found to be 0.918 ft.-candle. To determine where this maximum occurs, move from the maximum point of the characteristic curve in a horizontal direction to the 30-ft. "height of lamp" curve line, and then vertically downward to the scale of horizontal distances, and it is found to occur at 15 ft. from the lamp. At an elevation of 25 ft. the maximum illumination increases to 1.32 ft.-candles and would be at 12.4 ft. from the lamp. The maximum point of the characteristic curve of the tungsten lamp is not so pronounced and is approximately 5 deg. from the vertical.

Sometimes with very large units, when great accuracy is desired, it may be found convenient to plot the lower portion of the characteristic curve, say from 90 deg. to 70 deg., to scale $B$ or $C$, and the remaining portion to scale $A$, bearing in mind that the illumination is to be read on the corresponding foot-candle scale. That is, if the part of the curve plotted to scale $A$, for instance, is employed in solving a problem, then the correct illumination will be found on scale $A$ of the foot-candle axis.

We have now completed the description of the method of construction of these charts, and have also considered the most important problems which they assist in solving. There are other points of minor interest, however, which might have had attention, such as finding the illumination on a wall or other vertical plane when the lamp is suspended vertically or the illumination from a lamp whose axis is at an inclination. Aside from the very great saving in time and labor which these charts make possible, in comparison with the customary methods of performing illumination calculations, it may be well to emphasize one or two other features. Errors will not, in general, exceed 2 per cent. When it is necessary to interpolate they are liable to increase to 5 per cent, unless special care is taken. Charts printed on paper suitable for blue-printing are most serviceable. Tracings, each with the characteristic curve of a lamp on it (or perhaps two or three, one for each kind of reflector, etc.), may be made and blueprint copies filed in the same way that distribution curves are now filed in all illumination laboratories and engineering offices, either for use in making calculations in the laboratory and office or for distribution to prospective customers.

## Two-Phase to Three-Phase Auto-Transformers

By Roy E. Uptegraff

Occasionally it is desired to transform from two-phase to three-phase or three-phase to two-phase, as the case may be, for the purpose of running a three-phase motor or other apparatus from a two-phase line, or vice versa. This may be accomplished by placing on each leg of a three-phase core single windings as shown in Fig. 1. Each leg is wound with sufficient turns for 115.2 per cent of the line voltage, and taps are brought out for 100 per cent and 50 per cent of the line voltage as shown.

For a better understanding of the two-phase and three-

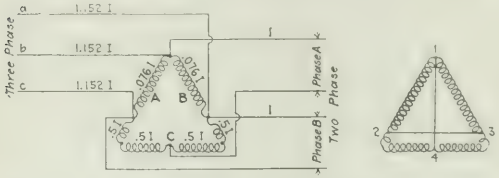
phase relation, reference should be made to Fig. 2. Lines 1 and 4 and 2 and 3 in the figure represent vectorally the two phases of the two-phase circuit since they are equal in length and at right angles to each other, the two-phase angle being 90 deg. Lines 1 and 2, 2 and 3 and 3 and 1 are equal and are at the angle of 60 deg. with each other, this being the three-phase delta angle.

If the current in the two-phase side be represented by $I$, the current in the three-phase lines will be 1.152 $I$, neglecting the magnetizing and loss currents. The currents in the three legs of the delta are not equal but are as shown in Fig. 1.

The winding in legs $A$ and $B$ required for 100 per cent of the voltage need be large enough for only 7.6 per cent of the two-phase current, while the extra 15.2 per cent of the winding must be designed for 50 per cent of the two-phase current. The current in leg $C$ must be designed for 50 per cent of the line current.

In explanation of the different currents in the windings it will be noted first that in Fig. 1 the apex of the delta is connected to one three-phase line and one two-phase line. Since the currents in the three-phase lines are equal to 1.152 $I$ and the two-phase current is $I$, then the current in the upper parts of sides $A$ and $B$ of the delta is $1.152\ I - I = 0.152\ I$, or 0.076 $I$ in $A$ and $B$ each from the apex to the tap. The rest of the sides $A$ and $B$ must be designed for the same current as in side $C$, as these are connected in series.

As the whole two-phase current flows into the middle of side $C$ as shown, it can be easily seen that 50 per cent of




FIGS. 1 AND 2—CONNECTIONS FOR TWO-PHASE AND THREE-PHASE TRANSFORMATION

this current will flow in each half and the lower parts of sides $A$ and $B$.

The size of standard three-phase transformer parts required for a two-phase-three-phase auto-transformer of this type is found as follows:

The value of the kilovolt-amperes in the sides $A$ and $B$ is $2\ (0.076\ I \times E + 0.5\ I \times 0.152\ E) 10^{-3} = 0.304\ I E \times 10^{-3}$.

The kva in side $C$ =

$$0.5\ I \times 1.152\ E \times 10^{-3} = 0.576\ I E \times 10^{-3}.$$

The total kva in the windings =

$$0.304\ I E \times 10^{-3} + 0.576\ I E \times 10^{-3} = 0.88\ I E \times 10^{-3}.$$

As this amount of power is transmitted through only one winding on each leg, while an ordinary two-coil transformer would have two windings on each leg, for this amount of power, in terms of an ordinary transformer, the rating would be equal to $\frac{0.88\ I E \times 10^{-3}}{2} =$ 0.44 $I E \times 10^{-3}$ in kva. The power in the line is $2\ I E \times 10^{-3}$. Therefore, the rating of the auto-transformer in terms of a standard transformer as a percentage of the line kva may be expressed as $\frac{0.044\ I E}{2\ I E \times 10^{-3}} = 22$ per cent.

The most desirable feature of the above auto-transformer over that of other methods for two-phase to three-phase transformation, according to the author's point of view, is its balanced operating condition. The above-described method of transformation was devised by Mr. William T. Taylor.

## Motor-Operated Wharf at Montgomery, Ala.

To accommodate the 50-ft. rise and fall in the Alabama River opposite Montgomery, Ala., an electrically operated municipal steamboat wharf has been installed, the feature of which is a movable unloading platform which can be lowered along an inclined trackway to the water's edge. As freight is unloaded from the barges onto this platform,




FIG. 1—GENERAL VIEW OF MOTOR-OPERATED WHARF AT MONTGOMERY, ALA.

small cars, also running on the inclined track mentioned, transfer the freight to wagons waiting at the top of the bank. The inclined trackway is 300 ft. in length and rises at an angle of 22 deg.

A 60-hp Westinghouse 500-volt direct-current motor furnishes power through a Lambert hoist mechanism to operate both the movable platform and the two 8-ft. by 12-ft. cars. The latter, of course, are in continuous operation while the wharf is in use, while the 30-ft. by 60-ft. platform

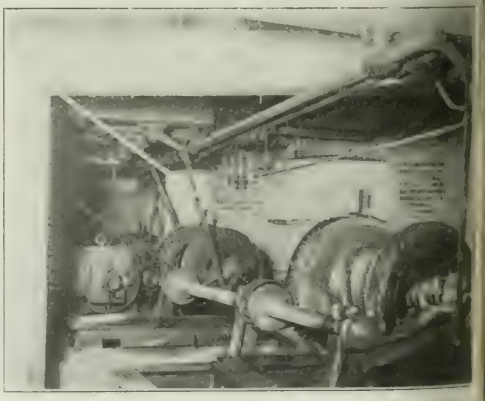


FIG. 2—MOTOR AND HOIST APPARATUS AT MONTGOMERY WHARF

need be moved only with changes in the stage of the river. Montgomery is at the head of all-year navigation on the Alabama River, being 410 miles up from Mobile and the Gulf. In the general view, Fig. 1, there is seen the rear of Montgomery's big "Key to opportunity" electric sign which faces the railway station.

# Central Station Management

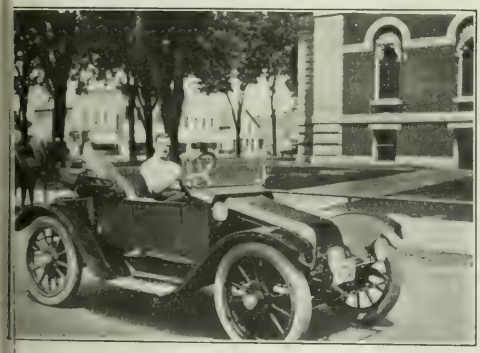
**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Renting Tungsten Fixtures at Houston, Tex.

The Houston (Tex.) Lighting & Power Company has inaugurated a tungsten-fixture rental campaign, offering to present or new customers the use of a 250-watt pendant fixture, complete with 14-in. globe and 250-watt lamp, at the rate of 40 cents per month. More than 200 of these pendants are now in service at Houston and have shown surprisingly few renewals. In addition to the rental, the customer pays 12 cents per kw-hr. for the energy used. The first cost of the pendant is made up as follows: Lamp, $1.39; fixture, $1.50; shade, $0.75; total, $3.64.

## Electric Roadster in Difficult Run

Much attention was attracted recently in Chicago automobile circles by a run from Chicago to Cedar Lake, Ind., and return made by an electric roadster driven by Mr. Richard Mansell, Chicago retail branch manager of the Borland-Grannis Company. This is said to be the first time that an electric vehicle has been driven to Cedar Lake and

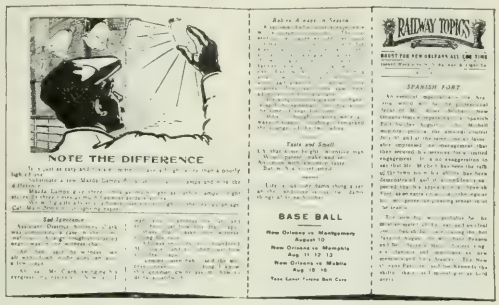


ELECTRIC ROADSTER IN DIFFICULT RUN

back. The distance, according to the speedometer on the car, is 97.2 miles and there are many grades and hills to negotiate. Because of the hills it had been thought impossible for an electric car to make the trip on one charge. The car used was a stock car of the Borland company, having an equivalent of forty-two cells of eleven-plate high-rate exide batteries. The average speed during the run was 18 miles per hour.

## Street-Car Folder Advertising at New Orleans

Each week the commercial department of the New Orleans Railway & Light Company issues 30,000 copies of a little central-station folder, "Railway Topics," which is distributed from boxes on the street cars of the company. During the tedium of a ride home or downtown the passenger without a newspaper is usually glad to avail himself of one of these breezy little four-page fliers, and for these minutes the central-station arguments it contains invariably have his undivided attention. "Railway Topics" is a four-page sheet, folded four times into one-column vest-pocket width. Besides the central-station propaganda, the pages are enlivened with many paragraphs in lighter vein, and there is usually an illustrated article on some energy-consuming device which the commercial department is pushing at the moment. This street-car folder, the New Orleans commercial staff declares, is one of the most valu-

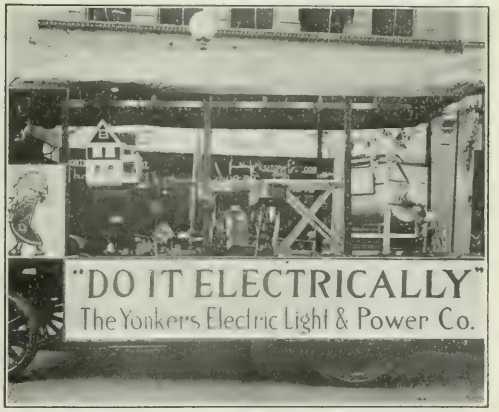



STREET-CAR FOLDER

able forms of advertising available for a combination railway and lighting company where use can be made of the company's cars.

## A Moving Electrical Exhibit at Yonkers, N. Y.

In the accompanying illustration is shown one of the trucks displayed by the Yonkers Electric Light & Power Company in the automobile division of the "Bright Light




ELECTRICAL EXHIBIT ON TRUCK AT YONKERS, N. Y.

Parade" which was held at Yonkers, N. Y., early in September to celebrate the installation of 150 lamp-posts. "Do it electrically" and the company's name were painted in big letters on each side of the truck. The truck carried a miniature dwelling and various kinds of apparatus to be operated electrically from the central station's lines.

## Electric Service Data from Fort Worth, Tex.

Fort Worth, Tex., a city of 85,000 population, has 15,014 residences, in 10,022 of which electric service is in use. The Fort Worth Power & Light Company has in all 12,500 electric customers, of which number 500 are users of electric motors having a total connected load of 12,000 hp. All of the forty-four local hotels, including the million-dollar Westbrook, employ central-station service. Nine ice factories constitute the only isolated plants in the city, and even these are prospective users of central-station energy.

Nearly 10,000 electric irons are now in use, three-quarters of these having been sold during the last six months in a two-man campaign under an offer of 50 cents cash and three monthly payments of $1 each. The residence rate is 11 cents per kw-hr. for the first 2 kw-hr. per lamp per month, and 7 cents per kw-hr. for all thereover. In competition with this schedule natural gas is sold at 30 cents per 1000 cu. ft.

Fort Worth's new steam-turbine station has a present maximum load of 25,000 kw and is the central generating point for fifteen nearby towns, all within a radius of 150 miles.

## Electric Iron Exchange Sale at Marion, Ind.

Following the publication of the accompanying advertisement in the daily papers of Marion, Ind., announcing that the Marion Light & Heating Company would give


BRING IN YOUR OLD IRON AND EXCHANGE IT FOR A NEW ONE

One that is guaranteed for five years. The price does not mean only Electric Irons, but any kind of an iron from the old fashion sad iron up. We are going to give every lady in Marion a chance to secure one of the very latest type irons on the market between the 1st and 10th Inst. of July for $2.25 and the old iron. Don't look forward to ironing day with dread, but do as your neighbors do and do your ironing with an Electric Iron. They are now used in twenty-six hundred homes in Marion, might that not be strong proof that the Electric Iron is the kind you want in your home. Don't miss this opportunity to dispose of your old sad iron. After using the Electric you will realize why they call your old one the sad iron. Remember you must have a old iron of some kind to get a new one for the above price.

MARION LIGHT & HEATING COMPANY

FIG. 1—FLATIRON ADVERTISEMENT OF MARION COMPANY

a new electric flatiron with a five-year guarantee to each person bringing in an old iron and paying an additional $2.25, the office of the company began to resemble the storeroom of a dealer in scrap iron. As the end of the sale was approaching the old irons were arrayed upon a table to have their picture taken. The photograph shows the result of the ten days' sale. At the end of that period



FIG. 2—OLD IRONS RETURNED IN CAMPAIGN AT MARION

the company was the possessor of sixty-seven old sad-irons and also of sixty-seven new electric iron users on its circuits. Considering that there was one electric iron in use for each seven and one-half persons in the city before the sale began the results accomplished are worthy of notice. Mr. Homer Gant is contract agent for the Marion company.

## Exceeding the Saturation Limit at Athens, Ga.

A round thousand electric irons are now in service on the lines of the Athens (Ga.) Railway & Electric Company, the last 202 having been added during a recent finishing campaign in which messenger boys delivered "blind" packages to the customers' doors. These 202 represent the number placed out of an original order of 225, although counting those returned and later shipped out again some 300 deliveries were made in all. The irons were delivered by messenger at a cost of 10 cents per package. Next day the salesmen followed over the routes and in most cases closed contracts with the housewives. These agents were paid on commission, receiving 50 cents for each iron sold. Purchased in quantities the irons cost the company $2.06, and they were sold to customers for $3. Mr. A. H. Sikes, sales manager of the company, had charge of the campaign.

## Large Sub-Aqueous Coal-Storage Basin at Indianapolis

For the storage of coal under water the Indianapolis Light & Heat Company has put into service at its Mill Street generating station one of the largest sub-aqueous coal-storage bins in the country connected with an electric service plant. The basin is built of concrete, the bottom and side walls being from 1 ft. to 1.5 ft. thick, reinforced with 0.5-in. twisted steel rods. The pit measures 100 ft. wide, 300 ft. long and 18 ft. deep below the water line. It affords space for storing about 15,000 tons of coal under water, and an equal quantity may be heaped above the water line, making a maximum storage of 30,000 tons. The plan will be to store below the water level coal which is rich in sulphur and cheaper in price, placing above the water line qualities not containing ingredients apt to ignite by spontaneous combusion.

In the bottom of the pit 40-lb. T-rails are laid longitudinally and spaced 18 in. from center to center. The heads of the rails project 0.5 in. above the concrete, protecting the latter from the scraping of the grab-bucket. A row of concrete piers placed on 15-ft. centers extends lengthwise through the middle of the pit. These piers support a trestle



FILLING COAL-STORAGE BASIN AT INDIANAPOLIS, IND.

with a standard-gage track at grade level. A 15-ton Bro steam locomotive crane travels back and forth on th trestle and handles the coal on both sides with a 2-yd. c grab-bucket, suspended on a 40-ft. boom. Crane a bucket are both operated by one man from his stand on the cab. As the crane is self-propelled and equipped wh trucks, couplers and steam brake, it does the switch g

f the cars off and on the trestle. The coal cars are run ut on the trestle with the crane and dumped, and when the oal is required in the power house it is loaded into cars y the crane and is then carried to the boilers. The ties n this track constitute the only wood employed in the jt construction.

A 7.5-hp, 4-in. centrifugal pump is used to fill the pit, btaining its water from the condensing-water well of the ation, which is supplied in turn from a creek that has een dammed to secure a constant supply of condensing ater. The cost of building this basin was about $25,000. he pit was designed by Mr. Thomas A. Wynne, general iperintendent of the company, and was built under his ipervision.

## The Double Fallacy of Flat Rates for Steam Heating

The accompanying table presents the experience of a central station in a Western town of 8000 population with its at-rate and metered steam-heating customers. The analysis was made in detail for every customer on this company's les with a view to locating those installations in which the ntracted "hours of usage" had been most flagrantly vio- ed. Those who are shown up as having deliberately sted steam will be notified that this must not continue ring the coming season and a watch will be kept to see if pper care is taken to use and not abuse the steam. The ble will also be used to convince customers that certain ngs are wrong with their systems. The company will nt out these faults and will help to get the consumptions wn to what they should be. As contracts for flat-rate am usage expire, they will not, however, be renewed.

The table makes itself clear, except perhaps as to the rcentage column in the flat-rate division. Here the total ceipts from the meter customers were divided by the total am in thousands of pounds used. This was considered unity and the "cents per 1000 lb." received from each flat- te customer was divided by this figure. In other words, e various percentages after the flat-raters are the percentages of revenue the company received from the flat-raters as compared with the percentages received from the meter users.

Summing up the results presented in the table, it is shown that compared with the metered users the flat-raters used 106 per cent more steam per 1000 cu. ft. and 111 per cent more steam per square foot of radiation. They paid $1.15, or 41 per cent, more per 1000 cu. ft. and 10 cents, or 44 per cent, more per square foot of radiation.

On the other hand, the company received 31.6 per cent less revenue per 1000 lb. from the flat-raters than from the meter users.

Thus, as the manager laconically expresses it, "We both lose." After inspecting the above figures, no further expression is required of the company's opinion of flat rates. It began service two seasons ago "without a great deal of knowledge of steam-heating and connected up some buildings we would not have taken on had we had our present experience. All in all we did succeed in getting some high rates for flat-rate usage," concludes the manager, "but it will be readily seen that we lost from the standpoint of cents per 1000 lb. sold."

1912-1913 SUMMARY OF HEATING SERVICE, TOWN OF 8000 POPULATION

| Class of Service | Contents, Cu. Ft. | Radiation, Sq. Ft. | Total Condensation, Lb. | Condensation per 1,000 Cu. Ft. | Condensation per Sq. Ft. Radiation | Ratio, Radiation to Cubic Content | Amount Received per 1,000 Cu. Ft. | Amount Received per Sq. Ft. Radiation | Percentage of Revenue |
|---|---|---|---|---|---|---|---|---|---|
| **Metered Customers Using Steam Entire Season** | | | | | | | | | |
| Grocery and meat store | 20,187 | 176 | 56 | 2,772 | 318 | 1:115 | $2.31 | $0.27 | |
| Flat | 18,872 | 511 | 152 | 8,055 | 297 | 1:37 | 5.71 | 0.21 | |
| Bank | 19,964 | 329 | 176 | 8,918 | 541 | 1:61 | 6.75 | 0.41 | |
| Bank | 25,594 | 504 | 172 | 6,721 | 341 | 1:51 | 4.47 | 0.23 | |
| Office | 10,005 | 270 | 98 | 9,800 | 363 | 1:37 | 8.18 | 0.30 | |
| Printing and telegraph office | 92,651 | 1,443 | 674 | 7,275 | 467 | 1:64 | 3.99 | 0.26 | |
| Garage and machine shop | 152,353 | 542 | 186 | 1,221 | 343 | 1:281 | 0.85 | 0.24 | |
| Lodge | 55,013 | 802 | 166 | 3,018 | 207 | 1:69 | 2.21 | 0.15 | |
| Totals—Total season metered customers | 394,639 | 4,577 | 1,682 | | | | | | |
| Averages—Total season metered customers | | | | 4,262 | 368 | 1:86 | $2.80 | $0.24 | |
| **Flat-Rate Customers Using Steam Entire Season** | | | | | | | | | |
| Bank, drugs and offices | 63,402 | 926 | 787 | 12,413 | 850 | 1:68 | $6.31 | $0.43 | 77.5 |
| Jewelry store and offices | 34,408 | 450 | 280 | 8,140 | 622 | 1:76 | 4.19 | 0.32 | 77.5 |
| Stores and room house | 65,613 | 870 | 625 | 9,527 | 718 | 1:75 | 5.34 | 0.40 | 85.1 |
| Store and offices | 130,828 | 1,833 | 1,170 | 8,945 | 638 | 1:71 | 4.23 | 0.23 | 54.7 |
| Stores | 296,493 | 2,365 | 2,029 | 6,843 | 858 | 1:125 | 3.13 | 0.39 | 69.8 |
| Saloon and rooms | 33,133 | 524 | 485 | 14,652 | 926 | 1:63 | 5.59 | 0.35 | 57.7 |
| Theater and rooms | 50,668 | 610 | 615 | 12,130 | 1,008 | 1:83 | 6.31 | 0.52 | 79.0 |
| Office | 4,384 | 125 | 103 | 23,462 | 824 | 1:35 | 10 25 | 0.36 | 66.8 |
| Photograph gallery | 20,144 | 249 | 317 | 15,771 | 1,273 | 1:81 | 4.10 | 0.33 | 39.5 |
| Office | 6,104 | 150 | 90 | 14,754 | 600 | 1:41 | 5.90 | 0.24 | 60.8 |
| Store and rooms | 37,009 | 652 | 370 | 10,000 | 567 | 1:57 | 4.05 | 0.23 | 62.3 |
| Store | 32,000 | 580 | 342 | 10,687 | 590 | 1:55 | 4.96 | 0.27 | 69.8 |
| Flat | 13,287 | 199 | 178 | 13,393 | 894 | 1:67 | 5 04 | 0.34 | 57.7 |
| Garage | 79,534 | 310 | 233 | 2,943 | 755 | 1:257 | 1 77 | 0.45 | 91.1 |
| Totals—Total season flat-rate customers | 867,007 | 9,843 | 7,625 | | | | | | |
| Averages—Total season flat-rate customers | | | | 8,795 | 775 | 1 88 | $3 95 | $0 35 | 68.4 |

## An Electric Fan with Many Uses

An enterprising negro bootblack in a small Indiana town has solved the problem of making his 6-in. electric fan a paying proposition for himself as well as for the central-station company. While he is putting the polish on the customer's shoes the fan is placed where its breezes cool the perspiring patron. The base of the fan is not fastened down, so that later, when shoes are to be dried, the blast from the whirling blades can be directed against the footware. At times when customers are few the bootblack uses the fan for his personal comfort, declaring that even if there were no customers for a whole day he would not regret the slight expenditure as long as he himself could be the beneficiary of the fan's cooling draft.

# Illumination and Wiring

## Street Lighting in Fort Wayne, Ind.

That part of the business district of Fort Wayne, Ind., including Calhoun Street from Superior Street to the Pennsylvania depot, a distance of about ten blocks, and four blocks of each of the three principal streets crossing Calhoun Street, is now being lighted by ornamental iron posts carrying five-lamp clusters of tungsten lamps. The city at present is operating 195 of these units, and there are besides a number of posts which were purchased by individuals where the spacing of 90 ft. was not satisfactory to the owners of the property.

The posts stand about 15 ft. over all above the street. The white alba globes surmounting the top of each post are 16 in. in diameter and inclose a 60-watt tungsten lamp,



FIG. 1—TUNGSTEN LIGHTING AT FORT WAYNE, IND.

while the four lower globes are 12 in. in diameter and are lighted by 40-watt lamps. The four lower lamps are operated until 11 p. m. and the top lamp remains lighted all night. Switching is accomplished automatically by means of time switches that are contained in the base of the posts.

To economize and at the same time to reduce the walk obstructions, fire-alarm boxes are hung on the corner posts, and at each station of this kind a red band painted on the 16-in. globe bears the words "Fire Alarm" in white letters. It is stated that the cost of this type of installation was approximaely $1.50 per front foot. Sixty more units of the same type will be installed within the next few months on Washington and Jefferson Streets.

In order to provide an opportunity for the residents of the city to contrast the tungsten lighting and the inverted magnetite-arc lamps, two blocks on Columbia Street have



FIG. 2—MAGNETITE-ARC LAMPS AT FORT WAYNE, IND.

been equipped with the latter system. The twelve lamps in this installation are staggered 90 ft. apart and are mounted on ornamental iron standards. The installation of 190 of these lamps is now contemplated in the outlying residence districts of the city. Mr. Frank Dix, who is chief electrician for the city, states that the maintenance charge on the tungsten lighting will somewhat exceed that of the magnetite-arc lamps.

The ornamental iron posts were made in the foundry of the Kerr-Murray Works, a manufacturing concern in Fort Wayne, Ind.

## Changing 35,000-Volt Insulators on Live Circuits

To change insulators on a 35,000-volt transmission line while several large glass factories are taking energy from the line is rather an uncommon feat. Such work was, however, performed by a lineman of the Marion (Ind.) Light & Heating Company on one of its transmission lines not far from the city limits. A common hand-axe handle



CHANGING 35,000-VOLT INSULATORS ON LIVE CIRCUITS

made into a wrench and insulated with four thicknesses of varnished cambric held in place with friction tape was used to free the line from the insulator. The handlines used in the operation were baked over night in an oven to drive out all moisture. In a very short time the broken insulator, which may be distinguished in the illustration was removed and a new one put in its place. The fact that the wishbone cross-arms on the line were all grounded made the feat an exceptionally perilous one.

## A Noteworthy Central-Station Chimney Sign

At its 13,500-kw generating station on Webster Stree Worcester, Mass., the Worcester Electric Light Compan has recently erected a large double electric sign as show in the accompanying illustration, making one of the mo conspicuous display advertisements in the city. When th plant was built provision was made in the concrete chim neys for the attachment of such a future sign, steel plat suitable for holding fabricated steel shoes being embedde in the chimney walls. This sign bears only the company name, but it is 56 ft. long and 18 ft. high. The letters a 4 ft. high, the top of the structure being 120 ft. above t street. The sign, which is double, just spans the distan between the two stacks, each of which is 175 ft. in heig The illumination is furnished by 800 5-watt, 11-volt tun sten lamps, half the lamps being on each face. The si was built by the American Publicity Company, of Worc ter, and is operated nightly from dusk until dawn. T frame is of steel angles assembled on the ground. Erecti was effected by the use of heavy hooks, blocks and tack at the top of each chimney, with other blocks near

ound through which the hoisting cables passed on their
y to a steam engine at the street level. After the frame
s hoisted into place it was attached to the plates above-
ntioned by shoes. The weight of the sign complete is




CENTRAL-STATION CHIMNEY SIGN

about 6 tons. It can easily be read at a distance of over
a mile from the station.

## Operating Results with a 2300-Volt Single-Wire Ground-Return Transmission Line

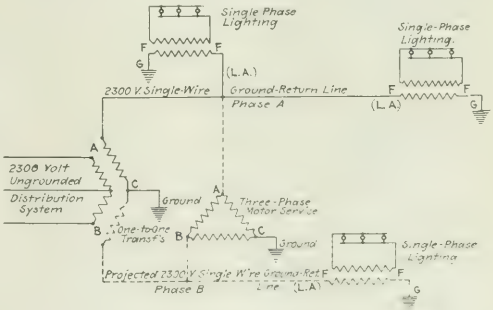
In April of this year the Benton Harbor-St. Joseph (Mich.) Railway & Light Company began the construction of a 2300-volt single-wire ground-return transmission line, employing the scheme outlined in our issue of Aug. 3, 1912. Regular service began June 1, and since that date the system has been continuously in operation, according to M. J. A. Cavanaugh, superintendent for the company.

For the purpose of the severest possible test, this single-wire grounded line was built under the most adverse conditions that such a line could be expected to meet. A telephone company already had a line of poles along the route, carrying a rural-line circuit of two wires on brackets. Permission was obtained to reconstruct this line by placing standard 5-ft. four-pin cross-arm in the top gain of these 25-ft. poles, transferring the telephone wires to two pins on one side of the arm and running the 2300-volt wire on the outer pin at the far side. The single-wire line thus built is approximately 2.5 miles long. Triple-braided weatherproof wire was used throughout for both primaries and secondaries. Owing to delay in securing the one-to-one transformers desired for connecting the ground-return line with the company's ungrounded system, a pair of standard distribution transformers were utilized, their secondaries being connected together to take the place of the one-to-one units.

Customers' secondaries, it will be noted, are not grounded, and all possible effort is made to prevent such grounding. Lightning arresters are installed at every transformer. Transformers are fused between terminal and ground and between the primary wire and ground. Both secondary and transformer construction is of the company's standard type, the second or grounded wire of the primary being run to a No. 4 rubber-covered conductor, which is nailed to the pole and covered with special wood molding. This ground wire connects with both a 24-in. copper ground-cone buried in moist earth, with one sack of charcoal around the cone, and a 0.75-in. galvanized ground-pipe driven deep into the earth at the base of the pole. In some cases it was necessary to go back two or three poles to find lower ground which would retain moisture better.

Leaving the main transformers, at the end of the first five poles, it became necessary to cross a millpond with a 575-ft. span. This was done with a single messenger and two No. 8 triple-braided weather-proof wires carried on a specially insulated hanger so arranged that if necessary the entire span could be drawn in at either end and any necessary repairs made directly from the pole. Two wires were carried across this millpond in the expectation that a little later the second phase might be run out on another circuit, thus assisting in balancing the system.

When first starting a great deal of trouble was experienced with induction on the telephone lines. Finally the telephone wires were transposed every fifth pole, using standard Michigan Telephone Company transpositions. This helped the matter, but there was still considerable noise caused by grounds where the primary line ran through trees, some sections of the line traversing heavy maple, elm and willow shade trees. This trouble was only partly cleared up before the men were called away. After the line had gone through several severe electrical storms the men were again put on the line, thoroughly clearing it of all tree grounds, etc. While there is still a slight buzzing, caused by induction and noticeable when using the rural telephone, it cannot be detected at the other end of the line and the voice transmission is perfectly clear and normal. Mr. Cavanaugh also reports that he has not had a single fuse on this line put out by lightning, either on the transformers or in residences. At present there are no motors on the line, but one of the customers is getting ready to




SINGLE-WIRE GROUND-RETURN TRANSMISSION, SHOWING PROVISION FOR THREE-PHASE MOTOR SERVICE

install a 5-hp single-phase motor, which will give further data on operation.

The aim in installing the single-wire circuit in such a questionable position as on the telephone poles was that the tests might be made under the most adverse circumstances possible. Thus far, Superintendent Cavanaugh has felt thoroughly satisfied and has expressed the belief that

with a properly constructed pole line on a private right-of-way, avoiding heavy trees such as shade many rural highways, single-wire lines can be built much more cheaply than the standard two-wire construction and with less danger from high winds, sleet and other line troubles. A line of this character using 25-ft. poles with 5-in. tops costs about $228.65 per mile as itemized in this table:

| | |
|---|---|
| [illegible] | [illegible] |
| [illegible] | [illegible] |
| [illegible] | [illegible] |
| [illegible] | [illegible] |
| Twenty wood pins, at 2 cents | 0.40 |
| Forty glasses, at 2 cents | 0.80 |
| Bolts, lags, etc. | 1.00 |
| [illegible] | [illegible] |
| [illegible] | [illegible] |
| Total | [illegible] |

A line of equivalent capacity constructed of the same material, but employing the usual two wires instead of one, would cost $380.30 per mile, a difference of $151.65 per mile. It will be noted in the above tabulation that no estimate has been made for the necessary amount of two-wire line where transformers were installed, nor for the grounding of transformers. The latter costs about $5 per transformer.

### Recent Telephone Patents

IMPROVED RECEIVERS

The mechanical details of the telephone receiver are under continual improvement, and this improvement involves practically every part, from magnetic system to shell. Some recent work of this kind is covered by three patents granted to different inventors, all assigned to the Western Electric Company and all describing different improved methods of assembling the magnetic system.

In the invention of Messrs. E. B. Craft and N. Reynolds, the magnet is built up of straight bar stock, the yoke and soft-iron pole pieces being electrically welded together. The cup piece is held in position by bolts extending through the yoke. Mr. V. Anderson varies this method by securing the cup during the welding process. To this end the cup is perforated with slits slightly narrower than the pole pieces, the end of these pole pieces being reduced to fit. The parts are adjusted so that when the pole pieces are welded to the magnet proper the cup will be clamped rigidly.

In his patent, Mr. J. J. Lyng provides for a notch in the base of the pole piece, leaving two projecting legs. These legs register with perforations in the cup pieces so that when the legs are welded to the magnet the cup is secured.

## Letters to the Editors

### The Nose-Mouth Telephone Transmitter

*To the Editors of the Electrical World:*

SIRS:—Permit me to call attention to an early anticipation of the much-heralded attachment to the long-distance telephone transmitter used by Dr. Glover in Paris. In United States Letters Patent, No. 341,288, on apparatus for recording and reproducing sounds, granted to Mr. Sumner Tainter, of Washington, D. C., dated May 4, 1886, and which forms the basis of the dictaphone as developed today, under the list of improvements, we read as follows: "It is found that a mouthpiece which concentrates the sound is desirable to increase the strength of the record, that a mouthpiece which *covers the nose* is desirable to convey the nasal as well as other vibrations, etc."

In view of the fact that Messrs. C. A. Bell and S. Tainter worked together on phonetic apparatus for years and were experts on acoustics and phonology in general, it is evident that Dr. Glover's invention has been clearly anticipated in principle. It has perhaps not been a commercial necessity to supply nose-pieces with the dictaphone, but under modern conditions of constant use of such apparatus we shall doubtless soon reap the benefits of this old-new discovery.

*Manila, P. I.* O. C. ROOS.

### The Cost of Factory Motor Service

*To the Editors of the Electrical World:*

SIRS:—In the issue of the *Electrical World* dated Aug. 23, 1913, there appeared an article entitled "Investigation of Cost of Motor Drive in a Six-Story Factory." This article closed with a tabulation of the costs of motor drive with central-station energy and the cost of operation by mechanical drive from the mill engine.

Without going into the undisputed advantages of electric drive, the writer wishes to take exception to the method of arriving at the actual yearly cost of operating the plant by the two methods. Under the heading of "Fixed Charges" there appears for both the steam and electric plant an item entitled "profit," the charge being 10 per cent on the plant cost. Why should the power equipment be burdened with charge for profit? Power is an absolute necessity in practically every line of manufacturing, just as necessary as the operatives in the factory or the building itself, yet it is not believed that an item of profit is charged against the employees' yearly salaries or the money invested in the buildings.

Including this item of 10 per cent, the yearly cost of the steam plant, fixed charges and operating expenses totals $12,545.30, while for the electric motor equipment the total is $11,875.50, a so-called saving by the use of electric drive of $669.80. Eliminating the item of profit from the fixed charges, the totals are $10,850.30 for steam drive and $11,467.20 for electric operation, resulting in an actual saving of $616.90 yearly by the use of the steam equipment, accepting the other charges as correct. Although as stated previously the electric drive is undoubtedly the more desirable of the two, the extremely questionable charge of a profit against an absolute necessity is what turned the tide in favor of the motor drive. Furthermore, it was not stated what was done with the abandoned steam equipment. Had this equipment about run its useful life and had the depreciation fund reached such proportions that the plant could be written off the books and this fund applied to the new equipment, or was the plant in good condition with a considerable life ahead of it? If the latter condition existed, it is only fair to the stockholders of the concern that the burden of the remaining amortization charges, less the salvage value of the plant, be included in the cost of the motor drive.

A charge of profit against a part of the money invested in motor-service equipment should be made under the following conditions: The question of central-station service or an isolated plant is being considered for the industrial requirements of a mill. Let us assume that, as regards manufacturing processes, service from either source would be equally satisfactory. If the isolated-plant installation would cost say $35,000 and the motor equipment for central station drive $20,000, the estimates of the yearly cost of the former service should include a charge of the average percentage profit of the industry on the $15,000 extra cost of the plant, for the reason that, if not put into the motor-service equipment, this sum would be available as working capital for the business and thus earn a profit.

Unfortunately, factory motor-service costs seem to be more or less a matter of bookkeeping, quite a few of the published costs being about as definite as an expression of steam consumption per kilowatt-hour without any mention of pressure, superheat or vacuum.

*Washington, D. C.* FRANK T. LEILICH.

# Field of the Operating Engineer

**A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers**

## Electrically Propelled Inclined Railway for Unloading Coal

Along the shores of the Ohio River there are now in use two electrically propelled inclined railways for unloading coal from the barges which bring their supply from the Eastern coal fields. Both are operating very economically



FIG. 1—FRONT VIEW OF ELECTRICALLY OPERATED COAL ELEVATOR ON OHIO RIVER

and with far less attention than was necessary with the old-fashioned types driven by steam. One of these inclines is located at Louisville, Ky., and the other, shown in the accompanying illustrations, is at Cincinnati, Ohio. The Cincinnati elevator, owned by the Whetstone Coal Company, is constructed of concrete and has a total capacity of 800 tons.

The concrete portion of the structure measures 30 ft. wide by 70 ft. long, and the peak of the wooden housing which covers the elevator is 62 ft. above the ground. The elevator proper, which consists of three bunkers, is supported on twenty-four concrete piers, arranged in three rows, so that wagons may be driven beneath and filled with coal. On each of the two longer outside walls are seven coal chutes opening into the bunkers. Opening into the wagon drive beneath the bunkers are fourteen other chutes which catch any slack coal which can pass through a 4-in. screen. On the land side of the elevator is a coal storage space where the upper layers of coal from the barges can be dumped from the elevated track, as they do not contain much slack. The lower part of the barge load, which contains more fine coal, is stored in the elevator, where the slack can be separated more readily.

Running from the second-floor level of the elevator on the side facing the river to a point on the river bank where coal barges can be unloaded is an inclined double track which is about 380 ft. long. This track has a vertical drop of about 90 ft. and is supported on wooden trestle work firmly keyed to concrete piers which extend several feet into the ground. At the river end of the inclined track is an adjustable float which supports double tracks joining the inclined track at a slight vertical angle.

The cars are pulled up the incline by a steel cable wound on a drum gear driven by a 75-hp, 220-volt wound-rotor induction motor. There are two of these drums, one for each track, each drum being about 3 ft. in diameter. One car is thus pulled up while the other is going down. The controlling mechanism, which consists of a General Electric ten-speed forward and reverse controller and two sets of drum brakes (one mechanical and one electrical), is situated near an observation window on the side of the building facing the river, where the operator has a good view of the track.

An ingenious method is used for automatically unhooking the cars from the cables when they reach the top of the incline. The cable pulling the car, as shown in Fig. 2, is supported at the top of the incline by a pulley which is in turn supported by a rope running over another pulley and weighted at the other end. The traction cable ends in a steel eye which is slipped over a hook on the car. When the latter reaches the top of the incline the pulley supporting the slack in the cable raises the eye vertically off the hook and the car is free to continue along the level track

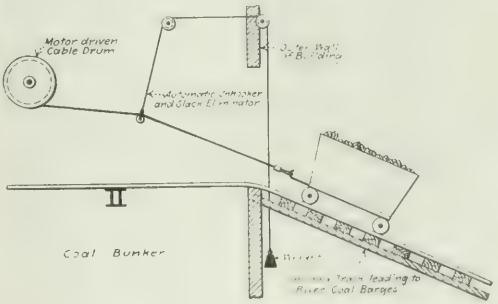



FIG. 2—ARRANGEMENT OF CABLES FOR HOISTING COAL CARS

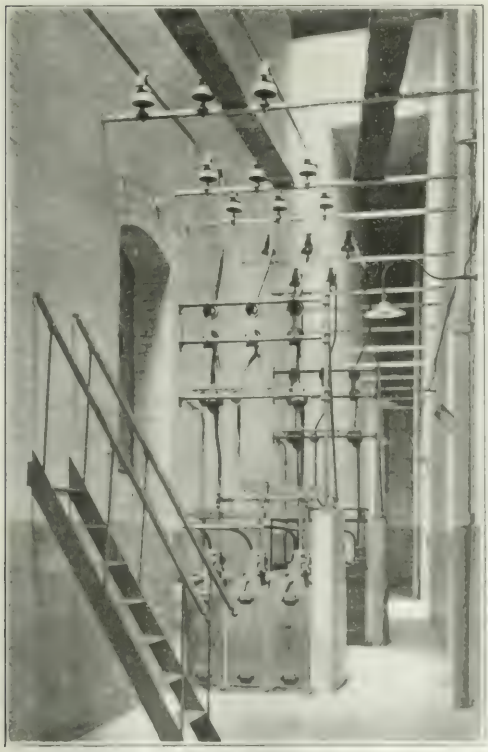
until it reaches the man stationed on the elevated track to dump it. This way of unhooking the cable from the car allows the motor to be kept running at full speed until the car is unhooked, as the automatic unhooker or "slack eliminator," as it may be called, will follow the cable and wind up on the drum. By allowing the motor to run without any slackening in speed the car is given an impulse sufficient to

cost of hauling along the elevated track to the point where the dumper is located.

Under ordinary conditions from 150 to 200 cars are hoisted per day, but as many as 300 cars have been hoisted with a crew of three men—one for operating the hoist, one for dumping the cars, and one for operating the switch which is used when three cars are being worked at a time. Each car holds two tons and can be pulled up the incline in thirty seconds if necessary. The energy cost for pulling the cars is about 0.019 cent per ton of coal raised.

## Oil-Switch Installation in Restricted Space

An electric-railway company recently built a substation on a triangular lot in the center of the largest city served by its lines, this being the only feasible site. The engineers who designed the installation were accordingly hard-pressed to locate the oil switches and 13,200-volt busbars on the floor above the operating room, but the problem was solved as shown in the accompanying photograph by placing the switches in a narrow corridor between the outside wall of the building and the wall of the transformer room. Pipe framing run between the walls supports the insulators on which the incoming line is run; the oil switches are

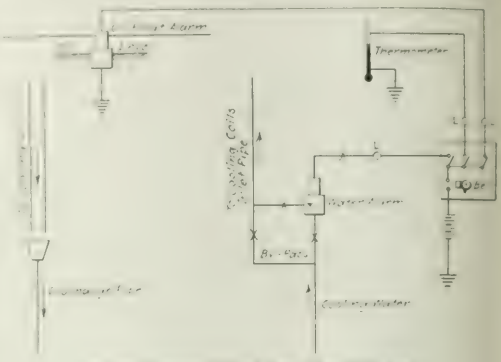


INSTALLATION OF OIL SWITCHES IN [illegible]

mounted in compartments on the floor [illegible] by thick slabs of concrete, and everything is either housed in or protected by pipe framing against accidental contact by attendants. The space is unusually limited, but the clear-cut arrangement of the wiring and switches renders the installation safer than many [illegible] designed.

## Alarm Connection for Transformers

In the accompanying diagram alarm circuits are shown for detecting any abnormal rise in temperature, failure of cooling-water supply or lowering of oil level, in cases where station transformers are installed at points remote from frequent inspection by the switchboard operator. By




ALARM CONNECTIONS FOR TRANSFORMER

the arrangement illustrated the operator can test his oil, water and temperature without leaving his position.

The water alarm is provided by a compression element inserted in the inlet line so that as long as pressure is on the piping the contact is open. If pressure fails for any reason, the circuit is completed, ringing the alarm bell and lighting an indicator lamp. A generally similar oil-level float alarm is installed at the top of the transformer tank to give warning of lowering of the oil. Here also is placed a thermometer with an electrical contact inserted at the point of maximum allowable temperature rise. If the transformer becomes overheated the thermometer circuit will be completed, also giving an alarm. The switchboard circuits may be arranged to give visible and audible warning automatically, or the attendant may be required to make regular inspections and tests.

## Automatic Protection of Line by Differential Relays

Please describe the principle of operation of the Merz-Price system of relay protection by means of which faulty sections of transmission [illegible] with [illegible] from the circuit in case of trouble.

K. G. I.

The Merz-Price system, which originated in England, preferably utilizes a ring scheme of connection between stations and substations and depends for its principle of operation on the fact that the currents entering and leaving a given "clear" section of line will be identical in value. If the current values entering and leaving that section become different owing to the development of a short-circuit or ground, relays are automatically energized, operating the main switches and isolating the section in trouble. This is accomplished through pilot wires paralleling the main conductors and connecting together series transformer secondaries whose developed emfs are opposed and normally balanced as long as the entering and leaving currents are identical. If this balance be destroyed by the occurrence of a fault, the resulting unopposed current in the pilot circuit actuates the relays, which at once open the main switches, cutting the affected section clear of the rest of the system. This scheme of protection has the disadvantage of requiring expensive pilot wires paralleling the main line, although a recent improvement by Messrs. Merz and Price splits each main conductor into two parts, the currents in the respective pairs being balanced against each other through relays to secure similar protection.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*Commutation Theory*—K. PICHELMAYER.—A theoretical note with reference to Menges' recent article on the theory of commutation. The present writer endeavors to show that Menges' "neutral zone" cannot possibly be neutral.—*Elek. u. Masch.* (Vienna), Aug. 17, 1913.

*General Transformers.*—F. NIETHAMMER AND E. SIEGEL.—An English translation in abstract of their German paper on the ratio of transformation in the general transformer with distributed windings (trapezium-triangle transformer, etc.). It is shown, both theoretically and experimentally, that in transformers with the primary and secondary windings differently distributed, and with consequently different magnetic interlinkage of the main flux with the two windings, the pressures and current are not in simple relation to the number of turns. Formulas are then given for calculating the ratio of transformation from the distribution of the windings. These formulas are simplified for the case of the induction motor and are confirmed by experiment.—London *Electrician*, Aug. 15, 1913.

*Commutation.*—A. MAUDUIT.—A long account of an experimental investigation with respect to the theory of commutation. When a commutator segment passes below a brush the resulting variation in the distribution of the current in the armature circuits causes a modification of the field produced by the armature. This modification is necessarily periodic and its period is equal to the duration of the passage of a commutator segment. There is a sort of balancing of the field of the armature on the one side and the neutral line on the other and emfs are thereby reduced in the section short-circuited by the brush. The author has investigated this matter with three different types of dynamos and gives a series of interesting oscillograms. The phenomena in question are far more regular in slotted armatures than in smooth armatures. Ring armatures give rise to supplementary non-symmetric deformations. These displacements of the armature field flux modify considerably the value of the emf in the short-circuited coils and render illusory any theory of commutation which does not take this fact into account.—*La Revue Elec.*, July 18 and Aug. 1, 1913.

### Lamps and Lighting

*Arc Lamp.*—P. HOEGNER.—An illustrated article on the Dia arc lamp, which is an inclosed arc lamp with flaming-arc carbons, held one above the other. A double globe is used with a small interval of air. The inner globe is thereby maintained always at a high temperature so that no deposits of salts from the combustion of the carbons will form on the inside of it. Any deposit occurs in the upper part of the lamp, which can be easily cleaned. The life of the carbons is 55 hours for direct-current and 120 hours for alternating current. The direct-current lamp is built for 42 volts, the alternating-current lamp for 39 volts. Data are given which enable the calculation of street illumination by these lamps.—*Elek. Zeit.*, Aug. 21, 1913.

*Tungsten Filaments.*—A note on a recent British patent (No. 6952, 1913) of G. Lüdecke and Brimsdown Lamp Works. With the object of carbonizing, decarbonizing and forming filaments from the raw state in one operation, a cylinder of metallic tungsten or molybdenum is provided within the heated zone of a furnace, as described in specification No. 8996, 1911. Rods of tungsten or molybdenum are arranged in the form of a cage and serve to conduct the heating current. The cage is placed in a furnace shaft of copper or nickel, and the filaments to be treated are introduced into the cage through the top of this shaft, which may then be closed. Provision is made for the expansion of the cage by providing a mercury contact at its base. The furnace is water-cooled.—London *Elec. Eng'ing*, Aug. 21, 1913.

### Generation, Transmission and Distribution

*Oscillations in Direct-Current Networks.*—G. SEIBT.—In direct-current networks which are fed from rotating machinery weak alternating currents flow continually. These currents are due to the phenomena at the commutators of the machines. In the course of some experiments which were made for other purposes the author determined the frequency of these oscillations. The arrangement is shown in Fig. 1. The connections of the network are shown by + and —, $W$ being a resistance and $D$ a choking coil. The current in this circuit acted on a resonance circuit formed by a standard of self-inductance $S_1$ and the condensers $C_1$

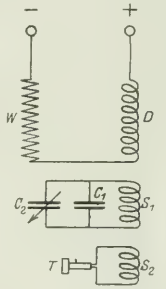



FIG. 1—ARRANGEMENT OF NETWORK FOR DETERMINING FREQUENCY OF OSCILLATIONS

and $C_2$. $C_1$ was a condenser the capacity of which could be changed step by step, and $C_2$ was a condenser with a continuously adjustable capacity. From the constants of the circuit the frequencies corresponding to the resonance conditions can be figured by Thomson's formula. By means of the telephone $T$ in a third loosely coupled circuit $S_2$ the condition of resonance could be determined. It was first found that the network showed no oscillations of a higher frequency than 4400. Other sharp resonance maxima, besides 4400, were found at frequencies of 2400, 1820, 1200 and 910. The last two frequencies gave in the telephone very loud and pure musical sounds.—*Elek. Zeit.*, Aug. 21, 1913.

*Large Electrical Mine Hoist.*—A note on what is held to be the largest electrically operated mine hoist in the world. It is in course of erection at the Crown Mines in South Africa. This company is equipping its shaft with a 4000-hp hoist which will operate on the mains of the Victoria Falls Power Company without any attempt at equalization of the maximum and minimum power demand. With a hoist of this description the motors will require some-

thing like 7000 hp during acceleration, resulting in a load of 9000 hp on the transmission line. The electrical equipment, which has been built by the General Electric Company of this country, consists of two 2000-hp direct-current motors, one being connected at either end of the drum shaft of the hoist itself. The drums which the motors will drive are the cylindro-conical type, the smaller diameter being 12 ft. and the larger 20 ft. 8 in. The speed of the drum is 52.5 r.p.m. The voltage at which the direct-current motors operate is 500 volts, the motors running in series and being controlled on the Ward-Leonard system. These hoist motors will receive their power from a motor-generator set converting the 50-cycle, three-phase energy to direct-current energy. The motor-generator consists of a 5000-hp, three-phase induction motor, operating on the 50-cycle, 2000-volt circuit at 375 r.p.m. It is directly coupled to two separately excited direct-current generators, each rated at 1650 kw. These generators are connected in series and have compensating and commutating field windings to prevent sparking. In order to supply the necessary current for exciting the fields of the two hoist motors and the two generators a 60-kw shunt-wound exciter is provided. The total weight of the motor-generator set will be 138,000 lb., while the total weight of each hoist motor will be approximately 142,000 lb., exclusive of shafting and bearings. This mammoth electric hoist is only one of a hundred or more electric hoists operating on the lines of the Victoria Falls Power Company.—London *Electrician*, Aug. 8, 1913.

### Traction

*Great Britain.*—A. J. LAWSON.—The conclusion of an statistical article in which an analysis is given of the financial position of the tramways of the United Kingdom, the items examined being capital expenditure, cost of construction and equipment, traffic, revenue, appropriations, aid from rates, relief of rates and costs. The average total working costs of all the tramways in the kingdom amounted to 13.248 cents per car-mile run, and, by a coincidence, the average of all the tramways in the London district came to 13.252 cents per car-mile, those of the London County Council tramways being 13.532 cents per car-mile. Actual costs of less than 11 cents per car-mile have been obtained in seven cases, though in one or two of them permanent way and car repairs do not seem to have been adequately provided, and the very lowest traffic expenses appear to be due to the payment of too low a rate of wages to men engaged in rather exacting employment. Eleven cents per car-mile may, therefore, be regarded as the absolute minimum under ordinary conditions which can be obtained in undertakings of moderate size, with 11.5 cents as a general average. For economy, therefore, as well as for comfort and safety, the tramway can not only hold its own but under proper management must prevail against the motor omnibus, whose minimum working costs at the present time, when the vehicles are new and the heavier charges for repairs, maintenance and depreciation are only beginning to accrue, already reach 15 cents per bus-mile on roads as well paved as the London streets.—London *Electrician*, Aug. 15, 1913.

*Electric Traction in Italy.*—A fully illustrated description of the new direct-current locomotives in use in the Milan district of the Italian State Railways, where the direct-current system at 650 volts with a third-rail is in use.—*La Revue Elec.*, Aug. 15, 1913.

### Installations, Systems and Appliances

*Electrostatic Valve.*—O. STEELS.—An illustrated description of the construction and applications of the author's "electrostatic valve," which acts as an insulator as long as the emf impressed on its terminals is below a certain value, which may be as small as 10 volts. If the voltage increases above the predetermined value, the valve permits the current to pass. As shown in Fig. 2, the valve consists of a glass tube $A$ hermetically closed at its ends by means of two fixed pieces $C_1$ and $C_2$, within which the electrodes $B_1$ and $B_2$ are movable so as to permit adjustment of the distances of their spherical ends from each other. Within the center of these electrodes screws $B_1'$ and $B_2'$ are inserted, ending in points. The distance of these two points from each other can also be adjusted. In order to regulate this valve so that it operates at a certain voltage, the arrangement shown in Fig. 3

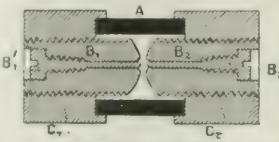


FIG. 2.—SECTION OF ELECTROSTATIC VALVE

is used. $C$ is the valve, $A$ and $B$ are lamps, $R$ is a rheostat. The two spherical electrodes $B_1$ and $B_2$ are brought together so as to make contact with each other and are then removed from each other by means of a screwdriver, until the lamp $B$ is extinguished and the lamp $A$ lights up. The same operation is then repeated with the points of the screws $B_1'$ and $B_2'$. For instance, if the valve is to operate at 350 volts, the voltage $U$ is made equal to 50 volts, or if the voltage to operate is 110 volts, $U$ is made equal to

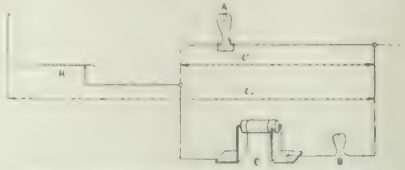


FIG. 3.—ARRANGEMENT FOR REGULATING VALVE

10 volts. The author briefly discusses the scientific principles on which the instrument is based and some of its applications as for the protection of telephone lines. In order to diminish the chances of an accidental short-circuit a thin piece of cigarette paper is inserted between the electrodes.—*La Revue Elec.*, Aug. 1, 1913.

### Wires, Wiring and Conduits

*Electrolytic Lightning Arresters.*—G. C. DILL.—An illustrated article on the construction, installation and performance of electrolytic lightning arresters.—*Elec. Journal*, August, 1913.

*Circuit-Breakers.*—J. N. MAHONEY.—An illustrated article describing some recent developments in oil circuit-breakers and several new types.—*Elec. Journal*, Aug. 19, 1913.

### Electrophysics and Magnetism

*Gamma Rays from Radium D and Radium E.*—E. RUTHERFORD AND H. RICHARDSON.—Radium D emits two types of gamma radiation for which $\mu = 45$ and 0.99 $(cm)^{-1}$ in aluminum. Relatively to radium D, radium E emits a very weak gamma radiation, and not more than 2 per cent of the gamma radiation given out by radium D + E in equilibrium is to be ascribed to radium E. In other words, the transformation of each atom of radium D is accompanied, on the average, by fifty times the amount of gamma radiation from an atom of radium E. The soft type of radiation $\mu = 45$ from radium D, and radium E is slightly less penetrating than the corresponding radiation from radium B. There appears to be little doubt that this radiation corresponds to the characteristic radiation of the L type to be expected from an element of atomic weight 210.—*Philos. Magazine*, August, 1913.

### Electrochemistry and Batteries

*Electric Furnaces.*—WOOLSEY MCA. JOHNSON AND GEORGE N. SIEGER.—The first article of a serial on electric fur-

naces, their design, characteristics and commercial applications. The serial is intended for students, engineers and business men. In the first article the general principles of electric furnaces, their design and economics, are given. The chief points brought out are as follows: Electric heat is expensive and can be used only where its efficiency is great. Electric heat can be employed in certain work where it is needed badly. If intelligently studied and applied, electric furnacing will become of large industrial importance and the existing limits pushed to extremes not now thought possible. If an electric furnace be thought of as a short-circuit under control, we must strive to put it under good and intelligent control.—*Metall. and Chem. Eng'ing*, September, 1913.

### Units, Measurements and Instruments

*Electric Method for Measuring the Gradient of Slopes.*—B. AUDRAN.—At the recent exhibition of the French Physical Society in Paris the "inclinometer" of Abraham was shown. This is an electrical apparatus for measuring the gradient of a slope in mines, etc. The transmitter (Fig. 4), which is placed on the slope the gradient of which is to be measured, is a small transformer, the secondary of which is

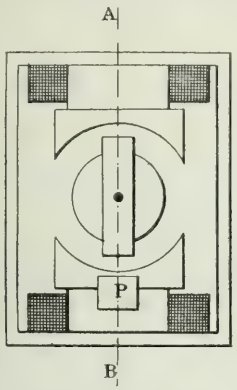



FIG. 4—TRANSMITTER USED IN APPARATUS FOR MEASURING GRADIENT IN MINES

a coil movable around a horizontal axle and maintained in a vertical position by means of the weight *P*. What is desired to measure is the angle between the axle *AB* of the primary coils and the vertical plane of the secondary coil. The primary coils are wound on cores as shown and the magnetic circuit is closed through the frame of the apparatus. The primary is supplied with alternating current from any source. The flux produced by this current through the secondary depends on the angle $a$ of the sec-

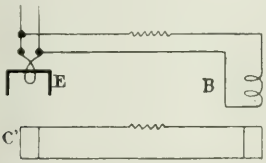



FIG. 5—RECEIVER USED IN APPARATUS FOR MEASURING GRADIENT IN MINES

ondary with *AB*, so that the ratio of the induced emf $U'$ to the impressed emf $U$ is $U'/U = f(a)$. The receiver (Fig. ;) has the appearance of a voltmeter and consists of an alternating-current electromagnet $E$ which is supplied from the same source of emf as the primary of the transmitter-transformer, the impressed emf being also the same. The field of the electromagnet acts on a coil which is thereby displaced. It is not subjected to any directive action of springs, but is connected by two thin silver ribbons with a secondary of the transmitter-transformer. These ribbons do not exercise any appreciable mechanical action. The electromagnet induces in the secondary coil an emf $U''$ which depends on the angle $d$ between them, so that $U''/U = F(d)$. The coil is in equilibrium when the current in it is zero; that is, the emf in the movable coil of the receiver and in the secondary of the transformer-transmitter must be equal and opposite. We, therefore, get $U'' = U$, $F(d) = f(a)$, or the angle $a$ is a function of $d$. The apparatus may be calibrated directly in degrees of gradient. —*La Lumière Elec.*, July 26, 1913.

### Miscellaneous

*Gaseous Explosions Caused by Electric Heating of Bitumen in Cable Troughs.*—W. M. THORNTON AND J. A. SMYTHE.—A case of explosion through the accidental heating of bitumen in cable troughs led the authors to investigate the action of heat upon bitumen. Heat was applied under four different conditions and the resulting gases were examined. The conclusion is reached that bitumen gas, however produced, lies between marsh gas and coal gas in its inflammability.—London *Electrician*, Aug. 22, 1913.

# Book Reviews

REGULATIONS GOVERNING RADIO-COMMUNICATION. Bureau of Navigation, Department of Commerce. Edition of July 1, 1913. Washington: Government Printing Office. 15 pages. Gratis.

This pamphlet contains the regulations under which radio stations and operators are licensed by the Department of Commerce, in pursuance of the act of Aug. 13, 1912. The extent of each of the nine administrative districts having radio inspectors is given, and clear statements are made as to the classification of radio stations according to the services they perform. In a similar way there are set forth the requirements for each of the several grades of operator's license. The circular should be studied by persons contemplating erection of any radio plant.

HANDBOOK FOR WIRELESS TELEGRAPH OPERATORS WORKING INSTALLATIONS LICENSED BY HIS MAJESTY'S POSTMASTER-GENERAL. British Post Office. Revised edition. London, England: Eyre & Spottiswoode. 80 pages. Purchasable from Wyman & Sons, London. Price, 3d.

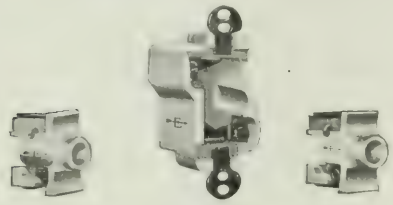
This book is intended to provide a guide whereby operators at ship and coastal radio stations may carry on their traffic according to the international radiotelegraph convention of London, 1912. The six divisions cover the following: Introductory and general comments; form and acceptance of radiograms; special supplementary services; methods of charging, keeping accounts and making reimbursements; procedure to be observed in transmission, and a complete copy of the service regulations annexed to the international convention of 1912. There are also six appendices, giving the international Morse code, standard list of service abbreviations, etc. Although the book is directed to British radio stations, its interpretation of the convention regulations (which are effective in the United States also) recommends it to radio operators in this country. A curious discrepancy is that the internationl abbreviation "QST" is given as meaning "I have received the general call," whereas in the copies of the London convention circulated by the United States Department of Commerce the meaning is stated to be "General call to all stations," American practice, therefore, involves two general calls, namely: "QST" and "CQ." Since "CQ" is accepted internationally as a general inquiry call, the British translation of "QST" would seem preferable.

# New Apparatus and Appliances

**An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers**

## Combination Flush Receptacle

The Arrow Electric Company, Hartford, Conn., is manufacturing a combination flush receptacle which may be used interchangeably with standard plugs and has the added advantage of being adapted for use with a "polarity" plug. The receptacle is grooved so that the polarity plug may be inserted in one position only, but at the same time

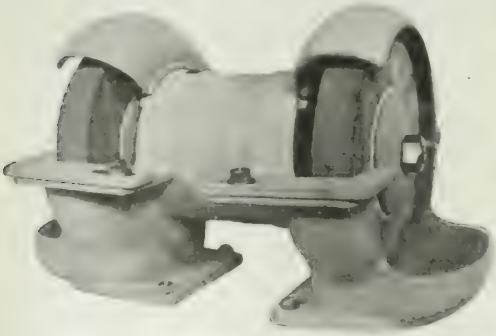


FLUSH RECEPTACLE AND POLARITY PLUG

the groove does not interfere with the insertion of the standard plug in either position. This polarity feature is said to be of advantage in the use of electrically driven machines and in other cases where a fixed polarity is necessary. It is stated that this receptacle is adapted for use with more than 300 types of outlet boxes and fittings now on the market.

## Double-Disk Grinder with Wheel Guards

In the motor-driven grinder shown in the accompanying illustration the frame of the induction motor is extended to form a water basin and support for the adjustable tool rest. The guard over the top half of the wheels is made of a separate piece so that it can be removed if desired. The bearings, which are of the heavy ball-bearing type, are rated at 1600 lb. and are protected from grit off the wheels by



DOUBLE DISK GRINDER, WITH WHEEL GUARDS

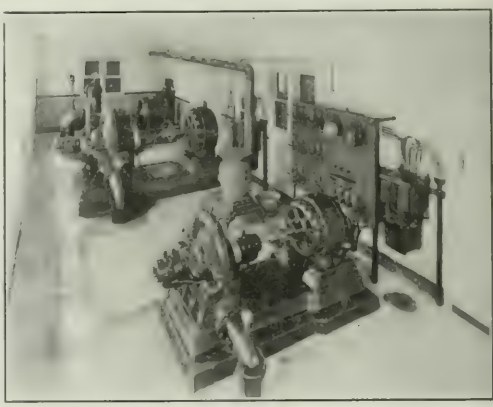
tight-fitting covers. The wheels shown in this illustration are 12 in. in diameter by 2 in. wide, but it is stated that the grinder may be equipped with other wheels.

This grinder is the product of Forbes & Myers, electrical manufacturers, of 172 Union Street, Worcester, Mass.

## Electrically Operated Pumping Station

The 8,000,000 gal. of water used daily in the city of Utica, N. Y., is obtained from two natural watersheds, one north and the other south of the city. From these points the water is conducted through 20-in. mains and by direct intake to three reservoirs known as the Pleasant Street station. The three reservoirs are designated as Nos. 5, 2 and 4 and are located above the city 218 ft., 200 ft. and 254 ft. respectively. Their capacities are 200,000,000 gal., 40,000,000 gal. and 284,000,000 gal. By drawing water from reservoir No. 5 only, the heads provided by the northern and southern supplies "balance" very closely so that a uniform city pressure is obtained.

In order to take advantage of this condition, an electrically operated plant was installed to pump the water from reservoirs Nos. 2 and 5. The equipment consists of three motor-driven centrifugal pumps, shown in the accompanying illustration. The most distant pump in the picture is a 10-in., single-stage, single-side suction pump, having a



PUMPING STATION AT UTICA, N. Y.

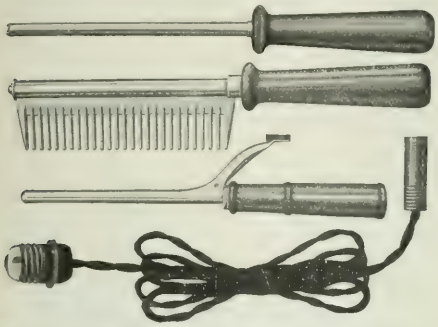
rating of 3500 gal. per minute against a 60-ft. head. This pump is driven by a 100-hp induction motor operating at 690 r.p.m. The middle unit is a 10-in., 3500-gal., single-stage, double-suction centrifugal pump directly connected to a 75-hp induction motor. The third pump is a 5-in. single-stage, double-suction centrifugal unit rated at 700 gal. per minute at 150-ft. head. This pump is directly driven by a 50-hp induction motor. The motors operate on a two-phase, 60-cycle, 220-volt circuit of the Utica Gas & Electric Company.

The piping is so arranged that the two 10-in. pumps can be used to take water from either of the two lower reservoirs and discharge it into the higher one, or they can be used as booster pumps discharging directly into the city mains.

The plant was designed by Mr. A. B. Tracey, engineer in charge of the water-works. The pumps were furnished by the Goulds Manufacturing Company, Seneca Falls, New York, and the motors by the Westinghouse and Crocker-Wheeler companies.

## Combination of Electric Waver and Hair Drier

A combination set which includes an electric waver, a curling iron and a hair drier, the three having a total demand of 110 watts, is being manufactured by the William E. Slaughter Company, of Chicago. Each of the devices



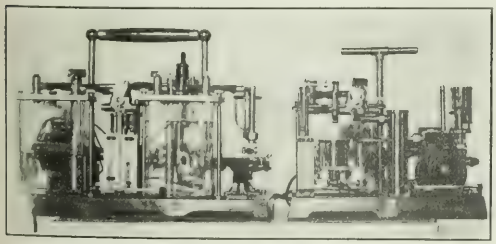
COMBINED ELECTRIC WAVER, CURLING IRON AND HAIR DRIER

is small and very light, being made of aluminum, a material heretofore considered unsuitable for such use. The heating units in the waver and curler each consume 22 watts and that in the comb hair drier takes about 65 watts.

The heating unit consists of a central steel rod surrounded with an insulating compound on which is wound a spiral of resistor wire. The entire unit is then covered with a special compound which prevents oxidation of the wire. Connection is made to the element by means of a plug having a tip and sleeve similar to a telephone jack. The plug and cord furnished with the outfit can be used interchangeably with any one of the devices. An advantage of this type of connection is that the waver or curling iron can be rotated in the hand without twisting the cord, the motion aiding to insure a perfect contact. A twisting, pulling motion is required to remove the plug. The handles of the devices are made of wood which has been baked at a temperature of 340 deg. Fahr. and coated with a rubberoid enamel which will stand 300 deg. Fahr.

## Producing Anesthesia Electrically

The accompanying illustration shows a new application for small motors in connection with a machine for producing anesthesia. The apparatus used consists of a fractional horse-power motor driving a small air compressor, a glass chamber containing ether and another containing



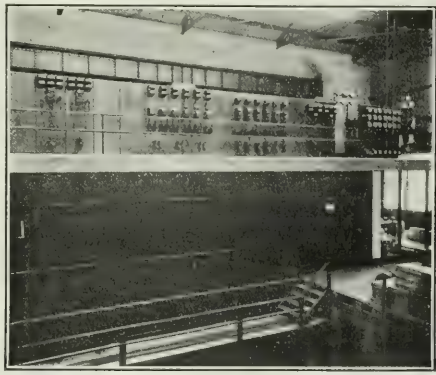
APPARATUS USED FOR THE PURPOSE OF PRODUCING ANESTHESIA ELECTRICALLY

water, together with a filter for purifying the air. A series of valves and connections direct the flow of the air and ether vapor, and a condensing chamber frees the etherized vapor of moisture while a slide-valve permits the functions of respiration.

Compressed air passes from the purifying chan through the ether, and the vapor is then carried to water chamber, where it is heated, at the same time joi air which had previously been diverted. The wate warmed by an electric heater attached to the switch the motor. From the water chamber the vapor goes thro the condenser and then through a long tube to the patie lungs. The pressure which is indicated by a manom may be regulated from zero to 88 mm of mercury. safety valve on the pipe affords protection against exces pressure. Another valve permits the anesthetist to cor the vapor, increasing or decreasing the ether strengt administering warmed air toward the end of the operat The motor shown in the illustration was made by the D Manufacturing Company, Elizabeth, N. J.

## Improved Insulating Material

An insulating material recently put on the market by H. W. Johns-Manville-Company, New York City, is b utilized by central stations in places where it was form considered good practice to use marble, slate or wood. the accompanying photograph is shown a portion of new water-power development at Elkhart, Ind., in wh



DOORS AT ELKHART (IND.) PLANT

this material known as "asbestos wood," was extensi employed. The three-panel doors, measuring 4 ft. 11.2 by 2 ft. 7.75 in., are made of this material. The top is equipped with a lower panel of wire and inserted g to facilitate the inspection of the high-tension appar without removing the doors.

This type of insulating material has also been use the construction of the horizontal and vertical barr separating the high-tension switches, high-tension bus and the lightning arresters in the tower of the plant.

The material itself is a composition of asbestos fi and a binding cement which has been subjected to h hydraulic pressure and a patented curing treatment. I said that the material will take on a high polish and be machined and worked in much the same manner a done where wood is used.

## Electric Vehicle for Milk Delivery

The Detroit Creamery Company recently purchase 1-ton commercial electric truck for the route through Grosse Pointe district, which is 11 miles from Detroit. special body was devised for milk delivery service. sills and side-risers are protected with copper and windows are plate glass. The interior is equipped w

dome lamps to act as flares and night workmen. The lettering is gold-leaf pencil varnish and is placed upon a white background. The wheelbase of this car is 84 in., the tread is 58 in. and the tires are 32 in. by 3 in. in front and 34 in. by 3.5 in. in the rear. The speed is 12 miles per hour, and the mileage radius is 55 miles loaded.



ELECTRIC VEHICLE FOR MILK DELIVERY

The vehicle was made by the Anderson Electric Car Company and is furnished with an equipment of sixty cells of Edison storage batteries.

## Improved Portable Testing Set

A portable testing set for measuring conductor and insulation resistance has recently been brought out by the Thompson-Levering Company, of Philadelphia, Pa. The instrument is a modified form of circular slide-wire bridge



PORTABLE TESTING SET

made in such a manner as to give a large number of steps, making it equivalent to a very long slide wire. The system of moving parts has been made as light in weight as possible so that shocks and jars will not as readily injure the sapphire-jeweled bearings. For the convenience of the tester a battery switch has been added to the instrument which allows the use of the middle finger and thumb for turning the resistance dial indicator, while the index finger of the same hand is used for tapping the battery key at will. This leaves the other hand of the tester free for other purposes. Another switch has been added to the equipment, which simplifies the connections that have to be made for the Murray and the Varley loop tests. This switch combines all of the connections for these tests so that turning the button to the name of the test desired renders the bridge ready for the test.

All metal parts of the instrument are of brass and the case is of solid oak. The mounting plate is made of hard rubber.

## Electric Dumb-Waiters

The art of electric dumb-waiter construction has shared—if, indeed, not gone ahead of—recent refinements in elevator design and operation, until now electric dumb-waiters are available for all purposes and special applications, be-

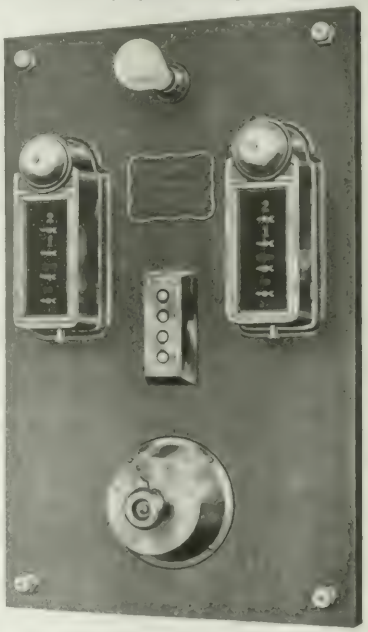


FIG. 1—OPERATING BOARD FOR ONE-POINT CONTROL

coming conveniences that are really practical necessities about well-equipped hotels, clubs, apartment houses, restaurants, libraries and factories.

There are two general methods of control available for such dumb-waiter manipulation, the selection depending upon the particular purposes for which the system is to be used. In the "car-control" system the car itself is equipped with a full set of push-buttons, one for each floor, by means of which it can be dispatched to any floor desired. The car will not start, of course, until the door has been closed. Approaching the floor for which it was designated, the car automatically slows up, finally coming to a full stop at the proper position and lighting a signal lamp to give notice of its presence. If some one on another floor wishes to summon the car, he has only to press a button located at the side of his shaft-door, and if the dumb-waiter is unengaged, as shown by the door being closed, the car will come at once to the calling floor. No door can be opened until the car is in position. Limit switches prevent over-travel at top and bottom of the shaft, and a slack-cable switch immediately

applies the brake and safety devices in case of breaking of the supporting cable. The driving mechanism is equipped with a spring brake held free by an electromagnet in series with the motor, so that the brake is automatically applied when the motor stops.

The other system is known as the one-point control, the movement of the car being effected from a centralized control station on one of the floors where an attendant is always present. This operator may, of course, have other duties besides that of operating the dumb-waiters. This system applies especially where a group of dumb-waiters is to be controlled. Such a control station is shown in the accompanying illustration. Indicators show the source of calls for the car, and others report when the car has reached its destination and whither it is next ordered. A signal lamp indicates whether the car is idle or in use and whether any door is open. The bank of signal buttons for dispatching the car is installed in the car itself. They connect with annunciators at the control station, apprising the attendant there who actually governs the car's movement. Alarm bells also connect with each floor so that the operator can sound a warning in case a door is carelessly left open or the car is unnecessarily detained.

Electric dumb-waiters are now in operation running at speeds of 1000 ft. per minute. With the automatic stops used,

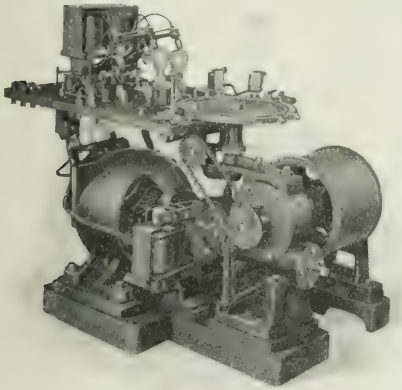


FIG. 2—OPERATING MECHANISM FOR PUSH-BUTTON CONTROL

the cars are always brought within an inch or so of the floor positions, regardless of loads carried. These loads may range from 150 lb. to 700 lb., low speeds of 50 ft. per minute being recommended for the heavier loads. Amplifying the systems above described, a number of modifications of automatic and push-button control can be introduced to meet particular conditions. Each machine is designed especially for the conditions of load, speed, travel and voltage of the intended installation. The equipment described is built by the Burdett-Rowntree Manufacturing Company, Chicago and New York.

## Indirect Lighting in Substation

The new 187th Street substation of the United Electric Light & Power Company in New York City, recently placed in operation, has been equipped for indirect illumination, with a provision for direct emergency lighting.

A night photograph of the control-board balcony, where indirect lighting is used exclusively, is shown in Fig. 1. The meter dials are brightly lighted without the customary glare and reflection from their glass covers, which in certain positions makes it extremely difficult to read the instruments. The balcony itself is 13 ft. high, 82 ft. long and 8.5 ft. wide in front of the board. Eight outlets, using a total of 1200 watts, give a specific consumption of 1.72 watts per square foot for this area. The lighting fixtures are suspended at a distance of 30 in. from the white ceiling.

Fig. 2 is a view of the main transformer and rotary room, where the ceiling is 31 ft. high, the room being 89 ft. wide by 265 ft. long. The indirect lighting used in this

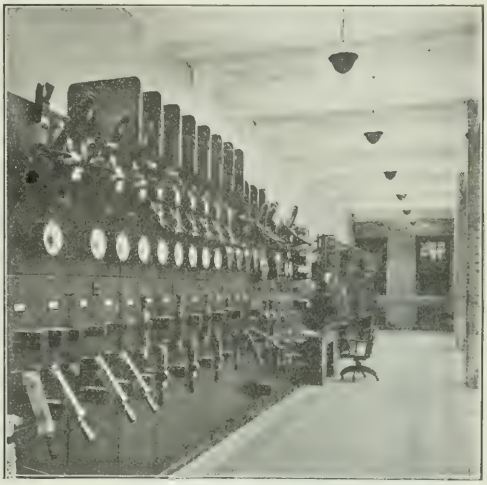


FIG. 1—INDIRECT LIGHTING IN SWITCHBOARD ROOM

room practically all the time is furnished from five fixtures each carrying lamps with a total rating of 500 watts. The power consumption in this room is 1.06 watts per square foot. The tops of the reflectors are 42 in. below the ceiling. The auxiliary lighting system consists of twenty 100-watt lamps each equipped with a reflector. These units



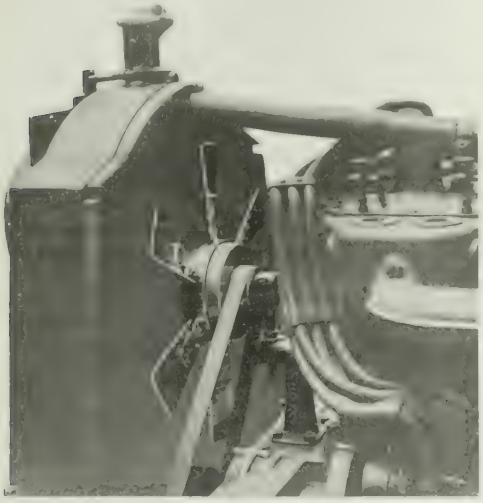
FIG. 2—AUXILIARY LIGHTING UNITS IN OPERATION

consume a total of 2000 watts, or 0.85 watt per square foot. The picture of the transformer room was taken with the emergency lamps in operation while the indirect units were not lighted.

The fixtures for both systems were furnished by the National X-Ray Reflector Company, Chicago, Ill.

## Generator for Automobile Lighting System

A belt-driven electric generator which may be installed on old models of automobiles such as those which came out before the days of electric starting and ignition is shown in the accompanying illustrations. The generator is hermetically sealed to prevent damage from water and dirt. The armature revolves outside the field coils so that no matter what speed the engine may attain no trouble can arise due to centrifugal stresses on the windings. The brushes are made of round pieces of carbon and are inclosed. Of the charging characteristics of the fan generator it is said that low speed gives a high rate of charge while the rate drops off as the speed of the engine increases. The claim is made by the manufacturers that the placing of the generator in



AUTOMOBILE LIGHTING SYSTEM GENERATOR

the center of the fan actually increases the fan's efficiency since it prevents the air from being drawn back through the center of the fan as it is sent in toward the engine by the ends of the fan blades.

This so-called "fan-type generator" is being made by the Kouyoumjian Electric & Manufacturing Company, of Cleveland, Ohio.

## Electricity for Office Appliances

Evidence of the strides which manufacturers are making toward replacing manual and mental operations by electrically operated machinery was shown by the number of motor-driven office labor-saving devices on exhibition at the business show held in Chicago on Sept. 8 to 13. Probably the most recent application of electricity there shown was a system of master, program and time-switch clocks which operate on 110-volt energy. These clocks wind and synchronize every five minutes, storing up enough energy each time to operate the clocks two hours and a half in case the energy should fail at any time. The time-switch attachments are made in sizes large enough to make and break 400 amp, obviating what has heretofore been one of the drawbacks where a simple mechanism is desired. This line of appliances was exhibited by the Baird Equipment Company, Chicago.

An electrically operated rapid calculator was displayed by the Ensign Manufacturing Company, Chicago. It has the novel feature of automatically shutting off its motor when not needed. While operating normally the motor does not run all of the time, as enough energy is stored in a spring to accomplish seven operations, after which the motor again starts.

Machines which accomplish the act of sealing, stamping and counting envelopes in one operation were exhibited by the Mail-om-eter Company, Detroit. Similar machines which accomplish the results separately were exhibited by the American Multigraph Sales Company, Cleveland, and by Saunders & Company, Kansas City. A device for opening letters was shown by the Lightning Letter Opener Company, Rochester, N. Y. This machine is capable of turning out 200 letters per minute. Letter folders were also on exhibition at the booth of the American Multigraph Sales Company.

Extensive displays were made by the National Cash Register Company of Dayton, Ohio, showing various types of electrically operated cash registers and credit telephone systems. An electrically operated display which attracted considerable attention in this booth represented the different outlets for money collected by a business enterprise. It consisted of a table on which were three open money bags labeled "Overhead," "New Stock" and "Profit." Supported above the table was a revolving display sign which enumerated the different outlets for money and gave the percentage of the gross income which goes toward the maintenance of different branches of a business. In synchronism with the different displays shown on this sign, coins would appear at the edge of the table and travel across it, propelled by the agency of concealed magnets, finally disappearing in the open mouths of the money bags which lay on the table. In addition to the exhibition of manufactured products, this company conducted a free "kinemacolor" moving-picture show which was of an educational value along the lines of manufacture and use of the company's products.

Dictating machines were on exhibition at the booths of Thomas A. Edison, Inc., Orange, N. J., and the Columbia Graphophone Company. The device manufactured by the latter company has several improvements, chief among which are the use of a new hand-control operated by direct spring wire and a ventilating fan on the operating motor, which cools the resistance, preventing the drying up of the lubricating oil on the mechanism. The Edison company is using a sanitary flexible steel speaking tube and a double collapsible mandrel which avoids breakage of cylinders when being put on.

Seven electric vehicles were displayed by the Argo Electric Vehicle Company, Saginaw, Mich., four of which were passenger cars.

An interesting booth was that of the General Acoustic Company of New York, where the practicability of the dictagraph for intercommunicating conference features was demonstrated. In this booth an intercommunicating dictagraph was substituted for the ordinary telephone, conversation being carried on in low tones with telephone operators located in different parts of the building. With the speaker 10 ft. away from the dictagraph the operator at the other end of the line could plainly hear figures spoken in low tones. An electric fan was humming in the room, showing the non-interfering quality of the set.

Tabulating machines having electrically driven adding and subtracting attachments were exhibited by the Underwood Typewriter Company. These machines have a varied application, being fitted to do billing, statement writing, cross and column footing, ledger entries where totals are desired, and many forms of statistical work.

Other electrically equipped office appliances were exhibited by the Adder Machine Company, Wilkes-Barre, Pa.; Addressograph Company, Chicago; Burroughs Adding Machine Company, Detroit; Moon-Hopkins Billing Machine Company, St. Louis, and the Lisenby Manufacturing Company, Fresno, Cal.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Semi-Indirect Fixture with Pull Socket Control.**—There is to be put out shortly by the Electrical Engineering Company, of Minneapolis, Minn., a 100-watt pendent semi-indirect fixture which it has recently developed and which it claims is different from anything so far seen in that a pull socket control is used with it.

**Milwaukee Concern Busy.**—The electrical work on the new Christian Science Church at Milwaukee, Wis., has been awarded to the Herman Andrae Electrical Company, of that city, which reports that it has also secured the contract for wiring the Industrial Chemical Institution at the same place. This company is now wiring a number of the post offices in different sections of the country.

**New Lighting Fixture Brought Out.**—The Elgin Motor Company, of Elgin, Ill., is marketing a new type of lighting fixture, called by it the "deflectolier," and it claims for this device a brisk sale both in this country and abroad. This apparatus consists of an inverted conical diffuser with openings at its center and around its sides from which a cluster of incandescent lamps may be hung. The New York office of the company, at 31 Barclay Street, is in charge of A. E. Goetz.

**Castings Produced from Wrought-Iron Stock.**—The Hess Steel Castings Company, of Philadelphia, Pa., has recently perfected a process for the production of castings from the purest wrought-iron stock. It is claimed by the company that this material produces castings of the greatest possible ductility, density and uniformity, which are particularly adapted for use in parts of electromagnetic equipment where high permeability is desired, and for use in service where high pressures or temperatures or excessive corrosion is encountered.

**Large Electric Excavator.**—A Lidgerwood-Crawford electric excavator of unusual size is under construction by the Lidgerwood Manufacturing Company under the supervision of Mr. G. M. Crawford, of Chicago. This machine will have a boom 100 ft. long and will be equipped with a bucket capable of holding 4 cu. yd. of earth. It will be operated by alternating-current 440-volt, 60-cycle, three-phase motors and has been ordered by Mr. D. C. Stevens, contractor, for 8,500,000 cu. yd. of excavation and levee building near Cape Girardeau, Mo. Energy will be purchased from an electric-service company for the operation of this large machine.

**Pacific Coast Appliance Manufacturer Busy.**—The Berkeley Electric Cooker Company, of Berkeley, Cal., reports a rapidly increasing demand for its automatic electric cooker. Orders are being received from European and Asiatic countries, South America, South Africa and Australia, in addition to a large volume of domestic sales. To accommodate the business the factory has been enlarged and now occupies the entire three-story reinforced-concrete building at 1932 Center Street, with offices on the second floor. A number of auxiliary cooking appliances are being developed and will shortly be placed on the market.

**Alliance Cranes for the Bethlehem Steel Plant.**—The crane equipment supplied by the Alliance Machine Company, of Alliance, Ohio, for the new Lehigh plant of the Bethlehem Steel Company, which was mentioned in the Sept. 6 issue of the *Electrical World*, consists of five 5-ton, ten 10-ton, two 15-ton, one 40-ton, one 60-ton and one 100-ton crane. This apparatus is of mill-type all-steel construction and is all equipped with dynamic braking, except in the cases of the last two machines, which are four-girder, ladle cranes of the latest type, provided with magnetic brakes. The crane switchboards are all equipped with Youngstown safety limit stops on the hoisting motors.

**Conditions on the Pacific Coast.**—A recent letter from San Francisco, Cal., indicates that conditions in the electrical and allied industries along the Pacific Coast are fairly quiet at the present time. Some difficulty is being experienced in certain quarters, it is understood, in the marketing of municipal bonds, and this has held up to some extent building operations in the localities affected. The statement is also made that many of the electric companies are having the same difficulty in disposing of their securities and that their construction work has been handicapped by this fact. However, there is apparently a feeling that these conditions are not permanent and that there will shortly be a picking up in all lines.

**Another Wireless-Station Contract Let.**—The J. G. White Engineering Corporation has obtained the contract for the construction of another wireless telegraph aerial at the station now being built at Oahu, Sandwich Islands. This addition to the equipment at that station will enable communication to be established between it and the stations in the Philippine Islands, and is a decided step in the globe-circling system of wireless communication planned by the Marconi Wireless Telegraph Company. It is expected that by the first of the year the above station will be able to communicate with the California station, also under construction now, and that early in 1914 Asiatic communication will be established. The J. G. White Engineering Corporation is doing all of this construction work.

**Sign-Selling Campaign Inaugurated.**—The Thomas Cusack Company, of Chicago, Ill., is placing before central-station managers an attractive offer in connection with the booming of the electric sign as an advertising medium. This company designs, builds, equips and maintains electric signs of all kinds and supplements this service by a campaign of mail and newspaper publicity which the individual station is not, as a rule, prepared to furnish. In return for its assistance in pushing this very profitable kind of business in its locality, the company proposes to lend to the central station the use of this organized publicity service. An attempt is to be made in this way to create an increased demand throughout the country for electric roof signs of the larger sizes.

**Locating a Broken Water Main.**—A new and interesting application of the "Telefault," manufactured by W. N. Matthews & Brother, of St. Louis, Mo., was explained in a recent letter to that concern from J. T. Greene, of the Department of Public Safety, Toledo, Ohio. Mr. Greene states that some time ago a large boat, dragging anchor, broke one of the heavy water mains that cross under the Maumee River. This main being buried, the divers were unable to locate it. When the water main was laid a large submarine cable was installed in the same trench by the Western Union Telegraph Company, and this cable was undisturbed by the anchor so that telegraph service was not interrupted. A circuit was devised using vacant wires in the cable, and by means of the "Telefault" this circuit was located, thus disclosing the location of the water main, and allowing repairs to be made.

**Reasons for the Stability of Public Utilities.**—"Publicity and absolute frankness in dealing with the public," said Paul Leake, publicity representative of the United Light & Railways Company, of Grand Rapids, Mich., "have come to be recognized as an advantageous necessity by public utility corporations and industrial companies. Well-managed public utility corporations are not only willing to give to the public full information as to their operations and earnings, but they court investigation as to these details. One reason for this attitude is that the showing is usually of such a nature as to inspire confidence in those

who have money to invest. In spite of political uncertainty and general timidity exhibited by capital, the securities of public utilities, especially those of gas and electrical companies, remain remarkably firm. That the general public realizes the stability of public utility securities is shown by the fact that to-day there is scarcely a large banking house in the East that does not carry a line of these securities in its investments."

**Copper-Coated Steel Sheets Offered.**—In anticipation of a pronounced rise in the price of copper within the next few months Herman Boker & Company, of 101 Duane Street, New York, have prepared a reserve stock and are ready to furnish samples or fill orders for their line of copper-covered steel-sheet metal, which is applicable for automobile parts, roofing service and other purposes where there is little waste of the metal. The copper is welded to the steel ingot in preparing this product and the whole passed through the rolls and forced out in the sheet form. The process is one which the company claims to have used for over twenty-five years. The standard thickness of copper is 20 per cent of the entire thickness of the sheet on both sides of the steel, making a total copper thickness of 10 per cent.

**Exterior Theater Illumination.**—At the opening of the Century Opera House, Sixty-second Street and Central Park West, New York, this week, a unique exterior illumination scheme was displayed. There had been formerly no adequate illumination of the exits along Central Park West and the means used for correcting this defect were both novel and attractive. These exits are designd with a prominent keystone arch effect and at the top of this stone there was bolted a short upright Corinthian column, from which two drooping arms extended. A single flaming-arc lamp was hung from each of these arms. There was a cluster similar to the above at each of the five exits, and the total effect with the lamps in operation was very pleasing. The ornamental metal fixtures for this installation were supplied by the J. L. Mott Iron Works and the flaming-arc lamps by the H. M. Hirschberg Company, both located in New York City.

**Large Turbo-generators for the Philadelphia Electric Company.**—Supplementing a note in the Aug. 9 issue of the *Electrical World*, the General Electric Company has given out further information on the big generating sets recently ordered by the Philadelphia Electric Company. The latter company has ordered two horizontal turbines, of 30,000-kw and 35,000-kw capacity respectively, each set consisting of a single turbine driving a generator of similar capacity. The smaller turbine will run at 1500 r.p.m. and will be directly coupled to a 25-cycle generator mounted on the same bedplate. A 60-cycle generator will be driven at 1200 r.p.m. by the larger turbine. With the exception of a similar 30,000-kw machine which the General Electric Company is building for the Commonwealth Edison Company, of Chicago, these turbines are considerably larger than any other single generating set heretofore contracted for in this country or abroad.

**Frost Warnings by Telephone.**—Many kinds of agricultural products, and in particular fruit, are very liable to severe injury from sudden frosts, even of short duration. To guard against the spoiling of its crops in this manner the Wood River Orchard Company, which owns extensive fruit orchards near Weiser, Idaho, has installed a novel system for giving frost warnings by telephone. Dial-type thermometers are located north, east, south and west of the orchard area and fitted with fixed and adjustable contacts which are arranged to close local circuits whenever the temperature drops to a certain predetermined point. This gives the signal at the main office of the company, indicating not only the fact that a frost is imminent but also from which direction it is coming. Following this signal the several orchard men in the affected district are immediately notified by telephone, allowing them time to start fire in the smudge pots with which light or medium frosts can be successfully combated

**Lockport (Ill.) Has Trouble in Getting Electricity.**—Lockport, a city on the Chicago Drainage Canal, was without electricity on the night of Sept. 8. It has been obtaining energy from the Sanitary District of Chicago and is said to be behind about $5,000 in its payments to the municipal corporation. A contract that had been in existence for about seven years expired on Jan. 20 last, and the Sanitary District gave the city notice that it would not renew and would shut off the supply of electricity on Sept. 1. This time was extended for a week by courtesy. The Sanitary District says that all its available energy is now needed for Chicago and furthermore intimates that the city of Lockport has not proved to be a prompt-paying customer. The municipality has been purchasing energy from the District for 0.5 cent per kw-hr., it is said, and retailing it to about 175 local consumers, all of whom are now without electricity. The Public Service Corporation of Northern Illinois has offered to supply energy, but at a higher rate. It is reported that a promoter has offered the city a bonus of $15,000 if allowed to furnish energy at 13 cents a kw-hr. This plan is opposed by the merchants, but is said to be favored by the Mayor.

**Motor Drive Supplied for Textile Mills.**—Among the textile mills which have recenty obtained motor equipment for drive purposes from the Westinghouse Electric & Manufacturing Company are the Pine Tree Silk Company, of Philadelphia, Pa., the Penn Tapestry Company, Glen Riddle, Pa., and the Cedar Cliffs Mills, Chambersburg, Pa. The Stroock Plush Company, of Newburgh, N. Y., has added a 400-kw engine-type generator to its power equipment, as well as 350 hp in motor equipment, part of which will be used as individual drive for its plush looms. Improvements which have been in progress in the plant of W. E. Hooper & Sons Company, Baltimore, Md., are practically completed and electric drive has been installed throughout. Energy is being supplied by the Consolidated Gas, Electric Light & Power Company, and the electrical installation is said to be one of the finest in Baltimore. One hundred and fifty motors, aggregating 2000 hp, are used. An addition of 300 looms has been made at the plant of the Rosemary Manufacturing Company, Roanoke Rapids, N. C., and individual drive will be used on these machines, as well as on the spinning frame and the pickers. At the same plant 300 hp in motor equipment is to be installed for driving line shafting.

**Lake Spaulding Development Nearing Completion.**—Vice-president John A. Britton, of the Pacific Gas & Electric Company, recently issued a statement to stockholders in denial of a report that the company had temporarily suspended operations on its hydroelectric development at Lake Spaulding. He wrote in part as follows: "Reports from our engineers show that greater progress was made on the Lake Spaulding dam in the last month than during any previous period in the history of its construction. This dam will be 365 ft. high and will impound in Lake Spaulding about 30,000,000,000 gal. of water. Concrete is being poured on the dam at the rate of 2000 cu. yd. a day, and it is now 150 ft. above bed-rock, with 75,000 cu. yd. of concrete already in place. By Nov. 1 the dam will be high enough to enable us to make use of it for our power plant below. The tunnel, a mile in length, leading from the dam through the rock into Bear Valley was completed May 1. Since that time trimming has been going on, and this tunnel with a diameter of 9.5 ft. is now ready for use. The canal which takes the water from the tunnel to the new power house in Bear River Gorge is to be 8.5 miles long, and a section of this 40,000 ft. in length has been completed. Three steam shovels are averaging 1000 cu. yd. a day on its excavation, and it is expected that it will be completed by Nov. 1. The reservoir which will be used as a forebay at the power house is to be 13 acres in extent and is now 85 per cent completed. From this reservoir the water will drop 1375 ft. to the power house. Most of the 72-in. steel pipe which will convey the water from the reservoir to the turbines is now on the ground and over 70 ft. of this pipe is being put in position each day. The high-tension transmission line, 114 miles long, from the power house to the distributing station at Cordelia is being rapidly completed. Of the 735 steel towers which will carry this line 400 have already been erected, while the remainder are at their foundations awaiting erection. The wires have been strung over a portion of the distance, and the entire line should be completed and ready to operate by October. Work on the big substation at Cordelia is progressing rapidly, and everything will be in readiness there by the time that the power house begins to deliver energy, early in November."

# Corporate and Financial

**Stone & Webster Securities Company Report.**—The Railway & Light Securities Company, an investing company formed by the Stone & Webster interests, has made a report for the fiscal year ended July 31, 1913. The total earnings for the year, including dividends received and interest received and accrued, were $274,868; interest paid and accrued amounted to $85,680; taxes were $3,992 and expenses were $8,758, leaving a profit from income of $176,438. Profits were also obtained by the purchase and sale of securities. Dividends of 6 per cent were paid on the preferred and common stock. The surplus was $70,467. The total surplus at the close of the fiscal year was $471,004.

**Mississippi River Power Company Stock Listed in Boston.**—The balance sheet as of June 30, 1913, shows that property, plant and contracts stand at $40,337,936; payments for additional construction at $1,399,134; interest during construction at $697,708, and cash at $65,222. On the liabilities side there are: Common stock, $16,000,000; preferred stock, $6,000,000; first mortgage bonds, $18,000,000, and notes payable, $2,500,000. Of the total stock outstanding $4,000,000 preferred and $15,999,500 common were paid for by the property, rights and franchises of the Keokuk & Hamilton Water Power Company and by the construction of the plant and the acquisition of land and other property in connection therewith; cash was paid for $2,000,000 preferred and $500 common stock.

**Development of Kanes Falls Company.**—An issue of first mortgage bonds of the Kanes Falls Electric Company, of Glens Falls, N. Y., is offered for sale by Ashley & Company, of New York, at 92½ and interest. The bonds are part of an authorized issue of $500,000, of which $178,000 are outstanding. They are dated 1905 and are due on June 27, 1955, but are redeemable at the option of the company at 105 on any interest date, or at 100 at the option of the holder on or after Aug. 1, 1923. The company is building a new power station and a 14-mile transmission system with steel towers from Kanes Falls to Granville, N. Y., and adjoining quarries. It has operated for four years a hydroelectric plant near Fort Ann, N. Y., with a transmission line extending 13 miles to Glens Falls, N. Y. It also owns another water-power at West Fort Ann, which is to be developed. The power in Glens Falls is sold to the Adirondack Electric Power Corporation under a long-term contract. Service is furnished in Fort Ann. A contract has been made with the Granville Electric & Gas Company guaranteeing the Kanes Falls company a minimum of $8,760 per year for a certain number of kilowatt-hours daily. The Granville extension will reach the slate district of Rutland County, Vt. In this district and the neighboring one in Washington County, N. Y., there are fifty-eight operators, nearly all of whom now make slate by hand.

**Progress of the American Public Utilities Company.**—The report of the board of directors of the American Public Utilities Company for the year ended June 30, 1913, mentions some of the physical improvements that have been made in the properties of the subsidiary operating companies, some of which are electrical companies. The Utah Gas & Coke Company of Salt Lake City, Utah, has discontinued an isolated electric generating plant and is now purchasing power from the Utah Light & Railway Company, thus effecting a very decided reduction in power cost. The overhead system of the electric department of the Jackson Light & Traction Company of Jackson, Miss., has been improved and strengthened. At the Edison station of the La Crosse Gas & Electric Company, La Crosse, Wis., additional boilers are being installed to take care of the heating business of the company and the heating station equipment is being overhauled generally. The business in Indianapolis has grown rapidly during the past year. The demand upon the two power houses of the Merchants' Public Utilities Company has developed to such an extent that it has become necessary to install additional boilers. It has also been deemed advisable to install a water-softening plant. The equipment at one plant is being entirely rehabilitated. The plant of the People's Light & Heat Company, of Indianapolis, is now being operated in connection with the plant of the Merchants' company, and considerable saving in operating cost has been effected. The electrical distribution system of the People's company is being improved and strengthened. The report says that while a great deal of attention has been given to the organization of the company and to the physical condition of its properties, the commercial possibilities have not been overlooked. At each one of the plants modern methods for securing new business have been employed, with marked success in every instance.

**Boston Edison Company's Operations.**—The return of the Edison Electric Illuminating Company, of Boston, Mass., which has just been filed with the Gas and Electric Light Commission for the year ended June 30, 1913, shows a total income of $6,365,874, compared with $5,787,345 for 1912, and total expenses of $3,558,721, compared with $3,195,718 a year ago. The company now has 52,447 customers in Boston and the thirty-eight suburban municipalities which it serves, compared with 43,246 in 1912, and its total energy output at the switchboard was 171,783,312 kw-hr. as against 150,987,350 kw-hr. in 1912. Its receipts from the sale of energy for commercial lighting were $4,248,441 in 1913, compared with $3,883,679 in 1912, and its sales for industrial purposes totaled $1,257,612, compared with $1,112,277 in the preceding year. The cost of manufacture for 1913 was $1,118,422, and for 1912 $920,136. During the fiscal year the company declared dividends of 12 per cent on the par value of its stock, amounting to $1,950,333. During the fiscal year 1913 the company used 167,097 tons of coal at an average cost of $3.80 per ton. In 1912 its fuel consumption was 141,668 tons, costing $3.56 per ton. The maximum station load was 60,143 kw, occurring Dec. 18, 1912, the previous year's maximum being 55,114 kw. The company sold 118,023,078 kw-hr., compared with 102,930,250 kw-hr. in 1912. The total connected load on June 30, 1913, was 175,146 kw, as against 153,583 kw last year. The company now supplies 2963 kw in municipal arc lamps, 4658 kw in commercial arc lamps, 819 kw in municipal incandescents, 97,825 kw in commercial incandescent-lighting service and 69,881 kw in motors. It has 8465 customers using energy for motors, etc., and 43,472 customers using only incandescent lighting service. During the year it gained 1002 customers on its motor circuits. The generating plants of the company have a total rating of 101,400 kw, of which 90,000 kw is the rating of the main station at L Street, South Boston, in the form of three-phase, 60-cycle units, 1000 kw is in three-phase generators at Waltham and 10,400 kw in direct-current machines at the Atlantic Avenue station, Boston. Two 12,000-kw and two 15,000-kw turbo-alternators are now included in the company's equipment. The company employs 1475 persons, compared with 1311 last year, there being 108 in the generating department, steam division, 175 in the generating department, electrical division, 503 in the distribution department, 461 in offices and the supply department, 101 on the construction force, 68 in the transportation department, 40 in the laboratory and 19 in the steam-heating department.

## NEW YORK METAL MARKET PRICES

| | Sept. 9 | | Sept. 15 | |
|---|---|---|---|---|
| | Bid. | Asked. | Bid. | Asked. |
| Copper: | | | | |
| Standard, spot* | 15.50 | 16.37½ | | 17.00 |
| | Selling Prices | | Selling Prices | |
| | £ s d | | £ s d | |
| London, standard, spot* | 73 5 0 | | 74 15 0 | |
| Prime Lake | 16.75 | to 16.87½ | 16.75 | to 16.87½ |
| Electrolytic | 16.60 | to 16.70 | 16.62½ | to 16.75 |
| Casting | 16.40 | to 16.50 | 16.37½ | to 16.62½ |
| Copper wire base | 17.75 | to 18.00 | 17.75 | to 18.00 |
| Lead | 4.75 | | 4.75 | |
| Nickel | 40.00 | to 45.00 | 40.00 | to 45.00 |
| Sheet zinc, f. o. b. smelter | 8.00 | | 8.00 | |
| Spelter, spot | 5.90 | | 5.85 | to 5.90 |
| Tin, spot* | 42.40 | to 42.75 | 42.75 | to 43.00 |
| Aluminum: | | | | |
| Prompt delivery | 21.50 | to 22.50 | 21.50 | to 22.50 |
| Future | 20.00 | to 21.00 | 20.00 | to 21.00 |

### *OLD METALS

| | | |
|---|---|---|
| Heavy copper and wire | 14.75 | 14.75 |
| Brass, heavy | 9.25 | 9.25 |
| Brass, light | 8.25 | 8.25 |
| Lead, heavy | 4.65 | 4.65 |
| Zinc, scrap | 4.75 | 4.75 |

### *COPPER EXPORTS

| | |
|---|---|
| Total tons to Sept. 15 | 13,052 |

*From daily transactions on the New York Metal Exchange.

## Business Notes

**The Reynolds Electric Flasher Manufacturing Company,** of Chicago and New York, has recently added to its traveling staff S. E. Johnson and W. B. Blair.

**The Best Pipe Engineering & Supply Company** has been organized by George Best, former president of the Best Engineering Company, and his son G. H. Best, and the offices of the new company are located at 3026 Liberty Avenue, Pittsburgh, Pa. The concern will manufacture and install high-pressure piping valves and fittings for various services.

**The Adams-Bagnall Electric Company, of Cleveland, Ohio,** has appointed R. G. Kittle district sales manager, with headquarters at 40 Wall Street, New York. Mr. Kittle succeeds G. A. Thomson and will have charge of sales in this territory for the regular line of electrical equipment put out by the company, as well as its new line of automobile accessories.

**The Mechanical Appliance Company.**—H. A. Barrett, formerly of the Electric Appliance Company and also of the Jenney Electric Company, has been appointed manager of the Chicago office of the Mechanical Appliance Company of Milwaukee, succeeding J. A. Adamson, resigned. This office has been moved from the Fisher Building to the Webster Building.

**The H. W. Johns-Manville Company, of New York,** has opened an office and warehouse in Galveston, Tex., to supplement its present branches at Houston and Dallas. Galveston, because of its location and shipping facilities, makes an ideal distributing center, and in the large brick warehouse there will be accumulated the stock for distribution to the firm's Texas territory. It is planned to receive at that point heavy shipments by coastwise lines from New York. Another fact that makes Galveston a convenient distributing point is the company's increasing trade with Central and South America.

**The Beck Electrical Construction Kompany** has been formed in Minneapolis, Minn., with V. S. Beck at the head. Mr. Beck has held various positions with several of the Stone & Webster companies in the Middle West, most recently being associated with the Mississippi River Power Company at Keokuk, Ia. The new company will do a general engineering contracting business, making a specialty of electric power plant and transmission-line work. It will also act as manufacturers' agents and has already secured the agency for several engineering concerns. The offices will be in the Andrus Building.

## New Industrial Companies

**The National Insulator Company,** of Pittsburgh, Pa., has been granted a charter with a capital stock of $5,000. The company will deal in insulators. The incorporators are: George A. Young, Andrew Hill, Jr., and William P. Welker.

**The Wayman-Aiken Electric & Manufacturing Company,** of Pittsburgh, Pa., has been incorporated with a capital stock of $5,000 by T. V. Wayman, G. V. Aiken and G. F. Wayman. The company proposes to manufacture gas engines, etc.

**The Pittsburgh Electric Tool Company,** of Pittsburgh, Pa., has been incorporated by Max Harris, Harry S. Stewart and M. K. Garrett. The company is capitalized at $5,000 and proposes to deal in electrical appliances and machinery of all kinds.

**The Masterphone Corporation of Manhattan** has been incorporated with a capital stock of $20,000 to manufacture talking machines. The incorporators are Matthew B. Smith, Walter J. Burchett and A. Parker Smith, 2 Rector Street, New York, N. Y.

**The Albert Goldstein Engineering Company,** of New York, N. Y., has been incorporated by Morris Greenblatt, William F. McCord and Isadore Newman, of 1522 Vyse Avenue, New York. The company is capitalized at $10,000 and proposes to manufacture and deal in electrical appliances.

## Trade Publications

**Electrical Supplies.**—The Illinois Electric Company has issued a price list and discount sheet applying to Catalog 19 on electrical supplies.

**Deflectoliers.**—Edward J. O'Beirne & Co., of Elgin, Ill., are distributing a small fourteen-page pamphlet describing their combination lighting diffusion and its various applications.

**Lighting Glassware.**—In order to call attention to its new showrooms at 71 West Twenty-third Street, New York, the Gleason-Tiebout Glass Company has issued an attractive four-page booklet on semi-direct glassware.

**Switches.**—Descriptive Leaflet No. 3551 issued by the Westinghouse Electric & Manufacturing Company fully describes and illustrates type F alternating-current magnetic switches. These switches are designed to withstand the severest forms of industrial service.

**Wires and Cables.**—The Simplex Wire & Cable Company, 201 Devonshire Street, Boston, has issued a price list of its Simcore wires and cables, which are made in accordance with the rules and requirements of the National Board of Fire Underwriters effective January, 1912.

**Insulators.**—Catalog No. 3 recently issued by the Pittsburgh High Voltage Insulator Company, Derry, Pa., contains a few general notes on the subject of its insulators, accompanied by working drawings of its comprehensive line of style and sizes. The catalog contains 160 pages, and is well printed on soft-toned paper inclosed in a dignified cover.

**Automobile Lamp.**—The Aiken revolving automobile lamp is briefly described and illustrated in a leaflet issued by the Herrick Aiken Company, Inc., Bay State Building, Lawrence, Mass. This lamp is easily adjusted on any make of car and is run by a battery or a generator. The revolving characteristic of the lamp is of special value to the automobilist.

**Outdoor Substations.**—The Transmission Engineering Company, Pittsburgh, Pa., has recently issued a folder in which are set forth the advantages of the outdoor substation, where dairies, factories and small towns near transmission lines are desirous of purchasing energy. Brief construction data and the estimated cost and income from these stations are given.

**Motors.**—"Selecting Motor Equipment for Electrically Operated Hoists" is the title of a bulletin (Section 3113) issued by the industrial and power department of the Westinghouse Electric & Manufacturing Company. This pamphlet gives interesting information on the subject of hoisting equipment, including a number of formulas and a diagram of connections of different systems.

**Mining Machine.**—A twenty-four-page illustrated bulletin, No. 118, has recently been issued by the Jeffrey Manufacturing Company, Columbus, Ohio, entitled "The Care and Operation of Jeffrey 28A Shortwall Mining Machine." This machine is used for cutting coal. Full details of construction and operation are given, and a number of good illustrations of the manner of handling the apparatus are shown.

**Automobiles.**—The Anderson Electric Car Company, Detroit, Mich., in its advance bulletin states that its 1914 line will be exceptionally comprehensive. Within the twelve pages of the bulletin six new models are shown, accompanied by descriptions and prices. Reference is also made to a new feature, the Detroit Duplex drive, by the use of which it is possible to drive the car either from the front or from the rear seat.

**Signs.**—The United States Sign Company, Gadsden, Ala., has issued a catalog describing its convex reflector illumination sign. It illustrates and gives specifications of some recent original and novel designs which the company has installed in various Southern cities. This illuminating sign is said to be an improvement upon the old studded-lamp arrangement by subduing the light through the reflector process so as to eliminate its blurring effect. It retains its attractiveness in the daytime and can be animated by the use of flashers at night. The sign is made entirely of metal and is said to weigh less and to cost less initially than other signs.

# Personal Mention

**Mr. W. T. Drew** has been appointed manager of the newly instituted electric-light plant at Titusville, Fla.

**Mr. G. H. Briggs** has been appointed superintendent of the Thornapple Gas & Electric Company, Hastings, Mich.

**Mr. J. W. Worthington,** of Sheffield, Ala., has been elected vice-president of the Alabama Power Company, of Talladega, Ala.

**Mr. L. S. Frantz** has recently been appointed superintendent of the municipal electric light and water works of Friend, Neb.

**Mr. R. H. Taliferro** has been appointed secretary and treasurer of the Appalachian Power Company, of Bluefield, W. Va.

**Mr. F. L. Annable** has been appointed general superintendent of the Pacific Electric Railway Company in Southern California.

**Mr. Charles F. Barnes** has been appointed acting manager of the London (Ont.) Electric Company, succeeding Mr. E. I. Jenking.

**Mr. J. C. Cornelius,** formerly superintendent of the Perry (Okla.) lighting plant, has joined the electrtical staff of Swift & Company, Chicago.

**Mr. L. A. Webb** is secretary and treasurer of the Central Power Company, of Pe Ell, Wash., recently acquired by the Central Light & Manufacturing Company.

**Mr. O. B. Niesen** has resigned as local manager of the Eastern Light & Power Company, of Claremont, N. H., and will be succeeded by Mr. R. W. Berliner, of New York.

**Mr. J. P. Brown,** superintendent of the Nashville (Tenn.) Railway & Light Company, has been elected president of the newly organized Jovian luncheon club of Nashville.

**Mr. Theodore N. Vail,** president of the American Telegraph & Telephone Company, has been elected a member of the executive committee of the New York, New Haven & Hartford Railroad.

**Mr. E. T. Cope** has resigned as instructor in the mechanical-engineering department of the University of Michigan, Ann Arbor, to join the staff of the Edison Electric Illuminating Company, of Detroit.

**Mr. Stanley Eisenhoffer,** formerly of the Toronto (Ont.) Hydro-Electric System office staff, has been appointed superintendent of the underground system of the hydro-electric department of the city of Hamilton, Ont.

**Mr. Joseph F. Lewis,** assistant professor of electrical engineering in Lafyette College, Easton, Pa., recently passed the civil-service examination for electrical engineer in the department of city transit, Philadelphia, Pa.

**Mr. F. B. H. Paine,** general manager of the Niagara, Lockport & Ontario Power Company, which purchases energy in bulk from the Ontario Power Company of Niagara Falls, Ont., and distributes it in New York State as far east as Syracuse, has severed his connection with the company.

**Mr. James E. Weaver,** who has served as superintendent for the Alabama Power Company at Talladega, Ala., for several years, has been transferred to the superintendency of the company's service at Huntsville, Ala. He will have charge of both street-railway and electric-lighting business in that city.

**Mr. K. L. Aitken,** formerly general manager of the Toronto Hydro-Electric System and under whose direction the system was designed, constructed and placed in operation, has returned from Europe and will re-establish his practice as consulting engineer. Temporarily his address will be in care of the Toronto company, 226 Yonge Street, Toronto.

**Mr. H. S. Black** has been appointed manager of works of the Westinghouse Lamp Company, Bloomfield, N. J., to succeed Mr. R. H. Henderson, resigned. Mr. Black has had considerable experience in the engineering and manufacturing departments of the National Quality Lamp Division of the General Electric Company and for the last three years has directed the work of the St. Louis factory of the company.

**Mr. Henry Waterman Peck,** president-elect of the Eastern New York Section, National Electric Light Association, is vice-president and general manager of the Schenectady (N. Y.) Illuminating Company. Mr. Peck is a graduate of Yale and took post-graduate work at Cornell. His first electrical experience was with the Westinghouse interests at Pittsburgh, but after four years he joined the staff of the Consolidated Gas & Electric Company of Baltimore, Md., as electrical engineer. Later he was appointed assistant electrical engineer of the Rochester (N. Y.) Railway & Light Company, having risen to the position of assistant general manager at the time he was appointed general manager of the Schenectady company. Mr. Peck is a fellow of the American Institute of Electrical Engineers.

**Mr. Harry L. Monroe,** whose appointment as district manager of the Chicago office of the General Electric Company has just been announced, has spent his entire business life with that company and its predecessor and is widely known among electrical men throughout the country. He was born in Parkersburg, W. Va., and removed to Chicago when hardly more than a boy, entering the employment of the Thomson-Houston Electric Company in September, 1888. Mr. S. A. Barton was then in charge of the Chicago office of the "T-H" company, and young Monroe was employed in the shipping and stock department, of which he was put in charge after about three months' service. In 1892 the Thomson-Houston company was consolidated with the Edison General Electric Company, forming the present General Electric Company. Mr. B. E. Sunny was appointed district manager of the new company and Mr. Monroe was made purchasing agent of the Chicago office. In June, 1894, Mr. Monroe was transferred to Texas, becoming manager of the Dallas office of his company. He remained in this position until January, 1905, when he returned to Chicago to succeed Mr. T. P. Bailey as manager of the railway department of the Chicago office. In January, 1913, after the death of Mr. J. W. Johnson, who succeeded Mr. Sunny as district manager of the Chicago office, Mr. Monroe was made district sales manager in Chicago, and his appointment as district manager of the Chicago office dates from Aug. 26 of this year, although it has been but recently announced. Mr. Monroe is a charter member of the Jovian Order, his "potential" being 5. He is also a member of the Union League, Automobile and South Shore Country clubs of Chicago and of the Mohawk Club of Schenectady. He is married and has two children, a daughter of nineteen and a son of seven.



HARRY L. MONROE

# Obituary

**Reuben Clark Winchester,** treasurer of the Holyoke (Mass.) Water Power Company, died at his home in Holyoke on Sept. 11 after a short illness. Mr. Winchester was born in Marlboro, Vt., fifty-six years ago, and after being educated at Holyoke and New York entered the professional baseball field for a short time, where he was highly successful among the earlier players of the national game. In the winters of 1878 and 1879 he was employed by the Holyoke Water Power Company as a collector, becoming permanently attached to the staff in 1880 and passing through the positions of paymaster and cashier to the treasurership, which he attained in 1903. The Holyoke Water Power Company supplies hydroelectric energy to many of the large mills of Holyoke, and Mr. Winchester's broad interests and diplomatic qualifications rendered him a leader in industrial affairs in the upper Connecticut Valley. He is survived by a daughter.

# Construction

## New England

[illegible] for lighting the streets now lighted by gas with electricity. There are now about 1000 gas lamps used in this city.

BOSTON, MASS.—Bids will be received by L. K. Rourke, commissioner of public works, 49 City Hall, Boston, Mass., until Oct. 28 for furnishing and erecting a pumping plant for high-pressure fire service in the proposed underground pumping station in Charles Street, between Beacon and Boylston Streets. Forms of proposals and a set of two plans showing general arrangements and details may be obtained at Room 49, City Hall.

BROOKLINE, MASS.—The Selectmen have granted the Edison El. Illg. Co. of Boston permission to construct and maintain underground conduits on Elba Street and Crowninshield Road, Washington Street and Beacon Street, Rawson Road and Crowninshield Road.

BUZZARDS BAY, MASS.—Plans are being considered to light the entire route of the Cape Cod Canal (8 miles long) with 40-cp tungsten lamps erected in pairs on opposite sides of the canal 100 ft. apart. Two highway bridges and a railroad bridge cross the canal, which are operated by electricity at present supplied by the New Bedford & Onset Ry. Co.

CAMBRIDGE, MASS.—The Cambridge El. Lt. Co. expects to install within the next 30 days an underground distribution system on Massachusetts Avenue from Lafayette Square to Central Square, and to install an incandescent lighting system on Fresh Pond Parkway. W. E. Holmes is treasurer and general manager.

TAUNTON, MASS.—The contract for the new turbo-generator and exciter for the municipal electric-light plant has been awarded to the Allis-Chalmers Co., of Milwaukee, Wis., at $24,000.

ANSONIA, CONN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 21 for construction, complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Ansonia, Conn. Drawings and specifications may be obtained at the above office or at the office of the custodian at Ansonia. O. Wenderroth is supervising architect.

WINDSOR LOCKS, CONN.—The Windsor Locks Business Men's Association is planning to install an ornamental lighting system on Main Street (about 1500 ft.); lamp standards will be erected on one side of the street only, about 90 ft. apart. Cast-iron posts carrying two pendent lamps (60-watt tungsten) each are under consideration. The proposed system will be maintained by underground wires. F. J. Bidwell, Jr., is president of the association.

## Middle Atlantic

BROOKLYN, N. Y.—Bids will be received by the Park Board, Department of Parks, Arsenal Building, Fifth Avenue and Sixty-fourth Street, borough of Manhattan, New York, until Sept. 25, for labor and materials required for the erection and completion of the general contract and electrical work for shelter house and comfort station located in Highland Park, borough of Brooklyn. Blank forms and further information may be obtained at the office of Frank J. Helmle, 190 Montague Street, Brooklyn, where plans and specifications may be seen. Charles B. Stover is president of Park Board.

DEPOSIT, N. Y.—The Deposit El. Co. expects to purchase within the next three months one 250-kw, three-phase, 60-cycle, 2300-volt, 200-r.p.m. engine-type generating unit and switchboard for same. The company has recently installed a new street-lighting system in Deposit, consisting of 62 32-cp, ten 200-cp and seven 350-cp tungsten lamps. John D. Mickle is treasurer.

JAMESTOWN, N. Y.—The managers of the municipal electric-light plant expect to purchase within the next six months a 1000-hp turbo-generator with condenser, switchboard panel for above machine and one 75-lamp rectifier outfit with 75-arc lamps. Clayton O. Johnson is superintendent.

NEW ROCHELE, N. Y.—The Council has authorized Mayor Waldorf to enter into a contract with the Westchester Ltg. Co. for installing and maintaining an ornamental street-lighting system on Main Street for a period of three years.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities, foot of East Twenty-sixth Street, New York, N. Y., until Oct. 6, for furnishing material and installing fire-alarm system, alterations, repairs, etc., in the various buildings under the jurisdiction of the Department of Public Charities of the city of New York. Blank forms and further information may be obtained at the office of A. L. A. Himmelwright, consulting engineer, 50 West Twenty-fourth Street, borough of Manhattan, where plans and specifications may be seen. Michael J. Drummond is commissioner.

ROCHESTER, N. Y.—The committee on lamps and electricity of the City Council has decided to install inverted magnetite-arc lamps erected [illegible] East Avenue [illegible] candle-power, on St. Paul Street from Avenue E to the city line, replacing the old-fashion arc lamps now in use. The residents of Chili Avenue have petitioned the Council for tungsten lamps to replace the present arc lamps on that avenue.

SODUS, N. Y.—The Wayne Pwr. Co., of Sodus, has connected its mains with Avoca, which completes the main line of 20 miles of 11,000-volt transmission system, and furnishes energy for lamps and motors in Atlanta, North Cohocton, Cohocton, Wallace and Avoca. Negotiations are under way toward extending the lines into Bath. Energy will be furnished to the Bath El. & Gas Co. for distribution. The company has a franchise in Naples, to which place extensions will be made in the spring, and will purchase all kinds of construction material and substation equipment for this extension. A proposition has been submitted to the company for Niagara Falls power, which may be accepted later as the lines of the Niagara company are only 20 miles distant from the Wayne company's lines. The Wayne Pwr. Co. is controlled by Mills Brothers, of the Sodus Gas & El. Co. and the Marion Pwr. Co. G. R. Mills is president.

SYRACUSE, N. Y.—Plans have been prepared by Henry C. Allen, city engineer, for establishing an ornamental street-lighting district, covering 3 miles of streets. An ordinance will be presented to the City Council creating the district, and it will provide that the cost be met by assessing one-half to the property-owners and the other half to the city at large. The proposed system will consist of 492 standards carrying five-lamp clusters, of which 277 are to be new, 215 standards now being in use. The Syracuse Ltg. Co., it is said, will begin work on the installation as soon as the district is established and other necessary action taken.

KINGSTON, PA.—The Borough Council has awarded the Luzerne County Gas & El. Co., of Plymouth, a contract for lighting the streets of the borough for a period of seven years. Under the present contract the borough pays $60 per lamp for 74 lamps; the new contract calls for 90 lamps at $50 each per year.

LEBANON, PA.—Contracts have been awarded by the Hershey Chocolate Co. for additions to its power plant which will increase the output by 2250 hp. The company furnishes energy to operate the street railway system of the Hershey Transit Co., which connects Lebanon and Campbelltown.

NORRISTOWN, PA.—Bids will be received by the trustees of the State Hospital for the Insane, Norristown, until Oct. 1 for a 120-r.p.m., 1200-cu. ft. air compressor. Specifications may be seen at the office of Dr. W. A. Drysdale, consulting engineer, 415 Hale Building, Philadelphia.

OIL CITY, PA.—The Citizens' Trac. Co., of Oil City, has nearly completed its reconstruction work and improvements and now has only to finish its power house, where a 1500-kw turbine with two boilers is being installed. It is also changing over steam piping and switchboard work. W. W. Cole is acting general manager.

SIPESVILLE, PA.—A company has been organized by the residents of Sipesville to install and operate an electric-light plant here. Contract for the construction of the plant has been awarded to Fairbanks, Morse & Co., of Cleveland, Ohio. The officers of the company are: Nelson Shaulis, president; Simon Swank, vice-president; Silas Bittner, secretary, and A. E. Friedline, treasurer.

WARREN, PA.—A new power plant, it is reported, will be erected at the Pennsylvania State Hospital for the Insane at Warren, to cost about $125,000.

SUCCASUNNA, N. J.—Steps have been taken to secure a street-lighting system for the most thickly populated sections of Roxbury Township. A resolution to appropriate funds not to exceed $3,000 will be submitted to the voters at the primary election.

TRENTON, N. J.—Bids will be received by the State House Commission at the office of the state comptroller, State House, Trenton, until Sept. 30, for construction and equipment of power plant for the New Jersey State Hospital in accordance with plans and specifications on file in the office of the commissioner of charities and corrections, State House, Trenton. For further information address Joseph P. Byers, commissioner of charities and correction. Edward I. Edwards is secretary of commission.

EASTON, MD.—The City Council has granted a franchise for the construction of an electric-light plant in Easton. The proposed plant will [illegible] power and will have an output of 275 hp. For further information address William Daunenhauer, 1117 Lincoln Street, Wilmington, Del.

SPRINGFIELD, W. VA.—The Magnolia Pwr. Co. contemplates the construction of a hydroelectric power plant on the south branch of the Potomac River. The present plans provide for developing 13,000 hp; a total cost of $1,000,000. Electricity will be transmitted to Springfield, Romney and other towns in this vicinity. F. Ernest Brackett, of Cumberland, is engineer.

WHEELING, W. VA.—The Wheeling Valley Lt. & Pwr. Co. has been granted a franchise by the County Commissioners to erect transmission lines throughout the Wheeling district to furnish energy for lamps and motors.

LYNCHBURG, VA.—The City Council is considering the installation of an electric-power plant to furnish electricity for street lighting, to cost $138,000, and providing for an auxiliary water supply in case of accident to the gravity system, involving an expenditure of $220,000.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until Sept. 26, for furnishing 3500 lance poles with combination tip as per specifications 176-B. Bids will also be received until Sept. 23, for furnishing the following supplies: (1) For 1400 lb. friction tape, 4-oz. rolls, ¾ in. wide, in tin boxes, as per specifications 569-B; (2) 600 lb. rubber tape, in 4-oz. rolls, ¾ in. wide, in pasteboard boxes, as per specifications 569-B. Major W. L. Clarke is disbursing officer.

## North Central

BAY CITY, MICH.—The contract for the general construction work of the addition to the water-works building for the new electric-light plant has been awarded to H. G. Beard, for $3,700.

GRAND RAPIDS, MICH.—Plans are being prepared by Wernette, Bradfield & Mead, architects, for the construction of a new power plant, 20 ft. by 40 ft., for the factory of the Stow & Davis Furniture Co., of Grand Rapids. A new 150-hp engine will be installed.

JACKSON, MICH.—Improvements are contemplated by the Commonwealth Pwr. Co. to its local system involving an expenditure of $50,000 during the fall and winter. The plans provide for utilizing energy in Jackson for both commercial and manufacturing purposes; all wires are to be placed underground. Orders have been placed for a 10,000-hp steam generating unit to provide energy for this city in case of accidents to the hydroelectric systems.

PONTIAC, MICH.—The Pontiac Commercial Association, of Pontiac, has appointed a committee to confer with the Pontiac Pwr. Co. relative to the installation of an ornamental lighting-system in the business section of the city.

AKRON, OHIO.—The Ohio Utilities Commission has granted the Northern Ohio Trac. & Lt. Co., of Akron, permission to issue $1,500,000 in bonds, the proceeds of $800,000 to be used for refunding purposes and the remainder to provide for power and railway developments.

BLANCHESTER, OHIO.—Improvements and extensions are contemplated to the municipal electric-light plant in Blanchester.

CAMBRIDGE, OHIO.—The New Midland Pwr. & Trac. Co., of Cambridge, has just completed the installation of a street-lighting system in Byersville, consisting of 44 tungsten lamps of 100 cp on Westinghouse adjuster socket system. C. H. Howell is general manager.

FINDLAY, OHIO.—The Toledo, Bowling Green & Southern Trac. Co., of Findlay, has submitted another proposition to the City Council for street lighting. The company offers to furnish new arc lamps, the minimum number used to be 225, at $55 per lamp per year. In return the company asks that its lighting franchise be extended seven and one-half years.

GREENVILLE, OHIO.—Within the next three months the Greenville El. Lt. & Pwr. Co. expects to erect a 33,000-volt, three-phase transmission line to Union City, a distance of 13 miles, and to purchase one 300-hp water-tube boiler, one switchboard panel for above transmission line, transformers, cross-arms and poles for above line. D. L. Gaskill is president.

MANSFIELD, OHIO.—The city of Mansfield is considering the installation of a municipal electric-light plant, to cost about $100,000. E. A. Blecker is director of public service.

CLOVERPORT, KY.—Preparations are being made by the Cloverport Ice Co. for the installation of an electric-light plant, to cost about $15,000. A. A. Simons is president of the company.

DAWSON SPRINGS, KY.—The New Century Hotel Co., of Dawson Springs, contemplates the installation of an electric-light plant, to cost about $7,500, and would like to receive estimates on same. F. M. Fisher, of Paducah, is president.

GRAYSON SPRINGS, KY.—The Grayson Springs Hotel Co., which proposes to build a hotel and summer resort in Grayson Springs, to cost $450,000, has engaged G. V. Newel, of Chicago, Ill., as architect. The proposed plans provide for a lighting plant.

LOUISVILLE, KY.—At a meeting held recently the stockholders of the National Pwr. Co. elected officers and completed plans for carrying out the project of utilizing the falls of the Ohio River. The headquarters of the company will be moved from Birmingham, Ala., to Louisville. George G. Fetter was elected president.

PINEVILLE, KY.—The Kentucky Utilities Co., of Lexington, has purchased the power plant near Pennington Gap, W. Va., in what is known as the "Pocket Country," and is contemplating the purchase of the plant at Varilla. If the deal is consummated, it will tie in the two plants at Harlan.

ANDREWS, IND.—The property of the Andrews Lt. & Pwr. Co. has been purchased by the Huntington Lt. & Fuel Co., of Huntington. As soon as arrangements can be made energy for operating the local system will be supplied from the Huntington plant and a 24-hour service established. The local plant will be closed down.

GAS CITY, IND.—The managers of the municipal water-works plant expect to install within the next two months two boilers of 150 hp each, 25 lb. working pressure, in the water-works plant; also to purchase within the next two months two motor-driven centrifugal pumps. T. S. McKee is superintendent.

INDIANAPOLIS, IND.—The Stenotype Co. will install a power plant in its new factory now in course of construction. The equipment will consist of two 250-hp Heine boilers, a 400-hp Chandler-Taylor steam engine, a 300-kva, three-phase, 60-cycle Westinghouse generator, one generator panel and two feeder panels (Westinghouse), 900 carbon, tungsten and Buckeye incandescent lamps. Contracts for machinery have been placed. S. J. H. White is engineer in charge of the work.

ELGIN, ILL.—The City Council is considering the question of submitting to the voters the proposition to issue $150,000 in bonds for the construction of a municipal electric-light plant.

GALVA, ILL.—The city of Galva has granted E. D. Brown, of Elmwood, a franchise to construct and operate an electric-lighting system here.

LA SALLE, ILL.—The Board of Supervisors of La Salle County has granted the Citizens' Ltg. Co., of La Salle, a franchise to construct and operate an electric transmission line across the La Salle-Oglesby concrete highway over the Shippingsport bridge and east to the Vermilion River bridge. This line will furnish energy to the Jonesville Mine of the La Salle County Coal Co. and for the illumination of the highway.

METROPOLIS, ILL.—The city of Metropolis expects to erect a concrete wall around the municipal electric-light plant for high-water protection in case of flood stage of the Ohio River. The State of Illinois will install concrete lamp standards in Fort Massas State Park in the near future and the city of Metropolis will maintain the lamps. P. M. Richards is superintendent.

NORTH CHICAGO, ILL.—A committee has been appointed by Mayor Christenson to secure estimates of the cost of building a municipal electric-light plant and report to the Council within 30 days.

ROCKFORD, ILL.—Plans are being prepared by Wernette, Bradfield & Mead, architects, for the construction of a new power plant for the tannery of the Hirth-Krause Co. in Rockford. The headquarters of the Hirth-Krause Co. are in Grand Rapids, Mich.

STREATOR, ILL.—Investigations, it is reported, are being made by the Public Service Co. of Northern Illinois, at Spring Lake, near Streator, with a view of establishing a new power plant there to cost approximately $250,000. Locations at Yorkville and Lacon are also under consideration.

BERLIN, WIS.—A fund is being raised by the citizens of Berlin for the purpose of installing an ornamental street-lighting system. The street-lighting service is furnished by the Berlin Pub. Ser. Co. S. W. Irwin is president of the company.

CLINTONVILLE, WIS.—Within the next 12 months the managers of the municipal electric-light plant expect to purchase one 16-in. by 36-in. Corliss engine, one 66-in. by 16-ft. boiler and one 300-hp. heater (open type), and within the next three months to purchase two switchboard integrating wattmeters, one recording voltmeter and one kilometer. George C. Stewart is superintendent.

NEENAH, WIS.—The city of Neenah is considering the question of establishing a municipal electric-light plant. As yet an engineer has not been engaged.

AURORA, MINN.—The Northern Minnesota Pwr. Co., of Aurora, will build a hydroelectric power plant on the St. Louis River, 2½ miles from Aurora. The equipment will include boilers with a rating of 600 hp, one 500-kva steam turbine, two waterwheels, two waterwheel governors, three 60-cycle, 2300-volt alternating-current generators, full switchboard equipment, synchronizer voltage regulator, eight transformers (2300 to 13,200 volts), 63 miles of wire and 800 poles, 2000 to 2300 ft. underground distribution, four three-phase meters; will also erect a substation in Aurora. J. H. Simons, of Aurora, is president.

CAMPBELL, MINN.—The Otter Tail Pwr. Co., of Fergus Falls, has submitted a propositon to the village of Campbell offering to extend its transmission line through Campbell and furnish electrical service here. The company asks for a ten-year franchise with the privilege of an additional five years; also contract for street lighting at $50 per month, for which it agrees to furnish 20 incandescent lamps, or four arc lamps and 12 incandescent lamps, or two arc lamps and 16 incandescent lamps.

GLENWOOD, MINN.—Negotiations are under way between Mr. Whalen and Mr. Claussen, of St. Paul, for the purchase of the property of the Glenwood Mill & El. Co. If the deal goes through, the new owners propose to rebuild the plant, replacing the direct-current system with alternating current. Messrs. Whalen and Claussen have applied for a 25-year franchise, which has been granted, with certain conditions.

MOUNTAIN LAKE, MINN.—At an election held recently the proposition to discard the present gas street-lighting system and install electric lamps was carried.

NASHWAUK, MINN.—The Water and Light Commissioners have entered into a contract with the Wisconsin Steel Co., which owns and operates the Hawkins Mine, for energy to operate the local system for a period of three years at the rate of 5 cents per kw-hr. A transmission line will be erected by the village from the plant at the mine, 2 miles distant, to the power house of the municipal electric plant, which will be used as a substation. The equipment of the plant will be held to use in emergencies. The village plant furnishes direct current, and the service from the Wisconsin company will be alternating-current system. Arrangements will be made so as to utilize either system as the

one 100-kw, three-phase, 60-cycle, 2300-volt generator, and one 150-kw

and manager.

ROCHESTER, MINN.—The contract for installation of a tandem com-

at $11,585. A petition has been presented to the City Council asking for the extension of the cluster-lamp street-lighting system from Fifth Street

build a new steam plant and will use power from the old flour mill until an arrangement can be made to erect a transmission line to Glenwood and purchase energy from the new power plant there. A. H. Dryer is superintendent.

WOODLAKE, MINN.—Bids will be received by H. F. Payne, village recorder, until Sept. 25 for furnishing material and erecting an electric transmission and distribution system for the village of Woodlake in accordance with plans and specifications which are on file in the office of the village recorder and also in the office of Earle D. Jackson, consulting

erecting a 13,200-volt transmission line from Granite Falls to Woodlake and a distribution system in Woodlake.

BAGLEY, IA.—At an election held recently the proposition to issue $6,000 in bonds for a municipal electric-light plant was carried.

GLENWOOD, IA.—It is reported that the electric plants of the Glenwood El. Lt. & Pwr. Co., of Glenwood, and the Malvern Lt. & Pwr. Co., of Malvern will be connected. When the proposed connection is completed energy will be supplied to other towns in the county. The plant at Malvern will not be used except in case of emergencies. Energy for operating the system in that town will be furnished from the Glenwood plant. The companies will continue to do business under their own names.

LE MARS, IA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 22, for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Le Mars. Drawings and specifications may be obtained at the above office or from the custodian of site at Le Mars. O. Wenderoth is supervising architect.

RIVERSIDE, IA.—Joseph Wingler, owner of the Riverside Roller Mill, it is reported, contemplates remodeling the mill, installing a larger waterwheel and furnishing electricity for lamps and motors in Riverside and to farmers in this vicinity.

VALLEY JUNCTION, IA.—At an election held Sept. 8 the proposition to grant the Des Moines El. Co., of Des Moines, a franchise to construct and operate an electric-lighting system in Valley Junction was carried.

WEST UNION, IA.—The City Council has voted to install ornamental lamps around the square and on Vine Street.

KING CITY, MO.—The King City El. & Mfg. Co. has recently purchased a 50-hp De Le Vergne oil engine, generator, extra switchboard panel, etc. As soon as improvements are completed the company will establish a 24-hour service.

KIRKWOOD, MO.—The Board of Aldermen has authorized the erection of 40 boulevard brackets in the business district, carrying 60-cp tungsten lamps. C. A. Trussell is superintendent of the municipal electric-light plant.

GRAND FORKS, N. D.—The lighting system will be extended along University Avenue to the campus. H. G. Lykken is city engineer.

WAKONDA, S. D.—The Wakonda Lt., Pwr. & Htg. Co. expects to purchase within the next two months a 50-hp two-cylinder oil engine and a 30-kw generator to replace a 30-hp engine and 18-kw generator.

AUBURN, NEB.—The proposition to issue $10,500 in bonds for the construction of a municipal electric-light plant will be submitted to the voters on Sept. 30.

COOK, NEB.—Bonds to the amount of $6,000 have been voted for the installation of a municipal electric-light plant and the erection of a transmission line to Tecumseh. Electricity for operating the system will be secured from the municipal electric plant at Tecumseh.

FRIEND, NEB.—The managers of the municipal electric-light and water-works plant expect to purchase within the next three months a 35-kw to 40-kw steam or oil outfit and one switchboard panel for above unit. The company would like to receive catalogs giving descriptions, etc., of 50-hp to 60-hp Corliss engine and oil engines. L. S. Frantz is superintendent.

WEEPING WATER, NEB.—The local electric-light plant and pumping station was damaged by fire on Sept. 6.

consulting engineers, Reliance Building, Kansas City, Mo., to prepare plans and estimates of cost for installation of a municipal electric-light

WHITING, KAN.—At a special election held recently the proposition to issue $8,000 in bonds to erect a transmission line to Horton to secure electrical service from the municipal plant there was carried. Electricity will also be furnished to farmers living along the line.

## Southern States

GEORGETOWN, S. C.—Preparations are being made by the Georgetown Gas & El. Co., recently incorporated, for the construction of an electric-light plant and gas plant. Bids for the construction of plants, it is reported, have been asked by Bachman & Co., 624 Stock Exchange Building, Philadelphia, Pa., who control the company.

YORKVILLE, S. C.—The electric light, water and sewer commissioners expect to erect a substation near the center of the town within the next two months, using the equipment previously owned jointly by the town and the Neely Mfg. Co.; also to purchase within the next two months three automatic oil switches and panels. The Neely Mfg. Co. has

TRION, GA.—The Trion Co. is installing a 750-kva steam turbine and one 300-kw generator, together with electrical equipment for lighting the village and mill. J. E. Sirrine, of Greenville, S. C., is architect and engineer. O. B. Carpenter is assistant treasurer of the Trion Co.

GREENSBORO, ALA.—The Greensboro Wtr. & Lt. Co., which has a water and electric-light plant about 1 mile from the depot and an ice plant at the depot, is contemplating removing the electric plant to the depot and installing electrically operated pumps and possibly new generating machinery.

COLUMBUS, MISS.—Bids will be received until Oct. 1 for the installation of an electric-light plant at the Mississippi Institute and College. For further information address D. T. Gaston, secretary and treasurer.

WELSH, LA.—At an election held recently the proposition to issue $15,000 in bonds for the installation of a municipal electric-light plant was carried. L. E. Robinson is chairman of light committee.

CHICKASHA, OKLA.—C. G. Johnson, receiver of the Chickasha Lt., Ht. & Pwr. Co., expects to sell the property to the Chickasha Gas & El. Co. some time this fall, permission having been granted by the State Legislature and the Corporation Commission. In anticipation of the consolidation the receiver is now installing additional equipment at a cost of from $35,000 to $40,000 as follows: One 625-kw General Electric steam turbine, one 2500-sq. ft. Worthington surface condenser with auxiliaries, including dry vacuum pump and turbine-driven circulating pump, one 325-hp Heine boiler, necessary switchboard and substation equipment for controlling the above installation and for tying together the water-power plant of the Chickasha Gas & El. Co. and the steam plant of the Chickasha Lt., Ht. & Pwr. Co.; also the erection of a transmission line with 900-kva transformers, 6600-2300 volt. The center of distribution of the new consolidated system will be the power house of the Chickasha Lt., Ht. & Pwr. Co. C. G. Johnson is superintendent of construction for the Chickasha Gas & El. Co. on this new work.

DALLAS, TEX.—At an election held recently the proposition to issue $400,000 in bonds for the installation of a municipal electric-light plant was defeated.

EAGLE PASS, TEX.—The International El. Co., of Eagle Pass, it is reported, will erect transmission lines to two irrigation pumping plants 9 and 16 miles respectively from Eagle Pass. The company also contemplates improvements to its plant, involving an expenditure of about $55,000, to increase its output.

FORT WORTH, TEX.—The North Side Improvement Association has petitioned the City Council for the installation of a new lighting system on North Main Street, from the new Baddock Bridge to Exchange Avenue, a distance of 2 miles. The cost of installing the system is estimated at about $28,000.

RUNGE, TEX.—We are informed that work will not begin before Jan. 1, 1914, on the proposed municipal electric-light plant, for which bonds to the amount of $20,000 were recently voted. As yet no engineer has been employed. J. F. Murray is clerk.

## Pacific States

SEATTLE, WASH.—J. D. Ross, superintendent of lights, is agitating the proposition of purchasing energy to the amount of 3000 kw from the city of Tacoma in order to meet the increasing demands for electrical service in this city. The municipal electric plant, located at Cedar Falls, is unable to furnish adequate service at this time. If it is decided to purchase energy from the Tacoma plant, a transmission line will be erected between Seattle and Tacoma, at a cost of $150,000.

SUMAS, WASH.—The Sumas El. Co., of Sumas, has applied to the towns of Everson and Nooksack for a franchise to furnish electricity for lamps and motors. Application has also been made to the County

for a franchise to erect a

mission line from Sumas to Everson. If granted a franchise, transmission lines will be erected from the Stave Lake plant in British Columbia.

WILBUR, WASH.—The Wilbur Electrical Co. has sold its property to the Washington Wtr. Pwr. Co., of Spokane, to take possession of same Jan. 1, 1914. Charles Kolb is manager.

FOREST GROVE, ORE.—The City Council has rejected the proposition of the Washington-Oregon Corpn. for street lighting and has decided to continue the municipal electric-light system. Arrangements are being made to install new equipment in the municipal electric plant.

MILTON, ORE.—The city of Milton expects to erect within the next 30 days series circuit for flaming-arc lamps and series tungsten lamps (54 in all). The city has purchased from the General El. Co. a 15-kw, 6.6-amp, 2300-volt constant-current transformer to handle the above street-lighting circuit. L. E. Coyle is business manager for the city of Milton.

PORTLAND, ORE.—A committee, consisting of Daniel Kelleher, M. O. Collins and others, has been appointed by the East Side Business Men's Club to investigate the question of establishing a municipal electric-light plant in Portland.

PORTLAND, ORE.—Bids will be received until Oct. 6 by the City Council for the installation of lighting fixtures at the new city hall. Plans and specifications may be obtained from Emil Schacht & Sons, architects, Commonwealth Building, Portland.

PORTLAND, ORE.—Bids will be received by William H. Daly, commissioner of public utilities, city hall, Portland, until Oct. 6 for lighting the streets, avenues, bridges, parks, public grounds, etc., with electric arc lamps and the buildings with incandescent lamps for a period of three years, beginning Jan. 1, 1913. Bidders may submit separate proposals for arc lamps and incandescent lamps. Plans and specifications are on file in the office of the commissioner, City Hall.

VALE, ORE.—Work will soon begin on the erection of the transmission lines of the Beaver River Pwr. Co., of Boise, Idaho, into this city.

HERMOSA BEACH, CAL.—Work will soon begin on the erection of a 20-ft. concrete walk along the ocean front to extend the entire length of the beach. The proposed walk will be illuminated by ornamental lamps erected in the center. The cost of the improvement is estimated at $35,000.

LOS ANGELES, CAL.—The City Council has voted to advertise for bids for street lighting for a period of two years, with the provision that 550 new lamps shall be furnished in 1914.

LOS ANGELES, CAL.—The Universal El. & Gas Co. has applied to the Board of Supervisors for permission to extend its pipe and conduit system to all parts of the city where the Pacific Gas & El. Co. has its mains. John F. Bowie, attorney, is representative for the Universal Company.

LOS ANGELES, CAL.—The Pacific Lt. & Pwr. Corpn., of Los Angeles, has applied to the State Railroad Commission for permission to issue $52,300 in capital stock, to replace a previous issue of stock, and to issue $1,730,000 in bonds, the proceeds of $497,000 of these bonds to be used for refunding purposes, and the balance to be used in connection with the extensive hydroelectric projects of the company.

RICHMOND, CAL.—The installation of electroliers to replace the arc lamps along the main business thoroughfares is under consideration. It is proposed to have the property owners pay for the electroliers and the city maintain the lamps.

ST. HELENA, CAL.—The Napa Valley El. Co. has applied to the State Railroad Commission for permission to issue $15,300 in capital stock and $20,500 in bonds, the proceeds to be used for the purpose of paying off existing indebtedness and enlarging its system.

SANTA BARBARA, CAL.—The Santa Barbara Gas & El. Co. is negotiating with the residents of Goleta Valley for the extension of its electrical service to that suburb. John T. Huntington is manager of the company.

SUTTER CREEK, CAL.—The Amador El. Lt. & Pwr. Co., of Sutter Creek, has applied to the State Railroad Commission for permission to issue $12,000 in bonds and $3,000 in capital stock, the proceeds to be used for paying off existing indebtedness and making additions to its system.

BOISE, IDAHO.—The franchises and physical properties of the Beaver River Pwr. Co. in Idaho have been taken over by the Idaho Pwr. & Lt. Co. According to reports, extensive improvements and expansions are contemplated. An ordinance was recently introduced in the City Council covering the transfer of the Boise franchise of the Beaver River company to the Idaho Pwr. & Lt. Co.

GRANGEVILLE, IDAHO.—Messrs. Gustad & Hill, of Grangeville, are reported to be interested in a project which has for its ultimate object the construction of a transmission line extending along the Payette and Idaho Northern to furnish electrical service to towns along the line.

MOSCOW, IDAHO.—The Washington Wtr. Pwr. Co., of Spokane, Wash., through M. C. Osborn, commercial agent, announces improvements involving an expenditure of thousands of dollars, including extensions of transmission lines to furnish energy for lamps and motors in Troy, Kendrick, Juliaetta, Genesee and other smaller towns in that vicinity. The transmission lines will also be extended into the rural districts to furnish electrical service to the farmers.

SALT LAKE CITY, UTAH.—The commissioner of water works has drawn up a resolution to be submitted to the city commission recommending the installation of a municipal electric-light plant. It is proposed to include in the next year's budget at least $50,000 to start work on the installation of a municipal electric plant.

CASPER, WYO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 24, for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Casper, Wyo. Drawings and specifications may be obtained at the above office or from the custodian of site at Casper. O. Wenderoth is supervising architect.

GRAND JUNCTION, COL.—The city of Grand Junction has been granted a preliminary permit by the Secretary of Agriculture for a conduit on the Battlement national forest reserve in connection with the proposed hydroelectric plant to be built and operated by the municipality.

RYE, COL.—Investigations are being made with a view of developing the water-power in Greenhorn Creek to supply electricity for lamps and motors in Rye and surrounding territory. The present plans provide for 1000 hp to be distributed from Beulah on the north and Walsenburg on the south. A company will be organized under the name of the Rye Lt. & Pwr. Co., to be capitalized at $25,000, which will be increased as developments require. L. M. Adkinson, E. W. Spencer, A. Boisclair, A. W. Storms and H. H. Wilson are interested in the project. L. M. Adkinson is consulting engineer.

## Canada

MEDICINE HAT, ALTA.—The gas and electric commission of the City Council has decided to install cluster lamps in the business district and a lighting system in the outlying districts.

SOUTH VANCOUVER, B. C.—The Municipal Council is considering the question of establishing municipal electric-light and gas plants.

SYDNEY, B. C.—The British Columbia El. Ry. Co. is negotiating with the City Council for furnishing energy for lamps and motors in Sydney, and also for street-lighting in this city.

AMHERST, N. S.—The Canada El. Co., of Amherst, expects to erect within the next two months a new substation at Amherst and to double the size of its power house at Chignecto Mines; also to purchase one 100-kw turbo-generator, two Robb boilers, of 800 hp each, equipped with underfeed stokers, new switchboard for above extensions, and to erect a new transmission line from Chignecto to Amherst, a distance of 8 miles. N. T. Avard is superintendent.

HALIFAX, N. S.—The Halifax El. Tramway Co. has applied to the Board of Public Utilities for permission to issue $o00,000 additional capital stock, the proceeds to be used to redeem outstanding bonds and for extensions, etc., to its system.

BARRIE, ONT.—The managers of the municipal electric-light plant have erected a 22,000-volt transmission line and installed step-down transformers with switchboard equipment and extra panels to care for increased loads this year. The Hydro-Electric Power Commission is now erecting a duplicate transmission line. The present arc-lamp street-lighting system is to be discarded and series tungsten lamps installed. J. A. Hare is superintendent.

PORT HOPE, ONT.—On Aug. 25 a by-law was carried authorizing the agreement between the Seymour Pwr. & El. Co., of Campbellford, and the town of Port Hope, under which the company will furnish street-lighting service, consisting of 340 tungsten lamps of 60 cp, at $12 each per year. The cost of installing the system is estimated at about $10.00Q

ST. CATHARINES, ONT.—Estimates submitted by the Hydro-Electric Power Commission on an electric-light system to give the city the same service that it now has placed the cost at $90,000, and $26,000 for a street-lighting system. The proposition has been approved by the Council. A by-law authorizing the installation of the plant will soon be submitted to the ratepayers.

TORONTO, ONT.—Tenders will be received by H. C. Hocken, Mayor, chairman Board of Control, Toronto, until Sept. 23, for furnishing fire-alarm boxes, one ten-circuit protector board, one eight-circuit storage battery board, one motor-generator set, three full joker sets, copper wire, etc. Specifications and form of tender, together with conditions governing tenders, may be obtained at the office of the Fire Department, 152 Adelaide Street, West Toronto.

REGINA, SASK.—Tenders will be received by the city commissioners, Regina, Sask., until Oct. 25 for furnishing one 3000-kw steam turbine and one 25-ton hand-power crane for 45-ft. span. Specifications may be obtained from E. W. Bull, superintendent of Light and Power Department.

## Miscellaneous

PANAMA—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Oct. 4 for furnishing chain, wire cable, track spikes, rivets, bolts, etc., Blanks and general information relating to this circular (No. 799) may be obtained at the above office or at the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. F. C. Boggs is general purchasing officer.

## New Incorporations

GALLIPOLIS, [illegible] Co. [illegible] W. E. [illegible] Vance and L. W. [illegible] for [illegible]

[illegible] chartered with a capital stock of $15,000. The incorporators are: E. E. Atherton, J. M. Conner and E. R. Wilson, all of Tulsa.

[illegible] operate in Somerset County. The companies are named for the districts in which they will operate, as follows: Summit, Milford, Lincoln, Elklick, Black and Brothers Valley Townships. Each company is capitalized at $5,000, and the incorporators are: H. H. Weaver, P. J. Morrisey and [illegible]. The headquarters of the companies will [illegible].

PITTSBURGH, PA.—Charters have been granted by the State Department to 29 electric companies to operate in Greene, Armstrong and Washington Counties. Each company is capitalized at $5,000, and the incorporators are: E. B. Beach, C. G. Hamilton and J. McC. Reed, of Pittsburgh; H. B. Smith, of Edgewood, and R. C. Lightcap, of Mount Olive Borough. The companies are named for the districts in which they are to operate as follows: Hanover, Hopewell, Independence, West Finley, East Finley, Jefferson, Cross Creek, Clarksburg, Deemston, Cokeburg, Claysville, Beallsville, Long Branch, Ellsworth, Marianna, Wickboro, West Kittanning, Parkers Landing, Applewold, Washington, Perry, Madison, North Buffalo, Hovey, West Franklin, Boggs and Brady's [illegible]. The offices of the companies will be located in Pittsburgh.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED SEPT. 9, 1913.

[Prepared by [illegible] Washington, D. C.]

1,072,422. ELECTRIC CONTROLLING APPARATUS; J. Burke, Erie, Pa. App. filed Oct. 9, 1907. For starting induction motors; transformer windings connected in star.

1,072,426. INDICATING DEVICE; C. R. [illegible], [illegible], Mass. App. filed May 11, 1908. For flashing numbers or words; all the signal lamps are arranged to direct their images upon the same portion of the field.

1,072,440. MOTOR-CONTROL SYSTEM; G. T. Eagar, Ballston Spa, N. Y. App. filed June 9, 1910. Current to actuate the accelerating means is automatically cut out upon complete operation of such means.

1,072,443. VAPOR ELECTRIC APPARATUS; S. Ferguson, Schenectady, N. Y. App. filed May 14, 1904. The number of vapor rectifiers in circuit is varied according to the load.

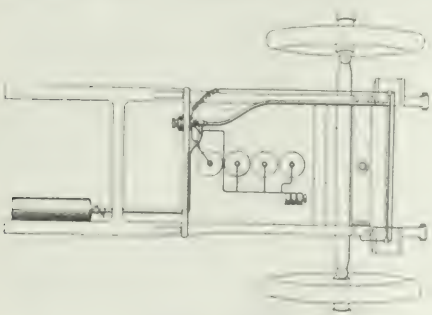
1,072,445. ALTERNATING-CURRENT-MOTOR CONTROL; V. A. Fynn, St. Louis, Mo. App. filed May 13, 1912. Automatically reorganizes the circuits of a single-phase motor when speed falls below or exceeds a certain value.

1,072,459. SUBSTATION SELECTIVE APPARATUS; O. B. Hjorth, Sandwich, Ill. App. filed July 18, 1912. Dispenses with all time elements, and system may be operated by ordinary keys and switches should central-station mechanism become inoperative.

1,072,460. PLUG-SOCKET ELECTRICAL CONNECTOR; W. F. Hoffmann, Detroit, Mich. App. filed Oct. 30, 1912. Plug is guided in a socket and quick breaking of the circuit is insured by a spring device which positively ejects the plug from the guide socket.

1,072,462. OUTLET BOX; W. H. Hope, Newark, N. J. App. filed Sept. 26, 1911. Has "knock-out" closures and adjustable clamps for the cables.

1,072,507. VALVE OR THE LIKE; O. A. Ross, Chicago, Ill. App. filed June 19, 1907. Electropneumatic valve, particularly for the fluid-pressure systems for signaling and train-stopping devices.



1,072,961.—Ignite

1,072,511. DYNAMO-ELECTRIC APPARATUS FOR [illegible]; K. Schattner, of [illegible], Austria-Hungary. App. filed Feb. 4, 1913. Dynamo is operated by a spring and apparatus can be operated only when the actuating [illegible] wound up.

1,072,513. ATTACHMENT FOR TELEPHONE TRANSMITTERS; E. M. Schollenberger, Chicago, Ill. App. filed Sept. 12, 1912. Sound-confining casing attached to transmitter mouthpiece.

1,072,523. INSULATOR; L. Steinberger, Brooklyn, N. Y. App. filed May 18, 1910. Molded insulator base with upstanding binding posts.

1,072,524. INSULATOR; L. Steinberger, Brooklyn, N. Y. App. filed Sept. 21, 1910. High-potential suspension insulator. (Thirty-three claims.)

1,072,525. SUSPENSION INSULATOR; L. Steinberger, Brooklyn, N. Y. App. filed Sept. 21, 1912. Alternate horizontal and vertically disposed separately formed suspension units in vertical column.

1,072,530. ELECTRIC HEATER; E. Thomson, Swampscott, Mass. App. filed Feb. 16, 1912. Element [illegible] in connection with a [illegible].

1,072,531. ELECTRICAL MEASURING INSTRUMENT; R. L. Triplett, Bluffton, Ohio. App. filed Nov. 28, 1910. Pocket type of voltmeter or ammeter; the active parts are assembled in fixed and predetermined relative positions.

1,072,537. INDIVIDUAL TELEPHONE MOUTHPIECE; C. S. Warren, Milford, Ohio. App. filed April 13, 1912. A series of individual telephone mouthpieces supported on the transmitter and adapted to be swung down into operative position.

1,072,540. CONTACT DEVICE; J. J. H. W. Weenen, Amsterdam, Netherlands. App. filed Nov. 23, 1912. "Point" or signal controlling apparatus for tramways.

1,072,551. ELECTRIC BATTERY; D. H. Wilson, Chicago, Ill. App. filed Sept. 18, 1905. Single positive electrode and two carbon electrodes, both ends of the carbon electrodes projecting through the receptacle.

1,072,561. TERMINAL CONNECTOR FOR SPARK PLUGS; C. W. Beck, Rockville Center, N. Y. App. filed Oct. 15, 1910. Has a switch and a pair of supplemental visible sparking points by which the proper working of the switch can be determined.

1,072,567. ELECTRIC SIGNALING ON RAILWAYS; H. Brown, Belfast, Ireland. App. filed Dec. 29, 1911. Cab-signaling system of ramp-rail type.

1,072,595. HEATER FOR AUTOMOBILE RADIATORS; W. Gallaher, St. Louis, Mo. App. filed April 28, 1913. Electric heater unit disposed in lower portion of the radiator which may be plugged in circuit.

1,072,614. METHOD OF ELECTRICALLY WELDING CHAIN LINKS; W. H. Hodges, Lynn, Mass. App. filed June 9, 1908. A large amount of the metal is forced into the weld and surrounding parts to reinforce the welded portion.

1,072,647. DYNAMO-ELECTRIC MACHINE; A. A. Pifer, Cleveland, Ohio. App. filed Oct. 14, 1908. Variable-speed motor with shiftable pole shoe sections.

1,072,656. MOTOR CONTROL; G. B. Schley, Milwaukee, Wis. App. filed July 22, 1911. For rolling mills, hoisting machinery, etc.; current in motor armature is automatically decreased if such current exceeds a predetermined value. (Eighty-eight claims.)

1,072,685. VAPORIZER; G. A. Arnold, Middletown, Conn. App. filed March 24, 1913. Has electric heating units of progressively decreasing intensity.

1,072,748. ELECTRICALLY HEATED BOILER; J. F. McElroy, Albany, N. Y. App. filed Sept. 16, 1908. To provide steam heat when steam locomotive is taken off and electric locomotive is coupled to a train; electrically heated boiler provided with air flues, this boiler being carried by the electric locomotive.

1,072,847. BUFFER; D. D. Gordon, Chicago, Ill. App. filed June 28, 1910. Portable-type, inclosed motor.

1,072,898. ELECTRIC SWITCH; E. Anderson, Bridgeport, Conn. App. filed April 21, 1913. Oscillating make-and-break mechanism for lamp-socket switch.

1,072,913. CHANGE SPEED GEAR; A. T. Collier, St. Albans, Eng. App. filed Feb. 18, 1913. Has plurality of magnetic clutches.

1,072,961. IGNITER; G. B. Lambert, New York, N. Y. App. filed June 12, 1912. For automobile head lamps; combined fuel valve and igniting means.

1,072,996. ELECTRIC LOCK-STRIKE; F. F. Schneider, Ridgefield, Conn. App. filed May 27, 1913. For releasing the door lock from a remote point.

1,072,999. TUBULAR INSULATOR; G. Simcoe, Trenton, N. J. App. filed Oct. 1, 1912. Has a pair of longitudinal openings to receive the loop of a cable or wire.

1,073,018. SIGNALING AND TELEPHONE SYSTEM FOR RAILROADS; W. J. Bailey, Cedarville, W. Va. App. filed Dec. 18, 1912. Uses track rails and a conductor alongside the track.

1,073,023. ELECTRIC SWITCH; J. M. Blain, Spring City, Utah. App. filed July 20, 1911. Has bridge piece for independently controlling either one of two circuits or both, at will.

1,073,024. ELECTRICAL SIGNALING DEVICE; C. L. Bopp, Waterloo, Ia. App. filed Sept. 8, 1911. Signal switch operated by deflection of a rail when train passes over same.

1,073,044. ELECTRIC ATTACHMENT FOR KEYBOARDS OF AUTO-PLAYERS; O. Herrmann, New York, N. Y. App. filed May 13, 1912. Electric bell-ringing attachment.

1,073,047. ELECTRIC SWITCH; M. L. Hubermann, Los Angeles, Cal. App. filed March 30, 1912. Float-actuated tank switch.

1,073,059. METHOD OF MAKING COILS; R. Varley, Englewood, N. J. App. filed Oct. 14, 1911. Preserves the symmetrical superposition of the layers of windings under all conditions of manipulation and use.

1,073,060. ELECTRIC COIL; R. Varley, Englewood, N. J. App. filed [illegible]. Discloses a coil of compact form and symmetrical

# Electrical World

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**Vaste or Economy n Milwaukee**

The Railroad Commission of Wisconsin has found that the city of Milwaukee can save money by making a ontract for street lighting with the public utility company nstead of building a municipal plant. The annual saving vill approximate $46,873, a sum equal to over 4½ per cent nterest on $1,000,000. The actual investment required by ne city in the event of the construction of a municipal lant is figured by the commission at $1,493,758. Howver, the investment of this sum is only part of the hazard nat would be incurred by the city. The practical-minded Visconsin commission has calculated the various elements f operating expense and set them forth so fully that the ssue is as clear as the light itself. It becomes a question f whether the best interests of the city would be served y supine compliance with a Socialist program at a waste f money or by a businesslike contract with the existing tility at a saving. It is not necessary to consider whether, f the city can get a reasonable rate, it is morally bound o patronize the company which supplies its citizens, nor is necessary to consider the economic waste ignored when competing plant is created to provide service that an xisting property can furnish. When a merchant receives wo bids for like service or commodities, good judgment eads him to accept the lower one. The conclusion of the ommission in this case should end the talk of municipal ervice for Milwaukee.

**esuscitation ero Medals**

As a practical aid to electrical-resuscitation propaganda, there is merit in the hero-medal plan suggested by Dr. auffer before the Eastern New York Section of the N. . L. A. and indorsed by that convention for adoption by e national association. The physician urged that bronze edals be awarded to persons who save lives by resusci:ing victims of electric shock, and proposed further the stitution of a commission to investigate the merits of ch case and the conditions leading to the accident. The ntimental value of such a medal need not be emphasized i this discussion, nor will it be contended that the promd reward of a bit of bronze could in the slightest influ:e any humane person in efforts to bring an unfortuie fellow-creature back to life and consciousness. Iedless to say, the problem is not that of stimulating the ential rescuer after the accident has happened; but it os lie in getting him to equip himself in advance with t necessary first-aid information so that he will have it ailable at the critical moment. Right here is the value othe medal scheme in forearming the rank and file of the iustry with knowledge of resuscitation methods. When such information is needed it must be available instantly. There must be no delay in beginning work on the victim, for in resuscitation cases "every second is an hour." The difficulty thus comes back to the general diffusion of proper knowledge and skill, so that every worker will be equipped when the time comes and if, therefore, his personal interest in the subject and in the study of the resuscitation rules is stimulated by the possibility of winning a medal, the great purpose of the plan will have been accomplished. And no one will deny the rightful pride with which such a token can be worn. There is one more point to add. Investigation of such hero cases would bring out a mass of practical data on the conditions and causes leading to these accidents, suggesting valuable precautionary measures for the future.

**The Conflagration Hazard**

When a widespread disaster such as fire or flood sweeps a busy American city the interval taken by its stricken populace to recover from the shock is largely measured by the speed with which local electric service can be resumed. The recent calamities of Dayton, Ohio, and Hot Springs, Ark., are cases in point. No better illustration could be given of the absolute necessity of electricity in the modern scheme of things than the general paralysis under which a community deprived of its energizing electric service labors. Lighting of streets and houses, operation of cars and newspaper plants, energy for telephonic communication, and often, as at Hot Springs, pumping of part of the water supply, are the pressing needs that wait upon the return of the current. Protection of the city, dismissal of militia and resumption of all the intricacies of commercial intercourse depend on the starting of the plant machines. Experiences like these, although infrequent, point out how, in selecting power-station sites, conflagration and flood hazards, however remote, should have careful attention in view of the vital and varied service which is more and more being rendered from the central-station buses. Most of the recently built turbine plants fulfil these conditions incidentally, for reasons of cheap real estate and alternating-current distribution, so that in the future destruction like that at Hot Springs (where an old power house was located in the midst of a thickly built and highly inflammable section) will be rare. But before dismissing the regrettable Hot Springs disaster a word of praise is deserved for the courageous plant operators who stayed behind to keep the electric pumps running, and for the undismayed and energetic management which, faithfully and with foresight, worked night and day to replace equipment and restore service.

## The Present Status of Heavy Electric Traction

In his presidential address before the engineering section of the British Association for the Advancement of Science Prof. Gisbert Kapp gave a [illegible] summing up of the work which has been accomplished in really large railway operation. So little has been done on main-line operation by electricity in America compared with the progress in railroading of the interurban class that one hardly realizes the aggregate importance of the equipment which has been put into service elsewhere. We do not hear day by day of roads working in Italy or Germany; we merely see a brief account of their initiation and then forget that they are going steadily on year after year to swell the list of successful electrifications. Everyone knows that for some years past the Italian government lines have been in course of conversion to electric traction with three-phase locomotives, but when one realizes that these locomotives in operation and under contract rise to the aggregate of about 200,000 hp it is clear enough, as Professor Kapp forcefully points out, that one has here no dubious experiment, perhaps soon to be abandoned, but a working method that has given good reason for continuous growth.

Likewise the now rather long list of electrifications on the single-phase system gives unmistakable evidence that in spite of oft-repeated tales of enormous unnecessary weights, rapid consumption of brushes, terrific heating and the like, the newer system has shown operative qualities that are of evident value. Well-advised governments and private corporations do not "blow in" millions on apparatus that cannot give a good account of itself. Likewise the recent work in relatively high-voltage direct-current traction has been uniformly successful and gives promise of permanent usefulness. Professor Kapp does not seem exactly enthusiastic about it, but very properly holds that there is no one system in traction which is quite suitable for all cases. Truth to tell, probably no small part of the hesitation of railway men about embarking in heavy electric traction has been due to the open abuse or damning with faint praise heaped upon each system by the advocates of the others. If one were inclined to cross a lake on his vacation and the skippers of the three available ferryboats bawled denunciation of the seaworthiness of their rivals' craft, the nearer shore would acquire added charm. The early lack of cordiality, to put it mildly, between the advocates of direct current and alternating current seems to have survived in the question of railroading when it has been forgotten almost everywhere else.

It is notable that the most important work in heavy traction is now being done by governmental action rather than by private initiative, especially in the electrification of existing lines; and this condition gives evidence perhaps of the real situation which one has to confront in looking forward. Once convinced that it is in the long run economical to adopt electric traction, a government operating its own railway lines can generally manage to raise the funds for the improvement. A privately owned line that has nearly reached the limit of advantageous credit by its flights in high finance, and that does not know when its employers may strike for higher wages or its rates be cut by the powers above, is not exactly in a position to pay the electrification bills even when the ultimate advantage is clear. Professor Kapp does not discuss the details of this matter, but shows the great advances that have actually been made as indisputable evidence that the improvement is here in force and here to stay. Electrical enthusiasts may present estimates shaved down to the last conceivable limits in cost, and railway managers confronted by a demand for electrification may produce figures fattened out of all semblance of veracity, yet the long list of successful installations stands as proof that electrical traction in important lines is actually with us and showing the cause for its continuance. The systems may quarrel enough to damage their own interests for a while longer, as they are doing now, but sooner or later sound engineering must replace invective and then heavy traction will come into its own.

## Lodge on Continuity

The presidential address of Sir Oliver Lodge before the British Association for the Advancement of Science is, in effect, the credo of an accomplished and original man of science regarding some of the fundamentals of physical knowledge. In its sympathetic study of some of the latest theories and discoveries it is illuminating, but its larger value lies in correlating these with the work that has gone before and the conceptions which have inspired it. Sir Oliver Lodge has been on the skirmish line of investigation long enough fully to realize that the battle cannot be won by a frontal attack but that its fate must depend on a series of turning movements, each, it is true, gaining ground, although seldom in the direct path forward. Such a turning movement is now under full way in the electrical theory of matter, the fundamental ideas of which are clearly set forth in his address. It bears much the same relation to the works of Faraday as did the researches of Hertz to those of Maxwell. And yet, as Lodge well shows, it does not touch the fundamental mystery that lies deeper than the electron.

It has long been evident that in some sense or other what people have been pleased to call electrical charge had the characteristics of a numerical coefficient—that it did not work in the infinitesimal differences required by the idea of continuity. It now turns out that the numeric is the enumeration of the electrons. And, whether we agree with the convention that the electron is electricity or hold that it is merely the minimum of matter with which a particular kind of strain is associated in amount proportional to its uniform mass, we do not yet know by what mechanism electric and magnetic forces interact. The old *"actio in distans"* problem confronts us to-day just as it confronted Newton, and Lodge turns to the continuity of the ether for the solution to-day just as he did when the atom instead of the electron was the fundamental unit. At the British association meeting twenty-six years ago Lord Kelvin, then Sir William Thomson, explained his theory of an ether possessing rigidity and elasticity in virtue of its dynamical activity like the water in the Niagara rapids. It remains for some one to correlate this conception with the action of the concentrated energy-points which we study

electrons. But throughout Lodge adheres to that view of continuous action which regards continuity as the general case in the dynamics of the universe.

It is a long way from the center of force postulated by Boscovitch as the atom, through the vortex theory in its various phases, to the electron, and yet all of these lead in the same direction as to the phenomena and leave the final mechanism of interaction just about where Newton puzzled over it. The great forward step of this century is the gain that has come from getting a view of the electron —coming one step nearer to the real interrelations of matter—but still the need of a continuous medium confronts the investigator. As Lodge plainly shows, we are now going through a phase of the philosophy of negation such as has been known before in the history of science. But it has always hitherto proved to be only the time of halting to reorganize the forces of investigation for renewed activity. May this keen analysis of the field in its larger relations by a veteran like Sir Oliver Lodge open the way for another forward movement that shall carry science once more from the negative to the positive—even to the positive charge.

## Electrical Cooking and Heating

Professor Morris' British Association paper on the subject of domestic electric cooking and heating, abstracted on a following page, discloses the results of a very practical test in which all the cooking and practically all the heating in a seven-room apartment was done electrically for an entire year, careful record being kept of the consumption day by day. As generally happens in the consideration of electrical heating, the hot-water problem was the serious difficulty, and in this instance it was met by giving up that part of the electrical program and putting in a coke-fired water heater. For the rest electric service worked out admirably, the average weekly consumption for cooking having been about 68 kw-hr. and for heating about two-thirds that amount, while the lighting was responsible for less than 5 kw-hr. The total yearly consumption was 2934 kw-hr. for cooking, 2068 kw-hr. for heating and 200 kw-hr. for lighting—in all, 5202 kw-hr. The total cost for the year is reported to have been approximately $122, including full allowance for the cost of coke and kindling wood. This appears economical enough until one is reminded that, beyond a standby charge aggregating about $32.50 for the entire year, the cost of energy was only 1 cent per kw-hr. This rate is not a rare figure in England of late, but where would Professor Morris have come out had he tried the experiment at American prices? To be sure, if his estimate of decreased domestic service is a fair one, a similar decrease at American wage rates would go far toward restoring the balance. We question whether such a lowered service cost can be depended upon, however, under average conditions in any country.

So far as energy consumption is concerned, the test was a representative one and the result may be looked upon as typical. Particularly instructive is the daily load curve, showing clearly the fact, now pretty well understood, that domestic load as a whole keeps well off the peak of the central station, which should be reason for encouraging special rates for such service. There is enough such heating and cooking work to be done to make it a very live issue where the local conditions permit low prices. One must not forget that an average English city has a much higher density of load than is reached by an American central station of similar output. But the acquisition of a big load for domestic use would tend to bring our load density to a figure that would make for much more economical distribution than now. Reducing the rates in the case before us to a straight meter basis, the equivalent figure of 1.62 cent per kw-hr. is not out of reach with a high density and good load-factor. Once bring electricity to the rank of a domestic necessity and surely interesting results will follow. In fact, the flat rate of $1 per person per month quoted in one American city comes out even a little better for a small family than a meter rate, and is near Professor Morris' figure for a family of five. So little has been done with heating as such, on anything but the smallest scale, that comparisons are difficult; yet it is clear enough that, with energy at or below 2 cents per kw-hr., electric heating is not at all out of the question, at least in fairly moderate climates. Further practical investigations like the one before us are needed to disclose the whole situation, At first glance it generally looks discouraging—probably to a degree quite unjustified by the real facts.

## Protection of Buildings from Lightning

A very interesting report has recently been published by the *Verband Deutscher Electrotechniker*, of Berlin, on the means recommended for the protection of buildings from lightning. This report is full, detailed and compendious. Although lightning does not frequently strike one and the same building twice in the same year unless the building is very tall or exposed on elevated ground, yet since nearly every heavy thunderstorm involves one or more lightning flashes to trees or houses, the aggregate amount of damage done to buildings by lightning in the course of a year is very large. The number of persons killed by lightning in the United States in the year 1899, for which statistics were given by the Weather Bureau, was 563, with injuries to a yet larger number. The number of livestock killed that year in the fields was over 4000, the total damage to property by lightning being more than $3,000,000—figures surprising in their magnitude.

The original experiments and deductions of Franklin are referred to as the basis of all subsequent development in the art of lightning protection. It is pointed out that at least two ground connections and ground wires should be furnished in the lightning-protection system of any building. Wires of galvanized steel may be used where expense for metal must be kept to the lowest terms, copper being preferable, mainly on account of its greater permanence and weather-resisting powers. Lightning-conductor systems are divided into three parts—that which intercepts the lightning flashes, that which extends over and around the building, and that which leads into the ground. The report is perhaps the most comprehensive which has yet appeared on the subject.

# The News of the Week

**Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.**

## Tungsten Lamps to Be Discussed by A. I. E. E.

At the meeting of the American Institute of Electrical Engineers to be held in the auditorium of the Engineers Building, New York, Oct. 10, the general subject for discussion will be tungsten lamps. Two papers will be presented as follows: "Tungsten Lamps of High Efficiency I," by Mr. Irving Langmuir, and "Tungsten Lamps of High Efficiency—II," by Messrs. Irving Langmuir and J. A. Orange. The first paper will describe investigations into the cause of blackening of the bulbs of tungsten lamps and discuss methods whereby the blackening may be avoided and the efficiency of the lamps increased. The second paper will describe in detail the new types of high-efficiency tungsten lamps which have been produced by filling the bulbs with nitrogen vapor. These lamps in the larger sizes have an average specific consumption in the neighborhood of half a watt per candle-power, and it is expected some of these lamps will be shown in operation. At the close of the technical session the meeting will adjourn to the Institute offices on the tenth floor, where a smoker will be held and refreshments served.

## Assessed Values of Ohio Properties

The valuation of electric light and power properties in Ohio for 1913 has been placed at $36,693,800 by the Tax Commission. This is an increase of $6,074,840 over the valuation for 1912. The increase in 1912 over the preceding year was also heavy. The Cleveland Electric Illuminating Company shows the largest increase, this year's valuation being $16,516,560 in comparison with $14,452,270 in 1912. It will be seen that the valuation of this company amounts to a large sum as compared with all the others in the State. It is possible that the valuation may be contested in the courts. The company's taxes on this valuation will be $31,996. The valuation of the property of the Dayton Power & Light Company was increased from $2,705,530 to $3,310,890; that of the Springfield Light, Heat & Power Company from $790,560 to $1,205,800, and that of the Youngstown Consolidated Gas & Electric Company from $3,149,370 to $3,373,880. A number of other companies had valuations increased in greater or less proportion to raise the total figures to a point that will produce the desired income to the State. Some remain unchanged and some have been slightly reduced.

## Illinois Water-Power Conference

At the invitation of Governor Dunne a conference on the water-power situation in Northern Illinois was held at the State House in Springfield on Sept. 20. There were present representatives of the Sanitary District of Chicago, the Illinois-Michigan Canal, the cities of Chicago and Joliet and the Public Service Company of Northern Illinois. The Attorney-General of the State was in attendance and also a number of other gentlemen interested. The project under discussion was the construction of the proposed deep waterway from Lockport, Ill., where the Chicago Drainage Canal connects with the Desplaines River, in or near the Desplaines River and the Illinois River, to Utica, Ill., the head of navigation on the Illinois River. The proposal is to construct without delay that part of the waterway from the Sanitary District's hydroelectric generating plant at Lockport, Ill., through the city of Joliet, on the Desplaines River, to a point below Brandon's Bridge, a distance of about 3.5 miles. This would permit of the development of an important water-power. The estimated expense is $7,000,000. The question discussed was whether the Sanitary District of Chicago shall proceed with this work or whether the State shall do it under powers granted by the deep waterway constitutional amendment and the proposed bond issue of $20,000,000 by the State, which has been sanctioned by the voters.

The scheme proposed calls for the elimination of the hydroelectric plant in Joliet at Dam No. 1 of the Public Service Company of Northern Illinois, successor to the Economy Light & Power Company. It is reported that the Economy Light & Power Company is ready to abandon its water-power rights at the site mentioned, provided it is reimbursed. The company's lease expires in 1916. Litigation is now proceeding in relation to claims of the company to the river bank and adjacent territory in Joliet, and this complicates the situation somewhat. It is possible that the Governor will call a special session of the Legislature to consider the subject.

## Neon Lamps

In the manufacture of liquid air by the process of Mr. G. Claude, of Paris, the so-called "rare gases" of the atmosphere are separated out. In a lecture on "Liquid Air and Its Uses," delivered at the time of the Chicago Refrigeration Congress, Mr. Claude said that neon is, perhaps, the most interesting of these gases. It is present in the air in perhaps one part in 66,000. It is produced as a by-product in the liquid-air oxygen apparatus of the lecturer. Neon, compared with atmospheric air, is an excellent conductor of electricity. Mr. Claude used the comparison that where 1000 volts are required for a given electrical transmission in air 13 volts suffice in the case of neon. This gave the speaker the idea of constructing with the aid of neon luminous tubes similar to those produced by Mr. D. McFarlan Moore, who used nitrogen. The light from these tubes is a bright red, but the inventor says that they have the advantage of much greater efficiency than the Moore nitrogen tubes, the relative consumption of electricity being given as about 0.6 to 1.7. Furthermore, the light is said to be of excellent quality from the point of view of visual acuity, contributing to sharpness of vision.

But the intense red of the light would hardly permit the use of these tubes for general illumination without correction to introduce some violet or blue. It happens that whereas the light of neon contains no blue, that of the mercury-vapor tube contains too much. Mr. Claude has made corrective tubes containing a little mercury. These tubes, when used in conjunction with the neon tubes, produce what seems to be a very satisfactory illumination as far as color effect is concerned. Without color correction the tubes may be used in decorative lighting or as advertising novelties.

## Pennsylvania Railroad to Electrify Suburban Line

The Pennsylvania Railroad Company announced on Sept. 24 that the board of directors had authorized the electrification of suburban service on the New York division to Chestnut Hill, a distance of 12 miles from Broad Street station, Philadelphia. The work, which will be completed by the fall of 1914, will involve an expenditure, including multiple-unit equipment, of $1,250,000. It has been determined that the electrification of the Chestnut Hill branch in connection with the electrification of the main line to Paoli offers the most prompt and effective plan, pending the further development of the company's final terminal plans, for congestion relief, since it is essential to obtain as quickly as possible greater train capacity in the present station at Broad Street. There are now eighty-five trains each day in and out of Broad Street station and sixty-six trains to and from the Chestnut Hill branch, all of which will be operated by electricity. It is very probable that the energy for the system will be purchased from the Philadelphia Electric Company, negotiations to that effect being still under way.

## Record Run by Electric Roadster

One of the hits at the convention last week of the New England Section of the National Electric Light Association at Burlington, Vt., was the arrival of Colonel E. W. M. Bailey, of S. R. Bailey & Company, Amesbury, Mass., in an electric roadster after making the trip of 258 miles from Boston at an average running speed of 19 miles per hour. The run was made to test the performance of this type of car and nickel-iron battery over a route never before attempted by an electric automobile and in supposedly difficult country. The trip was made in a total running time of thirteen hours and thirty-five minutes, with a stock machine which has made 10,700 miles in demonstration service in the past eleven months. It was equipped with sixty cells of "A-5" Edison battery and received partial charges at rates of 30 amp to 150 amp at five points en route, only a short time being given per charge in most cases. The route presented many difficulties in the country sections in the way of heavy grades and uncertain road conditions. No adjustments or repairs of any kind were required or made on the way, nor was any attempt made to run the car an extreme distance on one charge. Colonel Bailey stated that the performance could be materially improved by repetition and said that, with provision for frequent short charges, cross-country touring by electric roadsters would, he felt sure, be found entirely practicable with present car designs.

## Meeting and Convention Program of Electric Vehicle Association

In opening the regular monthly meeting of the Electric Vehicle Association of America at New York City Sept. 23 President Arthur Williams recounted his experience at the recent convention of the National Association of Corporation Schools at Dayton, Ohio, where the delegates were entertained at the factory of the National Cash Register Company. Throughout the session informality was the prevailing feature, and by engendering a round-table spirit freer exchange of ideas was fostered. President Williams stated that he hoped for similar informality at the coming Chicago convention.

The report of the secretary of the vehicle association showed an increase of approximately 125 members since last year, the total membership now being 428. The tentative program of the coming convention at Chicago was announced as follows: "Storage Batteries," by Mr. Bruce Ford, of Philadelphia; "Electric Vehicle Salesmanship," by a representative of the Baker Vehicle Company; "Why We Adopted the Electric Vehicle," by a representative of Gimbel Brothers, New York; "Electric Vehicle Tires," by Mr. F. E. Whitney, of Philadelphia; "Charging of Storage Batteries in Unattended Garages," by Mr. M. R. Berry, of Cleveland, Ohio; "The Merchant, the Central Station and the Electric Truck," by Mr. F. N. Carle, of Long Island City, N. Y.; "Co-operation Between the Electric Vehicle Manufacturers and the Central Station," by Mr. E. L. Callahan, of Chicago; a paper by a member of the Board of Fire Underwriters of Philadelphia, dealing with the effects of the electric vehicle on insurance rates; a paper, the title of which is not yet known, by Mr. Hayden Eames, of Cleveland, Ohio; a talk by Mr. Ralph Temple, of Chicago, on "Electric Vehicle Garages." An invitation has been extended to Dr. Pratt, of New York City, to deliver a lecture on the studies which he is making relative to the status of the truck in large cities. Announcement was made that a special train would carry the Eastern delegation to the convention.

The paper of the evening, presented by Mr. F. J. Ryan, of *The Commercial Vehicle*, reviewed the history of transportation from its beginning to the present day. The paper was general in its nature and dwelt upon the value of the commercial vehicle to the community in which it operates. General data on the number of times which merchandise is handled in its travels from producer to consumer were given. In the discussion, which was opened by President Williams, the following men engaged: Messrs. F. W. Smith, W. P. Kennedy, E. W. Curtis, Jr., E. P. Howland, F. N. Carle, Dr. Pratt, W. C. Andrews, H. C. Cushing, Jr., and G. H. Pride. It was stated that of the 5500 trucks now in use in New York City 2150 are electrically driven. Considerable debate was occasioned by the question of an annual tax which the city authorities are contemplating assessing upon all electric vehicles during the next year. The subject of cheaper electric trucks was also discussed and it was stated that the Ford Motor Car Company had recently concluded to build an electric vehicle which will compare in price and service rendered with the gasoline car which the company is now making.

## Gas and Electric Merger Reports in Chicago

Reports from Chicago say that Mr. Samuel Insull, president of the Commonwealth Edison Company, and his associates will take control of the People's Gas Light & Coke Company of that city. A statement was issued from the office of one of the interests in the transaction saying that no merger of the properties was contemplated. The stock of the People's Gas Light & Coke Company has been advancing and various explanatory rumors in reference to this movement have been circulated. These culminated in the reports that the basis for the activity in the stock was the proposed assumption by Mr. Insull of the controlling position in the People's company. The latter company was controlled for many years by the late Anthony N. Brady and his associates. It is supposed that the stock held by the Brady estate would be transferred in any deal involving a change in control.

According to the reports now in circulation, Mr. Insull will be elected a director of the People's Gas company, together with Mr. John J. Mitchell, president of the Illinois Trust & Savings Bank, and Mr. James A. Patten. The People's company has $35,000,000 stock outstanding and about $55,096,000 bonds. The Commonwealth Edison Company now has an authorized capital stock of $50,000,000, the stockholders having been called together this week to authorize an increase from $40,000,000 to that figure. The amount outstanding was about $38,000,000, but a stock dividend of 10 per cent is to be paid from part of the newly authorized issue. The People's company restricts its service to gas.

## British Association for the Advancement of Science

*By special correspondent*

From Sept. 10 to 17 there was held at Birmingham, England, one of the largest meetings for many years of the British Association for the Advancement of Science, the attendance being about 3000. The activities began with the admirable presidential address of Sir Oliver Lodge referred to elsewhere in this issue. The first paper in Section A was by Dr. C. G. Barkla, noted on page 564 of our issue for Sept. 20. Among the noteworthy features of Section G, Engineering, was the presidential address of Dr. Gisbert Kapp, discussed in this issue.

### X-Rays as Light

Prof. C. G. Barkla put the X-rays squarely into line as light waves, obeying all the general laws of light but differing in their enormously short wave-length which makes all ordinary surfaces give diffuse reflection with them. Only crystal cleavage planes split as it were between layers of atoms are of such smoothness as to give regular reflection. The polarization phenomena quite correspond to those of ordinary light, and quantitative measurements show these conditions to be fulfilled. More interesting still, he had found somewhat homogeneous radiation quite characteristic of the metal bombarded, which obeyed the laws of fluorescent light, following Stokes' law that fluorescence drops to a longer wave-length than the exciting radiation, and giving the typical uniform distribution of intensity of ordinary fluorescence. Sir J. J. Thomson and Dr. E. Rutherford backed up his statements, and the former openly stated that these "characteristic" X-rays were one of the big discoveries of our generation.

### Structure of the Atom

Then followed two papers by Sir J. J. Thomson and Dr. E. Rutherford respectively on the structure of the atom. Both were highly theoretical and agreed only in leading to Planck's law of radiation as their final end. The former investigator worked from certain mathematical fundamental assumptions, the latter from some experiments in radio-activity. Both theories may be regarded as first approximations to atoms built of positive and negative particles so related as to meet the general dynamical requirements of radiation, but so simple as to leave many phenomena quite unaccounted for. They were interesting studies which may serve as a basis for further work, but left all causal relations out of sight in much the way suggested in Sir Oliver Lodge's address.

### Efficient Utilization of Fuel

From the standpoint of engineering an extremely suggestive paper was read in Section G by Prof. W. S. Burstall, who brought to the front the fact that burning coal in a furnace merely to yield heat was a disastrously uneconomical way of using it. Coal as we find it is a highly complicated substance, capable of producing many valuable products if these are not broken up by complete combustion. This is particularly true of fuels which from the ordinary standpoint are of low grade. In his judgment the way to treat fuel to extract the greatest value from it is by heating in closed retorts, not probably as in ordinary gas manufacture. If properly carried out, this would give a valuable series of fuel oils, medium density oils and even lubricating oils, together with gas for the direct production of power. Even the exhaust gases from the engines may be treated to obtain various other products. Owing to the fixing of certain arbitrary standards for gas, this economic series could not now be worked out. Once realize that from the larger viewpoint the quantity, quality and purity of the gaseous products obtained are really of only secondary importance and the problem of fuel utilization takes on a new aspect. Even lignite and peat may well be utilized. This paper gave in most effective form that larger view of fuel utilization of which so much has been heard in recent years, but which has hardly yet been presented in so striking an aspect. Professor Burstall's paper was not printed, a fact unhappily true also of the others which are here noted, but when it appears it will certainly be well worth the study of engineers. The fundamental point is that simple and complete combustion is not the way to utilize fuel if the maximum of value, rather than of heat, is to be obtained.

### Radiation

The second day's proceedings opened in Section A with a long discussion on radiation, wandering into all sorts of theoretical bypaths, highly interesting, but not yet leading to any considerable increment of human knowledge. In fact, it reminded one of the witty characterization of metaphysics quoted in another section—that it resembled a blind man in a dark room looking for a black hat that was not there.

### X-Rays and Crystals

Then followed the most sensational and far-reaching paper that the meeting disclosed—a discussion by Prof. W. H. Bragg of X-rays and crystals. This started from his beautiful work in determining the wave-length of X-rays by their reflection from successive cleavage planes of crystals, lying as they do at substantially atomic spacing. It is much akin to the use of an almost infinitely fine échelon grating, and, as his starting point, yielded $0.61 \times 10^{-8}$ cm as the mean wave-length of the X-ray characteristic of rhodium, which was Professor Bragg's usual source. This given, it was a perfectly straightforward matter, although involving delicate experimentation, to determine the grating spaces, that is, the atomic cleavage distances found in examining crystals in general parallel to their various fundamental planes. The first thoroughly worked out was the diamond, and the results checked absolutely with the diffraction pattern obtained by passing a beam of X-rays through diamond. Zinc blende and fluorite were also attacked, the former showing clearly the relative loci of zinc and sulphur atoms, and the latter giving similar data. It looks very much as though a general method had been found for determining the space relations of the atoms in crystals. This gets at the very roots of stereochemistry, and if the method is effective it will give a new line of attack on the constitution of the atom which may throw much light on that fundamental problem. The point is that the X-rays, being only a few ten-thousandths the wave length of ordinary light, enable one to work down to the minute structure of matter.

### Lightning and Lightning Protection

Sir Joseph Larmor then read an all-too-brief paper on lightning and lightning protection. The investigation was directed at the possible protective effect of a straight vertical rod or wire, and he showed as the result of his mathematical investigation of the distribution of potential that such a conductor was practically powerless to determine a lightning discharge or to do more than in a purely secondary way to ionize the air near its tip and give some conductivity. A big and high building, in his opinion, could disturb an area large enough to determine a discharge and the grounded conductor might then carry it off. For this function it should be well attached to metallic portions of the structure. It was the building and not the rod upon it which really facilitated the discharge. Sir Oliver Lodge added the comment that Sir. J. Larmor's theory agreed with the experimental facts.

The number of facts and data brought to light at the meeting is really extraordinary judged by American standards. This is attributed in part to the activities of the committees and partly to the relatively short distances that have to be traversed by those who attend the meetings. The activities of the association are well advertised throughout the city, the newspapers issuing placards an-

nouncing their special reports of the sessions. This plan counts for much in keeping up popular interest. The net result is that the meetings are well attended, the average for many years being nearly 2000, and the papers are of high quality. The meetings furnish a most effective lesson in the real importance that is attached to scientific and technical matters when they are fairly brought to public attention.

## Illuminating Engineering Society Convention

The seventh annual convention of the Illuminating Engineering Society was held at Pittsburgh, Pa., Sept. 22 to 25. At the opening session of Monday morning, after brief addresses by Messrs. C. A. Littlefield, William H. Stevenson, President P. S. Millar and Vice-president Norman Macbeth, Prof. George A. Hoadley of Swarthmore College presented the society with an interesting historical gavel made up of parts which are significant in the development of artificial illumination in America. Mr. G. S. Barrows followed with the report of the committee on international co-operation, and Mr. F. N. Morton read the report of the committee on progress, which was discussed briefly by Professor Hoadley and Mr. V. R. Lansingh.

### Progress Committee Report

An unusually complete and highly valuable report on developments in illumination science was submitted by the committee on progress, of which Mr. F. N. Morton was chairman. The report dealt with the numerous improved electric and gas lamps recently introduced, an outline being given of the predominating characteristics of each. The electric lamps included the drawn-wire tungsten, the tungsten alloy, and the 0.5-watt tungsten-nitrogen incandescent lamps; the magnetite and the long-burning flame-arc lamps, and the vapor-tube lamps described from time to time in our columns.

Considerable attention was paid to improvements introduced in photometry practice with special reference to work with sources differing in color. Much interesting information was given concerning street-lighting practice, new fixtures, globes and reflectors, legislation on illumination, and photography in illuminating engineering.

### Incandescent-Lamp Improvements

In a paper by Messrs. Ward Harrison and Evan J. Edwards, Cleveland, Ohio, it was stated that since 1908 the strength of tungsten-lamp filaments has increased by more than 300 per cent. The greater strength permits operation at increased efficiencies at no decrease in total life. The use of chemicals in the bulbs, which has become general during the past year, has reduced the blacking of lamps to a marked degree, and it is therefore possible to operate them at efficiencies correct from the standpoint of total life with no shortening of the useful life. The performance of chemical lamps is not satisfactory when operated at low efficiencies. The use of chemicals has made possible a substantial reduction in the size of bulbs for several lamps. Decreased bulb size reduces the manufacturing costs and broadens the application of the lamp. During the past year lamp dimensions have been standardized in every particular. The average deviation from the standard is less than one-fourth that of a year ago. The introduction of the coiled filament makes possible many new forms of lamps which heretofore could not be manufactured. The strength of the filament is increased by this process and the candle-power maintenance is not affected. To the operation of helical filament lamps at high efficiencies and their use in small bulbs rather than poorer performance are to be attributed their comparatively low life ratings. The new tubular lamp and the focus type of lamp have many applications such as showcase lighting, use in projectors, stereopticons and the like.

The paper, which opened the afternoon session, was read by Mr. Harrison and was illustrated with lantern slides.

### *Discussion*

A written discussion was contributed by Mr. L. T. Lewison, New York. Mr. V. R. Lansingh, Cleveland, Ohio, pointed out that the new helical-coil filaments will particularly simplify the design of reflectors depending upon specular reflection, whether prismatic or mirrored. Mr. J. C. Little, New York, urged complete standardization between the lamp and reflector. Mr. L. C. Porter, Schenectady, N. Y., described new fields of usefulness for the focusing-type lamp, among them use in theater spot-lamps, obtaining effects impossible with the usual arcs. Projection and moving-picture machines, signaling lanterns and locomotive headlamps were some of the other applications he mentioned. Dr. H. S. Ives, Philadelphia, Pa., commented on the photometric advantage of coiled filaments, but questioned their reliable operation at high voltages. Prof. J. W. Howell described the use of electric lamps in lighthouses and declared that improved units will replace present forms wherever electricity is available. Dr. L. S. Meyer, Bloomfield, N. J., predicted further great improvements in lamp construction and efficiency. Mr. Norman Macbeth, New York, urged standardization of the lamp specifications of the laboratories and suggested that the society advance this matter. Mr. L. E. Dunning, Bloomfield, N. J., declared that lamps which have become blackened and lost candle-power later seem to come back to normal brightness. Mr. J. R. Cravath, Chicago, questioned whether the coiling of the filament might not have a shading effect, lowering the lamp's output. Mr. G. H. Stickney, Harrison, N. J., explained that the energy received by the shading parts of the filament simply raises the temperature of the part struck, or is reflected off, in either case being available as useful light without loss. In closing the discussion, Mr. Harrison, one of the authors, explained that the difference in the characteristics of the old and new lamps chiefly affects their manufacturing data, with only very slight changes in the performance curves. Recent investigation has shown, said Mr. Harrison, that the useful life of a lamp depends entirely upon its performance characteristics and is independent of its energy cost or lamp cost. Discoloration, declared the speaker, would probably have little effect on decreasing the total light flux.

### Leading-in Wires

The cooling effect of leading-in wires upon the filaments of tungsten incandescent lamps of the street series type was discussed in detail in a paper by Mr. T. H. Amrine, Harrison, N. J. As a result of an experimental study of the variation of the cooling effect with the leading-in material; the diameter and length of the lead wire and the size and material of the filament, the author concluded that the cooling effect is dependent mainly upon the resistance to heat flow presented by the leads and the cooled portion of the filament, the diameter of the filament and the maximum temperature of the filament, that is, the temperature of the uncooled portion. For lamps having lead and filament dimensions encountered in street series lamps the cooling effect decreases with increase of leading-in wire length, with decrease in lead diameter and with increase in thermal resistance of the material of the lead. With lamps having the same lead construction but with filaments of different diameters the cooling effect shows a maximum at a value of filament diameter which is dependent upon the lead construction used.

### Street-Car Lighting

Mr. S. G. Hibben, Pittsburgh, Pa., in a paper on modern practice in street-railway illumination, claimed that carbon lamps are no longer advisable for street-railway service on account of short life and high consumption. Tungsten lamps in 94-watt and 56-watt ratings seem to be the most

economical. Lamps now on the market, when equipped with proper deep-bowl reflecting shades, enable the current cost for lighting to be cut in half, at the same time allowing an increase in the usable light of more than 80 per cent. Special fixtures are available for supporting the shades, and selector switches may be employed to insure continuous lighting service of series burning lamps. More steady illumination is secured by the new system of lighting, under the adverse conditions of voltage fluctuations. The glare that exists at present in the majority of electrically lighted street cars is done away with through the medium of the shades.

*Discussion*

Mr. L. C. Porter, Schenectady, N. Y., commented on the greater flexibility and better distribution of the 56-watt lamp for car-lighting. When wired in two circuits, an outage failure causes less inconvenience than with the 94-watt lamp. Mr. E. B. Rowe, Cleveland, Ohio, contended that structural features of the lamps were of even greater importance than occasional outage troubles. Others who spoke briefly were Messrs. R. B. Ely, Philadelphia, Pa.; G. H. Stickney, Harrison, N. J.; J. B. Jackson, Chicago, Ill.; V. R. Lansingh, Cleveland, Ohio, and T. G. Hibben.

Psychological Values of Light and Color

At the session of Tuesday morning the first paper read was that on "The Psychological Values of Light, Shade, Form and Color," by Dr. F. Park Lewis, Buffalo, N. Y., who is president of the American Association for the Conservation of Vision. In his discussion Dr. Lewis pointed out the fact that all sense interpretations are essentially psychological processes and declared that scientific exactitude is true only in its individual interpretation. He then spoke of the application of light in its social and civic aspects, insisting that proof has been positively established that bad lighting is responsible for poverty, since poor illumination and bad vision reduce human efficiency. He also made a plea for a national organization of architects, illuminating engineers, physicians and public-spirited men to collaborate on better lighting for public buildings.

Dr. Lewis's address was warmly commended by President Millar, Dr. Ives, Dr. M. G. Lloyd, Chicago, and Mr. G. H. Stickney.

Efficiency of the Eye

Dr. C. E. Ferree, Bryn Mawr, Pa., reported the results of an experimental determination of the conditions affecting the ability of the eye to maintain its efficiency for continuous work. He found the distribution of the light to be the fundamental factor that most influences the welfare of the eye. If, for example, the light is well distributed in the field of vision and is diffuse, tests seem to indicate that the efficiency of the eye, so far as the problem of lighting is concerned, is practically independent of intensity. That is, when the proper distribution is present, intensities high enough to give the maximum discrimination of detail may be employed without causing appreciable damage or discomfort to the eye. For the kind of distribution given by the majority of lighting systems in use at the present time the tests showed that unquestionably too much light is being used for the welfare and comfort of the eye.

Dr. Ferree's paper occasioned much discussion and brought out several dissenting opinions. Among those who spoke were Drs. Ives and Lloyd and Messrs. L. B. Marks, New York; M. Luckiesh, Cleveland, Ohio, and W. Pierce, the consensus of opinion being that the author had not been specific enough in his statements and had not given sufficient data. Dr. Ives in particular urged more specific use of terms and definitions. In reply to his critics, Dr. Ferree defended his illuminating-engineering equipment and methods and declared he had included in the paper all the information he supposed necessary. The systems which he investigated were, he claimed, selected at the suggestion of qualified illuminating engineers and installed in such a way as to render the results truly comparative. The advocates of the direct, the indirect and the semi-indirect systems being equally dissatisfied with the results, he concluded that probably none of the systems had received decided advantage over the others.

At the suggestion of Mr. Lansingh, it was voted to refer Dr. Ferree's paper to the research committee to obtain its co-operation in the future work of investigation by Dr. Ferree.

Production of Light

Some theoretical phases of light production were discussed in a paper by Mr. W. A. Darrah, Pittsburgh, Pa. The author set forth some of the inherent limitations of the various electric illuminants now in use and outlined the effect of these limitations upon the progress of the art of illumination. The basic theory of light production by the acceleration of electric charges was analysed with a view to indicating the relative possibilities of the various types of illuminants, particularly the arc and the incandescent lamp. The structure of the atom was considered in the light of modern theories, and some general deductions were made regarding the properties which a substance is likely to exhibit if well adapted for use as a radiating body. A tentative explanation of the action of selective radiation was given, and of the part which this phenomenon plays in present illuminants. It was demonstrated that to secure high luminous efficiencies selective radiation must be relied upon, and therefore unless new materials are discovered which exhibit selective radiation while in the solid state, the efficiency of the electric arc will remain materially higher than the efficiency of the so-called incandescent lamp, where electrical energy is transformed into heat and then into light by means of the resistance of a conductor. Mr. Darrah remarked that the vapor-conductor type of illuminant, as for instance the flame arc and the metallic arc, has only begun to approximate its possible efficiencies and therefore has a very large field ahead of it.

Hospital Lighting

Many lighting units and arrangements that have proved satisfactory in hospital service were described in a paper by Mr. William S. Kilmer, New York. In the operating room use is made of a lighting system capable of producing an illumination intensity of not less than 25 ft.-candles. In the wards glare must be carefully avoided. For this purpose indirect-lighting fixtures have given good results.

The Tungsten Lamp

In his paper on current developments in the manufacture of incandescent electric lamps, Mr. J. W. Howell, Harrison, N. J., stated that a difficulty encountered with thin-filament lamps is their breakage; with thick-filament lamps, the blackening of the bulb. Fragility has been overcome by using ductile tungsten filaments and blackening by means of so-called "vacuum getters." He showed test data indicating that a 110-volt lamp operated at 0.9 watt per candle gives 900 hours' life with only 1 per cent decrease in candle-power. He also showed the results of tests on a 400-watt lamp operated at 1.01 watt per candle for 6000 hours. The life depends upon the specific consumption at which the lamps are run. The aim is now to obtain a commercial life of 1000 hours in all standard tungsten lamps, the consumption being adjusted to produce this result.

Mr. Howell claimed that manufacturing processes have been so far developed that practically absolute accuracy is now obtained in the rating of lamps. The filament diameter is so closely uniform that such seeming differences in the photometric measurements of different lamps of one rating are found to be attributable to inaccuracies in the photometers. In other words, lamps as manufactured in immense quantities are accurately uniform to a degree within the limits of error of photometric measurement.

In discussing the so-called "half-watt" lamp, Mr. How-

id that the nitrogen which surrounds the tungsten fila-ent and is introduced at atmospheric pressure has several fects. Its chief disadvantage resides in the fact that it ols the filament by conduction. This effect is greater the naller the filament, hence only large filaments are used in rder to obtain high efficiency. A 12-amp filament con-mes 0.5 watt per candle, while a 20-amp filament con-mes only 0.4 watt per candle. He exhibited a 3-amp, 6 watt per candle lamp giving about 500 cp, and also a 0-amp, 110-volt, 2200-watt lamp giving about 5000 cp. he latter has the largest output in candle-power ever btained in a single incandescent unit. Mr. Howell stated at 10,000-cp incandescent lamps can easily be produced in se a demand arises for lamps of this enormous output.

The meeting of Tuesday evening was held in Soldiers' Memorial Hall, the remarkable lighting effects of which ave been described in these columns. Following the tech-cal program, Mr. Henry Hornbostel, architect for the uilding, demonstrated the illumination effects producible ith the auditorium equipment and spoke briefly on the pic of appropriate lighting for the home, office, theater, urch, etc., pointing out that artistic considerations are ften more important than mere efficiency.

### The Neon-Vapor Lamp

The neon-tube lamp was described and demonstrated by s inventor, M. Georges Claude, Boulogne, France. The roperties of neon are very remarkable, its spectrum being xcellent although it contains no blue lines. However, neon very sensitive to the presence of small quantities of other ases, being annihilated by them. To overcome this diffi-ulty, the author utilizes charcoal, cooled by liquid air, to bsorb the gases.

In comparison with the Moore nitrogen-tube lamp the laude neon-tube lamp requires one-third the operating oltage, say 800 volts for a 6-m tube. It gives, say, 200 andles per meter instead of 60, and its specific consump-on is 0.6 watt as compared with 1.7 watts per candle.

The light of the neon lamp is too red. To correct this isadvantage use is made of mercury tubes placed near the eon tubes and operated with the same current. In this ay a very agreeable illumination is obtained at a total onsumption of from 0.8 watt to 0.9 watt per candle.

The speaker exhibited five neon tubes, each 12 ft. in ngth. Two, containing pure neon, produced red light, and he three others, containing a mixture of neon with other ases, gave a bluish color.

Mr. D. MacFarlane Moore, inventor of the Moore tube mp, a number of which are used in the lighting of the oldiers' Memorial, followed M. Claude and described the ork done in America in the development of vacuum-tube ghting systems. He expressed hope that some other gas ight be found with equal light-giving efficiency but a bet-r color than neon.

### Quartz-Tube Mercury-Vapor Lamp

Much interesting information concerning the quartz-tube ercury-vapor lamp was given in a paper by Mr. W. A. . Evans, Hoboken, N. J. The author explained the dif-erence between the glass-tube and the quartz-tube mer-ury-vapor lamps and gave some facts on the character-stics of quartz, also as to the construction of the burners. A description was given of the various types of lamps anufactured. The color of the light from the quartz amp is similar to that from the standard tube lamp with certain amount of red added, giving a closer approxima-ion to daylight. The wide application of the lamp in the ndustrial field was shown by figures from a few installa-ons. Figures were given as to the maintenance cost of he lamp. While the lamp has been developed as an illu-inant, it plays also an important part in the chemical and hysiological world owing to the ultra-violet radiation. onsiderable experimenting is being done at the present me to determine its availability in processes where sun-light is a factor, and new methods have been worked out and new fields opened up for the bleaching of cotton and vegetable fabrics, testing the permanency of colors, de-blooming oil, and in physiological and photographic work.

The paper by Mr. Evans followed Mr. Moore's address, being read in abstract by Mr. Berford Brittain in the author's absence.

Mr. Roscoe E. Scott, Cleveland, Ohio, closed the evening's program with a paper on "The Evolution of the Lamp," illustrated by lantern slides. His remarks traced the history of illuminants from the pine-knot to modern high-efficiency units.

On Monday evening a reception was tendered to President and Mrs. P. S. Millar. Dancing followed, the Westinghouse orchestra furnishing the music. There was no session on Tuesday afternoon, the delegates being taken on special cars to the East Pittsburgh works of the Westinghouse Electric & Manufacturing Company.

The registration at the convention numbered over 250. From the New York Section alone more than fifty members were present.

The papers presented at the remaining sessions, together with the discussion they provoked, will be reported in a following issue.

## Iron and Steel Electrical Engineers

The seventh annual convention of the Association of Iron and Steel Electrical Engineers was opened at the Hotel McAlpin, New York City, Sept. 27, 1913, with a business meeting in which the reports of the various committees were presented. The report of the membership committee showed an increase of thirty-eight associate members and thirteen members, making the total membership of the society 253. The treasurer's report indicated that a 40 per cent increase in yearly dues had been made.

### Carbon Brushes

The first paper of the afternoon, "The Selection and Operation of Carbon Brushes," by Mr. W. P. Poynton, sales manager for the W. J. Jeandron Company, reviewed the history of carbon-brush manufacture and operation from the year 1895 to the present date. The author gave general rules for the selection of brushes to suit different conditions met in practice and dwelt especially upon brush troubles met by the rolling-mill operating engineer. In conclusion, the advice was given that first cost of brushes be made secondary to total operating cost of machines, for while the cheaper brushes may wear for a long period, they do so at the expense of the commutator.

Mr. Poynton's paper was discussed by Messrs. C. S. Proudfoot, Munhall, Pa.; B. G. Beck, Gary, Ind.; F. H. McDowell, W. D. Stevenson and C. L. Corbett, Pittsburgh, Pa.; B. W. Gilson, Youngstown, Ohio; J. Farrington, Steubenville, Ohio; W. Jones, Cleveland, Ohio, and E. Friedlaender, Braddock, Pa. The discussion brought out the opinion that no one type of brush could be made to give satisfaction under all operating conditions. The experience of the majority of the members seemed to indicate, however, that the better grades of brushes were less expensive in the long run.

### Magnetic Control

In a talk on "Alternating-Current and Direct-Current Magnetic Control" Mr. M. A. Whiting, of the General Electric Company, showed lantern slides displaying characteristic curves of different types of motors and generators used in rolling-mill service. By the use of curves and diagrams the advantages and disadvantages of employing machines under certain conditions were pointed out with particular reference to the control problems involved. The author showed that two series motors with different speed characteristics mechanically connected together will operate more satisfactorily than will two shunt motors with a like

difference in their inherent speed. The talk was concluded with a brief explanation of the application of speed time curves as an aid in the correct selection of motors for table operation. No discussion followed the paper.

### Direct-Current Turbo-Generators

At the Tuesday morning session of the convention the paper on "Herringbone Gears for Steel Mills," by Mr. P. C. Day, was postponed, as the author was expected to arrive during the week on the *Mauretania* in time to present the paper in person. Mr. H. A. Rapelye, of the Westinghouse Electric & Manufacturing Company, in his paper on "Direct-Current Turbo-Generators," discussed the feasibility of several methods for using turbines where direct current was the ultimate product desired. According to the author, the most satisfactory solution is found in the use of the helical reduction gear with the floating-frame construction. Lantern slides showed the construction of the floating frame and several installations of reduction gears now in use with direct-current generators.

The paper was discussed by Messrs. W. E. Stevenson, of Pittsburgh, Pa., and F. A. Wiley, of Chicago, Ill.

### Standardization Meeting

Following the discussion of Mr. Rapelye's paper the meeting was placed in the hands of Mr. F. D. Egan, chairman of the committee on standardization, who called for discussion from the members relative to general specifications for electric cranes, transformers and automatic controllers. Experiences with electric-crane operation were recounted by Messrs. O. R. Jones, Youngstown, Ohio; E. Friedlaender, Braddock, Pa., and F. D. Egan, Midland, Pa. The most recent developments were explained and illustrated by the use of lantern slides. In the discussion the following took part: Messrs. W. F. James, Philadelphia, Pa.; H. F. Stratton, Cleveland, Ohio; M. A. Whiting, Schenectady, N. Y.; C. T. Henderson, Milwaukee, Wis., and W. O. Lum, Pittsburgh, Pa. It was brought out that any attempt to standardize details of mill apparatus would meet with universal dissent. However, it was admitted that the constructive policy of making standard general specifications, which would in no way limit or hamper the designer in the development of apparatus, would tend to lessen the troubles of the mill operators and was a work which the committee on standardization should undertake with zeal.

### Switching Devices

A paper on "Recent Developments in Switching Devices for Power Circuits," by Mr. T. H. Mahoney, of the Westinghouse Electric & Manufacturing Company, dealt with carbon circuit-breakers, air-break switches and oil circuit-breakers. The general trend of design was pointed out and illustrated with photographs showing the most recent types of each class. No discussion followed.

### Lifting Magnets

In the absence of Mr. B. E. Fernow, Jr., the paper on "The Design and Use of Lifting Magnets" was read by Mr. C. T. Henderson. Circular and bipolar lifting magnets were compared and data given which showed the circular magnet to be better adapted to handling scrap and open-hearth stock than the more recently developed bipolar type of magnets. Figures presented in the paper showed that the trouble experienced by the operators of lifting magnets was confined almost wholly to minor mechanical features and to wearing out of the current-carrying leads. The author quoted data from tests showing that pig iron can be loaded from a stock pile in the charging boxes by the use of lifting magnets for a trifle less than 2 cents a ton.

In the lively discussion which ensued the following men took part: Messrs. E. Friedlaender, of Braddock, Pa.; H. F. Stratton, Cleveland, Ohio; R. Tschentscher, South Chicago; K. H. Cederlund, Duquesne, Pa.; E. H. Wentz, Lorain, Ohio; W. T. Snyder, McKeesport, Pa.; C. T. Henderson, Milwaukee, Wis.; J. C. Reed, Steelton, Pa.; O. R. Jones, Youngstown, Ohio; C. W. Parkhurst, Johnstown, Pa.; G. W. Richardson, Philadelphia; T. E. Tynes, Buffalo, N. Y.; J. Herrington, Steubenville, Ohio; M. A. Whiting, Schenectady, N. Y.; W. F. Detwiler, Tarentum, Pa.; F. H. Woodhull, Coatesville, Pa.; F. H. Kittredge, Joliet, Ill., and C. Pirtle, Cleveland, Ohio. A written communication from Mr. A. C. Eastwood was read in his absence by Mr. F. R. Fishback, Cleveland, Ohio. It was evident from the discussion that the final word regarding the relative merits of the bipolar and the circular magnets has not yet been spoken. Mr. Eastwood's communication told of an installation where a saving of 30 per cent had been effected through the substitution of a 30,000-lb. skull cracker for a 15,000-lb. ball. It was stated that the increased weight made it necessary to lift the ball to only one-half its former height and that the speed of the lift was not seriously impaired by the added weight.

### Mercury-Vapor Quartz Lamp

At the afternoon session the paper which had been prepared by Mr. W. A. D. Evans on "The Mercury-Vapor Quartz Lamp" was read in his absence by Mr. M. B. Buckman. The author explained the difference between the standard mercury-tube lamps and the quartz mercury-vapor lamps, giving interesting facts and figures on the characteristics of quartz and the construction of the burners. A description was given of the various types of lamps, together with explanatory drawings and photometric curves. A few installations were described and the many industrial uses of the lamp were pointed out. It was stated that at present a 220-volt lamp of this type can be operated at a cost of from $4 to $5.50 per 1000 hours.

The paper was discussed by Messrs. D. M. Petty, South Bethlehem, Pa.; J. H. Reniers, Pittsburgh, Pa.; F. H. Woodhull, Coatesville, Pa., and W. T. Snyder, McKeesport, Pa. All of the speakers who have been using this type of lamp report that it is giving entire satisfaction and is furnishing cheaper illumination than was possible with previous systems.

On account of the absence of Messrs. Ward Harrison and H. H. Magdsick, the "progress" report on illumination was held over for the Thursday sessions.

### Entertainment Features

The time of the visiting ladies was well taken up during the week by automobile trips and theater parties. Trips were arranged Wednesday afternoon to the Brooklyn Navy Yard for those members who did not care to attend the meeting of the National Council for Industrial Safety, which held its second congress in conjunction with the convention of the Iron and Steel Electrical Engineers. The annual banquet of the two societies was held at the Hotel McAlpin Wednesday evening. Gov. John K. Tener of Pennsylvania was toastmaster. Howard Elliott, president of the New York, New Haven & Hartford Railway, and George W. Perkins, who were invited to speak, were unable to be present, but telegraphed their indorsement of the safety movement. Former Representative James T. McCleary of Minnesota, S. W. Tener of Cleveland and L. H. Burnett, of the Carnegie Steel Company, spoke. Mr. McCleary's speech was an attack on demagogy and a plea for real leadership.

### Election of Officers

The result of the election of officers for the ensuing year, as announced by President C. W. Parkhurst, is as follows: President, Mr. E. Friedlaender, Braddock, Pa.; first vice-president, Mr. O. R. Jones, Youngstown, Ohio; second vice-president, Mr. R. Tschentscher, South Chicago, Ill.; secretary, Mr. W. T. Snyder, McKeesport, Pa.; treasurer, Mr. James Farrington, Steubenville, Ohio.

In a latter issue of the *Electrical World* abstracts of the remaining papers and discussions will be given.

## Convention of the Pennsylvania Electric Association

The sixth annual convention of the Pennsylvania Electric Association (State branch of the National Electric Light Association) was held at the Water Gap House, Delaware Water Gap, Pa., Sept. 16, 17 and 18. The features of the sessions on Sept. 16 and 17 comprising President Van Dusen Rickert's address and the addresses of Mr. J. B. McCall, president of the N. E. L. A., and the Hon. Frederic W. Fleitz, of Scranton, Pa., were published in last week's issue.

### Membership

According to the committee on membership, the association now comprises 77 Class A members, 1230 Class B members, 24 Class D members, 35 Class E members and one honorary member, making a total of 1367. The association lost eight Class A members during the year owing to consolidations, yet it still remains the banner geographical section of the national body.

### Lamp Committee Report

The lamp committee report, presented by Mr. W. W. Cloud of Philadelphia, Pa., traced the developments and improvements in the incandescent lamp during the past year. From information obtained from the manufacturers the committee reported that they will shortly adopt a single-voltage rating for tungsten lamps. After discussing the operating characteristics of incandescent lamps the committee took up the question of drop due to interior wiring, and it is its recommendation that every central station give careful consideration to the problem of drop, since it may be possible to improve the service and at the same time show an increase in revenue. A reduction in the price of tungsten lamps, together with the improvement in quality, also calls for the serious attention of central-station managers as to the most desirable manner in which the consumer shall obtain the lamp. Whether lamps are given free or sold at a reduced price, the committee feels that the consumer should be encouraged to obtain his lamps from the central station so that the central station may have some influence over the voltage and wattage of lamps selected.

*Discussion*

Messrs. C. W. Bettcher of the General Electric Company, F. M. Noecker of Renovo, E. F. McCabe of Titusville, O. P. Anderson of the General Electric Company, H. P. Liversidge, T. Sproule and W. W. Sproule of Philadelphia, A. P. Schneider of Allentown, Van Dusen Rickert of Pottsville and C. W. Bears of Wilkes-Barre joined in the discussion of the lamp committee's report. The consensus of opinion was that regulation of lighting circuits should receive attention inasmuch as lighting companies sell service and if the light is not up to standard the service is unsatisfactory and the consumer has cause for complaint.

### Welfare Work

The committee on welfare work, of which Mr. H. Harris of Wilmerding is chairman, said that the national body is entitled to the credit of calling the attention of member companies to the important matter of employees' welfare and for making recommendations far more liberal and advanced than any advocated by larger employers of men in other industries. The main purpose of the committee's deliberations was to interest the smaller companies sufficiently to organize without further delay either by separate company plans or through mutual organizations of member companies. The committee forecast the enactment of a compensation act by the State and suggested that companies give some consideration to the preparation of such a law. The broad questions of welfare were discussed under the following heads: Safety of employees by the prevention of accidents and all diseases; compensation for disability or death due to accident and to other causes; service annuities; saving and investment funds; vocational education, and physical improvement. In view of the legislation everywhere urged, the committee said it must be apparent that sooner or later it will become necessary for companies to exercise more care in the selection of the men entering the service, since otherwise the industry will become burdened with the results of the careless acts of incapables who should seek employment where the possibility of damage to costly apparatus and of serious or fatal injuries to co-employees is less than in central-station work.

In discussing educational work carried on by many of the large companies and welfare work, the committee appreciated the impossibility of any very extensive developments by separate companies except through group work by N. E. L. A. sections or by the utilization of the facilities of existing correspondence school courses. The committee submitted for consideration the idea of establishing correspondence courses covering such branches of the industry as require men specially trained. Every inducement should be offered to employees to engage in healthy indoor and outdoor recreations which will build up the physical structure and keep both body and mind in that healthy condition so necessary to the employees of an ever-growing industry, aiming to render the best possible service to an exacting public.

*Discussion*

A rather interesting and lengthy discussion followed the presentation of the report. Messrs. E. D. Dreyfus of Pittsburgh, H. Harris of Wilmerding, E. H. Davis of Williamsport, W. Partridge of Clearfield, J. M. Wakeman of New York and W. R. Kenney of Connellsville took part. Mr. Davis called attention to the stringent provision of factory laws and to the necessity of companies insisting upon physical examination of employees in advance of the passage of such laws. He told of the methods employed by his company in dealing with the bereaved and afflicted families of employees. The company pays the funeral expenses and makes some compensation to the family irrespective of its liability, etc. Mr. Dreyfus called attention to the schools of the Commonwealth Edison Company and the New York Edison Company and suggested that a condensed course be taken therefrom for the benefit of the smaller companies. Mr. Harris proposed that a course be developed by the company sections or the national body which could be standardized and put within reach of everybody in the industry. Mr. J. M. Wakeman gave a very interesting account of European observations of liability laws and said that the companies here must work out a plan for injured and disabled employees or otherwise more drastic measures would be thrust upon them by the government. In this legislation labor leaders play quite an important part, with the result that the best thought is lacking and the laws are very stringent. Mr. Kenney praised the lectures available to members of the National Electric Light Association and also the work of correspondence schools. He suggested that if the companies would get classes together special rates could be obtained from the correspondence schools and an instructor sent to the class at times. He also advised companies to place at the disposal of their employees books on the electrical subjects and also technical journals. The latter should be available at the homes of the employees so that they could be exhaustively read. All work of this kind, he said, resulted in a lasting benefit to the central station through more intelligent employees.

### Street Lighting

Messrs. Preston S. Millar, president of the Illuminating Engineering Society, and Norman D. McDonald gave a very interesting paper on street lighting, prefacing their remarks with a description of the general conditions which existed up to the beginning of the last decade. The 4-amp metallic-electrode arc lamp has been widely used during the past few years and is expected to be a very acceptable lamp for street-lighting purposes, replacing the open and inclosed carbon-arc lamp. The 6.6-amp lamp of the same type forms an acceptable substitute of higher power and

in its adapted form for "white way" lighting is meeting with much favor. The inclosed flaming-arc lamp, upon the development of which manufacturers have specialized for the last few years, has hardly emerged from the development stage, so that no prediction can be made as to the place which the long-burning inclosed flaming-arc lamp will find in street-lighting practice. The quartz lamp which has been proposed for street-lighting purposes has not as yet been employed widely enough to afford adequate information as to its qualities. The tungsten lamp extended the field for electric service for street lighting by providing a satisfactory efficient illuminant which competes successfully against gas mantle lamps. The series tungsten lamp is giving satisfactory service and the multiple tungsten lamp is being employed in some cities as a competitor of the gasoline mantle lamp for lighting parks, etc. Among the most recent developments is the invention of the tungsten lamp of high power for series and multiple lighting, and it remains to be determined what effect this half-watt lamp will have upon street-lighting practice. Assuming it to be a reliable and satisfactory illuminant, the authors said it would appear to be a formidable competitor of the arc lamp. It is understood that arc-lamp manufacturers are looking to the use of high currents as a means of increasing the efficiency of arc lamps, so that all of the most recent developments point to much higher-powered illuminants for the near future. The authors called attention to the gradual increase in the intensities of street lighting throughout the country and went deeply into the subject of tests of street illumination, glare and the contractual aspects of street lighting. The intensities of illumination of street service, in foot-candles, were given by the authors as follows: Principal streets and cities, 0.25 to 1.0; important side streets, 0.1 to 0.25; resident streets, 0.1 to 0.05; suburban roads, 0.01.

As a standard for comparison of these intensities, it may be stated that bright moonlight is of the order of 0.015 horizontal ft.-candle.

*Discussion*

The paper on street lighting was discussed by Messrs. T. Sproule of Philadelphia, G. H. Stickney of Harrison, N. J.; G. E. Wendle of Williamsport, E. D. Dreyfus of Pittsburgh and Van Dusen Rickert of Pottsville. Mr. Sproule told of the various conditions which had to do with the placing of lamps on the public streets and asked the authors to recommend some reliable method of measuring the illumination of a lamp on a street rather than in a laboratory. He also desired to know if it is possible to get a specification covering gas, oil, incandescent and arc lamps that would be equitable to all. He said that the characteristic curve of an arc lamp bears some relationship to the total life flux, so that it ought to be possible to determine the illumination by a measurement in one direction. Mr. Sproule also suggested that tests made of arc lamps be spread over a length of time. Mr. Stickney emphasized the importance of the street-lighting question to the central station, since disagreements regarding the light and rates result oftentimes in the city giving a franchise to a competing company whose very existence depends upon its ability to secure the city lighting franchise. It is through disagreements over street lighting that openings are made for competing companies to get a foothold in territory already served by a central station.

Mr. Wendle called attention to the difficulties confronting a central station in combating complaints regarding the quantity of light delivered to the city on contract. It was the contention of Mr. Dreyfus that refinement in street-lighting contracts should be confined to companies operating in large cities and that in small cities possessing minor installations a simple commercially designated lamp should suffice as standard. Answering a number of questions, Mr. Millar said that glassware varies in quality so that its absorption could not be stated accurately within 20 per cent. He contended that the description of the lighting unit as called for by the N. E. L. A. specifications was intended for the protection of the central station, and that no common specifications could be drawn up for gas, oil, incandescent and arc lamps. He also stated that lighting companies should have a voice in drawing up the specifications for city street lighting, and that where improvements are made in lamps the central station should see that the municipality got its proper share of the saving effected.

FEEDER REGULATORS

The increasing use of energy as well as the tendency for central-station combinations result in an increasing variety and length as well as complexity in transmission and distribution systems, so that the question of the steadiness of voltage at distributing centers is of importance. Probably no other feature tends to create dissatisfaction with central-station service more easily than wide fluctuations of voltage, resulting in proportionate variations in candle-powers of lamps, speed of motors, etc. In a paper on feeder regulators prepared by Mr. A. D. Fishel, of the Westinghouse Electric & Manufacturing Company, the economies attending the use of automatic regulating equipment were outlined and the various types of regulators for feeder circuits described in detail. Although the single-phase feeder regulator has at present the widest application, there has been a specific increase in the use of polyphase feeder regulators during the past two or three years.

*Discussion*

Mr. H. P. Liversidge, of Philadelphia, touched briefly on the single-phase regulator, commenting on its size as compared to the switchboard and the importance of its noiseless operation in residential districts, where substations in which such regulators are used are in a great many cases located. Mr. Fishel pointed out that in the newer designs the humming noise is greatly lessened and that the floor space taken by the regulator is necessary in order to obtain rigidity and to eliminate the humming.

RATES

In a paper on this subject Mr. L. H. Conklin, of Scranton, said that the time has now come when central stations have not only themselves to consider but the regulating public as well. The rate research committee of the N. E. L. A., he said, found that it was quite impossible to make much headway by discussing the question of rates as a whole, although it found that the disagreement had to do with language and not with facts. He suggested that if attention be directed toward the standardization of forms the differences will become less and finally simmer down to questions of fundamentals. Mr. Conklin pointed out the difference between rates and rate of return, stating that if the community is to have full value in service and the stockholders a full return on the money invested, the rates must be adjusted between classes of business so as to get the fullest contribution from each class. Classes may be made from a value of service standpoint, load-factor or off-peak use. The central-station industry, he maintained, must educate itself and the public as well to recognize that anything which results in good to all is neither discriminatory nor unfair, and if service is sold to any class for less than it is worth to that class the burden falls on some other class.

*Discussion*

A very general discussion followed the reading of the paper, Messrs. E. H. Davis of Williamsport, E. D. Dreyfus of Pittsburgh, H. J. Harris of Wilmerding, G. E. Wendle of Williamsport, L. H. Conklin of Scranton, A. P. Schneider of Allentown and J. Murphy of Renovo participating. The speakers bore testimony to the value of the rate research committee's work and the valuable information given in the "Rate Research Bulletin."

### Rules and Regulations for Operators

Two papers were read at the closing session, one by Mr. ra G. Walborn of Pottsville on "Rules and Regulations 'or Station Operation" and the other by Messrs. S. W. 3rown and J. A. Metz of Hazleton on "Rules and Regula- ions for Outside Operators." The object of Mr. Walborn's paper was to strive to increase safety to station and other employees and to effect economy in operation as a result of safety measures. The rules and regulations given were general in character and need modification for local conditions. The author aimed to set forth some of the most important considerations, dwelling on some in detail but without attempting to frame an inflexible code to cover all conditions which obtain in the many power houses and substations throughout the country. Messrs. Brown and Metz suggested such rules and safety appliances for employees as will best promote safety, efficiency and economy.

*Discussion*

Messrs. W. Partridge of Clearfield, J. A. Metz of Hazleton, T. C. Walsh of Scranton, F. H. Stone of Pittsburgh, I. Walborn of Pottsville, C. W. Ward of Pittsburgh, T. Sproule of Philadelphia, E. F. McCabe of Titusville, S. W. Brown of Hazleton, T. G. Coghlan of New York and B. F. Day of Philadelphia joined in the discussion of both papers. Mr. Coghlan pointed out that many tests should be made daily and that a rule without a check was useless. By means of spaces in the boiler-room log book the engineer is enabled to see that the tests are made with regularity. Mr. Walborn told of the advantages gained by grounding the secondaries of transformers as a safety measure, and Mr. Day told of the difficulty of getting men to use the safety devices. A very general discussion ensued as to whether a company should furnish the lineman with belt and pliers or whether he should supply these himself. Some companies supply these and others do not.

### Economical Operation of Steam Boilers

Mr. T. G. Coghlan of New York read a very interesting paper on the economical operation of steam boilers, stating that whereas thousands are spent on switchboard instruments and other equipment, the boiler room is left with the same old steam gage, and that not very accurate. Hand-fired boilers, he said, are not conducive to good results nor to the peace of mind of the operating manager. Aside from the losses due to opening doors, leaks, etc., the difficulty of securing and keeping the intelligent and skilful labor required makes hand firing out of the question so far as economical operation is concerned. Except in small installations, hand firing is no longer necessary, as stokers can be obtained for burning every kind of coal on the market. Mr. Coghlan described the E. B. Coxe traveling grate stoker for burning the smallest sizes of anthracite and told of the results obtained with it in practice. The central station, he said, must lead all others in economical operation and in the reduction of cost of manufacture so as to be in a position to sell energy cheaper than the user can manufacture it. Continuity of service, steadiness in operation, increased output, etc., he said, serve to attract the smaller class of business, but in big business, where the manufacturer can meet the service, cost is the vital element.

### Election of Officers

At the closing session on the morning of Sept. 18 the nominating committee reported on the following ticket which was unanimously elected: President, Mr. Duncan T. Campbell, Scranton Electric Company; vice-president, Mr. Walter E. Long, Philadelphia Electric Company; secretary-treasurer, Mr. S. C. Pohe, Columbia Power, Light & Railways Company of Bloomsburg; executive committee to serve two years, Messrs. E. B. Greene, Penn Central Light & Power Company of Altoona; E. H. Davis, Lycoming Edison Company of Williamsport, and H. N. Müller, Duquesne Light Company of Pittsburgh. Mr. W. C. Anderson, Luzerne County Gas & Electric Company of Kingston, was elected on this committee to serve one year.

Mr. Duncan T. Campbell, the newly elected president of the Pennsylvania Electric Association, has had quite an extended experience in the central-station business and possesses a host of friends in various sections of the country. Born in Glasgow, Scotland, Dec. 7, 1875, he came to the United States when about twenty-one years old and went West. There, in 1900, he entered the employ of the Denver (Col.) Gas & Electric Light Company as a solicitor in the new-business department. Thoroughly versed in the art, he left Denver in 1906 to take charge of the new-business department at Grand Rapids, Mich., going to Scranton, Pa., one year later as new-business manager of the Scranton Electric Company. In 1910 he was appointed general manager, and early this year he was elected a vice-president of the company. For the past five years Mr. Campbell has been active on the different committees of the Pennsylvania Electric Association, serving on the executive committee of the association for the past two years. Mr. Campbell is a member of the National Electric Light Association, the Illuminating Engineering Society,



PRESIDENT-ELECT D. T. CAMPBELL

the Engineers' Society of Northeastern Pennsylvania and the Society for Electrical Development, in addition to numerous fraternal societies.

### Opposition to Use of Poles with Bell Companies

The report of the public utility interconstruction committee dealt at length with the joint use of poles with telephone companies and with overhead-line construction at railroad crossings. The committee, of which Mr. E. H. Davis of Williamsport is chairman, was continued, and at the final session the following resolution was unanimously adopted as representing the attitude of the Pennsylvania Electric Association on the question at issue: "Whereas, the report of the committee on public utility interconstruction advises that the standard form of joint pole use agreement proposed by the Bell interests is not acceptable: Resolved, that while appreciating the desirability of the association co-operating with the telephone interests in a friendly spirit to secure a fair and proper mutual working agreement, and believing that future conferences conducted as above should be productive of satisfactory results, the association unanimously support the position of the committee and recommend that our members do not sign the agreement above referred to in its present form."

During the closing session the association also passed a resolution indorsing the purpose of the Society for Electrical Development.

## Convention of New England Section, N. E. L. A.

The fifth annual convention of the New England section of the National Electric Light Association was held at Burlington, Vt., Sept. 17 to 19, inclusive, headquarters being maintained at the Hotel Vermont. Four hundred members and guests, including forty ladies, registered, and the gathering, despite lowering skies, was one of the most successful in the history of the organization. The largest party in attendance left Boston on a special train of eight cars on the morning of Sept. 17. Many made the trip to and from the convention city by automobile, and a triumph in long-distance touring into virgin territory was scored by a Bailey electric roadster which made the trip of 258 miles from Boston over hilly and unknown roads at an average speed of 19 miles per hour.

Four business sessions were held, abstracts of the papers and discussions being given below. On account of the large attendance it was necessary to hold the business meetings at the Fifth Regiment Armory.

At the opening session President A. F. Townsend addressed the convention upon the activities of the national body, which now has 12,500 members. He referred to the striking address of Mr. Frank A. Vanderlip at the recent Association Island meeting as instancing the enormous growth and possibilities of the industry, touching upon the plans of the New England Section for bi-monthly "Get-Together" meetings this winter, and urged the addition of new members. The secretary's report showed that the present membership is 869, 96 new members having been added since Jan. 1.

Secretary T. C. Martin of the national organization addressed the convention at the first meeting upon the value of membership in the association to the small company. He pointed out that such a company receives far more than the cost of its participation and outlined the practical value of the Question Box, emphasizing the "return-mail" service given every inquirer when possible and the promptness which is constantly sought in obtaining answers to problems submitted by the member companies. He sketched the possibilities of the industry from the point of view of per capita earnings, which are rising in some instances to $15 or $20, with no end in sight.

### "Problems of Central-Station Managers in Small Towns"

Mr. A. B. Marsden, Manchester (Vt.) Light & Power Company, in his paper on the above subject, emphasized the large numerical proportion of small central stations in towns of less than 5000 inhabitants and discussed the difficulties of the individual manager in such properties through multiplied duties. He urged the consideration by the section of more papers of practical interest to the "little fellow," who is immersed in details that often seem petty, but which must be cared for properly to insure success. In humorous vein the author described the daily round of duties of the small plant manager, who is "William the superintendent" one hour, dressed for office and street functions, and "Bill the electrician" the next, struggling with a wiring installation in overalls and jumper.

*Discussion*

The paper was discussed at length by Messrs. T. C. Martin, New York; Wilfred Smith, Woodstock, Vt.; Eugene Carpenter, Oak Bluffs, Mass.; H. R. Wilbur, Franklin, Mass.; W. P. Schwabe, Windsor Locks, Conn.; W. D. Jennings, New Haven, Conn., and A. L. Pierce, Wallingford, Conn. Mr. Smith made the suggestion that by the employment of blanks in connection with Question Box work the smaller companies could utilize the opportunities of this branch of the association's activities to better advantage. Mr. Carpenter pointed out that a paper which would interest a solicitor in a medium or large company should also interest the manager of a small plant. He also advocated raising new capital for extensions instead of trying to pay for them out of earnings. With open and frank statements of plans the money for an extension costing, say, $500 can readily be raised in many cases locally and the interest of the citizens sustained by the opportunity to share in the profits of the company.

Answering an inquiry by Mr. H. A. Sawyer, Amesbury, Mass., Mr. Carpenter said that in his properties each superintendent has a Ford runabout equipped with a 1200-lb trailer having roller bearings, the combination being utilized in taking the line gang and its tools to each job in the morning, after which the superintendent uncouples the trailer, which is left with the men as an outdoor shop. He then visits customers in trouble or needing the company's attention, and returns at noon to take the men home for dinner, again attaching the trailer. The program is repeated in the afternoon, and the combination equipment loaded, will make a speed of 15 miles per hour on the road. The cost of operating one of these cars since November, 1911, over 30,000 miles has averaged 5 cents per mile including gasoline, oil, repairs and sinking fund on the car. Other speakers emphasized the importance of having troublemen available in small companies and urged the education of customers in replacing fuses.

### "Principles Governing Central Stations in Line Extensions"

Under the above title, Mr. Alexander Macomber, electrical engineer of C. H. Tenney & Company, Boston, Mass., presented data from eighty New England central stations in connection with line extensions at first unprofitable. In fifty-eight cases the extensions are made with the assistance of the customer, in fourteen cases as a matter of policy or in hope that ultimate profits will result, and in eight cases such extensions are not considered by the companies. Twenty-six companies require payment for the whole or a part of the first cost. In case of part payment the amount is usually that proportion of the investment which will make the whole proposition feasible. Twelve of these twenty-six companies rebate this payment on the customer's part at a later time, the rebate taking the form of a lump sum, a percentage of the gross earnings of the extension, or a fixed percentage of the customer's monthly bill. Twenty-three companies favor obliging the customer to give only a guarantee of income. Fifteen of the twenty-three base this return on a percentage of the construction cost, while eight ask for interest and depreciation. The percentage guarantee varies from 10 to 50 per cent, the average number settling on 20 to 25 per cent. It is often required that this guarantee cover two to five years or more, in several cases the guarantee ceasing when a definite return is reached. Ten companies take no chances and require the customer to pay all or a part of the extension cost and to guarantee the income as a certain percentage of the cost, the latter being from 20 to 25 per cent as a rule. In conclusion, the author referred to decisions of the Ohio, Wisconsin and Maryland public service commissions bearing upon the problem of extensions.

*Discussion*

Mr. D. S. Boyden, Boston Edison company, said that it is poor practice to allow the prospective customer to pay for any proportion of the construction cost on highways. The simplest policy is to require an agreement insuring carrying charges on the investment and to oblige all subsequent customers to join in the obligations to the credit of the originator until such time as the company's interests are satisfied. Arrangements may be made for one or more years and for an amount equal to that required to discharge the obligations during the life of the agreement. Mr. R. D. Coombs, New York, favored private rights-of-way for extensions, particularly if commissions are to specify what detailed construction is to be installed upon highways. He considered this detailed supervision as beyond the scope of proper regulation. Mr. C. R. Haye

Fitchburg, Mass., cited the usefulness of joint pole-line utilization by central stations and telephone companies in districts offering little early revenue for the former, this being a good method of cutting down investment charges. He favored a liberal policy in constructing extensions. Mr. W. P. Schwabe, Windsor Locks, Conn., cited a case where a guarantee of only $2 per month was asked on an extension costing $250 upon estimates, and yet the prospective customer attempted to carry the matter to the state commission. The matter never got beyond the local selectmen, who recognized the justice of the proposed charge and refused to appeal to the state board. President A. F. Townsend said that he considered an extension of reasonable cost one whose investment would be equaled by the income in two or three years' time. An extension of six to ten poles would not be considered unreasonable in most cases in his practice. At Woonsocket, R. I., any extension cost up to $500 is met without hesitation by his company. Mr. E. F. Lawton, Hartford, Conn., said that the Hartford Electric Light Company will extend its lines without extra charge into any rural community which will contract for street lighting. Mr. Boyden said that the Boston Edison company will meet any extension or investment cost for a customer so long as it does not exceed $75, exclusive of meter and transformer expenses. Messrs. L. J. Chase, Concord, N. H., and A. L. Pierce, Wallingford, Conn., also spoke briefly.

### "Some Phases of Electric Appliance Merchandising"

Mr. W. G. Stetson, superintendent of appliance sales, Boston Edison company, presented a paper on the above subject which emphasized the need of adopting the principles of sound merchandising in marketing electrical conveniences. The sale of appliances should never be relegated to one side. These devices should be retailed according to the best modern business methods, without a colorless explanation and exhibit by the salesman which is described by the average central station as "preserving neutrality." All such apparatus is not equally good; the central-station man knows it, but in attempting to "keep friends" with all the manufacturers in the world, he is trying to carry water on both shoulders and the back of the neck at the same time. The appliance that is absolutely right is going to sell in every city in the United States. Appliances should be sold at a profit, like every other form of merchandise, and kept in service by intelligent follow-up methods. Some of the money which is being spent for the electrical education of the public should be used in the practical education of the trade.

*Discussion*

The paper was discussed by Messrs. E. M. Addis, Brattleboro, Vt.; R. P. Ingalls, Cambridge, Mass.; E. L. Cooley, Boston; J. T. Shannon, Waterbury, Conn.; C. B. Burleigh, Boston; A. F. Townsend, Woonsocket, R. I., and L. D. Gibbs, Boston. Mr. Addis took issue with the author regarding neutrality, contending that the central station should not express preferences when exhibiting competitive appliances. Neutrality has no attractions in Mr. Burleigh's opinion, his point being that the best apparatus will be demonstrated by use in the long run, and that nothing permanent can be gained by favoring all designs and makes alike. He criticised the use of the term "current-consuming devices" as one liable to scare off the public from the cost point of view, and favored the terms "electrical conveniences" and "current-utilizing devices." Mr. Townsend said that his company makes a free test of motor clearances, oiling conditions, etc., at intervals for the benefit of its customers. The desirability of having the families of central-station men become advocates of electrical service were touched upon by Mr. Gibbs, who said that every central-station employee should be provided with electricity in his home, even if the cost of installation had to be met by the company.

### "Value of the Electric Vehicle to the Central Station"

Messrs. W. H. Snow and David W. Beaman, of the New Bedford (Mass.) Gas & Edison Light Company, presented a paper reviewing the well-known favorable load characteristics of electric-vehicle battery charging and calling attention to the increase in New England registrations as printed in the Sept. 20 issue of this paper. Figures were also given of the increase in machines used in many of the cities of the country in the past year. At New Bedford, Mass., 100 per cent more electric vehicles are in use; at Springfield, Mass., and Worcester, Mass., the growth has been at the same pace, and even in Hartford, Conn., a successful electric-vehicle town of established reputation, the increase has been 75 per cent. In New York City there are now 498 electric pleasure cars and 1700 commercial electric vehicles in service; in Chicago 2200 pleasure cars and 630 commercial machines; at Washington, D. C., 654 pleasure cars and 255 commercial vehicles; in Greater Boston 282 passenger cars and 261 commercial machines, and in Denver, Col., 850 passenger and thirty-seven commercial vehicles. A valuable portion of the paper consisted of testimonials of nearly forty concerns using electric vehicles in manufacturing, central-station, meat-packing, teaming, baking, furniture store and other services. The company is building a 65-ft. by 100-ft. garage in the heart of New Bedford which will house thirty machines and has found that even under conditions of heavy snow the electric truck will handle the required service far better than the horse.

*Discussion*

Messrs. R. W. Rollins, Worcester, Mass.; F. H. Smith, Worcester, Mass.; W. M. Thayer, Hartford, Conn.; J. A. Hunnewell, Lowell, Mass.; H. H. Skinner, Providence, R. I.; Welles E. Holmes, Cambridge, Mass.; J. T. Day, Malden, Mass., and Messrs. E. S. Mansfield, J. S. Codman, E. W. M. Bailey and Day Baker, Boston, commented upon the electric-vehicle situation. The point was made that the electric truck must be run close to its mileage capacities in order to secure its full economy. Under these conditions the saving in labor cost in carrying linemen and other construction forces rapidly about a system is very striking. At Lowell, Mass., this saving has largely offset the cost of operating the trucks. Mr. Hunnewell made the point that central stations should do their utmost to encourage the use of electric trucks in industrial service even in cases where the batteries are likely to be charged from mill plants.

Mr. Holmes described the electric-vehicle equipment of the Cambridge central station, which is characterized by bodies built according to the company's own designs, recently described in this journal. The Malden Electric Company now has six electric machines in service, four of which are run over eighteen hours per day. One has run 18,000 miles in the past nine months. In Malden energy at the rate of 30,000 kw-hr. per year is sold to a coal company owning two trucks, the service being rendered after 6 o'clock p. m. The point was brought out that at Cambridge the company meters battery-charging energy on the direct-current side of the garage motor-generator set to give the garage owner the minimum rate without discrimination in favor of direct current.

### "Co-operation of Allied Electrical Industries"

A group of four papers was presented upon this topic—from the point of view of the manufacturer, by Mr. S. St. John Morgan, Westinghouse Electric & Manufacturing Company, Boston; of the jobber, by Mr. W. J. Keenan, vice-president Pettingell-Andrews Company, Boston; of the contractor, by Mr. J. G. Gilliland, New England Engineering Company, Waterbury, Conn.; of the central station, by Mr. Francis A. Gallagher, Jr., Narragansett Electric Light Company, Providence, R. I.

Mr. [illegible] pointed out that meeting [illegible] through [illegible] all to pursue an aggressive campaign for business and that collective effort is necessary to carry forward the industry. Competition offered by gas and other sources of power, apathy, ignorance and popular prejudice render co-operation the more necessary. The motto of the industry should be "The public be told." Local dealers, contractors and central stations should supplement the national advertising campaigns of the manufacturers by local advertising. Architect, contractor and builder need to be educated to provide outlets far more plentifully in new buildings. The public should be educated to equal familiarity with electrical and automobile terms. Larger use can be made of the literature, data, moving pictures and lectures available from manufacturers.

Mr. Keenan emphasized the good work being done by the Society for Electrical Development and contended that central stations should not become the active competitors of supply dealers in the appliance sales fields, but that in cases where such work is undertaken the electric service company should not sell appliances at a price below a merchandising profit. He was of the opinion that the free distribution of lamps for less than regular prices is injurious. Apparatus sold below cost by central stations means that the rates are higher in order to come out whole. Central stations should set the standard for the quality of apparatus permitted on their circuits. The author described the work of his company in endeavoring to popularize electricity. Notable features are a house organ with a circulation of over 5000 copies monthly and well-equipped "fixture studios." In the past decade more thorough technical knowledge has been acquired by jobbing houses.

Mr. Gilliland explained the necessity of the jobber to the contractor and severely criticised irresponsible electrical contracting. He favored a universal license law and closer scrutiny by central stations of the wiring connected to their distributing systems. The average property owner has no idea of the risk of incompetent or dishonest wiring. Central stations should not engage in wiring and the rates for service by electric heating devices should be lowered in many municipalities.

Mr. Gallagher pointed out that the manufacturer should be willing to teach the consumer the limitations of apparatus and should follow it in use. He condemned wiring by "basket contractors" and contended that for the present it is necessary for the central station to retail appliances in order to give the public the desired service. Ultimately this part of the business will gladly be turned over to the local dealers by central stations.

*Discussion*

Mr. H. E. Page, Hartford, Conn., said that the effect of giving the contractor too much credit is to encourage cheap work. Mr. H. T. Sands, Boston, maintained that the central station should control the lamp situation. Free renewals of defective lamps has been a powerful factor in the development of the industry. Mr. C. B. Burleigh, Boston, pointed out the benefit to the architect from increased commissions on a large number of outlets. Others who spoke briefly were Messrs. J. J. Myer, Boston; R. W. Rollins, Worcester, Mass.; Almon Foster, Boston; Charles Howes, Boston, and Eugene Carpenter, Oak Bluffs, Mass.

"Relation of the Central Station [illegible]

Mr. J. T. Shannon, United Electric Light & Water Company, Waterbury, Conn., urged the training of central-station employees to greater commercial efficiency and pointed out some of the difficulties resulting from indifferent, irresponsible or "smart" employees. He commented upon the importance of neatly dressed meter readers and courteous telephone operators and office assistants, and outlined the benefits of welfare work. A standard prize offer for suggestions resulting in service improvements is an excellent thing. In one case where a five-dollar prize was given the employee not in the new-business department who furnished leads developing the most new business 100 new customers resulted. Positive following of complaints and checking them by telephonic inquiries are good methods of cultivating the public's appreciation.

*Discussion*

Mr. H. T. Sands, Boston, emphasized the importance of small things in dealing with customers. Adjustments of meter bills should be made only to satisfy the customer and not because of its being his due. If this is made plain, most customers will refuse to take the money. Rigid rules were not favored in dealing with the public. Eighteen dollars a week is not too much to pay for a good meter reader. Mr. C. H. Ingalls, Boston, stated that all inquiries by customers of meter readers and inspectors which cannot be immediately answered are referred to the proper department for final attention. Mr. F. H. Smith, Worcester, Mass., advocated an open-type office in which the public can come into immediate contact with the officers of the company. Mr. H. W. Moses described the work of the Boston Edison Welfare Bureau, which has noticeably raised the standard of employees during the past few months.

"Socket Voltage Versus Lamp Voltage"

Mr. Henry Schroeder, General Electric Company, Harrison, N. J., presented a paper urging that tungsten lamps be operated at their rated voltage. For every extra volt on the circuit 1.5 per cent extra central-station revenue can be obtained. At a 10-cent energy rate 100-watt tungsten lamps would be most economically operated at 6 volts above their rating, even when the lamps are paid for at list prices, and the frequency of renewals would be about the same as with carbon lamps allowed to depreciate to 80 per cent candle-power.

Nitrogen-Filled Lamp

Discussing recent improvements and researches, Mr. Schroeder said that the nitrogen-filled lamps thus far built have a minimum rating of 15 amp to 20 amp and a specific consumption of 0.5 watt per cp. For street lighting a constant-current transformer is used at each lamp to give the 20-amp current required, and lamps of 500 watts and 1000 watts rating represent the smallest sizes yet made. The 60-watt and 40-watt street lamps are being developed with nitrogen filling and 110-volt nitrogen-filled lamps are being made in sizes of from 750 watts to 1000 watts, the specific consumption ranging from 0.55 watt to 0.7 watt per cp. with a life test of 1500 hours.

Mr. F. W. Prinse, Hartford, Conn., defended the practice of running lamps at sub-normal voltage during the transition period in free lamp renewal practice, to keep the customers' bills down. Since the company adopted free renewals of 60-watt lamps in April last over three times as many of these in proportion to the 25-watt lamp have been installed as were put in by customers previous to the inauguration of free renewals.

Mr. S. R. Keyes, Boston, stated that he recently had operated a 6.6-amp street lamp at 6.7 amp and obtained 1000 hours' life with only 10 per cent drop in candle-power.

Election of Officers

At the closing session the following officers were elected for the ensuing year: President, Mr. C. C. Wells, Middlebury (Vt.) Electric Company; vice-president, Mr. Louis D. Gibbs, Edison Electric Illuminating Company, Boston, Mass.; treasurer, Mr. R. W. Rollins, Worcester (Mass.) Electric Light Company; executive committee, Messrs. Harry B. Ivers, Portland, Me.; L. J. Chase, Concord, N. H.; A. B. Marsden, Manchester, Vt.; E. P. Rowell, Plymouth, Mass.; E. A. Barrows, Providence, R. I., and B. H. Gardner, Waterbury, Conn. Miss O. A. Bursiel, 149 Tremont Street, Boston, Mass., is secretary of the New England Section.

## Pacific Coast Convention of the A. I. E. E.

The Pacific Coast convention of the American Institute f Electrical Engineers was held at Vancouver, B. C., ept. 9, 10 and 11, with a total registration of 160, about ne-half of the delegates coming from out of town. Good tendance marked the technical sessions and lively discus- ons followed each paper. Besides the entertainment feat- res provided for the interims between sessions, two whole ays after the close of the convention were devoted to ght-seeing and inspection trips to nearby water-power ants.

At the opening session of Tuesday afternoon Alderman rown welcomed the delegates to Vancouver. Mr. R. F. ayward, chief engineer of the Western Canada Power ompany, then introduced Mr. J. A. Lighthipe, Los An- eles, Cal., vice-president of the Institute, who served as hairman throughout the business sessions. The first paper, resented by Mr. V. H. Greisser, was entitled "Snow and e Loading on Transmission Lines," and was read in Mr. reisser's absence by Mr. C. F. Uhden, chief engineer of e Washington Water Power Company, Spokane, Wash.

### Effects of Ice Loading on Transmission Lines

In his paper Mr. Greisser described a series of tests ade on an experimental transmission line to determine 1) the influence on the loaded span of the elasticity of ie cable, (2) the effect of swing of insulators, (3) the ffect of using strain insulators at frequent intervals, and 4) the combined effect of all of these conditions. Numer- us short-circuit failures which occurred during the winter eason on a line owned by the Washington Water Power ompany were traced to unequal loading of the spans aused by sleet and ice falling off some spans while it still ung to others. To investigate this class of troubles the st line was built, consisting of five 750-ft. spans identical ith the troublesome transmission line. The tests showed e desirability of a change from the vertical arrangement f the conductors. To accomplish this the middle cross- rm was lengthened. The great influence of the length of e insulator on the increased sag was emphasized, and it as urged that insulator designers endeavor to shorten spension-type insulators used for high-voltage work. In nclusion, consideration was urged for tower spacings at norter intervals, to secure reduced maintenance and reater reliability.

*Discussion*

In discussing Mr. Greisser's paper Mr. R. F. Hayward, ancouver, B. C., said he looked for radical changes in sulator design in the near future. He spoke in favor of ie rigidly supported pin type rather than the suspension sulator now in use. Chairman Lighthipe said that on a ,000-volt line in southern California pin-type insulators ave been in service for five years, but a large percentage f them have broken down under the high voltage, and a turn to the suspension type is contemplated.

In the debate on difficulties caused by sag in line wires ving to unequal loadings, it was suggested that the con- uctors be strung in a horizontal plane. Mr. Hayward, owever, held that the chief danger of excessive sag lies the near approach of the wire to the ground caused by ie swing of suspension insulators, and that no arrange- ent of wires will obviate this. Mr. T. R. Cornick, Petal- ma, Cal., pointed out that trouble on a line using pin- pe insulators can be more easily repaired than on one sing suspension insulators. He also cited a transmission ne in Mexico using pin-type insulators, which has been ubjected to the most adverse snow and ice conditions ithout sag troubles. The trend of the remarks in the dis- ssion indicated a general belief that spans are now being ade too long. Prof. V. Karapetoff, Ithaca, N. Y., also oke against the use of low safety factors in transmission- ne construction, suggesting a factor of four for transmis- on work in general.

### Mountain Railway Electrification

The paper by Mr. Allen H. Babcock, San Francisco, Cal., contrasted the merits of steam and electrical equipment for the Tehachapi division of the Southern Pacific Railroad. The two slopes to the summit of this division are 49.5 and 18.3 miles long respectively, with ruling grades of 2.4 per cent. A 2400-volt, third-rail system was assumed, using 100-ton electric locomotives for 500-ton freight-train units and 150-ton locomotives for passenger service. On the basis of present traffic it is shown that electrification of this division would not be justified from a financial viewpoint, whether energy were generated in a power house built by the company in the oil fields which lie 20 miles from the right-of-way or were purchased from some existing central station. Appended to the paper data were given on sub- station spacing, heating load, generating station, transmis- sion line, block signals, shops and inspection shed, electric locomotives, steam locomotive credits, maintenance of way as affected by locomotives, locomotive repair, enginemen's wages, fuel, tunnel clearances and annual tonnage.

*Discussion*

In reviewing his paper Mr. Babcock commented on the general disappointment resulting from the decision against electrification reached by the company, but said he felt sure the results as set forth in the paper were correct. A strong argument against electrifying certain divisions was the resulting discarding of steam equipment. Again, elec- tric motors can be operated only on electrified divisions, while steam locomotives could be taken to any part of the system in emergencies. Under favorable conditions on down grade a certain amount of power could be regener- ated and returned to the system. But, of greater import- ance, the enormous sum paid yearly for broken wheels, axles and other equipment destroyed by mechanical brak- ing methods could largely be saved by electric braking.

Mr. J. B. Fisken, Spokane, Wash., suggested that the decision of the Southern Pacific company might have been different if, at the outset of the investigations, a stretch of 300 or 400 miles had been considered, instead of 68 miles with heavy grades. The load-factor over the longer stretch would be higher, and the difference in operating cost might be such as to make the electrification of a moun- tain division feasible.

### Gulf of Georgia Submarine Telephone Cable

The submarine telephone cable recently laid between Point Grey, just off Vancouver, and the city of Nanaimo, on Vancouver Island, was the subject of a paper prepared by Messrs. E. P. La Belle and L. P. Crim. The cable, which is 32.6 miles in length, is of the continuously loaded type and is the first of its kind to be laid in America. Data from factory tests were contrasted by the authors with results obtained after the cable had been laid. Throughout the operation of stringing the cable its conductors were in use either as circuits for communication with the land sta- tion or for testing to discover faults that might result from handling. The depth of water in the channel, 1300 ft., made it impossible to lay the cable without subjecting it to a high tensile strain, which was the reason for using a large amount of gutta-percha in its manufacture. Prior to the selection of the type of loading, careful study was made of the relative advantages of a continuously loaded and a coil-loaded cable for the special Georgia Gulf con- ditions. The paper was concluded with an enumeration of the principal arguments for each type of loading.

### Substation in the Cœur d'Alene Mining District

In the paper by Mr. John B. Fisken, Spokane, Wash., a typical mine substation was described. This installation was one built by the Washington Water Power Company for supplying 2300-volt, three-phase service to the Bunker Hill and Sullivan mines and for lighting the mining towns of Kellogg and Gardner. The building has a frame of

structural steel, roofed and covered inside and out with corrugated, galvanized steel. This type of construction has been adopted in preference to brick on account of the ease with which the buildings may be taken down and reassembled as the development of the mine may require. The paper gave a detailed list of equipment, together with the total construction cost, the cost per kva, and the annual operating cost. The connected load of motors at the mine totals 3000 hp. Tables of distributed costs of electric-light and motor service for the average month were given, showing the outlay for this service for different mining operations.

*Discussion*

Referring to Mr. Fisken's paper, Mr. C. F. Terrell, Seattle, Wash., expressed his preference for self-cooled transformers over the water-cooled types in use. Although higher in first cost, the former afford greater simplicity and reliability. Mr. R. F. Hayward commented that automatic substations are more important in the West than in the East because of the former's higher labor costs. However, such stations must be very dependable, because to break even momentarily the circuit operating a mine concentrator would mean choking the machine and would necessitate its being cleaned out and started over again.

Professor Karapetoff mentioned trouble experienced with the blowing of fuses on a 60,000-volt circuit protected by copper wires about 16 ft. long incased in rubber tubes. There was no method of announcing the break to the nearest patrolman. After trying various complicated schemes, weights were attached to the wires so that when the fuse blew a circuit would be closed, ringing a bell. Mr. Fisken emphasized the fact that a bank of three single-phase transformers has six points of weakness in its entrance bushings, while the equivalent three-phase transformer has only three. He said, however, that the installation referred to had given satisfactory results for three years. Ten years ago, said Mr. Fisken, grounds were in use throughout the system, but operating experience has now led to the removal of all grounds except at the power plant, where "dead" grounds are used without resistance. The rate to mining companies in the Cœur d'Alene district is $3 per kva of maximum demand plus a charge of 0.5 cent per kw-hr. consumed. From these figures the discounts allowed, depending on the term of the contract, are as follows: Two years, 10 per cent; three years, 15 per cent; five years, 25 per cent.

### Oil Circuit-Breakers for High Potentials

The paper prepared by Mr. K. C. Randall, Pittsburgh, Pa., and read in his absence by Mr. A. A. Miller, gave a brief outline of recent important developments in oil circuit-breakers. Ideal conditions require that the current should not re-establish itself after passing the first zero of current value following the opening of the contacts, and this emphasizes the necessity of high opening speed in a circuit-breaker. However, there is nothing to be gained by increasing breaker speed beyond 0.5 cycle, as the stored energy of the circuit may be assumed to appear as heat at the arc; hence if the arc holds only till the first zero current value has passed, the stored energy of the circuit will have been dissipated.

Breakers have been designed in which resistances were introduced to limit the current to a value readily ruptured, but, owing to inherent difficulties with this method, reactance has been successfully substituted for resistance. Such reactance breakers have two sets of contacts—the main set, which carries the normal current, and an auxiliary set, which carries the reduced current after the reactance has been introduced by the opening of the main contacts. Oscillograph records showing the rupture of a 12,000-volt circuit carrying 12,000 amp were included in the paper to illustrate the action of current waves on the opening of the contacts of a reactance breaker.

*Discussion*

In discussing Mr. Randall's paper, Mr. L. G. Robinson, Vancouver, B. C., suggested the possibility of designing a type of circuit-breaker in which several gaps might be interposed in series by the use of a light mechanism. He proposed that sixteen or twenty gaps be employed for high voltages, thus securing a very steep curve of potential distribution across the opening. The sum of the distances at the several gaps need not be so great as that required for a single gap.

### Logging by Electricity

The paper on logging by electricity, presented by Mr. F. J. Barry and read in his absence by Mr. W. E. Herring, described the operation of the motor-driven timber-hauling and loading apparatus used in the Elk River district of Idaho. The author told briefly of the "sky-line" system by means of which all of the timber within a radius of 3000 ft. to 4000 ft. may be cleared without moving the haulage outfit. With this method of clearing only one end of the log is dragged on the earth, so that less trouble is experienced at the mill from stones and gravel in the bark of the timber. The speed of haulage for the average log is approximately 1000 ft. per minute.

The electrical equipment for each outfit consists of a 150-hp, 550-volt, 60-cycle, three-phase induction motor operating at 600 r.p.m. The motor is of the totally inclosed type and is fitted with a solenoid brake. Energy is transmitted to these machines over 11,000-volt transmission lines ending in portable substations or transformer cars.

Tests have shown that the saving effected by electricity over steam is about 50 cents for each 1000 log-ft. This fact, together with decreased fire risk, elimination of need of water supply and increase in speed of hauling, make central-station service highly desirable for logging operations. An average of 10 kw-hr. is consumed for each 1000 ft. logged.

### Entertainment Features

On Wednesday evening an audience of 200 listened to a piano recital by Professor Vladimir Karapetoff, of Cornell University, which was followed by a stereopticon lecture on the electrical-engineering features of the Panama-Pacific Exposition by Mr. A. H. Halloran, managing editor *Journal of Electricity, Power and Gas*, San Francisco, Cal.

At the banquet of Thursday evening Mr. R. F. Hayward acted as toastmaster, and addresses were made by Messrs. J. A. Lighthipe, F. L. Hutchinson, Ralph W. Pope, A. H. Halloran, V. Karapetoff, N. A. Bowers and G. R. Murphy. Besides the inspection trips and automobile rides about Vancouver, a special train on Friday conveyed the visitors to the Stave Falls water-power plant, and on Saturday launches transported them to the Lake Buntzen stations of the British Columbia Electric Railway Company. Spokane has been recommended as the meeting place for the 1914 Pacific Coast convention.

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## Third International Congress of Refrigeration

After the formal opening ceremonies in Washington on Sept. 15, the regular sessions of the third International Congress of Refrigeration were begun in the Hotel La Salle, Chicago, on Sept. 17. Meetings were continued until Sept. 24, when the closing sessions were held. The congress was divided into six sections. The first related to the scientific aspects of the subject, the second to refrigerating machinery and insulating materials, the third to refrigeration of foods, the fourth to refrigeration in the industrial arts, the fifth to refrigeration in transportation, and the sixth to questions relating to legislation and administration. The president of the International Congress of Refrigeration was Mr. André Le Bon, of Paris, former Minister of Commerce of France. The local president was Dr. Frank

V. Gunsaulus, president of the Armour Institute of Technology.

Dr. A. C. Humphreys, of New York, president of the Stevens Institute of Technology, was down on the program s president of the second section, but he was unable to be resent at the opening session, and Mr. N. H. Hiller, resident of the Carbondale Machine Company, Carbondale, Pa., vice-president of the section, occupied the chair. Four honorary presidents were elected. One of these, Prof. L. Marchis, of Paris, was present at the opening ession and made a speech in French. The other honorary residents of the second section were Messrs. Philip Porges, Austria; F. Schipper, Germany; A. W. Rjasantzeff, Russia, nd Johan Gustaf Richert, Sweden. Mr. V. H. Green, ngineer of the De La Vergne Machine Company, of New York City, was the secretary of the second section.

In the absence of President M. L. Holman, of St. Louis Vice-president R. H. Tait of the Tait-Nordmeyer Engineering Company, of St. Louis, presided at the opening ession of the fourth section. Prof. E. L. Ohle, of Washington University, acted as secretary. The honorary presidents of this section were Mr. E. Engelmann, Austria; Prof. J. T. Lundbye, Denmark; Mr. Casimir Monteil, France; Mr. M. Hirsch, Germany, and Mr. E. G. Perrimond, Russia.

A large number of papers were presented for the consideration of the congress. The official languages were English, French, German, Italian and Spanish. All papers were printed in English, French or German. Interpreters were present to be utilized as needed.

The attendance at the congress was about 700, about 150 coming from foreign countries. This is the first international congress of refrigeration to be held in the United States, the first having been held in Paris in 1908 and the second in Vienna in 1910. A refrigeration exposition was held at the International Amphitheater, Chicago, in connection with the gathering.

Many industrial and sight-seeing excursions took place during the convention, as well as several luncheons and dinners. On Sept. 19, under the guidance of Mr. Theodore O. Vilter, nearly all the members of the congress visited Milwaukee. One of the places of interest visited in Chicago was the Fisk Street station of the Commonwealth Edison Company.

A number of kindred societies, like the American Society of Refrigerating Engineers, held meetings during the congress.

An interesting paper was read at one of the sessions of the second section by Mr. L. C. Nordmeyer, of St. Louis, on "The Comparative Installation and Operating Cost of a Combined Ice-Manufacturing and Cold-Storage Plant." The authors, Mr. R. H. Tait and Mr. Nordmeyer, compared the cost of energy for operating a straight steam compression plant, a compound condensing plant and an oil-engine plant with electrical auxiliaries. They found that the oil-engine installation tested worked out considerably cheaper.

In the discussion Mr. N. H. Hiller, of Carbondale, Pa., contended that Mr. Nordmeyer had failed to take into account the advantages of the exhaust-steam absorption method, which he thought compared favorably with any of the others in operating cost. Several other members spoke about the cost of fuel oil. Mr. Nordmeyer in his paper figured on a cost of 95 cents a barrel of 42 gal. It was pointed out, however, that the price of oil is now about .22 to $1.25 a barrel or, by the gallon, from 3.5 cents to cents. One gentleman made the interesting statement at when the price of crude oil exceeds $1.10 a barrel it is ought to be more economical in the Southwest to use coal fuel under the boilers of ice plants. In answer to an quiry another delegate mentioned a plant in St. Louis here a gas engine is directly connected to an ammonia mpressor.

### Central-Station Electrical Energy for Ice Making

The paper of the greatest practical electrical interest was that on "Artificial Ice Making and Refrigeration from the Standpoint of the Central Station." It was read by the author, Mr. C. H. Stevens, manager of the power engineering bureau of the Edison Electric Illuminating Company of Brooklyn, at the session of the fourth section on Sept. 20. Mr. Stevens set forth the advantages of central-station electrical energy in ice making. He said that the use of high-pressure multiple-effect evaporators in connection with distilled-water ice plants is an important step in making feasible the use of central-station energy in ice making. Further, the advent of the raw-water system has put the ice plant distinctly within the field of the central station. Data from three large plants using central-station energy in making ice gave the average energy consumption per ton of ice as 46.89 kw-hr.

In a brief discussion Mr. George H. Jones, of the Commonwealth Edison Company, made the point that the use of central-station energy enabled the ice maker to cut down the cost of cartage by locating his plant near the center of the area of delivery. The cost of delivering ice is a large item, and, where there is no fuel to be delivered, medium-size ice plants supplied with energy from the central station can be located at advantageous points to effect economy in delivery. Mr. Jones believes that 150,000 tons of ice will be made electrically in Chicago this year. Mr. R. H. Tait, of St. Louis, a refrigerating engineer, remarked that unquestionably if the central station could sell energy to the ice man cheaper than he could produce it, the isolated power plant would be superseded in ice making. Mr. Dohrmann, an ice manufacturer of Brooklyn, said that boiler-room troubles are not uncommon in ice plants. These would be done away with by the purchase of electrical energy. This speaker has great faith in the future of central-station energy for ice plants. Mr. McGinnis, of the Lincoln Ice Company, of Chicago, one of the customers of the Commonwealth Edison Company, gave purchased electricity a hearty indorsement. He operates an electric raw-water ice plant and made 27,000 tons last year and expects to make 35,000 tons this year. He has no difficulty in competing with distilled-water ice and believes that, on the average, raw-water ice is better. It is worth a good deal, he said, to have no cares of power-plant operation. He is an ice-maker, he said, not an energy producer, and is content to remain so. In answer to a question Mr. McGinnis said that he paid 1 cent per kw-hr. for his energy. Mr. Stevens' paper, it may be added, showed that Mr. McGinnis' company's consumption for the year ended Feb. 28, 1913, was 1,455,012 kw-hr.

At the same session Mr. Peter Neff, of Canton, Ohio, president of the American Society of Refrigerating Engineers, read a paper on "The Manufacture of Distilled-Water Ice," in which he showed that it costs more to make ice by this process than is commonly supposed.

## Public Service Commission News

### West Virginia Commission

Action on the applications of different hydroelectric companies for permits has been postponed by the Public Service Commission of West Virginia until Oct. 14. Various coal, timber and railroad interests contend that the hydroelectric developments would interfere with their properties. After the receipt of the protest from these companies against the hydroelectric projects, the companies which seek permission to erect dams and develop water-power had an opportunity to file amended applications. The Tax Commission of West Virginia contended that the companies should pay a license tax before permits were granted, but the Public Service Commission ruled

that license fees should not be paid until the permit had been issued.

WISCONSIN COMMISSION

The investigation of the costs of street lighting in Milwaukee, made by the Railroad Commission of Wisconsin at the request of the lighting committee of the City Council of Milwaukee, has been mentioned in these columns. The commission found that the city would get its service cheaper if it made a contract with the privately owned utility than if it built a municipal plant for the purpose.

The general conclusions of the commission were stated briefly in the report as follows:

"It is believed that the adoption of a combined system of 4-amp series luminous arcs and tungsten lamps, substantially as proposed, would result in satisfactory illumination as measured by present-day standards.

"What would it cost the city to build and operate a lighting system to supply this service?

"The commission's conservative estimate of the investment is $1,493,258, and of the annual operating expenses $273,053. Assuming that two tungstens are equivalent to one arc lamp, as far as cost is concerned, the average cost of operation is found to be $75.11 per lamp.

"In arriving at the operating cost for service rendered by the privately owned utility, the estimated investment was divided between lamps on overhead and underground circuits. The difference in the cost as shown below is due to the difference in the fixed charges for the different investments: 4-amp magnetite arcs on overhead circuits cost per year $54.91; 80-cp series tungstens on overhead circuits cost per year $26.82; 4-amp magnetite arcs on underground circuits cost per year $75.69; 80-cp series tungstens on underground circuits cost per year $39.37.

"As the computed costs include nothing for deductions because of unavoidable outage and as the interest charges were determined on a very close basis, the suggested rates are placed at a slightly higher figure than the costs shown above. The following summary shows what the total charge to the city would be at these rates: Arcs on overhead circuits, 2227 at $55, $122,485; tungstens on overhead circuits, 298 at $27, $8,046; arcs on underground circuits, 1233 at $76, $93,709; tungstens on underground circuits, 51 at $40, $2,040; total, 3809, $226,280.

"The average rate, assuming two tungstens equivalent to one arc lamp, would be $62.25. It appears that the excess of cost of municipal operation over private operation is about $46,873 per year.

"The contract should specify the terms and conditions for the following matters: Period of contract, kind and initial number of lamps, burning schedule, rates for initial lamps of each kind, deduction for outages, rates for additional lamps during early life of contract, rates for additional lamps ordered during last three years of contract period, location of additional lamps, compensation for relocation of lamps, and substitution of different type of lamps.

"What is the cost of electric street lighting now furnished to the city of Milwaukee?

"The total annual operating expenses and unit costs per lamp per year as determined by the commission's apportionment of the operating expenses are shown below on several interest bases: Interest at 7.5 per cent, $175,104, or $75.50 per lamp; interest at 7 per cent, $171,104, or $73.77 per lamp; interest at 6.5 per cent, $167,104, or $72.04 per lamp.

"What would be the costs if 4-amp luminous arcs were substituted for all arc lamps on the system?

"The total estimated annual operating expenses and the unit cost per lamp per year on this basis are as follows for similar rates of interest: Interest at 7.5 per cent, $163,767, or $70.65 per lamp; interest at 7 per cent, $159,872, or $68.97 per lamp; interest at 6.5 per cent, $155,654, or $67.15 per lamp."

# Current News and Notes

ANNUAL MEETING OF THE IOWA ASSOCIATION.—The Iowa Street and Interurban Railway Association will hold its next annual meeting on April 23, 24 and 25, 1914. Mr. H. E. Weeks, of Davenport, Ia., is secretary and treasurer of the association.

* * *

ELECTRICAL INSPECTORS' ANNUAL MEETING.—The ninth annual meeting of the Western Association of Electrical Inspectors will take place in Cincinnati from Jan. 27 to 29, 1914. Mr. William B. Hubbell, First National Bank Building, Cincinnati, Ohio, is the committee of arrangements. Mr. William S. Boyd, 76 West Monroe Street, Chicago, is secretary and treasurer of the association.

* * *

A GOOD DAY'S WORK IN PULLING CABLE.—The *Canal Record* of Ancon, Canal Zone, reports that the force engaged in pulling in cable at the conduits at Miraflores locks established a record on July 25, when 7444 ft. of five-conductor cable and 10,000 ft. of eight-conductor cable was pulled into the ducts in the center wall of the upper locks. This is a total of 17,444 ft., or more than 3 miles of cable in a day of eight hours.

* * *

ST. LOUIS LEAGUE OF ELECTRICAL INTERESTS.—The first meeting of the season of the St. Louis League of Electrical Interests was held at the City Club on Sept. 23. The meeting was turned over to the Jovians, who are in the middle of an active campaign to elect next year's Jupiter. Mr. W. N. Matthews, vice-president of the League of Electrical Interests, is a candidate, and the St. Louis Jovians are backing him enthusiastically.

* * *

STEINMETZ LECTURE IN CHICAGO.—Dr. C. P. Steinmetz of Schenectady, N. Y., is scheduled to deliver his annual Chicago lecture at Fullerton Hall, Art Institute, on the evening of Oct. 29. The subject announced is "Stability and Instability in Electric Circuits." The lecture is to be given at a joint meeting of the Electrical Section of the Western Society of Engineers and the Chicago Section of the American Institute of Electrical Engineers.

* * *

ELECTRIC VEHICLES ECONOMICAL STREET CLEANERS.—The street-cleaning department of Berlin, Germany, employs eighteen battery-driven sprinkling and scrubbing machines, whose total daily operating and maintenance cost is $4.41 each. The daily cost of each of ten horse-drawn machines is $4.57. Each of the electrically driven machines cleans 55,496 sq. yd. in the average eight-hour day, while each horse-drawn machine cleans 44,013 sq. yd. The former therefore accomplish over 26 per cent more work at about 4 per cent less cost or, in other words, are about 30 per cent more economical.

* * *

ANNUAL MEETING OF THE EMPIRE STATE ASSOCIATION.—The annual meeting of the Empire State Gas & Electric Association will be held on Oct. 2 at the Engineering Societies Building, New York. President C. G. M. Thoma will review the work of the past year and offer suggestions for the coming year. Reports of other officers and committees will be made, and the plans for the advertising campaigns of the Society for Electrical Development and of the National Commercial Gas Association will be explained and discussed. Addresses will be made by Mr. Martin S. Decker, chairman of the Public Service Commission of the Second District, New York, and by Mr. M. R. Maltbie, commissioner of the First District. Accident prevention and fire prevention will be discussed at the afternoon session. Mr. C. H. B. Chapin, 29 West Thirty-ninth Street, New York, is secretary of the association.

# Commonwealth Edison System Operating Features

**Sharing by schedule peak loads of 233,000 kw between three great Chicago turbine stations—Work of the load dispatcher in supervision and control**

THE generating equipment of the Commonwealth Edison Company is comprised in three power plants, all of which have been fully described in previous issues of the *Electrical World*. The down-town and southern parts of Chicago are served from the Fisk Street and Quarry Street stations, which have a combined rating of about 200,000 kw. The new Northwest station, which has just completed a year of very successful operation, supplies a rapidly growing demand in the district covered by its name. As will be shown later in the present article, the capacity of all these plants was fully taxed last winter. Extensions are now under way to provide for the future, a 25,000-kw Parsons unit having just been completed in England. This great turbine will soon be erected and before long still larger horizontal Curtis turbines, now being constructed at Schenectady, N. Y., will be ready for installation.

The load on the Commonwealth Edison stations is made up of the demands of the surface and elevated railways and of the company's individual lighting and industrial motor-service consumers. At present the railway component predominates. The annual peak load occurs when the railway, motor and lighting peaks are superimposed, between the middle of December and the middle of January. From this period to midsummer a gradual decline takes place, the load at the low point being about 65 per cent of the winter peak. During the past winter it reached a maximum value of 232,950 kw, and it has since fallen to a minimum of about 160,000 kw in July. From the first of August it has again been rising gradually, but beginning shortly it will rise more rapidly to a winter maximum estimated at 265,000 kw.

The growth in the company's load during the past ten years has been remarkable, having on the average amounted to more than 25 per cent per annum. Judging from the rate at which new contracts are now being signed, this growth will be maintained for some time to come. Only recently the company contracted for 4500 kw of industrial service to a single customer and more large contracts of this kind are in prospect. The railway load also continues to increase rapidly.

### Composite Load Curves

In studying the nature of the load curves the company has for a number of years put them into the form shown herewith, in which form they are known as "composite load curves." They are plotted between the different values of the load and the duration of these loads. The curves



FIG. 1—THE "NERVE CENTER OF THE SYSTEM"—LOAD DISPATCHER'S OFFICE, COMMONWEALTH EDISON COMPANY, CHICAGO, ILL.

show that the total load exceeds three-fourths of its maximum value for but 150 hours during the year, while the energy output above three-fourths load is but 0.3 per cent of the total. This 150-hour peak is, therefore, a very expensive load as to produce it requires an investment of one-fourth the total.

During the last four years the load has exceeded one-

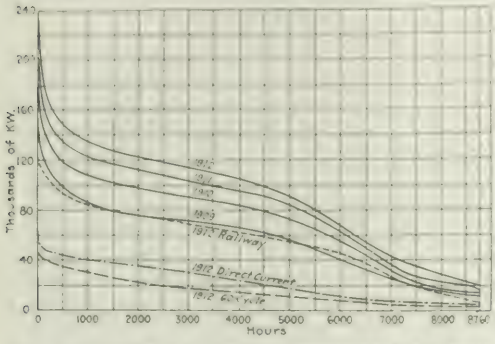



FIG. 2—COMPOSITE LOAD CURVES, COMMONWEALTH EDISON SYSTEM

half the maximum for somewhat less than 200 hours each year and one-quarter of the maximum for about 5300 hours. The curves for four years past show that these figures do not vary much from year to year. Undoubtedly, as the yearly load-factor continues to improve, the duration of the heavier load will increase, but as the load is now quite diversified the change will not be very great.

The total system load is made up of several distinct classes of service as already suggested. The lighting and industrial motor load is, in turn, of two varieties, direct-current service and 60-cycle alternating-current service. Each has its distinctive characteristics, the difference between the direct-current and 60-cycle loads being due largely to the nature of the districts which they supply. The bulk of the direct-current load is confined to the down-town districts, where very little residential lighting is



FIG. 3—BENCHBOARD AND OPERATING GALLERY, NORTHWEST STATION

encountered and where, consequently, the load largely disappears after office hours. In the outlying districts, where alternating-current is furnished, the chief part of the lighting load comes on after the motor load has become negligible. As a result the 60-cycle load has a broader [illegible] This is clearly shown in the curve, where the co[illegible] values for the railway, direct-current and 60-cycle load are given for last year. The 60-cycle load exceeded three fourths of the maximum for 550 hours, while the direct current load did the same for only 160 hours. It is interesting to note that the railway load curve conforms very closely to the characteristics of the direct-current and 60-cycle loads. Its peak is due to the increased traffic mornings and evenings, as well as to the car-heating load in winter. The peaks of these three different kinds of service are fortunately not coincident and, therefore, their sum does not give the total system peak, the diversity factor for different classes of service making itself here clearly evident.

### Division of Load Among Generating Stations

The load on the system is normally divided among the three generating stations, each of which operates under a predetermined schedule arranged in the load dispatcher's office. The only deviations allowed from this schedule are those due to trouble in one generating station or another necessitating special action on the load dispatcher's part. As all three stations are interconnected through tie-lines a schedule of this kind is the most satisfactory manner of regulating the output of each station.

For example, the Quarry Street station feeds normally about 2000 kw into Fisk Street, while another 2000 kw is carried by the Northwest station, which ties in with Fisk



FIG. 4—OPERATING GALLERY IN SWITCH HOUSE, QUARRY STREET STATION

Street by tie-lines in the middle of which the substation load is tapped off. In addition, the Northwest station feeds other substations over direct lines. Between the hours of 5 and 6:30 p. m. only the Northwest station, according to schedule, feeds 4000 kw into Fisk Street. The result of this plan of operation is that all stations have similar load curves and likewise proportional outputs. In case of trouble at one station or another, communication with the load dispatcher results in the issuance of instructions to the other stations to depart from schedule and to carry such additional load as conditions may require.

### Paralleling Through Reactances

At the present time the entire system is operated as one unit, all parts being run in parallel. The paralleling of its different parts, however, is done over system reactors having a total reactive drop of 20 per cent at their rated full load, which is 10,000 kw. These reactors are located at the Fisk Street station. Normally the Fisk Street and Quarry Street stations are operated as an open ring, with the Quarry Street plant in the center and the halves of Fisk Street at each end. The Northwest station is tied in with one of the two parts of Fisk Street but without system reactors. However, when the number of units in operation at Fisk Street is seven or less, the open ring is closed

at Fisk Street, it being separated again when the number of units exceeds seven.

The presence of the system reactance requires the preserving of the identity of each section, as with any large amount of power flowing over the tie-lines a considerable phase displacement results across the reactance. This phase displacement exists also between lines from these different sections, and if such two lines from different sections were closed together in a substation, the system reactance would thereby, in effect, become short-circuited through them. This would result in an extremely heavy cross-circuit between the two sections and the opening of the two lines would be the probable result.

For the above reason differently colored plugs are used to indicate on the load dispatcher's board the extent of each section, and red plugs are used wherever the lines from any two sections may be tied together. If at any time it becomes necessary to tie any two such tie-lines together, the load dispatcher must first adjust load conditions over the corresponding system reactance.

If it is necessary to tie together two lines from the two sections of Fisk Street, the load dispatcher orders the load on both of the Fisk-Quarry tie-lines reduced to zero, or else orders the load equalized in the same direction. If switching is necessary between a line from Quarry Street and a line from either section of Fisk Street, the load on the

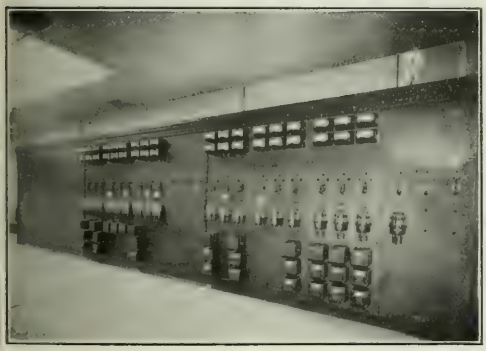


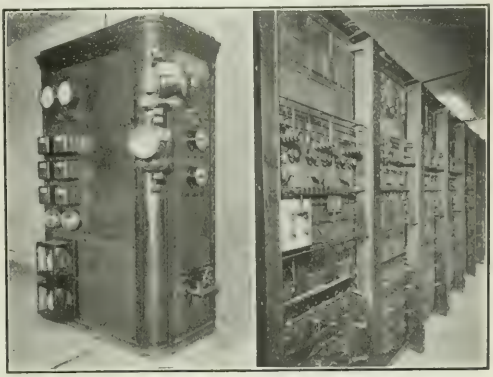
FIG. 5—FRONT OF FEEDER SWITCHBOARD, NORTHWEST STATION

tie-line connecting the Fisk Street section in question with Quarry Street must first be reduced to zero. After the necessary switching has been performed, schedule operation of the different generating stations is again resumed on order from the load dispatcher.

### Switching Operations

Ordinarily the bulk of the high-tension switching is done during the night hours, as at this time the routine high-tension repair work and all other work requiring the removal of important lines from service is in progress. Nevertheless, on a large system like this, work on the high-tension system is almost continually in progress at one point or another, and this, combined with the regular switching during the day required to keep within comfortable limits the temperature on certain heavily loaded lines, furnishes occasion for a considerable amount of switching during the day.

An interesting "kink" resorted to is the "line load-check," which the load dispatcher employs while giving orders for switching operations. If switching is to be done between any two lines, the load dispatcher first obtains a reading of the instruments of these lines. He then gives the order to tie the lines in question together. Except in very rare cases a change in load is observable after the two lines have been tied together, and this serves as a check to the load dispatcher that his order has been properly executed. He then separates the two lines at some other point, thereby completing the desired transfer of load from one line to another. If a load change on the two lines in question is not observed, it is an indication that the two lines have not been tied together, owing perhaps to such conditions as clips being left out of lines or



FIGS. 6 AND 7—AUXILIARY SWITCHBOARD AND REAR OF FEEDER SWITCHBOARD, NORTHWEST STATION

similar causes which can then be readily discovered on a "check-up."

### Repair or Inspection Routine

All apparatus in service is at all times under the direct control of the operating department, and to take any line or unit of any description out of service, there is required what is known as a "load dispatcher's permit." Application for such a permit is made out by the foreman in charge of the work to be done on a certain part of the system and is then forwarded to the starting engineer, who approves it and, in turn, forwards it to the load dispatcher's office after he has appointed a deputy. The load dispatcher then issues a permit for such hours as are most suitable for the performance of the work and returns it to the foreman



FIG. 8—OIL-SWITCH MECHANISM, NORTHWEST STATION

in charge. The latter, upon starting the work, presents his permit to the opertor in charge of the apparatus, who then consults the load dispatcher as to taking the apparatus in question out of service. The operator then disconnects the apparatus in accordance with the load dispatcher's orders. After applying proper safety devices for the protection of the men, he also attaches "hold cards," stat-

ing the time they were placed, the reason for cutting the line out of service, the name of the load dispatcher who ordered the cards placed, and the name of the foreman in charge of the work. Thereupon the foreman is permitted to proceed with the work.

After the work has been completed the foreman and



[illegible] OPERATING MECHANISM FOR 2000-AMP OIL SWITCHES, NORTHWEST STATION

starting engineer report to the load dispatcher that the work is finished, and that the apparatus is ready for service again. The load dispatcher then orders the "hold cards" removed. These are then signed by the starting engineer and sent to the load dispatcher's office. The apparatus is then put back into regular operation. The foregoing is a simplified statement of the most important safeguards provided to protect the men from harm. So far they have given perfect satisfaction.

The process of putting new apparatus into service follows a similar procedure, the basis of which is a "starting engineer's notice." Copies of this are distributed to the various departments through the load dispatcher's office and guide the load dispatcher in putting new apparatus into service without harm to the various departments interested in the apparatus or lines in question.

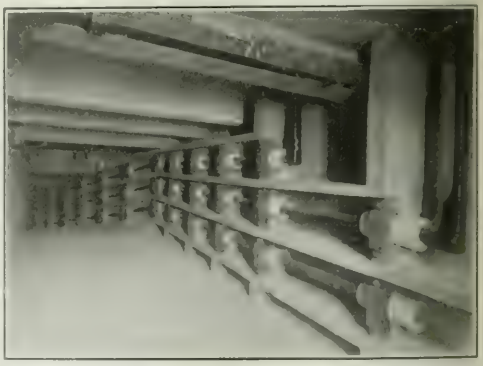


[illegible] ENGINE-GENERATOR UNIT, NORTHWEST STATION

As the load dispatcher must at all times be thoroughly informed in regard to conditions in any part of the system and must have an intimate detailed knowledge of all parts thereof, a complete set of maps is kept in his office, readily accessible at all times. These records show the routes, lengths and sizes of all transmission lines, feeders, circuits and overhead lines. If, for instance, a manhole explosion were reported in any part of the city the load dispatcher could from his maps in a very few minutes have very accurate knowledge of every line, feeder or circuit passing through that manhole. He could at once, therefore, proceed to "kill" all or part of such lines, thereby preventing the trouble from spreading.

As the load dispatcher is responsible for the prompt solution of all problems arising in case of emergency, every facility is afforded him for securing information in the shortest time possible. For this reason a private telephone board, which may be split up into four positions, connects him with all of the different generating stations and substations over leased, direct telephone wires. In case any line or lines should become disabled, connections through the Edison board are also available. By this means the load dispatcher is put in a position to survey the entire system in an intelligent manner and to restore abnormal conditions to normal in the shortest possible time.

Without the load dispatcher's office, which frequently and appropriately has been termed the "nerve center" of the system, the operation of a plant like that of the Commonwealth Edison Company would be practically impossible. The high degree of operating perfection which has



[illegible] GENERATOR LEADS IN CABLE VAULT, NORTHWEST STATION

been attained in the system as a whole is due in large measure to this ingeniously conceived and excellently organized department. The operation of the entire system is under the direct charge of Mr. W. L. Abbott, and the chief load dispatcher is Mr. P. B. Juhnke.

## Baking by Electricity Cheaper than by Gas

To compare the cost of baking with gas and with electricity an officer of the Utah Light & Railway Company, Salt Lake City, recently undertook a test by baking batches of three ordinary domestic loaves of bread, one batch being baked in a modern gas range and the other in a modern Simplex electric range. In each case the time consumed was the same, approximately one hour and five minutes. The results obtained were also practically identical, although the electrically baked bread was browned a little more than the other, since the operator supposed it was necessary to leave the electric oven at "high heat" longer in order to get the same degree of browning.

At the end of the test the electric meter had registered 1.4 kw-hr., which at the net heating rate of 3.6 cents per kw-hr. would cost 5.04 cents. The gas meter had meanwhile registered 60 cu. ft., which at the net heating rate of 90 cents per 1000 cu. ft. would cost 5.4 cents.

# Electrical Service in European Cities

**Wide use of tungsten and flame-arc lamps for street lighting—Tungsten lamps used everywhere to the exclusion of the carbon-filament lamps. By Dr. Louis Bell**

TO an extent that is by no means fully understood by Americans, tungsten lamps are in general use in Europe. To find a carbon lamp one almost requires a search-warrant, and it is the same story in every European city. Competition in lamps, a cheap enough not always first-class product, and no free supply of carbon lamps to encourage false economy in the parsimonious, combine to make the old filament a thing well-nigh forgotten. It is noticeable, too, that the ordinary tungsten lamps in use are rather small, say 40 watts and below. There is no such use of the lamps of 100 watts and above as in America, the practice being to replace carbon by tungsten lamps and let it go at that. Shades are commonly of the most rudimentary character, although now and then one sees some beautiful fixtures with diffusing shades. Here again is the result of cheap lamps. Where there is no great economy in using a few large units, the natural tendency is to put in lamp for lamp and let it go at that. But there certainly is need for illuminating engineering on an all-pervasive scale. As regards the whole lamp matter, the handwriting is on the wall, the universal opinion being that the tungsten lamps will be forced down by competition to the price of the old carbon lamps or very near it, in spite of the fact that 220 rather than 110 must be regarded as the normal voltage.

## Paris

From an electrical standpoint Paris has changed little in recent times. Press-gas, so rampant in London, is used in only one street in Paris, although gas is in evidence everywhere on the side streets, and some of the more important ones, in the usual form of Welsbach burners. In fact, almost the first sign noted was one on the proper use of gas cooking appliances maintained by the gas company. Street lighting has not very greatly changed; it is still accomplished by means of gas and plenty of it, with old open carbon arc lamps rather common except on the most important streets. The Avenue de l'Opéra is extremely well lighted with flame-arc lamps, light yellow ones, and curiously enough of the vertical-electrode long-burning type, which is relatively little used in England. However, with a row of arc lamps spaced at about 30 m on each side of the street, and another row down the center in the isles of safety, any avenue runs a good chance of being thoroughly lighted. The iron posts, by the way, are uniform in type, whether used for electricity or gas.

The price of electrical energy is much higher in Paris than in London, and the appliance business, actively pushed in England, is, from sheer cost, practically undeveloped in the French capital. There is "nothing doing" with energy at 10 cents per kw-hr. or thereabout. In fact, there is very little in Paris central-station practice which is impressive save the very large use of single-phase motors. They are rather largely of the Lalour compensated-repulsion type and seem to be giving satisfaction even in elevator service. I saw an excellent example of a 30-hp single-phase motor at the Laboratoire Centrale which has been in use now for a year, absolutely sparkless and functioning admirably.

In the front of a restaurant on the Avenue de l'Opéra there is made of Claude's beautiful neon-tube lamps. The color, a magnificent orange red, is conspicuous half the length of the avenue and compels one's attention on the moment. Neon of all known gases seems to have the greatest relative concentration of energy in the visible spectrum and consequently is extremely efficient as an illuminant, the latest tubes working approximately at half a watt per candle. Smaller tubes are now being made up into luminous signs and present a most striking appearance.

Transportation from St. Cloud by way of the tramway is a sort of bad dream. One waits for a train much as at home on a half-starved interurban line, and when the thing finally comes trundling along it is a shock. A compressed-air affair it is, with a dingy two-story motor car dragging a similar trailer at a snail's pace. I am glad to be able to report, however, that the wheezy abomination is near its finish, for the line is rapidly being changed over to electric traction. The trolley wires are supported on brackets from poles on the two sides of the street, well to the side, and the cars have very long trolley poles, inclined to one side. The result is that the overhead structure is, on a street blessed with trees, very inconspicuous indeed, and the arrangement is by no means a bad one.

Paris suffers, like many other cities, from an antiquated system not administered with great activity. There are individual points of striking interest without a striking ensemble. Perhaps the most noticeable thing is the way in which metallic-filament lamps are in general use, to an extent greater than in any American city of the first rank. The cost of lamps in the smaller sizes is, thanks to much competition, very low, even down to 20 cents. On the other hand, on account of the same competition, I have good reason to think that the average metallic-filament lamp is rather bad, not at all so excellent as our own in average life and efficiency. The larger sizes seem relatively scarcer than with us, and the half-watt lamp specter has not yet stalked abroad in Paris.

Quartz-tube mercury-vapor lamps are coming into considerable use for industrial purposes, but perhaps their most notable application is to sterilization of water for domestic, chemical and medical purposes. Some large sterilization plants have been erected, and there has been a large output of small apparatus furnishing from 100 liters to 300 liters of sterile water per hour. One of the latter capacity was used with admirable results in the field hospital of the French Morocco expedition. A process for milk sterilization has also been worked out which seems to promise well although not yet in commercial use. All such devices will ultimately add to the load obtainable from general appliances when our central stations get busy.

## Brussels

Brussels, from which I departed on the way to Cologne, has changed little in matters electrical during the past five years. The carbon incandescent lamps have gone, and more flame-arc lamps—white ones of the Blondel type—have come in. Large tungsten lamps are fairly common, and the smaller ones are universal. The Brussels trains are somewhat out of the ordinary in that they are largely on the conduit system, with slot in one track rail, through the center of the city and come in with the trolley pole hooked down but ready for business when they escape from the forbidden territory. They commonly carry trailers

of very diminutive size, so small that one has to shut up like a jackknife to get into them. I can [illegible] judge that the trolley wire is working its way inward, and it may be that the conduit will soon be a thing of the past. Cologne is much further advanced in tramway practice, and on some streets one sees admirably decorative center poles carrying the street lights at the top and the trolley wires on long ornamental arms. We are far ahead of European practice so far as the rolling stock is concerned but have much to learn on the construction of decent-looking overhead work for city streets.

### Cologne

Despite the aspersions of Coleridge, Cologne has become a beautiful, clean city of about 600,000 population, with a very active municipal electric plant having an output of some 40,000,000 kw-hr. annually. Its streets are well lighted, mostly with flame-arc lamps in the center of the city, and, be it written down to the credit of the government, no attempt has been made to light the cathedral except in the usual course of events. I am afraid that were the cathedral in some cities at home the public would not rest until it had turned a search-lamp beam up each of the spires.

One thing is particularly to be noted all along the line—that so far as general use is concerned, the carbon lamp is practically abandoned in Western Europe. While there probably are a good many hidden here and there, they are not used in public places. Competition has made tungsten lamps cheap, and while many of them are far from good, low cost has done its work in forcing them into use. But, since most cities supply cheap gas, I fancy that those who might stick to the carbon lamp from false economy have never been weaned from gas. The chief relic of the electrical old-timers is an occasional open-arc lamp, but even this is a good one, thanks to high-grade electrodes.

### Frankfort

Frankfort is a fine active city possessing an elaborate municipal central station with an annual output of almost 50,000,000 kw-hr. Street lighting is by the usual mixture of flame-arc and gas lamps, but there are some large tungsten lamps on the side. There is, however, lack of the rather common auxiliary gas lamps or incandescent lamps on the arc-lamp poles to take up the work after midnight. Instead, the arc lamps, yellow-flaming ones, are arranged in two alternate circuits, of which one is burned all night, the other only until midnight. In fact, in summer, save on Sundays and holidays, only one circuit is turned on, and that for all night. The theory is not a bad one, that of furnishing light approximately in proportion to the traffic. Such a schedule is likely to run from 3200 to 3300 hours, giving some saving without any real sacrifice.

### Leipzig

In Leipzig I saw a new variety of press-gas, using the air supply under pressure instead of the gas. It was stated to give 1000 hefners per mantle, but there are evidently others beside ourselves who forget to change mantles and shut the eye to the accusing photometer, for some of those mantles reminded me strongly of home.

### Berlin

In Berlin everything is on the jump. The changes in the last five years have been really tremendous. Perhaps the most striking thing is the immense increase in the number of motor taxicabs, the introduction of motor buses on a considerable scale, and the prodigious strengthening of the street lighting. Of course the city fathers, with nearly $25,000,000 of municipal funds in the gas plant, are somewhat addicted to gas, but whatever the source, flame-arc, press-gas, or the humbler inverted mantle lamp, the illumination is well planned and well executed, and there are very few first-class streets at home as well lighted as some of the distinctly second-class streets of Berlin. And the difference is a very simple one indeed—at home we generally try to make an arc lamp illuminate about double the length of street it can really cope with, while in Berlin lamps are installed to do the work thoroughly; and the costs per lamp are not low, at that.

### Munich

Munich is remarkable for a very artistic little steam and water-power station right in the middle of things. Most of the energy, however, is transmitted from works further up the Isar. In Munich is to be seen one of the finest applications of high candle-power incandescents in existence, in the illumination of the Prinz-Regenten Theater. The auditorium, seating over 1200, is admirably lighted by fourteen 1000-hefner-candle tungsten lamps placed close to the ceiling and suitably screened—a very simple and effective arrangement, with lamps practically out of the field of view. Incidentally this theater ought to be seen by every architect in that line of work, for it is far superior to anything known in Europe or America for general suitability and convenience.

### Zurich

There are no carbon lamps in sight; everything is tungsten well maintained. Many big tungsten lamps, up to 1000-hefner-candle, are used on the streets with very admirable results. Most of the arc lamps are of the white-flame type. Everything is in a sort of transitional stage—waiting perhaps for the half-watt incandescent lamp.

### Dresden

Dresden is interesting from the fact that it is using the large incandescent lamps, up to 1000 cp, for street lighting, replacing 8-amp alternating-current flame-arc lamps of the yellow variety. The change has not brightened up the streets, but one must remember that on the whole the lamps in Dresden are spaced rather more widely than is common in European cities, and that the flame-arc lamps were open ones of high efficiency, good for decidedly more than 1000 cp.

### Vienna

Vienna is well lighted, although they still adhere mainly to the old open-arc lamp with plain carbon electrodes of very high quality and sometimes taking as high as 15 amp. On the streets in front of shops there are many yellow-flame arc lamps and also many of the little and intensely brilliant intensified arc lamps. Electric signs are not as common as in Berlin. It would be worth the while of American sign designers to go to Berlin and take a look at things. The German signs are no more ingenious and flamboyant than our own, but they often are most clever in the way of compelling attention.

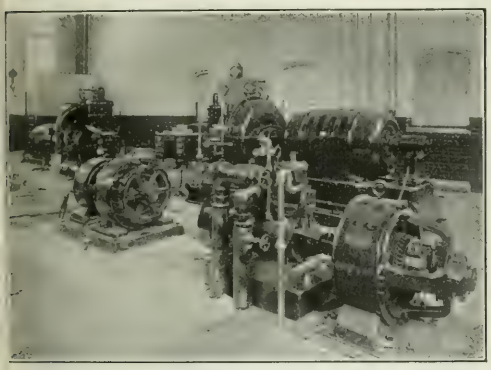
### Cheap Wiring

One of the minor things that give one a sort of awestruck feeling in Germany is the kind of interior wiring utilized. Over and over in good hotels I have seen the same thing—twisted wires that look like lamp cord carried not more than a quarter-inch from walls or ceiling all over the room, supported by tiny porcelain knobs forced between the turns of the wire. It probably represents bed-rock minimum cost in wiring an old building. I am informed that it is not half so bad as it looks, being a good grade of rubber-covered wire. Nevertheless, its appearance is against it, particularly after it has been painted a few times. Of course much new wiring is placed in high-grade conduits, the happy-go-lucky construction being used where gas pipes are taken out and the building equipped for electric light. And, after all, so long as the installation does really work as it is expected to, is it not better to have good tungsten lamps thus supplied than the flickering gas

## A Central Lighting Plant for Rhode Island Textile Mills

The Lonsdale Company, which operates several large textile mills in and about Lonsdale, R. I., has recently put into operation a new steam plant for lighting the Ann and Hope Mill, No. 4 Mill and Bleachery at Lonsdale and the Ashton Mill at Ashton. By this arrangement electrical energy is available for lighting or motor purposes at times when the steam or water-power plants at each mill are shut down. Furthermore, a general system of lighting for the villages can be developed by the company in accordance with the desire of the citizens.

The present generators consist of two Westinghouse turbo-alternators of 250-kva and 375-kva rating respectively. These machines run in parallel at a speed of 3600 r.p.m. and furnish three-phase energy at 2300 volts, 60 cycles. A 10-kw exciter, driven by a small vertical steam engine, is used at starting, and for continuous running a 20-kw motor-generator set is used. The two exciter sets appear in the foreground of the interior view. The turbines operate under a 150-lb. steam pressure and exhaust into a single Le Blanc low-level jet condenser, which is capable of main-



GENERATOR ROOM OF ANN AND HOPE MILL

taining a 26-in. vacuum when handling 14,500 lb. of steam per hour.

The water supply for the station is taken from the canal supplying the mills and flows by gravity to a concrete suction well. From this well the boiler-feed pump can draw if necessary, although when the turbines are running the boiler-feed water is taken from the condenser discharge. Should the condenser stop, however, or fail to supply enough water for the boilers, the feed pump immediately draws from the cold well. This change is provided for by a very simple arrangement of piping and takes place automatically without the manipulation of any valves. Before entering the boilers the feed water passes through a closed heater and a Greene economizer.

The first installation of boilers consists of two vertical Corliss boilers, 85 in. in diameter, rated at 223 hp each, good for 185 lb. pressure. These are set on 10-ft. centers and space is provided for two more. Draft is furnished by a brick chimney, 125 ft. high and 5 ft. in diameter, built after the characteristic design of the engineers, who were Messrs. Lockwood, Greene & Company, of Boston, Mass.

The power house is built of red brick and measures 69 ft. by 55 ft. outside, the space being about equally divided between the generator and boiler rooms. There is a high basement under the turbine room used for the condenser, heater and pumps. Ample provision has been made in the building and in the size of the chimney for adding equipment up to double the rating of the present installation. Coal is received on railway cars and dumped into a pocket close to the boiler house, from which it is wheeled across a concrete slab to the firing floor.

The general contractor for the buildings was Mr. William Williams, of Providence, R. I.

## Central-Station Construction-Cost Data

In connection with the completion of recent improvements in the plants and systems of several of the Tenney central-station companies in Massachusetts, the following cost data have been obtained. The data are somewhat miscellaneous in character, but can easily be segregated for the compilation of loose-leaf estimate sheets. The companies drawn upon are the Haverhill Electric Company, Malden Electric Company, Fitchburg Gas & Electric Company and Suburban Gas & Electric Company of Revere.

MISCELLANEOUS CENTRAL-STATION CONSTRUCTION DATA

| | |
|---|---|
| *Sea Wall for Haverhill Station, on Merrimac River.* | |
| Granite wall, rough cut stone, backfilled with earth filling; length, 410 ft.; width, 14 ft. to 18 ft.; height, 25 ft.; area, 6329 sq. ft. Cost of material and labor, $17,500; miscellaneous, $1,215; total | $18,715.00 |
| *Stock House Vault, Haverhill.* | |
| Built of brick, two stories, 8 ft. by 10 ft. inside dimensions, 8-in. outer wall, 2-in. air space and 8-in. inner wall. Cost, $580; doors, wiring, shelves, etc., $350.08; total cost | 930.08 |
| *New Generating Unit, Haverhill.* | |
| One 25-kw steam turbine arranged for direct connection and mounted on common bedplate, including one No. 16 Westinghouse LeBlanc condenser and electric generator; erected complete, Westinghouse Machine Company | 31,639.00 |
| *Miscellaneous Steam and Electric Plant Equipment, Haverhill.* | |
| One 9-in. by 12-in. by 10-in. duplex piston-pattern pump, brass-lined pump cylinders, Tobin bronze piston rods, composition pump pistons, brass valve seats, medium-hard rubber valves for cold water and high lift | 405.00 |
| Foundation, pipe connections, etc | 401.39 |
| One Sarco $CO_2$ recorder | 326.80 |
| One 6-ft. by 21½-ft. Scannell return tubular boiler removed from service; first cost complete, erected | 2,607.30 |
| One 3125-kva, 60-cycle, three-phase, 2300-volt Westinghouse turbo-generator | 9,227.87 |
| Switchboard apparatus | 955.38 |
| Cable | 248.52 |
| Air duct | 408.80 |
| Four 60-lamp, 60-cycle, 220-volt, 2.75-amp air-cooled, constant-current transformers | 1,040.00 |
| Four series arc oil switches, 9E, type F, form 2, 2.10 amp, 1200 volts | 224.00 |
| Ten 25-ft. ornamental arc-lamp poles ($38 each) | 380.00 |
| Sixty-eight 30 ft. chestnut poles, painted and shaved ($5.56 each) | 377.86 |
| 140 35-ft. chestnut poles, painted and shaved ($7.55 each) | 1,054.14 |
| Nineteen 40-ft chestnut poles, painted and shaved ($8.75 each) | 166.80 |
| One 50-ft. chestnut pole, painted and shaved | 10.50 |
| One 60-ft. chestnut pole, painted and shaved | 18.75 |
| 15,820 ft. (6252 lb.) No. 0, triple-braided, weather-proof, solid wire, at 14.2 cents per lb | 889.22 |
| One 30-in. Lumsden & Van Stone steam-exhaust head | 189.00 |
| One 16-in. Standard twin strainer, No. 684 | 428.63 |
| *Transformers, All 60-Cycle Equipment.* | |
| Nineteen 1-kw 2200-1100-volt primary, 220-110-volt secondary, single-phase, each | 17.06 |
| Eight 1½-kw 2200-1100-volt primary, 220-110-volt secondary, single-phase, each | 23.13 |
| Twenty-seven 2½-kw 2200-1100-volt primary, 220-110-volt secondary, single-phase, each | 30.68 |
| Thirty 5-kw 2200-1100-volt primary, 220-110-volt secondary, single-phase, each | 49.43 |
| Six 7½-kw 2200-1100-volt primary, 220-volt secondary, single-phase, each | 65.17 |
| Six 10-kw 2200-1100-volt primary, 575-volt secondary, single-phase, each | 80.95 |
| Three 15-kw 2200-1100-volt primary, 575-volt secondary, single-phase, each | 110.67 |
| One 20-kw 2200-1100-volt primary, 575-volt secondary, single-phase, each | 137.14 |

| | |
|---|---|
| [illegible] | $173.86 |
| | 183.82 |
| | 252.70 |
| | 310.88 |
| *Meters* | |
| Sixty-seven 5-amp. 110-volt Fort Wayne type "K3," each | [illegible] |
| 546 10-amp. 110-volt Fort Wayne type "K3," each | [illegible] |
| [illegible] Fort Wayne type "K3," each | 13.00 |
| Thirty-three 25-amp. 110-volt Fort Wayne type "K3," each | 13.00 |
| Twenty-one 50-amp. 110-volt Fort Wayne type "K3," each | 18.68 |
| One [illegible] Fort Wayne type "K3" | 27.00 |
| Two 400-amp. 110-volt Fort Wayne type "K3," each | [illegible] |
| Twenty 5-amp. 550-volt Fort Wayne type "K3," each | 32.80 |
| Sixteen 10-amp. 550-volt Fort Wayne type "K3," each | [illegible] |
| Three 15-amp. 550-volt Fort Wayne type "K3," each | 34.80 |
| Thirteen 25-amp. 550-volt Fort Wayne type "K3," each | 35.84 |
| Six 50-amp. 550-volt Fort Wayne type "K3," each | 39.60 |
| One 150-amp. 550-volt Fort Wayne type "K3," each | 66.26 |
| One 200-amp. 550-volt Fort Wayne type "K3," each | 51.60 |
| [illegible] | 5.78 |
| Six 75-amp Wright demand meters, each | 7.80 |
| *Power Plant Equipment Incidentals* | |
| [illegible] | [illegible] |
| [illegible] | $4.00 |
| [illegible] | 24.19 |
| Pipe, fittings and material | 30.57 |
| [illegible] | [illegible] |
| [illegible] ($85.19 per meter) | $295.90 |
| [illegible] | $4.00 |
| Labor of installing above | 4.38 |
| Miscellaneous material, gate valves, pipe, etc | 10.40 |
| [illegible] | [illegible] |
| Total ($117.58 per regulator) | $352.[illegible] |
| Two Murphy automatic smokeless furnaces | $3,[illegible] |
| Installation of above | 2[illegible] |
| One 5-hp. 550-volt motor | 3[illegible] |
| Miscellaneous material and labor, oil pan, steel spur, etc | 2[illegible] |
| [illegible] | [illegible] |
| Total ($1,661.37 per stoker) | $3,322.74 |
| One 13-ft. by 5-ft. straight-blade Sturtevant exhaust fan with engine | $7,220.00 |
| Piping for above | 664.74 |
| Labor and material | 1,782.83 |
| [illegible] | [illegible] |
| Total cost of fan installed | $9,667.57 |
| One Sturtevant economizer, 360 tubes, 10 ft. long. Total [illegible] sq. ft. | $5,240.00 |
| Foundations | 450.00 |
| One 5-hp motor, including labor | 262.00 |
| Miscellaneous material, including pipe, fittings, etc | 1,418.94 |
| [illegible] | [illegible] |
| Total ($1.50 per sq. ft. heating space) | $7,370.94 |
| *Overhead Lines, Poles and Fixtures, Incidentals* | |
| Ninety-three fixtures, each equipped with four 60-cp. 6.6-amp series incandescent lamps, connected to underground arc system through 1-to-1 transformers and mounted on local street-railway feeder poles | $1,860.00 |
| Labor of installation | 1,088.67 |
| Cable and wire | 1,838.61 |
| Miscellaneous material, cross-arms, cut-outs, pipes, etc | 1,419.58 |
| [illegible] | [illegible] |
| Total ($66.50 per fixture) | $6,206.86 |
| *Miscellaneous Power Plant Equipment* | |
| One steel structure, forced-draft cooling tower, 2000-kw capacity, complete with foundations | $14,551.47 |
| One Parsons ash ejector, installed, with 16-ton ash tank | 2,173.22 |
| Four Kibbs safety feed-water regulators with 2½-in. valves | 340.00 |
| Cost of installing above regulators | 103.65 |
| One 5-amp. three-phase, 115-volt wattmeter | [illegible] |
| One three-phase G. E. electrostatic ground detector | 115.51 |
| Three 500-kw indoor-type, oil-cooled 13,200-volt transformers | 4,325.00 |
| One 15,000-volt aluminum lightning arrester | 477.75 |
| 400 ft. 400,000-circ. mil. flame-proof cable for 5000 volts | 158.70 |
| *Miscellaneous Underground Work* | |
| 27,395 ft. 2½-in. fiber conduit | $923.87 |
| 100,830 ft. 3½-in. fiber conduit | 4,304.21 |
| [illegible] | 48,297.00 |
| [illegible] | [illegible] |
| [illegible] | [illegible] |
| [illegible] | [illegible] |
| 24,806 ft. No. 00, three-conductor cable for [illegible] | 1,210.83 |
| [illegible] | [illegible] |
| Total cost to Revere line | [illegible] |

| | |
|---|---|
| *Revere Underground Work* | |
| 22,751.5 ft. No. 00 cable | $1,[illegible] |
| [illegible] No. [illegible] cable | 1,[illegible] |
| [illegible] cable | 12,[illegible] |
| Cost of drawing in above 147,768 ft. cable | [illegible] |
| [illegible] Wire [illegible] | [illegible] |
| Labor, company's employees | 519.20 |
| Miscellaneous items, freight, tape, asbestos [illegible] | [illegible] |
| [illegible] | [illegible] |
| [illegible] | $50,[illegible] |
| Liability insurance, miscellaneous materials, labor of employees, etc., on general work | 3,865.30 |
| Total additions to underground system | 142,723.28 |
| *Revere Miscellaneous Work.* | |
| Driving 106 ft. 2.5-in. galvanized-iron pipe for cable grounding, at contract rate of $1.75 per ft | $189.14 |
| [illegible] labor and material including cost of pipe | [illegible] |
| [illegible] | [illegible] |
| Total | $[illegible] |
| *Revere, Miscellaneous Costs.* | |
| One 68-ft. by 58-ft., one-story cement and brick, steel-trussed garage: building, $5,300; trusses, $566; miscellaneous, $1,413.03 (including labor, $348.91) | $7,279.03 |
| (Included in above one 40 gal. chemical extinguisher on wheels, $144) | |
| 40,000 ft. duct; 3½-in-1½-in. socket joint conduit | 1,895.25 |
| Thirty manholes | 572.50 |
| Nineteen 500-watt sign-lighting transformers, at $10.67 each | 202.67 |

## Search-Lantern on Observation Car

An additional attraction to railroad travel has been made by the Chicago, Milwaukee & St. Paul Railway Company, which has installed a search-lantern on the train known as the "Fast Mail," leaving St. Paul and Minneapolis every evening for Chicago. The lamp is mounted on the observation-car platform at the end of the train and is in charge of an experienced operator. It provides a means by which the passengers on the train can view the scenery after nightfall. The "St. Paul" railroad runs parallel to the Mississippi River for over 100 miles. The boats, curious rock formations and the features of the landscapes come out clearly in a very interesting manner by the use of the search-lantern.

The search-lantern is 13 in. in diameter and stands on a pedestal 52 in. high over all, taking up 16 sq. in. of floor



SEARCH-LANTERN MOUNTED ON PLATFORM OF OBSERVATION CAR

area on the observation-car platform. The electrodes are 0.5 in. and 0.625 in. in diameter and were made by the General Electric Company especially for search-lantern work. They are placed horizontally and operate automatically after being focused. The lamp is built to operate on the standard 60-volt train-lighting circuit and requires 20 amp. The lantern can be swayed 90 deg. horizontally and 45 deg. vertically. It is said to make objects visible [illegible] miles.

# Central Station Management

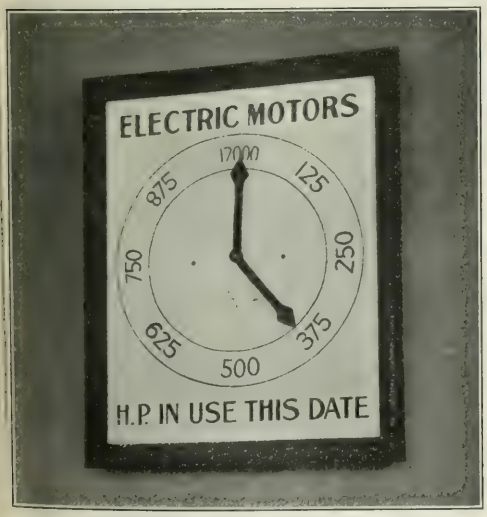
**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Advertising on Envelopes

Many business houses use the backs of envelopes to convey advertising messages, and among them is the Citizens' Electric Company, which supplies electrical energy in Hot Springs, Ark. This company uses envelopes for its business correspondence on which the name of the company does not appear, the return card simply mentioning the name of the city and the number of the post office box. On the back of the envelope, however, is conspicuously printed the following legend: "Do it electrically. Employ a silent salesman. Cost is surprisingly low. Trade comes your way and comes to stay if you use a tungsten electric sign, the modern business getter." The Citizens' company was practically burned out in the big Hot Springs fire of Sept. 5, but it was hoped to resume operation by Sept. 20.

## Displaying the Connected Motor Load

The Worcester (Mass.) Electric Light Company has an effective way of calling the attention of visitors in its offices to the growth of the company's motor load, as illustrated in the accompanying half-tone. Attached to the wall at the right of the counter where bills are paid is a 26-in. by 32-in. frame equipped with a 20-in. clock dial graduated in steps of 125 hp from 1 hp to 1000 hp. At the top of the dial is a slot displaying the motor load in thousands of hp,




DEVICE USED TO DISPLAY CONNECTED MOTOR LOAD

and each day the "hour hand" and "minute hand" of the dial are checked and corrected to the total connected motor load on the system. The rear of the dial is provided with an adjustable disk calibrated for large increases in motor load. The illustration shows a motor load of 12,375 hp, a growth of about 7238 hp in the past fourteen months.

## Washing-Machine Campaign at Elwood, Ind.

A window display which shows how to save labor in the home is in itself always attractive to housewives, but if the interest of the children can be separately enlisted the mothers will be dragged to the window by their youngsters to wait till the little folks have feasted their eyes on the wonderful sights therein. Such was the washing-




WINDOW DISPLAY OF WASHING MACHINES

machine display recently used in the window of the Elwood Electric Light Company at Elwood, Ind., a town of 11,000 inhabitants. The two lay figures, one with an old washing machine and the other using the new motor-driven type, pointed out the way to make the Monday washing an easy task, while in the foreground two miniature electric trains operating from a third-rail industriously plied back and forth on the figure-eight track. On the miniature pole line the type of overhead construction adopted by the American Gas & Electric Company's properties was rigidly followed, white, brown, blue and yellow beads being used to distinguish primary circuits, secondary circuits, arc-lamp circuits and ground wires respectively, as in the Elwood company's own outdoor plant. The electric trains, of course, were a never-failing source of interest to the younger generation and were the cause of many women stopping to look at the display who would otherwise have hurried past with but a casual glance.

Attention was called to the window display by newspaper advertising in the local papers, and while the subject was before the minds of the citizens solicitors followed up the opportunity, with the result that about thirty washing machines were sold in less than four months. Mr. Oscar Halderman is contract agent for the Elwood company.

## Central-Station Service for St. Louis Office Buildings

The sales department of the Union Electric Light & Power Company of St. Louis, under the energetic direction of Mr. F. D. Beardslee, is meeting continued success in its effort to supply electrical energy to the prominent office buildings in St. Louis. The Monward Building, now under construction, will be on the electric-service company's cir-

cuits. It will have a connected load of about [illegible] with a probable demand of about 250 kw. Other buildings recently taken over by the central-station company are those of the Title Guarantee Trust Company, the Hargadine-McKittrick Dry Goods Company, the Pierce Building, the National Bank of Commerce, the Chemical Building and the Central National Bank Building. The total connected load in all these buildings is about 2500 kw. Where isolated plants exist in buildings taken over the central-station company operates them in winter for generating electricity up to the heating requirements of the building. Eleven isolated plants are operated by the central-station company in winter in this manner.

## Tungsten-Pendant Campaign at New Orleans

Nearly 3000 tungsten pendants have been added to the lines of the New Orleans Railway & Light Company, according to Mr. W. E. Clement, contracting agent, by means of the rental campaign now under way in the Louisiana city. The fixtures, each complete with an opal ball and a tungsten lamp of 150 watts to 500 watts rating, are leased to customers at a rental of 30 cents per month, which includes free renewals and weekly inspection and cleaning.



TUNGSTEN PENDANTS FOR DEPARTMENT STORE LIGHTING, NEW ORLEANS, LA.

Where possible the customer is asked to sign a six-month contract. In installing the lamps the company will run the few feet of wiring necessary to reach the customer's circuits free of charge. In addition to the monthly rental, 30 cents for each pendant, the customer also pays for the energy consumed at the regular metered rate, which averages 8 cents per kw-hr. Assembled complete the cost to the company of these tungsten-pendant fixtures has averaged $3 each. The accompanying illustration shows a number of the tungsten pendants installed in the department store of D. H. Holmes & Company, on Canal Street, between Dauphin and Bourbon Streets, New Orleans.

## The Effect of Courtesy in Delinquent Notices

As a last resort customers' services must sometimes be [illegible] Mr. [illegible], superintendent of the Edison Sault Electric Company, Sault Ste. Marie, Mich., cited before the recent Michigan convention an instance of the value of courteous language, even in "cut-off" notices. The electric-lighting company he referred to formerly cut off all delinquent accounts thirty days old, serving such customers with an abrupt cut-off notice quickly succeeding a second notice on the 15th of the month. Receipt of these forms caused much irritation and dissatisfaction, and under this system twenty to thirty customers were cut off each month.

> TO AVOID DELAY, PLEASE BRING THIS BILL
>
> You possibly overlooked your electric light bill, which should have been paid before the 15th inst., so we respectfully remind you of it and request that you see that payment reaches us by the 21st inst.
>
> Very truly yours,
>
> _____ _____.

FORM OF DELINQUENT NOTICE

Some time ago, however, the system was changed, the second notice sent out on the 15th of the month being in the improved form reproduced herewith. On the 23d all doubtful customers are next sent statements giving warning of impending cut-off, but worded in the courteous and respectful form shown. Before actually cutting a customer's service off, however, he is always telephoned to or seen by the collector. Under the new plan much more friendly feeling has been engendered. Rarely are more than four or five accounts now cut off each month, and half of these are usually persons who have simply "jumped town."

> TO AVOID DELAY, PLEASE BRING YOUR BILL
>
> We again respectfully call your attention to your lighting account, which is past due. Kindly favor us with an immediate settlement. If we do not hear from you by the.....inst., we will assume that our service is no longer desired and shall discontinue same without other notice. A charge of 50 cents will be made to cover the cost of reconnecting where service is discontinued for non-payment.

FORM OF CUT-OFF WARNING NOTICE

## Technical Magazines and the Small-Plant Manager

Pointed advice to operators of small electric-light companies was given by Mr. E. G. Robinson, of Arlington, Wash., himself a manager in a town of 2000, at the recent convention of the Northwest Electric Light & Power Association, Seattle, Wash. Concluding an interesting paper on the problems of operation with restricted facilities and staff, he said:

"First, I believe that a successful manager of a small plant must be an engineer and that he should have had a varied and broad experience. The thing that is of prime importance is service. Your service must be faultless or as nearly so as possible. Many are the times in my early experience I fought hot bearings with tallow, graphite grease, oil, cold water, hot water and soap, etc., but in nearly every case we kept the lamps going. A lazy man or one who won't work when the occasion demands had better not tackle a small plant. Untiring energy is the price of other than mediocre success. There is no argument so effective to keep your men in line as the knowledge that you know the business from alpha to omega, and that if occasion requires you can run the steam plant and right any part of it; that you can put on climbers and hike any pole, or, in short, can do and will do any of their work.

"The manager of such a plant should keep up to date

on the latest and best lighting units and equipment. He should take several of the leading magazines and spend all spare moments in looking over these and use them for reference. To show a customer in a leading technical magazine the solution of some motor problem or some type of lamp installation is a strong and effective argument if it fits the case.

"Another thing which I believe is necessary is the absolute authority of the manager. I have seen plants where the manager was afraid to make any kind of a definite stand for fear the president or some other officer would reverse him or interfere. This condition is certainly deplorable and must result in disrespect for the manager and havoc in the organization. A man with gelatinous spine has no business to be in a position of authority in the electric-light business. He must have a keen appreciation of right and wrong and justice, and have the courage of his convictions. One must be able to discern between the person who has been honestly misled and thinks he has been wronged and the one who is a knave and a deadbeat and needs to be jumped all over roughshod and made to know that his game won't work. One should not be afraid of making an enemy if he is right. 'Be sure you are right, then go ahead.' A well-chosen enemy is often a man's best asset. My enemies have done a great deal to make me some very close and valuable friends.

"To be happy one must keep busy. There are a great many little things that come up which, though not strictly in line with a manager's duties, he can attend to probably better than any one else. Often a customer likes to know that the manager takes a personal interest in his troubles and his wants. This attending to many of the details takes one over the town and offers opportunities to inspect the various parts of the system. Make your customer know that you are vitally interested in his welfare and that you want him to have the rate that suits his circumstances.

"Remember you are a public servant and you are to look to the public for your business. Your personality will go far to making your business a success if you cultivate a spirit of co-operation and forbearance, but know when to draw the line and call a halt. Don't be imposed upon. You must serve two masters. One is the company that employs you and expects to have you make a reasonable profit on the investment, the other the public, to whom you must give value received."

## Costs of One Year's Electric Cooking and Heating

Detailed costs of electric cooking and heating in an apartment of six rooms, a bath and a kitchen, occupied by a household of six persons; were presented by Prof. J. T. Morris in a paper read before the British Association for the Advancement of Science, Birmingham, Sept. 10, and abstracted in the following paragraphs.

In general, declared the author, the experience of those who have tried electric cooking has brought out these facts:

(1) Joints of meat and steak are cooked better by electricity than by other means, the electric method requiring also a shorter period of training to enable the attendant to secure good results.

(2) The heavy work in the kitchen is largely reduced, owing to the fact that there is less coal to be handled and there is no kitchen range to be cleaned and polished every morning.

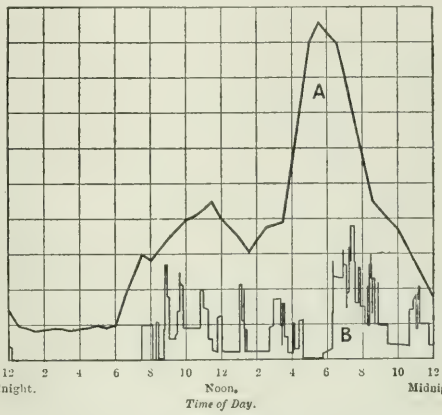
(3) The certainty that if the same time is given for the same operation exactly the same result will be produced.

(4) The convenience and cleanliness and the avoidance of an unhealthful hot atmosphere in the kitchen.

It must be admitted, however, that difficulty is experienced in the supply of hot water in large quantities, as for washing and for baths, where either the electric cooker or the ordinary gas cooker is used. Another difficulty is the heating of the kitchen in cold weather.

In the experiments quoted herewith the equipment used consisted of the Jackson (Marylebone) apparatus which is listed in Table I, with the average energy consumption per hour for each unit part.

The hot-water supply was obtained from a coke boiler, 32 in. high, 14 in. wide and 14 in. deep. As it was not large, it was set in a recess and gave very little trouble. It required lighting in the morning and stoking with coke two or three times a day, and burned practically any kind of rubbish. When electric cooking is used it is found that the kitchen is a much more healthful place. The extra warmth required in winter can be obtained from the coke




CURVES COMPARING STATION LOAD WITH CUSTOMERS' COOKING, HEATING AND LIGHTING DEMANDS

boiler by leaving its doors open, though naturally it is not then so efficient for heating water.

Tables II and III give the number of kilowatt-hours used each week and each day for five or six persons for a period of ten months. It will be seen that, neglecting exceptional cases, this quantity varies from 5 kw-hr. to 15 kw-hr., depending on the amount of cooking required. The "record" consumption, which occurred Dec. 16, was due, as might be guessed, to the Christmas pudding. The average daily consumption over the whole period was 9.75 units, which, at one half-penny or one cent per kw-hr., would amount to less than 10 cents per day.

TABLE I—HOURLY CONSUMPTION OF COOKING APPARATUS

| | Kilowatt hours Consumed per Hour | | |
|---|---|---|---|
| | Low | Medium | High |
| Hot-plate for boiling | 0.36 | [illegible] | [illegible] |
| Hot-plate for boiling | 0.36 | [illegible] | [illegible] |
| Hot-plate for simmering | 0.24 | [illegible] | [illegible] |
| Grille | | | [illegible] |
| Oven, 36 in. high, 30 in. wide and 24 in. deep | [illegible] | [illegible] | [illegible] |

Over the same period of ten months the quantity of coke used was six chaldrons, costing $22.75, which, taking into account the wood needed to light the fire each morning, comes out at 8 cents per day. Hence the running costs for electrical energy to the cooker and for the supply of hot water for all household purposes amounted to less than 18 cents per day.

ing are smaller than they would otherwise have been. Further, it should be remembered that these gas-gas gas gas-

cooking, heating and lighting load does not reach its maximum at the same time as that at which the peak load of the generating station occurs.

As to safety in use, it may fairly be claimed that of the

TABLE II.—DAILY ENERGY CONSUMPTION FOR COOKING AND LIGHTING, SEPT. 29, 1912, TO JULY 27, 1913

| Week Ending | October, 1912 | | | | November, 1912 | | | | December, 1912 | | | | January, 1913 | | | | February, 1913 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6 | 13 | 20 | 27 | 3 | 10 | 17 | 24 | 1 | 8 | 15 | 22 | 29 | 5 | 12 | 19 | 26 | 2 | 9 | 16 | 23 |
| Sunday | 3 | 5 | 10 | 11 | 62 | 56 | 72 | 61 | 60 | 60 | 56 | 50 | 48 | 65 | 71 | 71 | 71 | 62 | 70 | 70 | 70 |
| Monday | 10 | 9 | 10 | 11 | 11 | 46 | 11 | 11 | 11 | 10 | 11 | 14 | 15 | 14 | 15 | 14 | 14 | 13 | 13 | 13 | 13 |
| Tuesday | 3 | 3 | 4 | 4 | 5 | 5.5 | 5 | 5 | 5 | 5 | 5.5 | 5 | 6 | 6.2 | 6 | 6 | 6 | 5.5 | 5 | 5 | 4 |

| Week Ending | March, 1913 | | | | | | | April, 1913 | | | | May, 1913 | | | | June, 1913 | | | | July, 1913 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 | 9 | 16 | 23 | 30 | 6 | 13 | 20 | 27 | 4 | 11 | 18 | 25 | 1 | 8 | 15 | 22 | 29 | 6 | 13 | 20 | 27 |
| Sunday | 65 | 68 | 68 | 72 | 72 | 70 | 68 | 68 | 68 | 68 | 84 | 79 | 90 | 80 | 73 | 66 | 52 | 78 | 55 | 56 | 70 | 63 |
| Monday | 10 | 50 | 61 | 92 | 93 | 96 | 82 | 79 | 48 | 50 | 55 | 65 | 62 | 1 | 4 | 3 | 2 | 2 | 1 | 5 | 4 | 3 |
| Tuesday | 5 | 6 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4.5 | 4.2 | 5 | 3.2 | 3.4 | 3 1 | 2.4 | 3.2 | 3.3 | 3 | 3 | 3 3 |

Week Average 8.5 Cooking, 18.5 Heating, 6.0 Lighting.

in the flat. The maximum weekly consumption for heating is 129 kw-hr., and this was due to the presence of visitors.

For lighting the maximum weekly consumption was 6.5 kw-hr., costing 6.5 cents per week. It is interesting to note that this amount is insignificant in comparison with that of the annual charge, but it should be remembered that this annual charge covers all uses of electricity, though based on the maximum possible lighting load.

In comparing this method of heating and cooking with methods in which coal is used, it must be borne in mind that a saving of from $125 to $150 has been made in the cost of domestic service, and therefore on the above tariff it is an indisputable fact that a considerable gain has been made on the score of economy, cleanliness and independence.

A typical load curve is given herewith showing the total

three most common methods of cooking food the electric cooker is, when properly installed, by far the safest. There is no chimney to get on fire, nor is there danger from stray cinders, or of explosions, unpleasant fumes or "firing back."

Following is a statement of the individual charges which go to make up the total expenditure throughout the year from July 27, 1912, to July 26, 1913:

| | |
|---|---|
| Annual charge | $5 [illegible] |
| Rental of meter, at $0.75 per quarter | [illegible] |
| Cooking, 2068 kw-hr., at 1 cent per kw-hr | 20 [illegible] |
| Heating, 2068 kw-hr., at 1 cent per kw-hr | 20.65 |
| Lighting, 200 kw-hr., at 1 cent per kw-hr | 2.00 |
| | $99 52 |
| Coke and wood | 22 [illegible] |
| Total | $122 2 |

TABLE III.—DAILY ENERGY CONSUMPTION FOR COOKING, IN KW-HR., FOR THE PERIOD SEPT. 29, 1912, TO JULY 26, 1913

| Week Ending | October, 1912 | | | | November, 1912 | | | | December, 1912 | | | | January, 1913 | | | | February, 1913 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5 | 12 | 19 | 26 | 2 | 9 | 16 | 23 | 30 | 7 | 14 | 21 | 28 | 4 | 11 | 18 | 25 | 1 | 8 | 15 | 22 |
| Sunday | [illegible] | 4 | [illegible] | 5 | 5 | [illegible] | [illegible] | [illegible] | 8 | 5 | 5 | [illegible] | 6 | 5 | 6 | 6 | 7 | 7 | 5 | 6 | 12 |
| Monday | [illegible] | [illegible] | 9 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 36 | [illegible] | [illegible] | 6 | 8 | 13 | 6 | [illegible] | [illegible] | [illegible] |
| Tuesday | 12 | 11 | 14 | 13 | 9 | 11 | 12 | [illegible] | [illegible] | 14 | [illegible] | 17 | 10 | [illegible] | 12 | 13 | 13 | 9 | 6 | [illegible] | [illegible] |
| Wednesday | [illegible] | 11 | 11 | 6 | 13 | 14 | 13 | [illegible] | 9 | [illegible] | [illegible] | [illegible] | 13 | [illegible] | 8 | 9 | 12 | 10 | 6 | [illegible] | [illegible] |
| Thursday | 9 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 11 | [illegible] | [illegible] | [illegible] | 9 | 6 | 11 | 12 | 10 | [illegible] |
| Friday | 15 | 6 | [illegible] | [illegible] | 11 | [illegible] | [illegible] | 13 | [illegible] | [illegible] | [illegible] | [illegible] | 13 | 11 | 13 | 11 | 9 | 12 | 10 | [illegible] | [illegible] |
| Saturday | 14 | 12 | 14 | 12 | [illegible] | [illegible] | [illegible] | 12 | [illegible] | 12 | 13 | 13 | 6 | 13 | 12 | 14 | 17 | 17 | 12 | [illegible] | 12 |
| Weekly total | 72 | 57 | 76 | 61 | 62 | 65 | 72 | 75 | 63 | 62 | 66 | [illegible] | 50 | 48 | 65 | [illegible] | 77 | 72 | 60 | [illegible] | [illegible] |

| Week Ending | March, 1913 | | | | | April, 1913 | | | | May, 1913 | | | | June, 1913 | | | | July, 1913 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 8 | 15 | 22 | 29 | 5 | 12 | 19 | 26 | 3 | 10 | 17 | 24 | 31 | 7 | 14 | 21 | 28 | 5 | 12 | 19 | 26 |
| Sunday | [illegible] | [illegible] | [illegible] | 9 | 8 | 6 | 8 | [illegible] | [illegible] | [illegible] | [illegible] | 13 | [illegible] | 15 | 8 | 8 | [illegible] | 8 | 8 | [illegible] | [illegible] | [illegible] |
| Monday | [illegible] | 8 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 13 | 10 | [illegible] | [illegible] | [illegible] | 10 | 10 | 8 | 6 | 9 | 7 | [illegible] | [illegible] | [illegible] |
| Tuesday | [illegible] | 15 | 10 | 11 | 10 | 12 | 11 | 10 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 11 | [illegible] | 15 | 8 | [illegible] | [illegible] | [illegible] |
| Wednesday | [illegible] | 10 | [illegible] | 12 | 12 | 12 | 11 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 14 | 11 | 10 | 2 | 9 | 9 | 13 | [illegible] | [illegible] |
| Thursday | [illegible] | [illegible] | 14 | [illegible] | [illegible] | 10 | 11 | 15 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 11 | [illegible] | 11 | 10 | 14 | 8 | 10 | [illegible] |
| Friday | [illegible] | [illegible] | 10 | [illegible] | 8 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 11 | 14 | [illegible] | [illegible] | 10 | 10 | 11 | 11 | 13 | [illegible] | 9 | 10 |
| Saturday | 11 | 14 | 10 | 15 | [illegible] | 11 | 15 | 11 | [illegible] | [illegible] | [illegible] | 15 | [illegible] | 14 | 14 | 9 | 10 | 10 | 9 | 11 | 12 | [illegible] |
| Weekly total | [illegible] | 69 | 66 | 74 | 71 | 69 | 81 | 66 | 62 | [illegible] | 84 | 81 | [illegible] | 86 | 72 | 68 | 50 | 78 | 56 | 57 | [illegible] | [illegible] |

[illegible] for all electrical purposes in the flat on [illegible] day, Jan. 20, 1913 (weather, fair; temperature 45 deg. Fahr.). Alongside it is shown the station load for the [illegible] a week [illegible] are placed on the same chart with the object of showing

[illegible] great advantage of perfect cleanliness. Saucepans for instance, can never become sooty outside. This fact alone saves a not inconsiderable amount of labor. [illegible] and ceiling of the kitchen remain much longer clean.

# Illumination and Wiring

## Lighting the Way Off the Traveled Path

The Majestic Theater, Fort Worth, Tex., is located one square back from the main street of the city. To attract the attention and patronage of the public in the more traveled thoroughfare the theater management has therefore arranged to have the connecting alleyway lighted by the elaborate tungsten installation shown herewith. At intervals ornamental steel posts on each side of the street sup-




ALLEYWAY LIGHTING AT FORT WORTH, TEX.

port 250-watt lamps covered by porcelain enameled shades, which take the place of gar "arcs" formerly used. In addition to the 250-watt lamps, the principal spectacular effect is furnished by strings of 40-watt lamps run down each side of the street. These conduit lines are suspended from the steel posts and are securely braced by small channel irons. Each line of sockets at the side of the street contains 100 such 40-watt tungsten lamps.

The arch over the entrance to the street is made of wire mesh, the letters being of wood coated with goldleaf. The lamps on the arch are also 40-watt tungsten units. The entire installation is, of course, a great improvement over the gas-arc lighting previously used. The management of the theater is very highly pleased with the illumination obtained, attributing the large increase in its business this season to this display lighting.

## Electric-Sign Regulation at Boston

A new law relative to the display of signs, awnings and other projections in the public ways of Boston, Mass. (Chapter 680, Acts of 1913), became effective on Aug. 12, by the terms of which the board of street commissioners has complete authority to regulate the placing of all such structures and to prescribe the conditions under which they may be used. A maximum fee of $1 per sign permit may be assessed. The act does not apply to poles, wires, conduits and other distributing equipment for public utility service. Hearings were begun by the board a few days ago for the purpose of preparing sign regulations and tentative rules were discussed. According to present plans the board will require that signs affixed to buildings at right angles must clear the sidewalk by 10 ft; unilluminated signs may project not over 1 ft. over the walk, illuminated signs not more than 4 ft. To guarantee that these signs are safely supported and properly wired inspection by the city building department and by the city fire department is to be required.

## Magnetite-Arc Lamps at Owatonna, Minn.

The city of Owatonna, Minn., recently installed fifty magnetic-arc lamps of the inverted ornamental type. This installation was put in from the proceeds of a bond issue, the work being done by the city with day labor.

Energy is furnished by the Public Service Operating Company of Owatonna at 5 cents per kw-hr. measured at the switch. The city furnishes electrodes, rectifier tubes and other necessaries, and makes repairs. The electric company trims the lamps. To date, the cost of energy has been 3.04 cents per lamp-hour.

The conductors are inclosed in 2-in. iron conduit laid behind the curbs. The cable used is No. 6 stranded, covered with a 0.219-in. layer of 30 per cent Para braided rubber and 0.047 in. of lead. Specifications called for a working pressure of 7500 volts and a breakdown test of 16,000 volts, which was withstood in a test at the University of Minnesota.

COST OF INSTALLING FIFTY MAGNETITE-ARC LAMPS ON POSTS AT OWATONNA, MINN.

| | |
|---|---|
| Fifty lamps, at $35 each | $1,750.00 |
| Fifty cut-outs and lightning arresters | 231.50 |
| 8,500 ft. 2-in. iron conduit, at $12.82 per 100 ft | 1,089.70 |
| 9,000 ft. cable, at 17¼ cents per ft | 1,552.50 |
| 600 ft. connecting cable | 80.19 |
| Fifty posts, cast iron, 600 lb. each, at $25 | 1,250.00 |
| Extra fittings and repairs to tools | 19.81 |
| Freight | 173.47 |
| Labor | 468.25 |
| Cement, twenty-five sacks, at 50 cents | 12.50 |
| Total | $6,627.92 |
| Cost of rectifier | 1,900.00 |
| Total, including rectifier | $8,527.92 |

In Fig. 1 is shown a single lamp-post. Each post has a base 14 in. square and is painted a French green, the caps included. The rich red-brown color of the insulators helps to enliven the appearance. The posts are made of cast iron and weigh 600 lb. each. The lamps are of the magnetite-arc type, requiring 6.6 amp, and were manufactured by the General Electric Company. The standards are spaced at an average distance of about 90 ft. measured along the street, and are staggered, four being used in a 280-ft. block and six in a 462-ft. block. The installation lights 5325 linear ft. of street, illuminating a pavement area estimated at 29,184 sq. yd.

The accompanying table gives the cost of the installation in detail. The rectifier was bought by the Public Service Operating Company with the understanding that if the city ceased using the company's service within ten years the city would purchase the rectifier, paying one-tenth of the original cost for each year from the time the company's service was discontinued till the ten years expired.



FIGS. 1 AND 2—SINGLE LAMP-POST AND NIGHT ILLUMINATION AT OWATONNA, MINN.

## European and American Wiring Practice

By A. H. Bernhard

In a previous article (Jan. 11, 1913) the writer described the flexible-cord system of wiring as used in European countries, especially France and Italy. While that is probably the most used method of interior wiring for circuits of small current-carrying capacity in finished houses, a great deal of wooden molding is also used, chiefly in combination with flexible-cord wiring for ceiling circuits. Although the use of wooden molding for wires has been prohibited in Germany, Austria and Switzerland, and the writer believes in Italy also, wiring in molding is very popular in France on account of its low cost and sightliness as compared with open wiring on cleats or porcelain knobs.

### Wiring in Molding

Wooden molding in France is proportioned differently from American molding. Owing to the prevalent use of No. 19 unbraided wire for branch circuits, narrow molding with very small slots is considered ample. It cannot be denied that this type of construction permits making a very neat and inconspicuous job, especially as no bulky porcelain devices are used at junctions. The division between the slots of the wooden molding is cut out with a chisel to make room for such splices as are necessary, and after these are made the cap of the molding covers them completely.

This molding is generally made of pine and is often nailed unpainted against brick walls in cellars, hotel kitchens, laundries and other damp places. The outside of the completed molding may subsequently be painted to match the decorations of the place in which it is installed, but while in France the writer saw no wooden molding painted on the inside except that installed under his direction. In many instances wiring is installed on the outside walls of buildings in molding with slots large enough to contain lead-covered conductors.

No effort is made in France to supply special types of snap-switches, receptacles, rosettes, etc., to fit wooden molding. When any wiring device is to be attached to a circuit the molding is cut off at the proper place and a thin wooden block is fastened to the wall or ceiling. The wiring device is attached to this block after slots have been cut and holes bored in its back to admit of the wires.

French and Italian practice (and, to a great extent, that of other European countries as well) avoids centralizing branch-circuit fuses and switches on panelboards, as is done in America. If the wiring is done with wooden molding, with flexible cord, with cleats or knobs, or even with conduit, it is usual to place a fuse for each lamp or group of lamps where the branch circuit is tapped into the mains. For small branch circuits carrying currents as high as 5 amp a very popular scheme is to place a single-pole open-wire fuse inside the cover of the snap-switch controlling the circuit. In this way practically each lamp is protected by a separate cut-out, so that if trouble occurs with one lamp the others will not be affected. The experience of the writer has been that these small fuses give much more trouble than they are worth, and that the American system of bringing all branch circuits to a panelboard, and equipping the panelboard with a double-pole cut-out for each circuit is by far the better plan. The writer believes that no conductor of less than 1.6 mm in diameter (No. 14) should be used (excepting flexible cords), as the difference in cost over smaller wire is insignificant in comparison with the superior mechanical strength and conductivity

### Wire

Excellent rubber-covered wire of the better grades is supplied by the reputable manufacturers in France and Italy and is usually listed under trade denominations.

Probably 90 per cent of this wire is supplied taped, without even a single braid, as single-braided wire costs about 20 per cent more than unbraided and is not considered worth the difference. The writer saw no double-braided or triple-braided wire in Europe, except perhaps in flexible cables for portable lamps and motors. The trade designations follow:

[illegible] vulcanized rubber insulation (unguaranteed).
Medium vulcanized rubber insulation (unguaranteed).
Heavy vulcanized rubber insulation (unguaranteed).
Vulcanized rubber insulation, guaranteed insulation resistance of 300 megohms per km after twenty-four hours' immersion in water at 15 deg. C.
Vulcanized rubber insulation, guaranteed 600 megohms after twenty-four hours' immersion at 24 deg. C.
Vulcanized rubber insulation, guaranteed 1200 megohms after twenty-four hours' immersion at 24 deg. C.
Vulcanized rubber insulation, guaranteed 3000 megohms after twenty-four hours' immersion at 24 deg. C.
Vulcanized rubber insulation, guaranteed 5000 megohms after twenty-four hours' immersion at 24 deg. C.

All the above grades of wire are also furnished with lead sheaths. These lead-covered wires are very popular in France and Italy for outdoor work and for work in damp places when the wires are not supported on insulators. In such installations the wires are held in place by means of small strips of sheet zinc tacked to the supporting surface. This type of construction is preferred to iron conduit as being cheaper and quicker to install.

There is no National Electrical Code in France, but most of the central-station companies make rules of their own in regard to wiring. For instance, most of the rule books issued by these companies lay great stress on the necessity of using only copper conductors of at least 98 per cent conductivity. A guaranteed insulation resistance of 300 megohms per km is generally specified for all insulated wire except flexible cords. It is recommended that all joints be soldered, using only rosin as a flux. The other rules are mostly unimportant.

The writer's experience has been that the enforcement of the above rules is largely subject to the contractor's wishes, especially the rule concerning soldered joints. In fact, it is almost necessary to supervise personally the making of each joint, in order to be sure that the wireman will actually take the trouble to solder it, so little do French wiremen seem to be accustomed to the use of solder when splicing small wires on interior house wiring. There seems to be considerable hesitation on the part of French central-station companies about enforcing their wiring rules, their legal right to do so not being clearly established.

In European countries conductors having a diameter of 0.9 mm (No. 19) are very commonly used for branch circuits feeding up to three or four lamps. Contractors using other methods have often been accused of squandering money by using wire of a diameter of 1.6 mm (No 14) for all branch circuits. Experience in conduit work has shown that even a single braid is not absolutely necessary, and often it has been found preferable to eliminate the costly braid and apply the saving in price toward the substitution of wire with 600 megohms per km insulation resistance instead of 300 megohms.

### Knob and Tube Work

Besides being preferred to molding in Germany, Austria and Switzerland, open wiring with cleats and knobs is very popular in Italy, and to a lesser extent in France. However well work of this kind may be done, the wires are sure to sag and look untidy in a very short time, making this style of construction entirely out of place in residences, stores, hotels, etc., where it is quite commonly seen in Europe. Although wire covered with fancy mercerized cotton braid of a color to harmonize with the surroundings is often used, the unsightliness of this type of wiring offends the French taste, and molding is therefore used generally in France. When Swiss or German contractors do wiring in France, however, they frequently use cleat or knob wiring, as in their own countries the us-

of molding is no longer approved. For installations in factories, cellars, damp places, etc., cleat or knob work is considered good practice even in France, and is used quite extensively. Special wire without rubber insulation is used as a rule for work in such locations.

A great many small cleats with two grooves about an inch apart and only one screw hole are used for branch circuits, but these are hardly advisable. However, a type of cleat which has come into use in part of France since the Marseilles International Electrical Exposition of 1908 is considered very meritorious. It is made of greenish glass, about 3 in. wide over all and 1.25 in. broad, and is provided with three grooves for wire up to about No. 12 in size. There are two screw holes for fastening. The great advantages of this type of cleat consist not only in the broad bearing space provided for the wires but also in the fact that it is furnished with two high legs which keep the wires about 1¼ in. from the supporting surface. Although the distance maintained between wires in this cleat is less than that of American types, the writer believes that it could be widely used here to advantage.

Ordinary insulating knobs are practically the same in Europe as here, although the absence of wooden lathing in houses of European construction often makes it inconvenient to attach the knobs by screws to the plastered walls. Hence the knobs are commonly supplied, singly and "in gangs," mounted with machine screws upon galvanized iron strips provided with projections adapted to be plastered into holes cut in the walls or ceilings. This is a great convenience where knobs are used on stone, brick, hollow-tile or reinforced-concrete construction.

Outdoor work is generally done with porcelain or glass insulators, and at present bare copper wire is used almost exclusively for this work. The one point which is most noticeable in European insulator work is the fact that cross-arms are rarely used, each insulator being attached to the pole or wall by a separate galvanized-iron bracket.

## Recent Telephone Patents

Ringing is usually accomplished by the use of alternating current, but in a system invented by Mr. O. M. Leich, of Genoa, Ill., direct current is used with a vibrating polarized-type bell. The invention lies in the arrangement of the circuits so that the potential normally maintained on the line will not affect the bell. A reversed current is applied when the ringing key is operated. Mr. Leich's patent is assigned to the Cracraft-Leich Electric Company.

Mr. C. V. Richey, of Washington, D. C., has patented a register or lock-out system in which apparatus is used that may be actuated by the operator by ringing back on the calling line. The ringing-back operation sets the counter, and the subscriber completes the count by restoring the hook switch in replacing the receiver. The same apparatus may serve as a lock-out by holding open the transmitter circuit until the operator rings back.

The lock-out system patented by Mr. R. C. M. Hastings, of Columbus, Ohio, is a step-by-step system in which a selective mechanism at the exchange and circuit-changing devices at the stations must operate synchronously.

A step-by-step system for which a patent has been issued to Mr. E. E. Kleinschmidt, of Brooklyn, N. Y., is designed for railway dispatching work. The novelty lies in the rise of a common battery sufficient for all stations, all parts, including the battery, being bridged on the line. This patent is assigned to the General Railway Equipment Company.

An improvement in automatic systems has been made by Mr. J. N. Reynolds, of Greenwich, Conn., the patent being assigned to the Western Electric Company. The object is to make the operation of the connecting machines more positive by rendering them irresponsive to an accidental current impulse after the selection of the digit.

# Letter to the Editors

### Merits and the Early History of Some Phase-Transforming Systems

*To the Editors of the Electrical World:*

SIRS:—The peculiarity of systems in which currents of one number of phases are changed into currents of another number of phases lies in the method and means for effecting the transformation. Each portion of the system with its given number of phases is precisely the same and operates in the same way as if the system were of that number of phases throughout. For instance, if three-phase currents are generated and supplied to apparatus from which two-phase currents are obtained and utilized, the three-phase portion of the system behaves like any three-phase system and the two-phase portion behaves like any two-phase system.

One method of effecting a transformation from one-phase to two-phase was patented by Dr. Charles P. Steinmetz. This method is practised by using two transformers so constructed that the reluctances of the magnetic circuits are different, by winding on the magnetic circuits in series two primary coils having different numbers of turns, and by making provision for short-circuited secondaries around the magnetic circuits of the two transformers, these coils being in series and having a variable resistance in their circuit. Phase differences are obtained by using a number of transformers equal to the number of phases, and by modifying the flux in the magnetic circuits of the transformers so that there is a phase difference between the currents in the secondary circuits.

The real purpose of this method (at the time the patent was granted) was a change in the magnetic fluxes in the circuits of induction motors or of transformers to produce

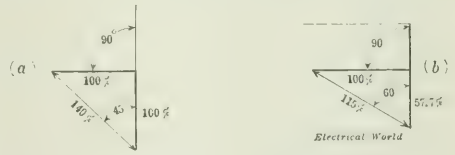



FIG. 1—EARLY TWO-PHASE TO THREE-PHASE CONNECTION AND MODIFICATION

two fluxes differing in phase from a single alternating current and to utilize these differences in phase to operate induction motors; in other words, to produce from a single-phase current a "split-phase" current, that is, a current with two phases, known and practised long before Dr. Steinmetz mentioned it in this way.

On Dec. 26, 1893, Mr. Nikola Tesla obtained a patent on this identical method, that is, the production of a two-phase system from an initial single-phase current. On Jan. 27, 1891, a patent was issued to Mr. Tesla on the same line of invention, while on Dec. 3, 1889, a patent was issued to Mr. Tesla in which it was shown that alternating currents of different phases can be obtained from a single-phase alternating current.

On Aug. 14, 1888, Mr. O. B. Shallenberger obtained a patent for a method of obtaining two currents differing in phase from a single-phase circuit. On July 7, 1891, Mr. M. von Dolivo-Dobrowolsky patented a system in which he claimed " . . . transformation from a polyphase current of one number of phases to a polyphase current of another number of phases. . . ." The only disclosure of Steinmetz is a method of splitting a single-phase current into a two-phase current—something that had been done in the art long prior to the date of his application. However, the point which stimulated its special mention here is that in reading through the clauses of his patent one finds the wording so broadened that it extends far beyond the speci-

fication, so that the patent, if interpreted by [illegible] might include the transformation of polyphase currents of one number of phases to polyphase currents of another number of phases, as if he were the first to accomplish this in any way, whereas, as we have seen, Tesla and others had preceded him. In 1891 Dobrowolsky showed a large number of dispositions of apparatus by which polyphase cur-

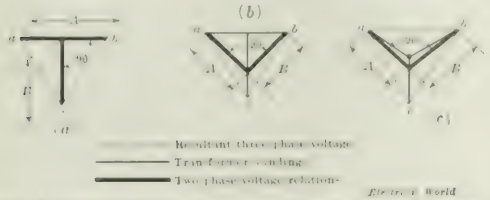



FIG. 2—T-CONNECTED TRANSFORMERS AND PRACTICAL MODIFICATIONS

rents of one number of phases are transformed into polyphase currents of another number of phases. This early system of transformation of Dobrowolsky's covers many phase relations, including all those commercially used at the present time—that is, 30, 45, 60, 90, 120, etc., deg.—and, in fact, is the system of connections by which the well-known "T" system (first patented by Mr. Charles F. Scott) was made known to the electrical field; hence the real original of the "Scott" connection was the Dobrowolsky system, claimed subsequently by Steinmetz.

In the last paragraph it is stated that Shallenberger disclosed one method in 1888; the same year (Sept. 8, 1888) he brought out another method clearly describing the application of resultants, and he produces from two-phase currents a resultant phase—hence three-phase currents, or two-phase to three-phase (see Fig. 1).

The connection *a* of Fig. 1 was modified by Scott, as is shown at *b;* that is, instead of connecting the winding at the extreme end as at *a*, Scott connected one of the transformer windings to the approximate center point of the other.

It is very interesting to review the history of the "Scott-Steinmetz" three-phase to two-phase system shown in vector diagram *b* of Fig. 1. In the year 1894 a patent was granted to Mr. Charles F. Scott for the "T" three-phase to two-phase transformation (using two transformers). Prior to this (1892) Huton & LeBlanc had obtained a patent on a similar method. Not many years passed before the General Electric Company (Steinmetz) came along with the same thing on which Scott obtained his patent. An interference was instituted and priority was granted to each in turn. The examiner of interferences granted priority to Scott. On appeal, the board of examiners-in-chief awarded priority of the issue in interference to Hutin & LeBlanc.



FIG. [illegible]—T-CONNECTED TRANSF[illegible]

while on a further appeal the Commissioner of Patents reversed the decision of the board of examiners-in-chief and awarded the priority to Steinmetz. The other parties appealed to the court. By this time, however, it is generally understood that the patent interests of the General Electric Company and Westinghouse company had been the subject of agreement and were practically identical. During this year the Huton & LeBlanc interests and patents were contracted for and controlled by Mr. George Westinghouse. The three contestants had come under a single control and they immediately ceased to contest. The appeals were withdrawn, and a decision by the court was thereby avoided. A patent was then issued to Steinmetz after the Scott patent on the same arrangement was twelve years old. The advantage of having a new patent issued after another patent on the same method was twelve years old is quite obvious.

In March, 1894, Mr. Charles F. Scott read a paper before the National Electric Light Association on "Polyphase Transmission" in which he treated the "Scott" system. In referring to the new system, he said: "In considering the marked advantages of the two-phase system of distribution and of the three-phase system for transmission, it occurred to me that a combination of the two-phase systems might secure the advantage of both in a combined system, and I have worked out a simple and effective method of accomplishing this result."

No public mention of any kind before any society or any engineering body or the like was made by any person or persons prior to March, 1894. During the discussion of a paper read by Mr. Charles F. Scott before the National Electrical Congress in 1893 Dr. Charles P. Steinmetz said: "Now, with regard to the polyphase and the single alternating current, it makes no difference how many phases you use because any system of polyphase currents can be transformed into any other system of polyphase currents by using two transformers. . . . If I may be permitted to take a look into the future, although we do not know what to-morrow will bring, I think the system of the future will be the single-phase system." This clearly goes to show that Steinmetz had no faith in any polyphase system sufficient to warrant him to attempt to solve the two-transformer Scott system prior to the reading of the paper by Scott in 1894, and the polyphase conversion is but a repetition of the Dobrowolsky method of 1891, already referred to. In his patent Dobrowolsky stated that "the three-phase currents may again be changed by passing through other transformers into a different number of currents," and with respect to the different systems of transmission that might be used, he went on further to say:

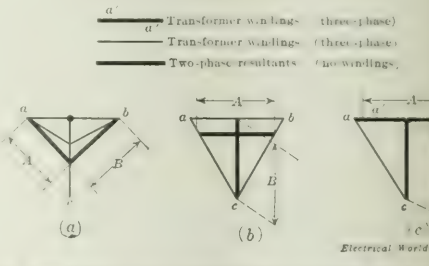



FIG. 4—METHODS OF TRANSFORMING PHASES WITH THREE TRANSFORMERS

The mains may be arranged in circuit with the coils of the transformers in the ordinary manner or by means of the system of connections in which each main forms a circuit with one of the other mains and one or more of the transformers (or transformer coils), and which I shall call 'concatenated circuits,' the said system requiring only as many mains as there are currents to be transmitted, but in this system a common return wire may be introduced." Hence, before the year 1890 Tesla, Bradley, Dobrowolsky and others jointly and in part disclosed all the methods of electrical transmission, transformation and distribution which are in common practice at the present time.

In Fig. 2*a* is shown the ordinary "T" or Scott connectio

and two modifications, *2b* and *2c*, of this, as presented by Steinmetz in his patent case against Scott. In reality the three methods are decidedly distinct; that is to say, each has its particular distinction from any other, as:

(a) * * * Consists of two single-phase transformers of equal ratios or one differing in ratio approximately 13 per cent from the other. The main transformer, which

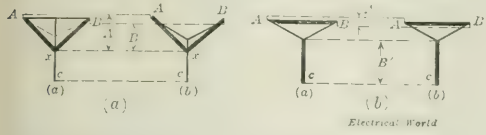



FIG. 5—THREE-PHASE-TWO-PHASE FROM THREE-PHASE SYSTEM

is always the one having the 100 per cent ratio, has a center tap provided to which the extreme end of the other transformer is connected. Applying three-phase currents to the three remaining ends of these two transformers—that is, impressing three single-phase currents, each differing by 120 per cent—two-phase currents are obtained from the secondaries.

(b) * * * This consists in using the same transformers and the same center of connection; in fact, it is identical in all respects with *a* so far as it goes, but it extends beyond *a*. A difference exists and to such an extent as to make the method employed quite distinct from either *a* or *c* of Fig. 2. The distinctions are fourfold, namely, first, provision for a special connection on the "supplementary" transformer in order to obtain the desired two-phase relations; second, the two-phase relations are resultants and are out of phase with those of *a* of Fig. 2; third, the two-phase resultant voltages are much less; fourth, the two-phase voltages are of three-wire.

(c) This method has so many disadvantages as to make it almost useless, principally because the connection of coils on the 120 deg. "Y" system is objectionable and unreliable for safe operation. Its distinctions from any of the other two are, first, that a specially designed transformer is required to handle correctly the two-phase resultants, and, second, that if three single-phase transformers are provided they may be of the ordinary design, but a special tap is necessary for at least one transformer.

Of the three different methods employed in obtaining secondary two-phase currents, the most reliable and the cheapest is the Scott method. Method (c) may be reckoned as taking its origin from the "delta" form, as shown in Fig. 3*b*.

According to the method *a* of Fig. 3, the transformer windings are connected in *Y*, while those of *b* are delta-connected, but the voltages of the corresponding phases in *a* and *b* are in phase with each other, *b* having a greater two-phase voltage than *a*.

Fig. 3, *a* and *b*, are to be classed as coming under the heading of two-phase to three-phase transformation with three transformers.

Fig. 4, *b*, shows another method of transforming phases with three transformers. In this method the magnetic fluxes are not modified, but they remain exactly the same as if each transformer were operating on a single-phase circuit, receiving a single-phase current in the primary and giving out a single-phase current in the secondary. A single polyphase unit or three single-phase transformers may be employed, the respective primaries and secondaries having common magnetic circuits.

The essence of the method employed here is that it requires no modification whatever of the action of the transformers used. In the three-phase system of supply the emfs of the primary coils differ by 120 deg. and the emfs of the secondary coils differ by the same number of degrees, there being no modification of the phase relations of the two sets of emfs when the three single-phase transformers are connected to give two-phase currents in two pairs of conductors joined to approximate selected points of the secondary coils. In other words, this method is based on the fact that the currents and emfs differing in phase relation may be compounded in exactly the same way that mechanical forces differing in direction are compounded, there being in each case a resultant dependent upon the magnitude and relation of the forces that are involved.

From the practical viewpoint the above-described groups of three-phase to two-phase methods are:

(1) *"T" or Scott Method.*—Two ordinary single-phase transformers or one ordinary and one special transformer connected in "T," but in no other way. (See Fig. 2, *a*.)

(2) *"T" or Scott-Steinmetz Method.*—Two ordinary single-phase or one ordinary and one special transformer connected in "T," but in no other way. (See Fig. 2, *b*.)

(3) *"Y" Two-Phase Method.*—Three ordinary single-phase transformers or one ordinary and one special transformer connected in "Y" to a three-phase supply; but never in delta.

(4) *"Delta" Two-Phase Taylor Method.*—Always three ordinary single-phase transformers and always connected in delta. (See Fig. 4, *b*.)

Method (4) has the three following main distinctions from methods (2) and (3): First, different apparatus is necessary to obtain equal results; second, distinct method of connecting the apparatus; third, different phase relations of the two-phase resultant voltages, prohibiting parallel operation with the others.

And, as regards the use of either (1), (2) or (3), when any one unit of the group becomes disabled it is impossible to operate and deliver polyphase currents, as can be done in the case of (4), which has the advantage of delivering three-phase and two-phase currents when any one unit becomes disabled by simply dropping back to the open delta or V connection, as at *c* in Fig. 4.

In an article on the Lauffen-Frankfort transmission system in the London *Electrician* of Sept. 18, 1891, communicated by Dr. Gisbert Kapp, there is described a system in which three-phase currents generated at Lauffen by three-phase transformers were transmitted to Frankfort, a distance of 110 miles, the three-phase currents being conveyed by three conductors such as are shown in Fig. 5.

At the receiving end (Frankfort) the secondary circuits of the three-phase transformers were connected so that a four-wire system was employed; thus in this early system use was made of the same method of transformation—that is, three-phase to two-phase or vice versa.

If the Lauffen-Frankfort plant, indicated at *a'* and *b'* of Fig. 5, be compared with the arrangements *a* and *b* of Fig. 3, it will be seen that the latter involve nothing in the way of transformation, transmission or distribution distinct from what was already in use other than the fact that one transformer has a greater or lesser number of turns or a different part of its winding connected to obtain

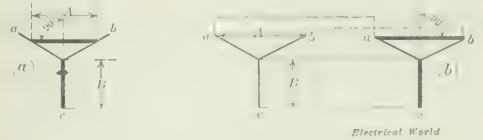



FIG. 6—USE OF TRANSFORMER TAPS

the two-phase relation. The same thing applies (if at all necessary) to the Lauffen-Frankfort plant, since if one transformer is connected as at *b* the remaining two half-coils must have the same ratio tap for flexibility and reliability of operation. (See Fig. 6.)

William T. Taylor.

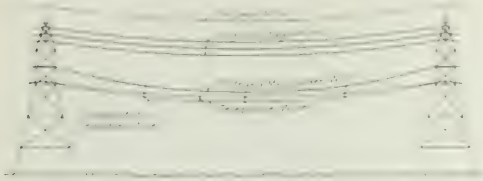
*Richmond, Surrey, England.*

# Field of the Operating Engineer

**A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers**

## Long-Span Construction for Telephone Lines on Transmission Towers

A power transmission company in northern New York State has adopted a type of construction for the telephone circuit used in connection with its high-tension lines which does away with the difficulties usually encountered in long-span telephone construction. As the towers were spaced about 350 ft. apart, the tensile strength of the light copper



LONG-SPAN CONSTRUCTION FOR TELEPHONE LINES

telephone wire prohibited the dispatch line from being placed on the main towers without some intermediate support. Accordingly a light seven-strand messenger cable was strung below the high-potential wires, and upon this supporting steel cable are hung iron brackets such as are sometimes used on long-distance telephone lines for making phantom transpositions. Three of these supporting brackets in each tower span divided the weight of the telephone spans into four parts, so that it is readily supported and the danger of trouble on the telephone line due to accidental short-circuits caused by the wires swinging together is reduced to a minimum. The high-tension lines and the telephone wires are placed in separate vertical planes in order to lessen the danger of contact should one of the power wires fall.

## Pumping and Heating of Oil Fuel

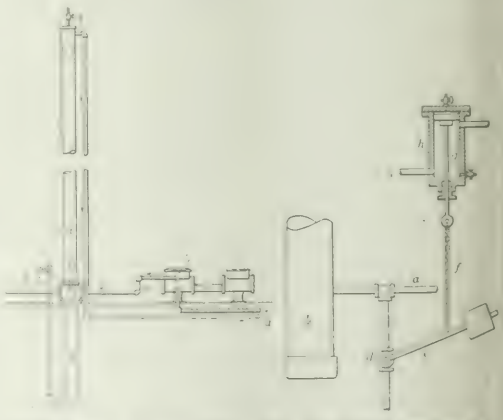
By R. T. Strohm

In every oil-fuel installation there must be pumps to draw the oil from the storage tanks and deliver it to the burners under pressure. The storage tanks are invariably located underground and therefore at a lower level than the burners. The primary purpose of the pumps, consequently, is to lift the oil from the tanks. The heavy oils employed for fuel are usually too viscous and sluggish to flow freely of their own accord, and so the pumps fulfil the second object of supplying the oil under pressure. In this way the maximum amount of oil supplied may be regulated to suit the demand, regardless of the condition or quality of the oil.

One of the simplest methods of insuring a steady pressure of oil at the burners is to use a standpipe, as shown in Fig. 1. The oil is drawn from the storage tank through the suction pipe *a* by the pump *b* and is discharged through the pipe *c* into the standpipe *d*. This is made of 4-in. pipe and is of sufficient height to give the desired pressure of oil at the burners. An overflow pipe *e* one or two sizes larger than the discharge pipe *c* is connected near the top and is carried back to the storage tank. The speed of the pump is regulated so that the amount of oil delivered is somewhat in excess of that used by the burners. As a result, the standpipe is constantly kept full to the level of the overflow. The excess of oil simply flows back to the storage tank through the pipe *e*, and as the height of the oil column in the standpipe remains unchanged, the pressure in the oil main *f*, leading to the burners, remains constant. The pipe *g* is an extension of the standpipe that serves as a trap for water and sediment contained in the oil. These impurities, being heavier than the oil, fall to the bottom of the pipe *g* and may be blown out at intervals through the pipe *h*. A vent cock *i* is added at the top of the standpipe to allow the release of gas that enters with the oil and collects above the column.

The object of maintaining a uniform pressure of oil is to insure proper working of the burners and economical combustion. If the pressure were allowed to vary rapidly, the rate of flow of the oil would be changed and the burners would work erratically. Not only that, but the ratio of air to oil would be altered continually and inefficient combustion would result. There seems to be no fixed value for the pressure at which the oil is delivered to the burners. In an extended series of tests made by the Bureau of Steam Engineering of the United States Navy, the pressure varied from 9 lb. to 160 lb. per sq. in., depending on the type of burner, the quality of the oil and the nature of the installation. In the greater number of cases, however, the pressure lies within the limits of 10 lb. and 50 lb. per sq. in.

The required height of the column of oil in the standpipe to produce a desired pressure may easily be calculated,



STANDPIPE USED TO SECURE STEADY OIL. SAFETY DEVICE FOR DRAINING STANDPIPE

if the specific gravity of the oil is known, by the use of the formula $H = 2.304\ P \div G$, in which $H$ is the height of oil column, in feet; $P$, the required oil pressure, in pounds per square inch, and $G$, the specific gravity of oil used.

The height $H$ of the oil column thus found is the vertical distance between the level of the burner orifices and the level of the overflow at the top of the standpipe. For

example, if a pressure of 15 lb. per sq. in. is required and the oil has a specific gravity of 0.96, the height of the oil column must be

$$H = 2.304 \times 15 \div 0.96 = 36 \text{ ft.}$$

With the standpipe arrangement, a considerable quantity is stored at a point above the level of the burner outlets; consequently, if a burner should inadvertently be left open when out of service, the furnace would be flooded with oil. Because of this, some insurance companies refuse to insure plants in which oil is fed by gravity.

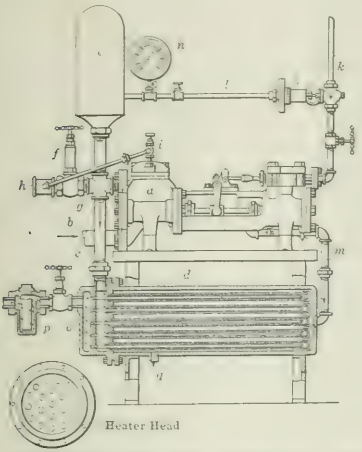



FIG. 3—METHOD OF OBTAINING UNIFORM OIL PRESSURE

The danger of flooding with oil may be overcome by using a safety device, so that when there is no steam pressure for atomizing, the oil in the standpipe will be returned to the storage tank. An arrangement of this kind is shown in Fig. 2. The pipe *a*, leading from the standpipe to the burners, has a branch *c*, in which is fitted a cock *d* that is opened when the weighted lever *e* is allowed to fall. This lever is connected by a chain *f* to the piston rod *g* of a small piston in the cylinder *h*. A steam pipe from the boiler is attached at *i* and a pipe *j* leads to the oil pump, so that the steam supply to the pump must pass through the cylinder *h*. The pressure of the steam forces the piston to the upper end of the cylinder and holds it there, thus keeping the cock *d* closed as long as there is sufficient pressure in the boiler. But when the steam pressure falls below that required to run the pump and atomize the oil, the lever *e* drops and opens the cock *d*, thus allowing all the oil in the standpipe to run back into the storage tank.

Another way of maintaining a uniform pressure of oil is to employ a duplex feed-pump and to put on the discharge pipe a relief valve set to open when the desired pressure is exceeded. A side view of such an apparatus is shown in Fig. 3 in connection with a longitudinal section of an oil heater. The duplex pump *a* has a suction pipe *b* that leads direct from the storage tank. The discharge from both sides of the pump is led through the pipe *c* to the heater *d*. The air chamber *e* and the relief valve *f* are in communication with the discharge pipe through the cross *g*. The air chamber cushions the intermittent discharges of oil and prevents shocks. The relief valve, which is merely a spring-loaded valve, is set to the pressure desired at the oil burners. As soon as the pump supplies too much oil, and this pressure is exceeded, the valve rises and the excess of oil is returned to the storage tank by a pipe connected at *h*. Two small pipes lead from the tops of the discharge chambers to the overflow pipe and are fitted with valves *i* to allow any gas collecting in those chambers to be removed.

The speed of the pump is regulated automatically by a governor *j* on the steam line *k* to the pump. The governor consists of a flexible diaphragm directly connected to a throttle valve in the steam line. One side of the diaphragm is acted on by the pressure of the oil, which is transmitted through the small pipe *l*, and on the other side by a spring that can be adjusted as desired. When the oil pressure rises too high, the pressure of oil on the diaphragm overcomes the spring pressure and closes the throttle valve somewhat. This reduces the steam supply to the pump and lessens its speed. The oil pressure then decreases and the spring forces the diaphragm back again, opening the valve and admitting more steam. By adjusting the tension of the spring, a very uniform speed of the pump may be obtained. The exhaust from the steam ends of the pump is led through the pipe *m* to the heater, where it is used to heat the oil. A pressure gage is attached at *n* to show the pressure of the oil on the discharge side of the pump.

The object of the heater is to increase the temperature of the oil and thereby decrease its viscosity. The heavy crude oils are very sluggish, and in this condition they are not easily atomized. If their temperature is low, their rate of flow is still further reduced. Therefore, a heater is inserted in the oil system to render the oil more fluid and easy to break up into a spray. In the illustration the heater is placed between the discharge of the pump and the burners. It consists of a cylindrical outer shell *d* into which the exhaust steam is conducted by the pipe *m*. The head *o* of the heater has two compartments, and into it are screwed two sets of tubes. The larger tubes are closed at one end and fit over the smaller ones, which are open at both ends. The oil from the pump flows into the inner compartment in the head, thence into the larger tubes, around the smaller ones, and finally back through the inside tubes to the outer compartment, from which it passes to the burners through the strainer *p*. The water and uncondensed steam are drawn out of the shell at *q*.

The form of heater shown in Fig. 3 is efficient, because the oil is divided into a number of thin films that pass between the outer and inner tubes while the heat is transmitted through the outer tubes. A much simpler form, and one that is less expensive, is shown in Fig. 4. It consists of two cast-iron cylinders *a* and *b*, one inside the other.

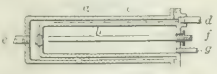


FIG. 4—SIMPLE OIL HEATER



FIG. 5—STEAM COIL OIL HEATER



FIG. 6—STEAM COIL OIL HEATER

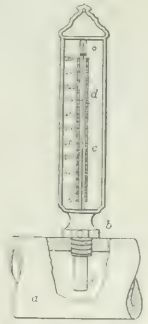


FIG. 7—ARRANGEMENT FOR OBTAINING OIL TEMPERATURE

The narrow space *c* between the inner and outer shells is filled with the oil to be heated, which flows in at *d* and out at *e*. Steam is led into the inside cylinder through a pipe *f*, and the water and waste steam are removed at *g*. This form is not extremely efficient, because the cast-iron walls are thick and the oil is not divided into very thin sheets.

Another way of arranging the coils in the heater is

shown in Fig. 5. The oil flows into the heater shell *a* through the pipe *b* and surrounds the pipe coils *c*, which are made up of straight pipes joined by return bends. Steam is admitted into the top coil through the connection at *d*, and the water is drained out at *e*. The oil flows through the heater from *b* to *f*.

The heater shown in Fig. 5 is more efficient than that in Fig. 4, but the one shown in Fig. 6 gives better heating than either, because the coil *a* that carries the steam has a greater amount of heating surface exposed to the oil. It is made in a continuous coil that fits closely inside the shell *b*. Steam enters at and the condensation escapes at *d*. The oil enters at *e* and is discharged at *f*.

The corrugated film heater shown in Fig. 8 is designed with a view to obtaining a very high efficiency. It consists of two spirally corrugated copper tubes *a* and *b*. These fit very closely, leaving only a thin space between them, and oil is led into this space through the inlet *c*. It flows upward between the two corrugated tubes and passes out at *d*. Steam is admitted through the pipe *e* and flows directly to the interior *f* of the tube *b*. At the same time a branch pipe *g* admits steam to the chamber *h* surrounding the outer tube and formed by the inclosing cylindrical shell *i*. The oil film is thus heated by the transmission of heat inward through the outer tube and outward through the inner tube. The steam and oil flow in opposite directions, so that the warmest oil meets the steam entering the heater. This countercurrent adds to the efficiency of operation. The drain pipe *j* serves to remove all condensation from the steam chambers, and the shell is protected by a non-conducting covering *k* that reduces the loss of heat to the surrounding air. The tubes may be removed for cleaning; or the plugs *l* and *m* may be taken out and live steam may be blown through between the tubes. This will quickly and thoroughly clean out all sediment and tarry deposits.

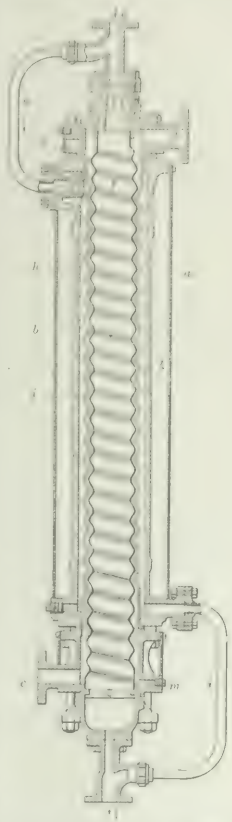


FIG. 8—CORRUGATED FILM OIL HEATER

As the heater is placed between the pump and the burners, it is subjected to the full pressure of the oil, and it should be tested to see that it is capable of withstanding the maximum pressure that may be put upon it. Some makers guarantee their heaters for a pressure of 200 lb. per sq. in., which is well above the point that will be reached in ordinary work. The joints of the steam coils or of the tubes fitted in the head of the heater should be absolutely tight, so that no water can leak into the oil supply. Also, the pipes and tubes should be arranged so that they can expand and contract freely, without springing joints open and causing leaks.

Heating of the oil between the pump and the burners is done to make atomization easier. In some cases, however, it is necessary to heat the oil in the storage tank so that it will flow readily to the pump. This is particularly true of installations in cold climates. There are crude oils that at temperatures of from 30 to 40 deg. Fahr. become so sluggish that they cannot be drawn to the pump, and they must be heated sufficiently to cause them to flow. It is neither necessary nor advisable to heat the entire bulk of oil in the storage tank. A steam coil can be located around the lower end of the suction pipe. This will heat the oil in the immediate neighborhood of the entrance to the pipe and enable it to be drawn up. In any case, the heating must not be carried to a point at which the oil will begin to decompose, that is, break up into its constituent hydrocarbons. The temperature at which decomposition occurs varies for oils of different qualities and from different localities, but usually it does not exceed 180 deg. Fahr.

The temperature of the oil may be observed by a thermometer placed in a mercury cup in the oil line leading to the burners, as shown in Fig. 7. The pipe *a* conveys the oil to the burners, and into it is screwed a fitting *b* that carries the thermometer tube *c* and the scale *d*. At the bottom is a long cup *e* filled with mercury, in which the lower end of the tube *c* rests. The heat of the oil flowing through the pipe is thus transmitted to the tube and the temperature is registered on the scale.

If the plant is of such character that even a brief shutdown would entail great loss or inconvenience, the oil pump should be duplicated, so that one set of pumps will be in reserve in case the other set fails. This can be arranged by using a system of cross-overs in the piping. Also, it is an excellent plan to have the entire system of oil pipes connected so that live steam may be blown through it to clean it of dirt and tarry matter adhering to it.

## Energy Consumption of Electric Vehicles

Can you give data on the kilowatt-hour consumption per mile for electric trucks of various sizes? I am seeking figures in terms of energy actually supplied through the charging switchboard; in other words, the meter reading likely to be registered and for which the customer has to pay. M. N. O.

Obviously the kilowatt-hour consumption per mile of travel will depend upon the type and size of the vehicle, number of miles traveled, conditions of charging and use, character of roads, whether paved or hilly, and numerous other factors. A definite figure cannot therefore be given, but following are actual reports received from a number of electric-truck users in response to inquiries recently sent out from this office:

| | Kw-hr. per Mile |
|---|---|
| [illegible] | [illegible] |
| 4000-lb. truck, lead battery | 1.20 |
| [illegible] | [illegible] |
| 500-lb. roadster, nickel-iron | 0.70 |
| [illegible] | [illegible] |
| 750-lb. roadster, lead cells | 0.50 |
| 4000-lb. truck, nickel-iron cells | 2.25 |
| 3000-lb. truck, lead cells | 1.00 |
| 1000-lb. truck, lead cells | 0.54 |
| Average of fifteen vehicles, 750 lb. to 4000 lb., lead cells | 0.80 |
| Average of five vehicles, 750 lb. to 3000 lb., lead and nickel- | 0.60 |
| [illegible] | [illegible] |
| Average of four cars, 700 lb. to 7000 lb., lead cells | 2.80 |
| Average of four cars, 700 lb. to 2000 lb., lead cells, approxi- | |
| [illegible] | [illegible] |
| Average of thirteen cars, 750 lb. to 4000 lb., lead and nickel-iron. | 1.80 |
| Average of 25 cars, 500 lb. to 8000 lb., lead cells | 0.38 |

These figures are in no sense comparative, for they represent widely different conditions in remote parts of the country, but they afford some practical estimate of the operating results which are being accomplished to-day. Hilly roads and poorly paved streets are among the factors which notably increase kilowatt-hour consumption, as the higher figures in the list above were invariably taken from vicinities where the cars were required to climb grade

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*Electrolytic Rectifier.*—KARL SIEGL.—The disadvantage of the ordinary electrolytic rectifier is the formation of little sparks all over the surface of the aluminum cathode. This results in the heating of the cathode and of the electrolyte and in a considerable reduction of the capacity of the rectifier. To overcome this difficulty the author uses a hollow aluminum cathode, the cooling water being continually passed through its interior. Its effect is so beneficial that a cooled cell will stand a current ten times as large as an uncooled cell. In order to utilize both half waves of the alternating current four cells must be connected in the well-known manner and the cooling water is passed successively through the different cathodes. To prevent shunts on that account, the aluminum cathode is made in the form of an aluminum tube with a lead tube in its inside, the aluminum tube and the lead tube being insulated from each other by paraffine oil. The cooling water passes through the lead tube.—*Elek. Zeit.*, Aug. 21, 1913.

*Improving the Power-Factor.*—GISBERT KAPP.—An article illustrated by diagrams in which the author discusses the economical value of methods for improving the power factor. The author then explains theoretically the operation of the "vibrator" (which has already been described in detail in the *Digest*) and shows how the circular diagram is changed by the use of a vibrator. Finally the results of tests and practice are given.—*Elek. Zeit.*, Aug. 14, 1913.

### Lamps and Lighting

*Photometer for the Measurement of Light Distribution.*—M. SCHANZER.—An illustrated description of a new photometer of K. Satori for the measurement of light distribution which may be described as a modification of the photometers of Martens and Brodhun. The new photometer shown in Fig. 1 connects the movable arm with the photometer. At one end of the bench two rings are mounted on a stand; these rings carry a tube, which can revolve within the rings on roller bearings. The end of the tube facing the photometer carries an achromatic objective, the focus of which lies immediately above the zero mark of the bench. At the other end is a collimator lens with mirror. An arm 1.5 m long is mounted on the tube and carries a second mirror, as shown; a counterweight is provided in the usual way. The light is received by the collimator lens from the mirrors. The broken line which represents the optical distance of the source of the light from the collimator lens is equal to the focal strength of the lens, and the divergent ray that falls upon it is, therefore, converted into a parallel ray. By means of the objective a real image of the source of light is formed above the zero of the photometer scale. A shield prevents the direct access of the light to the photometer. Thus all the lenses are fixed instead of being carried on the rotary arm, and this allows the use of large heavy lenses, comparatively speaking, with short focal lengths, which tends to increase the amount of light received on the photometer. Thus the real image of the source of light always appears above the zero of the photometer and is available as a measure of the illumination in the given direction in which the arm happens to be placed. The arm is then moved into different positions, and readings are taken by adjusting the position of the standard lamp at the other end of the bench. There is no need in this case to measure the distance from the source of light to the photometer screen. Scales are mounted on the instrument for reading the precise position of the rotary arm. For sources of light of considerable volume a matte screen is provided. Thus the mirror on the rotary arm is reversible, the back of it being a matte reflecting surface. In this case the photometer screen is so adjusted that the image of the diffused light on the matte surface falls directly upon the screen. The final adjustment, therefore, is not made by moving the photometer but by altering the aperture of the lens, which is provided with an iris diaphragm for the purpose. This diaphragm is provided with a scale.

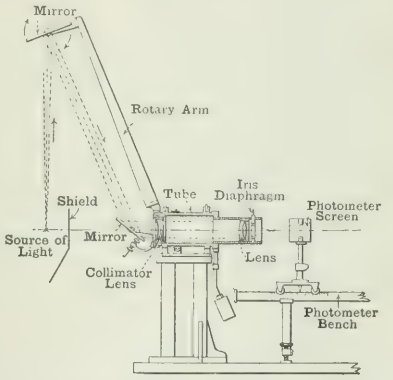



FIG. 1—PHOTOMETER FOR MEASURING LIGHT DISTRIBUTION

The reading on the scale multiplied by the candle-power of the standard lamp gives the reading required. For the lowest part of the scale the plain reflector is, of course, used on the rotary arm. The upper limit of the capacity of the instrument is very high, seeing that the photometer screen can be adjusted in position, and in addition to this, if the source of light is very strong, the iris-diaphragm method is also available. The new photometer, therefore, has great range in the measurement of the distribution of light and can also be used in connection with flicker methods. There is no need to measure distances in any case, and the results are obtained by taking the readings on the various scales provided with the instrument.—*Elek. u. Masch.* (Vienna), May 25, 1913; translated in abstract in London *Electrician*, Aug. 29, 1913.

### Generation, Transmission and Distribution

*Explosion of a Turbo-Generator.*—An illustrated article on the explosion of a 2500-kva turbo-generator in the lighting station of Trieste. It seems that the speed of the generator in the instant of the explosion was 2500 or 2600; that is, at least, twice the normal speed. Firms which build turbo-generators guarantee in general their machines only for an increase of speed of 15 to 20 per cent. If machines stand an increase of speed of 50 per cent, they are considered perfectly reliable. "The generator in this case was damaged only at double the normal speed, so that this rare accident is really a brilliant proof of the perfect

safety of the design."—*Lok. u. Masch.* (Vienna), Nov. 16, 1913.

*Ventilation of Steam-Turbine Engine Rooms.*—C. C. KNOWLTON.—The gradual growth of the output capacity of those power stations which have replaced some or all of their reciprocating engines by high-speed turbines without increasing the size of their engine rooms has, in some cases, reached such a degree that the original ventilating systems have been found to be inadequate, resulting in discomfort to the attendants and abnormal operating temperatures of the electrical apparatus. This article cites the growth of several typical plants and shows how imperative it is that special attention be given to the ventilation of the engine room. It describes the most approved methods of supplying air to, and conducting it from, both vertical and horizontal turbines; discusses and furnishes formulas to apply in the design of the air ducts to accomplish this purpose, and states the quantity of air required. The operation of a humidifier is described, and its cost per kilowatt of station capacity is given. Its effects on the specific heat of the ventilating air, on its cleanliness and on its temperature are explained. The article concludes with recommendations for the improvement of ventilation of present existing stations and the designs of future ones.—*Gen. Elec. Review*, September, 1913.

### Traction

*Electric Traction on Trunk Railroads.*—W. USBECK.—A lecture given before the annual meeting of the German Association of Electrical Engineers. The author gave a brief historical sketch and discussed the different systems of electric traction on trunk railroads and their advantages over steam traction. The chief economical advantage is the concentration of the generation of energy in large power plants with the rational utilization of the natural sources of energy available in form of water-powers, bituminous coal fields and peat deposits. With cheap electric power thus becoming available, an economical electric operation of the main railroads becomes possible.—*Elek. Zeit.*, Aug. 21, 1913.

### Installations, Systems and Appliances

*Condenser-Type Outlet Terminal.*—C. FORTESCUE AND J. E. MATEER.—An illustrated article on the condenser-type outlet terminal. The first author discusses the theory of design, the second author construction and application.—*Elec. Journal*, August, 1913.

*Paris.*—T. PAUSERT.—An illustrated article on the electricity supply of Paris. The Parisian Company of Distribution of Electricity is building at present two central stations of 50,000 kw and 25,000 kw respectively. These are called the Northern station and the Southwestern station. Both produce two-phase currents at 12,300 volts with a frequency of 42 cycles per second. The Northern station has eight turbo-generators, each of 10,000 kw to 15,000 kw. The Southwestern station has three turbo-generators.—*La Revue Elec.*, Aug. 15, 1913.

*Electric Equipment of Battleships.*—H. A. HORNOR.—A Franklin Institute paper on the modern equipment of battleships. The author suggests certain modifications to the present equipment, based on land usages and their adaptation for marine purposes. The use of alternating current on shipboard is proposed.—*Journal Franklin Inst.*, August, 1913.

*Automatic Pressure Regulators.*—R. I. MARR.—The conclusion of his illustrated article on various types of automatic pressure regulators. In the present instalment the Thury and Brown-Boveri regulators are described.—London *Electrician*, Aug. 29, 1913.

### Electrophysics and Magnetism

*Electric Resistance of Pure Metals at Helium Temperatures.*—H. KAMERLINGH ONNES.—A further account of his very careful experimental investigations on the potential difference which is necessary to pass an electric current through a mercury thread at a temperature of 4.19 deg. Kelvin. The surprising phenomena may be summed up as follows: At every temperature below 4.18 deg. Kelvin for a mercury thread inclosed in a glass capillary tube a "threshold value" of the current can be given, such that at the crossing of the threshold value the electricity goes through without any perceptible potential difference at the extremities of the thread being necessary. It appears, therefore, that the thread has no resistance, and for the residual resistance which it might possess a higher limit can be given determined by the smallest potential difference which could be established in the experiments (here $0.03 \times 10^{-6}$ volt) and the threshold value of the current. At a lower temperature the threshold value becomes higher, and thus the highest limit for the possible residual resistance can be pushed further back. As soon as the current density rises above the threshold value a potential difference appears which increases more rapidly than the current. This seemed at first to be about proportional to the square of the excess current above the initial value, but as a matter of fact at smaller excess values it increases less and at greater excess values much more rapidly. The experimental arrangement and various modifications of the same are described in some detail, and the view is expressed that the disappearance of the ordinary mercury resistance at 4.19 deg. Kelvin occurs quite suddenly, and in a thread that has been cooled to below that temperature, as soon as the threshold value of the current density is exceeded, somewhere heating occurs which carries the thread at that place to above that temperature, at first over a scarcely perceptible length but at higher currents over a rapidly increasing resistance, by which ordinary resistance is generated in this part of the wire. With these larger currents the thread then reaches a state in which there is no uncertainty; it assumes over its entire length the new temperature equilibrium of a thread carrying a current, which equilibrium is determined above the vanishing point in the usual way. It seems that small additions of other metals to mercury do not change the phenomena.—London *Electrician*, Aug. 29, 1913.

### Electrochemistry and Batteries

*Action of the Magnetic Field Upon Electric Discharge Through Gas.*—L. T. MOORE AND G. J. MAUCHLY.—An account of an experimental investigation from which the authors conclude that the function of the magnetic field is to modify the discharge rather than to create a new type of rays such as has been proposed by Villard and Righi. The main action of the magnetic field is to reduce greatly the potential drop at the cathode and to force charged particles in the tube to move away from the cathode in helical paths. Owing to their greater mobility and longer free path, this action is more pronounced on electrons than on positive gaseous ions.—*Philos. Magazine*, August, 1913.

*Great Falls Electrolytic Copper Refinery.*—WILLIS T. BURNS.—A long and profusely illustrated paper read before the American Institute of Mining Engineers on the electrolytic copper refinery in Great Falls, Mont., which is unique in two respects. The current density is at least 60 per cent higher than that regularly employed elsewhere and the anodes treated are the direct product of the converter rather than of the reverberatory furnace.—*Metall. and Chem. Eng'ing*, September, 1913.

*Electric Steel Refining.*—O. FRICK.—An abstract of a paper read before the (British) Iron and Steel Institute on electric steel refining in an induction furnace. The results given in this paper are based on results obtained in the Frick furnaces at Krupp's works in Essen, and "serve to show that whatever the history and present position of the electric furnace in the steel industry, its future possibilities are such that it may be anticipated that a time will come when half the steel produced will have been passed

through the electric furnace."—London *Electrician*, Sept. 5, 1913.

### Units, Measurements, and Instruments

*Electrical Methods for Comparing Thermal Conductivities.*—WILLIAM EVES, 3D.—An illustrated article on a method of Mr. E. F. Northrup for comparing thermal conductivities. The method was used by the author for comparing the thermal conductivities of commercial impregnating compounds such as are used for the field coils of electrical machines. It consists in the heating of two coils of copper wire, identical in every respect—namely, size, shape, electrical resistance and in insulation—except for the compounds with which they are impregnated and of which the conductivities are to be compared. This heating is done by passing such currents through them as will cause them to become each equal in resistance to some set resistance which is previously calculated and the magnitude of which determines the mean temperature of the coils. Sufficient time must be taken to allow a steady state of heat flow to be reached, in order not to obtain false results. If this steady state has been reached and if the external temperatures are maintained equal, the total energy input into each coil will be equal to the heat flow and therefore to the energy dissipated by the coil. Since the coils are identical in size and shape, the thermal conductivities of the wire, insulation and impregnating compounds of the coils will be proportional to the amount of energy input, since the material of greater conductivity allows proportionately greater energy to be conducted through it. The watts dissipated from the two coils will be: $W_1 = C_1^2 R_t$ in coil $A$ and $W_2 = C_2^2 R_t$ in coil $B$, where $R_t$ equals the resistance of coils $A$ and $B$ at the higher temperature $t$, and $C_1$ and $C_2$ are currents passing through $A$ and $B$ respectively. Therefore $k_a/k_b = W_1/W_2$

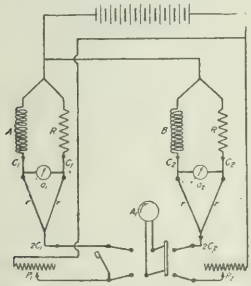


FIG. 2—CONNECTIONS FOR COMPARING THERMAL CONDUCTIVITIES

$= C_1^2/C_2^2$, where $k_a$ is the conductivity of coil $A$ and $k_b$ is the conductivity of coil $B$. Hence it follows that for equal mean internal temperatures steadily maintained for both coils their thermal conductivities will be in direct ratio to the squares of the currents passed through each. The arrangement of the experiment is shown in Fig. 2. $A$ and $B$ are two identical double-cotton copper wires, but impregnated with different insulating compounds. The apparatus consists of two Wheatstone bridges, in which the heating current passes through the bridges. Coils $R$ $R$ are adjustable resistances of wire of very low and equal, or zero, temperature coefficient, which are set to the calculated resistance which the coils $A$ and $B$ will have at the temperature at which it is desired to take the measurement. Resistances $r$, $r$, $r$, $r$ are ratio resistances, equal in value. $a_1$ and $a_2$ are small portable galvanometers, which were found sufficiently sensitive for this method. Millivoltmeters can be used. $A$ is an ammeter connected through a double-throw switch and short-circuiting switches, and of suitable range to measure the total currents passing through the bridges, which are each twice the currents flowing through the coils $A$ and $B$, or $R$ $R$, since the arms of the bridges are equal in resistance. $p_1$ and $p_2$ are variable rheostats of any rough type for adjusting the impressed voltage. Current was passed through the bridges until the detectors showed that the mean internal temperatures of the coils $A$ and $B$ had risen until their resistances were equal to the set resistances $R$ $R$. The results obtained in comparison of four insulating compounds are given in a table and show the high accuracy of the method. The apparatus may be set up in a small space and is simple and the method is commercially practical.—*Metall. and Chem. Eng'ing*, September, 1913.

*Electrolytic Iron for Construction of Instruments.*—MOELLINGER.—A communication with reference to the recent article by Breslauer on the use of pure electrolytic iron for the construction of dynamo-electric machines and transformers. The present writer emphasizes that the low remanence and hysteresis and the high permeability of the electrolytic iron can be made use of also in measuring instruments, especially in electricity meters. Meters can be made far more efficient by electrolytic iron. Such iron can also be used for the cores of measuring transformers and for the cores and armatures of overload circuit-breakers and relays.—*Elek. Zeit.*, Aug. 14, 1913.

*Testing.*—Continuations of the long illustrated serial on shop testing of electrical apparatus. In the present instalments direct-current shunt and compound motors and industrial series and heavily compounded motors are taken up.—*Elec. Journal*, July and August, 1913.

### Telegraphy, Telephony and Signals

*Traffic Distribution in Manual Telephone Exchanges.*—J. BAUMANN.—An illustrated article in which the necessity of improving telephone service by equalizing the operator's load is demonstrated. The selector-switch system of automatic traffic distribution is described, and its immediate applicability to any existing central-battery telephone exchange is shown.—London *Electrician*, Aug. 29, 1913.

*Telephone Stations of the World.*—W. H. GUNSTON.—A statistical article on the telephone development of the world and especially in the great cities up to the beginning of 1912. The paper contains six interesting tables.—London *Electrician*, Sept. 5, 1913.

## Book Review

TELEPHONE ERECTION AND MAINTENANCE. By Herbert G. White. London: S. Rentell & Company. 129 pages, 12 illus., 36 diagrams. Price, 50 cents.

This little publication is in reality a handbook for the contractor and wireman which has been written for the purpose of explaining the principles underlying domestic telephones of the type met with in contracting experience. The work is divided into eight chapters, which treat of house-bell circuits, battery-ringing telephones, magneto-call telephones, intercommunication systems, secret intercommunication systems, switchboard systems, instrument erection, line construction, testing and fault finding, each of which covers its subject in a thorough and interesting manner. Illustrations and simplified wiring diagrams are used effectively for supplementing the descriptive text. An idea of the thoroughness with which the work of the author has been done may be gained from the statement that every point which might confront the contractors from pole-hole digging to switchboard wiring has been carefully and fully covered. The author's twenty-one years' experience in the telephone field, about equally divided between manufacturing and contracting, makes itself felt in the character of the book.

# New Apparatus and Appliances

## An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

### Compound for Attaching Brush Leads to Brushes

For the operating engineer who has need of a means of attaching the flexible copper leads to motor or generator brushes at short notice the Nungesser Carbon & Battery Company, Cleveland, Ohio, has recently put upon the market a copper compound for facilitating the work of making reliable joints of this kind. The compound is sold in a powdered form which may be carried in a small bottle or a box. A hole drilled in the top of the brush to be repaired receives the brush lead and the remaining space is filled with the compound. A hammer and any other tool small enough are used to tamp in the powdered product much after the fashion used by the dentist in placing a gold filling.

It is maintained by the manufacturers that the resulting joint gives satisfaction both as to lasting qualities and current-carrying capacity. It is also stated that the compound may be used with carbon, graphite or metal brushes with equal success.

### Central-Station Service Car

Two electric-service wagons of the type illustrated herewith were shipped recently to the Edison Electric Illuminating Company of Boston by the Waverley Company of Indianapolis, manufacturer. This serviceable car weighs 3500 lb. and will carry a load of 1000 lb. without counting the weight of the driver. Its maximum speed is 15 miles an hour and it is manufactured to run 60 miles on one battery charge.

Sixty cells of type A4 Edison storage battery, in an underslung compartment, supply electricity to a series-wound

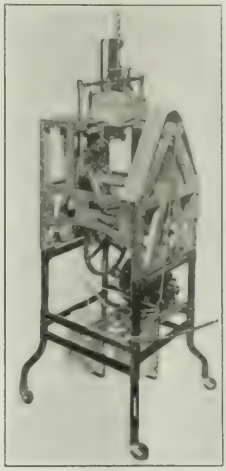



ELECTRIC-SERVICE WAGON

motor, mounted on the steel frame of the car. Shaft drive is used, and all driving gear is inclosed. The braking equipment is of the dual-expansion hub type, which places both brakes on the rear hubs, avoiding braking through any driving mechanism. The vehicle has a wheelbase of 90 in. and is fitted with solid cushion tires.

### Motor-Driven Package-Tying Machine

As letters are sorted in city post offices they are tied up by towns into packages, each marked with its destination. A given piece of mail between post-box and carrier's bag may thus form part of several packages, each of which has now to be tied by hand. A clerk can tie up about six such packages a minute, but the motor-driven machine illustrated herewith is capable of handling thirty-two per minute, tying each package firmly with a double-loop, hard knot, which is proof against slipping. A 0.125-hp Westinghouse motor drives the device, first applying compression to hold the letters in place while being fastened. A lever actuated by the operator's wrist controls the starting of the machine while the hands continue to hold the package in position. Fifteen hundred packages an hour have been tied by one of these machines, the piles ranging from five or six letters to seventy-five in each. As soon as they are tied the packages are automatically swept into a basket at the side, and the machine is ready for another operation. No cord is wasted by the machine, a saving of 40 per cent over the amount required for hand tying being thus effected. Sample machines are now on test by the Post Office Department at New York and Chicago. The machine has, of course, numerous other applications in the tying of packages of all kinds besides that above described. It is the invention of Mr. B. H. Bunn and is manufactured by the Automatic Package Tier Company 9970 Charles Street, Chicago.



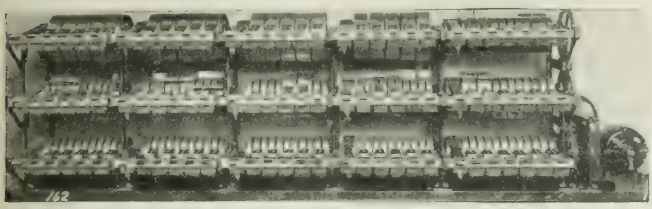
AUTOMATIC PACKAGE TIER

### Central-Station Sign at Washington, D. C.

Manufacturers of electric signs are always striving to produce new displays to attract the attention of passers-by. One such novel sign completed recently for the Potomac Electric Power Company, of Washington, D. C., will be

used to advertise central-station energy. It represents four zouaves going through the military manual, with guns successively at the position of "shoulder arms," "present arms," "parade rest," etc. After the drill is completed the display changes to the central-station advertisement, which reads: "Use Electric Light. Potomac Electric Co."

The sign measures 40 ft. long and 40 ft. wide, being



MAMMOTH FLASHER WHICH OPERATES SIGN HAVING 118 CONTACTS

supported on a frame made of angle irons arranged in the shape of a truss. The frame is supported on 30-in. I-beams, which are in turn carried on the walls of the building. Each zouave figure is 30 ft. tall and measures 9 ft. across the chest. Five thousand incandescent lamps are used on the sign and 20,000 ft. of wire connects them with the flasher. The latter device, illustrated herewith, was built by the Reynolds Electric Flasher Manufacturing Company, Chicago. Color effects are produced by the use of Reco color hoods. Besides its complication in construction, the flasher mechanism is of unusual size. It is built in three tiers placed one above the other. One hundred and eighteen contacts are required to produce the effects described. The sign was manufactured by the Valentine Electric Sign Company, Atlantic City, N. J.

## International Refrigeration Exposition

In connection with the third International Congress of Refrigeration an interesting exposition was opened at the International Amphitheater in Chicago on Sept. 17, the date of closing being Oct. 1. The principal feature is a mammoth glass-walled refrigerator containing a large display of refrigerated foods of many kinds, the exhibits being assembled by the United States Department of Agriculture. Refrigeration for this building and for other refrigerated exhibits is furnished from a service plant consisting of compressors of the Frick, Vilter Manufacturing, York Manufacturing, Larsen and Baker Ice Machine companies belted to electric motors. Indeed, all operating exhibits are electrically driven, Westinghouse, Wagner, Century and other motors being used for this purpose.

A liberal display is made of frost-covered piping used for decorative features, railings around exhibits and lettering. These snowy outlines present a striking appearance and show the effectiveness of refrigeration at once.

"Electric Refrigeration" is the sign displayed at the booth of the Commonwealth Edison Company, which distributes literature and exhibits photographs of the nine ice-making plants in Chicago operated by central-station electric energy. Another electrical exhibitor is the Westinghouse Electric & Manufacturing Company, which has on display a number of alternating-current and direct-current motors and automatic starters. The Triumph Ice Machine Company, of Cincinnati, has in its booth direct-current and alternating-current motors made by the Triumph Electric Company.

In the exhibit of the Carbondale Machine Company, Carbondale, Pa., is shown an evaporator furnishing steam for an engine driving an electric generator. The engine exhaust operates a Carbondale by-product refrigerating machine, producing ice and refrigeration. The Baker Ice Machine Company shows a small raw-water ice-making plant complete. The Huetteman & Cramer Company, of Detroit, has also a complete raw-water ice plant in operation. The Vilter Manufacturing Company, Milwaukee, shows one of the largest ammonia compressors in the exposition, its rating being 125 tons. The York Manufacturing Company, of York, Pa., has a large and well-arranged exhibit of its various stock machines.

Some interesting electric instruments made in Germany are shown by the Hanovia Chemical & Manufacturing Company, of Newark, N. J. These include, among others, resistance thermometers for long-distance measurement of temperature, and telehygrometers, or instruments for testing the humidity of the air at a distance by electrical means. Other exhibits in which the electrical visitor may be interested are those of the American Steam Pump Company, motor-driven pumps and compressors; De La Vergne Machine Company, crude-oil engine; Draeger Oxygen Apparatus Company, pulmotor and oxygen helmet; Goldschmidt Thermit Company, pipe-welding equipment; Harrison Safety Boiler Works, feed-water heaters; H. W. Johns-Manville Company, insulators and supplies; Otto Gas Engine Works, gas engine; Ozone Pure Airifier Company, ozone machines.

## Improved Electric Range

An electric range, which stands 65 in. from the floor to the top of the oven and occupies a floor space of 30 in. by 28 in., has been brought out by the Hughes Electric Heating Company, Chicago, Ill. The increase in height, it is expected, will save much of the labor of stooping to inspect the oven's contents. The body is built of steel with nickel trimmings and the oven is constructed on the fireless-cooker principle. The net weight of the stove is 165 lb.

With all burners turned on to give the highest temperature the stove will take 40 amp at 110 volts. Both top units



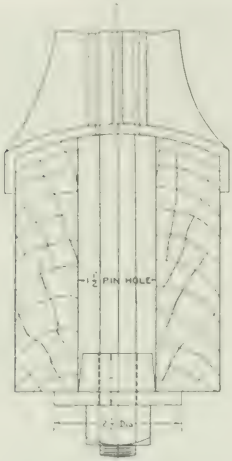
ELECTRIC RANGE

and burners are provided with so-called "three-heat" switches, giving low, medium and high temperatures, the resistance units consuming respectively 220, 440 and 880 watts at the various switch positions. The switches are located where they may be seen so that the cook may know from the switch dials at what temperature the plates or ovens are being operated.

## Cross-Arm Washer

A washer or bushing of special design has been placed on the market by the Electric Service Supplies Company, of Philadelphia, Pa., for use in connection with truss pins on cross-arms.

The function which this washer performs is illustrated in the accompanying drawing. When used in conjunction

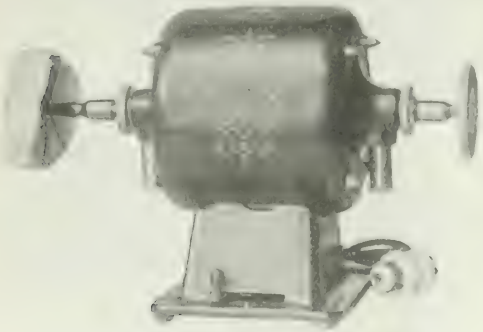



CROSS-ARM WASHER

with these pins the washers reduce the 1.5-in. cross-arm hole so that an iron truss pin having a curved base may be used. This adapter makes possible replacing wooden truss pins with iron pins without renewing cross-arms.

## Motor-Driven Dental Lathe

The Westinghouse Electric & Manufacturing Company has placed on the market a motor-driven lathe designed especially for the use of dentists. The motor is made for operation on either direct-current or alternating-current lighting circuits and is rated at ⅛ hp. The lathes driven by alternating current have two speeds, and those driven by



MOTOR-DRIVEN DENTAL LATHE

direct current have three speeds. The sped changes are effected by a switch lever at the base, which also has an "off" position, so that the lathe can be stopped and started at the work.

The shaft is extended at both ends for mounting chucks which carry buffing and grinding wheels of various sizes, drills, burrs, etc.

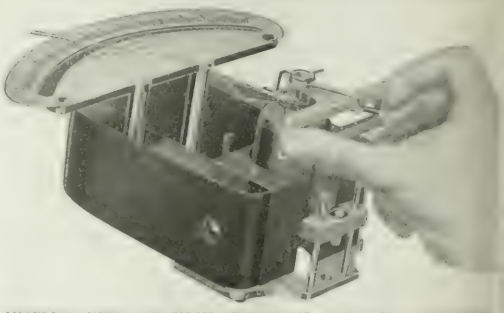
## Glassware with Low Absorption Factor

A white glassware of exceptional reflecting and diffusing qualities is now being manufactured by the General Electric Company, Ltd., London, England. The claim is made for the new product that it has an absorption factor of about 5 per cent over the effective angle of illumination. The inner or reflecting surfaces of the units of this type are of a dull unpolished nature which is not affected by cleaning or rubbing. The outer surfaces are said to possess a subdued polish which combined with their whiteness and texture produces a pleasing effect. This "superflux" glassware, as it is called, is being manufactured in a variety of forms and sizes for use with lamps of all ratings.

## High-Resistance Electric Pyrometer

Electric pyrometers in the past have been instruments of low resistance which when used with leads or thermocouples other than those supplied with the device or their exact duplicates were inaccurate to a considerable degree. With the high-resistance pyrometer just put on the market by the Brown Instrument Company, Philadelphia, Pa., it is claimed that the length of the leads may be varied from 1 ft. to 1000 ft. and the length of the thermocouple may be changed without causing more than a 5 per cent deviation from the correct readings. It is also claimed that the temperature of the leads does not affect the instrument readings.

An accompanying illustration shows the interior construc-



INTERIOR VIEW OF HIGH-RESISTANCE ELECTRIC PYROMETER

tion of the high-resistance system, the redesigned pole pieces and the small moving element. The internal resistance of both the indicating and recording type of instruments is 100 ohms. The moving element, which has been made as light as possible, is of the pivoted type and is supported in sapphire bearings. For the thermocouples either the metal base or the platinum is recommended by the manufacturers for use with the instrument.

## Introducing Electric Washers to Housewives

One of the live agents for the Hurley Machine Company, Chicago, in a college town is using a novel method of acquainting housewives with the merits of the Thor electric home laundry machine. He first advertises that he will do any housewife's washing in her own home at so much per hour. Meanwhile he keeps in touch with a number of students working their way through college who are glad to earn a little extra money. When he gets a call he sends to the house a student with one of the washing machines. The student runs the washer and wringer, finishing in one-third the time it takes by hand, and takes the machine away. This novel advertising stunt effects several good results—the student makes some extra money, the housewife sees the advantages of the washer and usually orders one, and dealer and central station both profit.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Safety Lamp Finds Application.**—The Mannesman Light Company of America, maker of the Ceag portable electric mine lamp, states that the device is finding a good sale in the Pennsylvania coal district. Among the recent buyers of this lamp are the Naomi Coal Company and the H. C. Frick Coal Company, the latter having purchased 300 for use in its various properties.

**Appliance Manufacturer Specializing.**—While about 60 per cent of its business is done in the standard lines of small heating and cooking appliances, the Simplex Electric Heating Company is giving an increased amount of attention to the pushing of its sales in larger and more specialized installations of similar apparatus. The entire equipment of factories, laundries, hotels and large private residences is proving a profitable end of the business which is capable of further development.

**Missouri Manufacturer Moves Offices.**—Because of a large increase in business, which made the carrying on of the same under the old arrangements inefficient, the American Carbon & Battery Company has decided to move its main offices from St. Louis to East St. Louis, where its factory is located, and this change will be effective on and after Oct. 1. Accompanying this change, the company announces that on the same date D. E. Ford, formerly with the Wesco Supply Company, of St. Louis, will join its staff as sales manager.

**Chicago Office Opened.**—The Detroit Fuse & Manufacturing Company has recently opened an office and established a warehouse in the Electric Building at 629 West Jackson Boulevard, Chicago. A full line of its products has been placed in stock, including "Arkless" fuses and iron-clad switches. The office is in charge of Morgan P. Ellis, who will take care of the Middle West business. This is the first time that the company has had its own office and warehouse in Chicago, having been represented by S. M. Farris before the recent change.

**Big Turbine-Driven Blowers Installed.**—At the power plant of the Rhode Island Company, Providence, R. I., there are to be installed shortly two of the largest turbine-driven forced-draft blower sets in the world. Each unit consists of a 600-hp Terry type C high-speed turbine driving, through a set of Falk reduction gears, one of the American Blower Company's No. 11 double-inlet Sirocco blowers. The capacity of each unit will be 250,000 cu. ft. of air per minute. The speed of the turbines will be 3370 r.p.m., while the blowers will run at 460 r.p.m.

**Fer-Lux Lighting Glassware Shown.**—The Max Schaffer Company, of New York, on the occasion of its removal from its old quarters at 258-260 Grand Street to its new and larger ones at 26 Warren Street, held a special fortnight exhibition of domestic and imported electric lighting glassware for indirect and semi-indirect systems. The showroom opening began on Sept. 15 and special attention was drawn to the line of Fer-Lux reflectors, shades and dishes. The company plans to carry a large stock so as to be ready to make prompt shipments on rush orders.

**The Motograph Company of America,** of Detroit, Mich., has closed a contract with the Federal Sign System (Electric) licensing the latter company to construct, operate and lease electrical display signs under the Motograph patents for the United States. At the last meeting of the board of directors F. C. Reilly, who has been prominent in the organization of the concern, was elected its president and general manager. Much comment was aroused by this company's sign at the recent convention of the National Electric Light Association in Chicago, a description of which appeared in the June 7 issue of the *Electrical World*.

**Exhibits Allowed to Accompany Bids on Panama Canal Equipment.**—In connection with the purchase of machinery and equipment for the Panama Canal an order was issued from the office of the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., on Sept. 18, stating that, contrary to usual custom, manufacturers of such equipment would be allowed to file in that office at any time prior to the opening of the bids an exhibit consisting of triplicate copies of detailed specifications, descriptions or drawings covering any of the equipment (particularly the electrical equipment) to be furnished. These exhibits are to serve as an aid in describing the apparatus, and the points to be observed by bidders in order to have them perform this function in a clear, thorough and uniform manner are mentioned in the notice.

**Business Conditions in Europe Said to Be Good.**—The gist of an interview given by Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, on his return Sept. 19 from a five weeks' business visit abroad, was very optimistic. He claimed that business conditions in Europe are good, especially in Engand and France, and that a feeling of confidence has appeared. This gain, he said, has been rather along industrial than financial lines, but money conditions are improving. Regarding the operations and earnings of the European subsidiaries of the Westinghouse company, he said: "The English company is doing excellent business and earnings are better than ever. The French company is also doing good business. The Italian company has done all of the work in the electrification of the government railway and is now engaged in the manufacture of fifty locomotives for the Italian government."

**Booming Detroit Electrically.**—In connection with "Home-Made Week" in Detroit, Mich., an event which took place from Sept. 8 to 13 inclusive, the following electrical manufacturing concerns made exhibits of their products: American Electric Heater Company, Process Manufacturing Company, Smith Chandelier Company, John D. Templeton Company, Hoskins Manufacturing Company, Detroit Fuse & Manufacturing Company, American Electrical Heater Company, Thomas E. Clark Electric Laboratory, George H. Barnes Company, General Service Engineer, Electro Lamp Company, Raymond Electric & Manufacturing Company, Eureka Vacuum Cleaner Company, Dorigan Electrical Company, Dongon Electrical Manufacturing Company and Detroit Insulated Wire Company. So successful was this event, the first of its kind ever held in Detroit, that plans are already under way for a similar affair next year, although on a much larger scale.

**Indiana Company to Build Large Transformer-Oil Plant.**—It is understood that the Standard Oil Company of Indiana proposes to spend over $1,000,000 in the building of a plant addition at Whiting, Ind., for the manufacture of transformer oil, for which there is a large demand in the electrical industry. The Vacuum Oil Company, of Rochester, N. Y., which has hitherto been the largest producer in this field, has been handling its product through the larger electrical manufacturers, but the Indiana concern plans to handle it in a different way, selling direct to the consumer. It is claimed that this arrangement will be to the benefit of all concerned in the long run, since some advantage in freight rates is possible in all but a small territory, and there is less expense involved in the direct shipment to the consumer than in the shipping of large quantities to the big manufacturers, from whom second shipments have usually been made. The changed method of distribution will also remove from these manufacturers a burden in the shape of a special department foreign to the general character of their business.

**New Type of Tungsten Lamp.**—The [illegible] the same type as its "Rayline" lamp, but with a tungsten [illegible] to obtain the required resistance it has been found necessary to make up the unit lamp with two bulbs, each the size of the regular single carbon lamp of that type, the two being connected in series. About 48 cp is obtained on a power consumption of 60 watts. One of the design features is the provision of three anchor wires to take part of the strain from the filament. While this lamp has been on the market for only about three weeks, it has met with success in two fair-sized installations, one at the new Manufacturers' Club, in Philadelphia, Pa., and the other on the pier at Atlantic City, N. J. This company is finding sales brisk and expects an exceptionally busy season in all of its lines.

**Copper Prices and the Copper Wire Situation.**—One of the large copper wire manufacturers, interviewed this week on conditions in that line and on the copper situation in general, stated that there is being experienced a large and steady demand for wire in various sizes and that if there is any point upon which any dissatisfaction can exist it is rather with respect to prices than to the volume of business. Conditions have reached such a basis in this branch of the electrical industry that further large improvements are not looked for either in design or material and there is pretty severe competition between the several large manufacturers for the larger orders. This results in fluctuating prices so that the volume of sales is not an absolute index of the financial status of the industry. This manufacturer, when questioned as to the outlook for higher copper prices, inclined to the opinion that these would come, but not with any suddenness such as has been predicted in some quarters lately.

**New Regulator of the Automatic Rheostat Type to Be Made.**—The Merrill Electric Manufacturing Company, with offices at 313 South Clinton Street, Chicago, has been organized for the purpose of manufacturing and marketing a new device called the Merrill electric regulator. This is described by the manufacturers as being a regulator of the automatic rheostat type but operating more rapidly than anything of this kind yet produced, and in fact comparing favorably in speed with vibrating-type regulators. Its resistance element is continuous and no friction is involved in its operation. According to the manufacturers, the device may be connected in the field circuit of a generator and wound to regulate either voltage or current and is also available for use in connection with storage batteries. F. W. Merrill, president, and J. L. Arthur, vice-president of the company, are chief engineer and assistant engineer, respectively, of Roth Brothers & Company, of Chicago, large motor manufacturers.

**Lamp Factory Building in Minneapolis.**—In the Aug. 26 issue of the *Electrical World* appeared a short description of the new lamp factory in course of construction at Minneapolis, Minn., for the Minnesota Lamp Works of the National Quality Lamp Division of the General Electric Company. Advices since received indicate that some of the figures then given were not accurate. The capacity of the plant at present under construction will be about 22,000 lamps per day and about 600 employees will be engaged. A ground area of 4½ acres will be covered by the structure and 150,000 sq. ft. of floor space will be available for manufacturing, testing and commercial departments. Semi-mill type construction will be used and a sprinkler fire protection equipment installed, together with the latest factory-lighting system. The operating equipment will consist of motor-generator sets and transformers receiving their energy from the local power company at 2300 volts. These lines will enter the building underground, and energy will be delivered through proper transformers to the distributing board, which is subdivided into circuits for each department of the plant. Each individual circuit will be metered so as accurately to determine the consumption of energy in the corresponding department. The apparatus is to be driven by individual motors or by motors from reduction transmission outfits to groups of apparatus, thus reducing to a minimum the use of belts. The testing will be handled through specially designed transformers with appropriate steps so as to give any voltage desired at the delivery point.

**Riley Underfeed Stokers Sold.**—The Toronto (Ont.) Electric Light Company, Ltd., has recently purchased 2200 hp of Riley self-dumping underfeed stokers, which are to be used in a stand-by steam station as a reliability reserve for the power from Niagara Falls. These boilers will carry banked fires continuously and must always be ready to pick up the load instantly in case of any transmission-line trouble. In this type of stoker the reciprocating movement of the grates, which slice the fire, is so well adapted to quick steaming that a boiler at the plant of the Narragansett Electric Lighting Company recently showed 300 per cent of rating in six minutes from a fire that was banked for twenty-four hours. Among the other companies to which the Sanford Riley Stoker Company, Ltd., of Worcester, Mass., has recently sold stokers of the above type are the following: New York Central Railroad, Weehawken, N. J., 2000 hp; Interborough Rapid Transit Company, Seventy-fourth Street station, New York, 500 hp; B. F. Sturtevant Company, Hyde Park, Mass., 400 hp; New York Central Railroad, Yonkers, N. Y., 500 hp; Worcester (Mass.) Electric Light Company, 1500 hp; Municipal Power Plant, Regina, Sask., 3000 hp; Glenlyon Dye Works, Phillipsdale, R. I., 500 hp; International Railway Company, Buffalo, N. Y., 800 hp, and the Youngstown Sheet & Tube Company, Youngstown, Ohio, 2500 hp.

**Legislation for Protecting Foreign Exhibitors at the San Francisco Exposition.**—In order to secure the exhibits of England, Germany and some other foreign countries at the Panama Pacific Exposition in 1915 it was necessary for Congress to pass some measure for the protection of the exhibitors from those countries against piracy of their designs and ideas by American manufacturers, or, more properly speaking, by a certain class of American manufacturers who are content to do business on this plane, since the present patent laws in this country are not of broad enough scope to give any protection in matters of this kind. A bill introduced by Representative Kahn, of California, and passed by both houses of Congress, provides for the granting of an American certificate of registration on all designs exhibited by foreign manufacturers where they have a certificate of registration, trade-mark, patent or copyright issued by any foreign country. This American certificate is to protect the design from unauthorized use by American manufacturers for a period of three years after the close of the Exposition. There has developed a strong opposition to this measure on several important grounds. In the first place it proposes to give a form of protection to foreign exhibitors that is not afforded to American manufacturers. It is also open to the objection that the certificates issued by foreign countries are of small value comparatively, since they are in many cases obtained without the formality of an investigation of the design, that step being put off until such time as litigation for alleged infringement arises. Besides this, the Kahn measure does not provide that the designs registered abroad shall be original, but plans to give protection to any design with a foreign certificate. If it is finally passed and signed, the bill will enable foreign manufacturers to bring over old designs or ones which they have borrowed from American manufacturers—in either case designs which are now in use in this country and at present legally protected—and, by virtue of consenting to their exhibition, obtain the right to control their manufacture and sale in this country for a period of from three to four years, irrespective of the present rights of the American manufacturer. The Kahn measure was regarded as so imperfect in the above-mentioned points and so fraught with danger to legitimate American interests that the Federation of Trade Press Association of the United States at its annual convention in New York on Sept. 18-20 appointed a committee to draw up and file protest against the signing of that bill. However, this association advocates strongly the passing of proper laws for the protection of foreigners as well as of American manufacturers against design piracy, and at its convention steps were also taken preliminary to the calling of a convention at which might be discussed by representatives of all of the interested parties measures for getting efficient laws for this purpose passed.

# Corporate and Financial

**American Public Utilities Company Subsidiaries.**—A bulletin issued by the American Public Utilities Company contains a map showing the location of its various operating plants. The United States Census for 1910 showed a total population in the cities served by the operating subsidiary plants of 471,451, against 332,929 for the year 1910, or an increase of 41 per cent.

**Appalachian Power Company Changes.**—A number of changes have been made in the officers and directors of the Appalachian Power Company. Mr. Frank L. Dame, Mr. Robert C. Morse, Mr. Ernest L. Carr and Mr. F. C. Walcott have been made directors. Mr. Morse succeeds Mr. H. M. Byllesby as president, and Mr. Walcott has been made a vice-president. Mr. Byllesby is a vice-president and a member of the board. Mr. A. P. Taliaferro has been made secretary-treasurer to succeed Mr. R. J. Graf.

**Columbus Reorganization.**—A decision has been rendered by the Court of Common Pleas, Columbus, Ohio, denying the contention of the stockholders of the Columbus Light, Heat & Power Company that the proposed plan of reorganization of the Columbus Railway & Light Company should have been approved by shareholders of the various subsidiary companies before its submission to the Public Service Commission of Ohio. The court held that the plan could be submitted to either the commission or the stockholders first.

**San Joaquin Light & Power Corporation Results.**—The San Joaquin Light & Power Corporation reports gross earnings for the year ended June 30, 1913, of $1,608,960, as compared with $1,379,912 for the preceding year. Operating expenses, maintenance and taxes amounted to $624,179, as compared with $537,701. The net income was $984,781, as compared with $842,211. Interest charges amounted to $359,734, as compared with $339,852. The surplus was $625,047, as compared with $502,357. Preferred dividends amounted to $390,000.

**Alabama Power Consolidation.**—The Alabama Power Company has been formed as a consolidation of the Alabama Power Company, the Alabama Electric Company, the Wetumpeka Power Company, the Alabama Power & Electric Company and the Alabama Power Development Company. The companies which have been merged are subsidiaries of the Alabama Traction, Light & Power Company. The Alabama Power Company will have an authorized issue of $20,000,000 bonds, all of which will be deposited as security under the $10,000,000 first mortgage bond issue of the Alabama Traction, Light & Power Company.

**Northern Ohio Traction & Light Company Bonds.**—An issue of $1,500,000 new collateral trust 6 per cent bonds has been made by the Northern Ohio Traction & Light Company. The bonds are dated Aug. 1, 1913, and are due $100,000 annually on Nov. 1 of 1914, 1915 and 1916, and thereafter at the rate of $100,000 semi-annually until Nov. 1, 1922. They are redeemable, however, in whole or in part at 101 and interest. The bonds are offered by Hayden, Miller & Company, of Cleveland, at par and interest. They are secured by a deposit of $2,300,000 of various mortgage bonds issued by the company or its subsidiaries.

**United Gas & Electric Corporation Report.**—The United Gas & Electric Corporation has issued a report for the twelve months ended June 30, 1913. The statement of earnings, as compiled, includes the equity in the net earnings of subsidiary companies whether or not received as dividends. The total stated as direct earnings, less expense, is $1,214,824. This amount is made up of the direct earnings, less expenses, of the corporation, and the net earnings of its subsidiary companies, after the deduction of dividends on the preferred stock of the subsidiary companies, including the equity of direct subsidiary companies in the operations of their respective subsidiary companies, calculated on the basis of their holdings at the end of the year. From the amount stated there were deducted as interest on notes $283,125, and for preferred dividends $555,738, a total of $838,863. This leaves a surplus of $375,981. Of the surplus earnings determined in this way the proportion added to the surplus account of subsidiary companies and not declared as dividends was $369,969, leaving as the net addition to the surplus of the United Gas & Electric Corporation from operations $6,012. Of the sum of $369,969, added to the surplus of subsidiary companies and from the previous accumulations of surplus of such companies, various amounts were charged during the year on account of extraordinary expenditures which were not held to be applicable directly to the operations of the year. Of these amounts, the proportion corresponding to the holdings of the United Gas & Electric Corporation is $133,420. The balance sheet surplus as of June 30, 1913, was $116,508.

**Electrical Receipts of American Railways Company Subsidiaries.**—The fourteenth annual report of the American Railways Company, covering the fiscal year ended June 30, 1913, shows that the increase in receipts from lighting and power furnished by the subsidiary companies was 15.18 per cent. The gross receipts of the subsidiary companies from all sources, amounting to $5,164,007, gained only 5.55 per cent. The report refers to various improvements made in physical properties during the year. The Home Electric Light & Steam Heating Company, of Tyrone, Pa., obtained 213 new customers, an increase of almost 14 per cent. A contract was made for five years with the borough of Tyrone at a fair advance in the price of lighting. The business of the lighting department of the Roanoke Railway & Electric Company has been extended and shows an increase of about 16.5 per cent. The Scranton Railway Company has made a contract for power with the Scranton Electric Company. The loss in gross receipts of subsidiary companies during the March floods in Ohio was about $50,000.

**Progress of the Consolidated Company of Baltimore.**—A booklet has been issued to show the development of the Consolidated Gas, Electric Light & Power Company of Baltimore since the formation of the present company in 1906. The total gross income of the company in the fiscal year ended June 30, 1913, was $6,114,973, an increase of 70.07 per cent over the year ended June 30, 1906. The other items in the statement and the percentage of increase in 1913 as compared with 1906 were as follows: Operating expenses and taxes, $2,963,180, increase 52.62 per cent; net earnings, $3,151,793, increase 90.56 per cent; interest, $1,476,768, increase 25.49 per cent; surplus, $1,675,025, increase 250.99 per cent; dividends, $810,673, increase 77.27 per cent; balance, $864,352, increase 4,238.25 per cent; reserve for depreciation, amortization, etc., $460,000, no reservation made in 1906; surplus, $404,352, increase 1,929.48 per cent; special reserve, $300,000, no reservation made in 1906; net surplus, $104,352, increase 423.76 per cent. A table is published which shows various statistical results. The number of electrical customers in the 1913 fiscal year was 29,927, an increase of 16,272, or 119 per cent, over the fiscal year ended June 30, 1908. Sales were made last year of 94,876,887.7 kw-hr., an increase of 192 per cent over the 1908 year. The income from the sale of electric energy last year was $2,801,995, an increase of 92 per cent over 1908.

## NEW YORK METAL MARKET PRICES

| | Sept. 15 Bid. | Sept. 15 Asked. | Sept. 22 Bid. | Sept. 22 Asked. |
|---|---|---|---|---|
| Copper: | | | | |
| Standard, spot* | | 17.00 | | |
| | Selling Prices | | Selling Prices | |
| | £ s d | | £ s d | |
| London, standard, spot* | 74 15 0 | | 72 15 0 | |
| Prime Lake | 16.75 | to 16.87½ | 16.75 | |
| Electrolytic | 16.62½ | to 16.75 | 16.50 | to 16.62½ |
| Casting | 16.37½ | to 16.62½ | 16.37½ | to 16.50 |
| Copper wire base | 17.75 | to 18.00 | 17.75 | to 18.00 |
| Lead | | 4.75 | | 4.75 |
| Nickel | 40.00 | to 45.00 | 40.00 | to 45.00 |
| Sheet zinc, f. o. b. smelter | | 8.00 | | 8.00 |
| Spelter, spot | 5.85 | to 5.90 | 5.80 | |
| Tin, spot* | 42.75 | to 43.00 | 41.50 | to 41.87½ |
| Aluminum: | | | | |
| Prompt delivery | 21.50 | to 22.50 | 21.50 | to 22.50 |
| Future | 21.00 | to 21.00 | | |

### *OLD METALS

| | | |
|---|---|---|
| Heavy copper and wire | 14.75 | 15.00 |
| Brass, heavy | 9.25 | 9.75 |
| Brass, light | 8.25 | 8.50 |
| Lead, heavy | 4.65 | 4.65 |
| Zinc, scrap | 4.75 | 4.75 |

### *COPPER EXPORTS

Total tons to Sept. 22 ..... 21,575

*From daily transactions on the New York Metal Exchange.

## Business Notes

**The American Insulating Machinery Company,** of Philadelphia, has announced the removal of its plant and offices from the corner of Hancock and Oxford Streets to the northwest corner of Fairchild and Huntingdon Streets.

**The Arthur Jones Electric Company,** of 223 South Clinton Street, Chicago, has appointed [illegible] Paine as assistant manager in charge of sales. Mr. Paine was formerly connected with the General Electric Company in its sales department.

**The H. P. B. Electric Company,** with main office at Rye, N. Y., has completed arrangements with the Chelten Electric Company, of Philadelphia, Pa., for the manufacture of its line of switches for use in connection with electric ignition, lighting, starting and horn equipments on automobiles.

**The Esterline Company,** Indianapolis, Ind., through its president, Mr. J. W. Esterline, announces the appointment of Mr. W. McK. White as sales manager. Mr. White will have charge of the company's products for automobile lighting, self-starting, etc., while the electrical-instrument department will continue to be directed by Mr. Hansell. In the future Mr. Esterline expects to devote the major part of his own time to technical study of the fields in which the company is engaged. The Esterline Company recently moved to Indianapolis from Lafayette in order to secure increased manufacturing facilities for producing its lighting system for automobiles, motor boats, locomotives, harbors, street railways, etc., and for its several other electrical appliances.

## New Industrial Companies

**The Broad Electric Company,** of Wilmington, Del., has been chartered with a special stock of $[illegible] to manufacture and deal in removable and refillable batteries.

**The Derby Electrical Engineering Company,** of Derby, Conn., has filed a certificate of incorporation with the Secretary of State with a capital stock of $5,000. The incorporators are: Charles J. Dickgiesser, Clinton W. Gray and John T. Donnelly.

**The Killman Hydraulic Power & Transmission Company,** of Tullahoma, Tenn., has been incorporated with a capital stock of $100,000. The company proposes to use the Killman improvements for the transmission of power in the manufacture of automobiles.

**The Holley Company,** of New York, N. Y., has been incorporated with a capital stock of $25,000 to manufacture and deal in electrical appliances, etc. The incorporators are: William V. Holley, Arthur E. Carpenter, 1476 Broadway, New York, N. Y., and Frank S. Barnett, 87 Burnett Street, East Orange, N. J.

## Trade Publications

**Second-Hand Machinery.**—Archer & Baldwin have issued their August list of used electrical and steam machinery, power-house equipment, cars, etc.

**Tools.**—The Smith & Hemenway Company, 150 Chambers Street, New York, has recently issued a catalog listing the net price of 3000 "Red Devil" tools.

**Second-Hand Machinery.**—In a booklet of twenty-two pages the firm of George Sachsenmaier & Company, 142 North Third Street, Philadelphia, publishes its latest list of used electrical machinery on hand.

[illegible] Electric & Manufacturing Company, covers type KB section insulators. The iron parts of this device are sherar-[illegible]

[illegible]

**Turbines.**—Victor-Francis turbines are fully described in Bulletin 708 issued by the Platt Iron Works Company, Dayton, Ohio. Pictures of a number of installations of this apparatus in various power plants are shown.

**Motors.**—Descriptive Leaflet No. 3698 issued by the Westinghouse Electric & Manufacturing Company covers motors for driving intertype and linotype machines. The characteristics necessary for this service are explained, and application views are shown of motors driving these machines.

**Single-Phase Motors.**—Single-phase motors are the subject of Bulletin No. 101 issued by the Wagner Electric Manufacturing Company, St. Louis, Mo. A general description of the apparatus is given, accompanied by many illustrations in some of which are shown their application in various industries.

**Reflectors.**—In an attractive booklet issued by the Gleason-Tiebout Company, 71 West Twenty-third Street, New York, two designs of reflector bowls in special shapes are shown. An invitation is extended to the reader to visit the company's new showrooms and to inspect its full line of artistic semi-indirect glassware.

**Measuring Instruments.**—In Bulletin G, 1913, the Thompson-Levering Company, Philadelphia, Pa., gives descriptions and illustrations of its line of measuring instruments. The Peerless switch-dial testing set, the portable testing set, plug set, improved fault-finder, portable cable-testing outfits and other instruments are referred to.

**Transformer Shipments.**—Leaflet No. 3569, issued by the Westinghouse Electric & Manufacturing Company, describes and illustrates the shipment of transformers in tanks with oil. This method has been adopted in the shipment of large transformers, as it enables them to be installed immediately upon arrival at destination.

**Ball Bearings.**—The Hess-Bright Manufacturing Company, Philadelphia, has recently published some additions to its loose-leaf series 336. Sheet 95, Class IX, refers to ball bearings on vertical spindle of matching machine, and Sheet 96, Class IV, describes and illustrates adjustable mountings for automobile bevel driving pinions and gears.

**Small Turbines.**—The De Laval Steam Turbine Company, Trenton, N. J., has published in booklet form a paper by Mr. George H. Gibson, entitled "Improved Methods of Connecting Small Turbines in Steam Power Plants and Exhaust Steam Heating and Drying Systems," reprinted from the *Journal* of the Engineers' Society of Pennsylvania. It refers to the De Laval apparatus.

**Transformers.**—Catalog 130 of the Adams-Bagnall Electric Company, Cleveland, Ohio, devoted to transformers for lighting and power, is divided into two sections. Section 1 refers to A-B constant potential transformers and Section 2 to balancers. Some general information on balanced design in potential transformers, illustrations and diagrams of special transformer connections make up the contents.

**Household Appliances.**—In connection with its line of nickel and silver plate, solid copper and aluminum ware, Manning, Bowman & Company, Meriden, Conn., manufacture various electrical appliances. These are fully illustrated in the company's mammoth catalog, No. 63, recently issued. In it electric coffee-percolators, tureens, toasters, chafing dishes and numerous other devices are excellently illustrated. Dimensions and prices are given.

**Conduit.**—A pamphlet of sixteen pages has been issued by the American Conduit Manufacturing Company, Pittsburgh, Pa., devoted to "galvanite," a conduit treated by an electrolytic process which is said to produce an article that is non-corrosive and capable of resisting mechanical injury. Comprehensive information regarding the manufacture of the product is given, and also a partial list of installations, in which are included the names of many prominent buildings in the country.

**Lighting Plants.**—Bulletin No. 110 issued by the United States Light & Heating Company, Niagara Falls, N. Y., refers to electric-light low-voltage isolated plants for coun-[illegible] sts of an internal-combustion engine, a direct [illegible] battery and a [illegible] to install and operate. The bul[illegible]s in detail many types of plant and the meth[illegible]g on a plant to meet any requirement.

# Personal Mention

**Mr. R. C. Morse,** of Boston, Mass., has been elected president of the Appalachian Power Company, of Bluefield, W. Va.

**Mr. D. W. McGee** has been appointed local manager of the Fort Lupton (Col.) Light & Power Company as successor to Mr. O. F. Nats.

**Mr. R. S. Smyth,** formerly with the Hornell (N. Y.) Electric Company, has been appointed manager of the Dansville (N. Y.) Gas & Electric Company.

**Mr. H. C. F. Poste,** formerly superintendent of the Canadian Light & Power Company at St. Timothée, Quebec, has been appointed superintendent of the entire system.

**Mr. O. F. Nats,** formerly manager of the Fort Lupton (Col.) Light & Power Company, has been transferred to the Arapahoe Electric Light & Power Company of Littleton, Col., as superintendent.

**Mr. Thomas Shipley,** of York, Pa., was elected vice-president of the American Association of Refrigeration at the annual meeting in Chicago on Sept. 22. He is vice-president of the York Manufacturing Company.

**Mr. W. T. Edmondson, Jr.,** new-business manager of the Alliance (Ohio) Gas Power Company, has severed his connection with that company to become sales manager in the South for the Premier Vacuum Cleaner Company. Mr. Edmondson will make his headquarters at Montgomery, Ala., after Oct. 1.

**Mr. J. S. Alexander,** superintendent of the Houghton County Electric Light Company, of Houghton, Mich., has been transferred to the Savannah (Ga.) Electric Company, which is also managed by the Stone & Webster Management Association. Mr. C. Curtis is the present superintendent of the company at Houghton.

**Mr. Edwin W. Allen,** recently promoted to be assistant district manager of the Chicago office of the General Electric Company, will continue to act as district engineer in the Chicago office. Mr. Allen is a native of Buchanan, Va., and was born in 1879. He was graduated from the Virginia Polytechnic Institute, class of 1900, taking the course of electrical engineering. A year later he entered the testing department of the General Electric Company at the Schenectady works. After two years' training in this department he was transferred to the engineering department under Mr. W. L. Emmet. Here he remained until Oct. 1, 1911, when he was sent to the Chicago office as district engineer, succeeding Mr. James Lyman, resigned. Mr. Allen is an associate of the American Institute of Electrical Engineers and secretary of the Chicago Section of that society. He is also a member of the Engineers' Club of Chicago and has read several papers before technical societies.



EDWIN W. ALLEN

**Mr. Frank L. Dame** has joined the staff of Mr. Harrison Williams, New York. He has just been elected a director of the Central States Electric Corporation and the Appalachian Power Company. Mr. Dame was vice-president of the Electric Bond & Share Company, in charge of the operating department, from 1909 until Jan. 1, 1913. Since his resignation from that position he has been taking a long vacation. Mr. Dame is a graduate of the Massachusetts Institute of Technology. For some years he was connected with the General Electric Company interests on the Pacific Coast and afterward was general manager of the Union Electric Company, Dubuque, Ia. He resigned from that position to become engineer for the Electrical Securities Corporation shortly after the organization of that company in 1904. He held that position until his resignation in 1909 to become vice-president of the Electric Bond & Share Company.

**Mr. Edward W. Lloyd,** of Chicago, general contract agent of the Commonwealth Edison Company and third vice-president of the National Electric Light Association, is one of the real workers in the electric-service industry. Born on Feb. 3, 1872, in Belleville, Ont., Mr. Lloyd spent his boyhood in Erie, Pa. He attended school in that city, but shortly before graduating from high school he began work in a machine shop and partially learned the machinist's trade—a training that was valuable to him in after life. While thus at work he attended night school and studied drawing, and afterward he became a draftsman in local manufacturing concerns in Erie. In 1890 he sought a larger field in Pittsburgh, and in that city he worked as a draftsman for engineering firms engaged in the design and construction of steel plants. Two years later the young man came to Chicago and secured employment with the Crane Elevator Company as a draftsman. In 1893 he formed a connection with the Chicago Edison Company, predecessor of the Commonwealth Edison Company, which has lasted until the present time. Mr. Lloyd's first experience in central-station work was as a draftsman in the electrical department of the company, working on the plans for the Harrison Street station. Gradually he worked into steam testing and general work in the engineering division under the construction engineer. He calibrated instruments and gained a general and diversified experience in the practical features of electrical engineering and construction. In 1898 Mr. Lloyd was transferred to the construction department as a foreman. He developed an aptitude in selling second-hand machinery acquired in shutting down isolated plants and gradually grew familiar with the selling end of the business by estimating on wiring jobs as he had opportunity. In 1902 Mr. Lloyd was made assistant superintendent of construction under Mr. J. H. Goehst. His practical experience and mental alertness proved valuable in getting customers for the company in industrial work. In 1906 he was promoted to be general contract agent of the company. Mr. Lloyd's department has charge of selling the output of the Commonwealth Edison Company and he has about 200 men under him. For a number of years Mr. Lloyd has been prominent in association work. He has written a large number of papers and reports relating to the commercial side of the business for the National Electric Light Association and the Association of Edison Illuminating Companies. His first paper, on "Purchased Electric Power in Factories," was read before the Edison convention ten years ago, and he presented a report on the same subject at the Denver convention of the N. E. L. A. in 1905. He has contributed to the proceedings of these associations nearly every year since then. He is chairman of the heating committee and the electric-vehicle committee of the Edison association and has been chairman of the rate research committee of the N. E. L. A. since 1911. This committee maintains permanent quarters and has done excellent work, for which Chairman Lloyd and the company backing him are to a considerable degree responsible. Mr. Lloyd has served as a member of the executive committee of the Commercial Section of the N. E. L. A. since its organization in 1910. For the year 1912-13 he served as chairman of the Commercial Section. At the Chicago convention of the N. E. L. A. in 1913, to the success of which he contributed not a little, Mr. Lloyd was made third vice-president and a member of the executive committee of the whole association. He is a man of keen discernment, an enthusiast regarding the usefulness of electricity, yet practical withal and with an apparently unlimited capacity for work. Mr. Lloyd is an associate of the American Institute of Electrical Engineers and a member of the Illuminating Engineering Society, the Society for Electrical Development and the Electric Club of Chicago, as well as the Chicago Athletic, Union League and Midday clubs and a number of Masonic organizations.



EDWARD W. LLOYD

# Construction

## New England

[illegible] The Pepperell company has purchased the electric plant of the Clark Pwr. Co. at Union, which furnishes electricity in the towns of Hollis, Bar Mills, Salmon Falls and Clark Mills.

ATHOL, MASS.—The Athol Gas & El. Co. expects to purchase within the next six months 1000-hp waterwheels and 680-kw generator for its plant at Wendall Depot. Paul B. Webber, 35 Congress Street, Boston, [illegible]

BEVERLY, MASS.—The Beverly Gas & El. Co. is building about 12 miles of underground conduits, using Orangeburg fiber conduits, material for which has already been purchased. It is expected to have the conduits finished and the cables nearly pulled through by Jan. 1, 1914. A. W. Rogers is treasurer and general manager.

BOSTON, MASS.—Plans are being prepared, it is reported, by the Commonwealth Ice & Storage Co. for the construction of a cold-storage and power plant on Pier 6, Northern Avenue, to cost about $300,000. The building will be eight stories high, 220 ft. by 250 ft., built of concrete and steel.

BROCKTON, MASS.—The Edison El. Ltg. Co. of Brockton is erecting a 13,000-volt transmission line from East Bridgewater via Whitman to the plant of El. Lt. & Pwr. Co. of Abington and Rockland in North Abington. The line will form a complete triangle so that Brockton, Abington and Whitman can be supplied with energy either way in case of trouble with the lines.

GREENFIELD, MASS.—During the past summer the Amherst Pwr. Co. has erected a two-circuit steel-tower line from Turner's Falls to Springfield, which will operate at 66,000 volts, three-phase, 60 cycles. The spacing of the towers is arranged so that the line can eventually be operated at 110,000 volts. A substation has been built at Amherst containing a bank of transformers which step down to 2300 volts to supply the local requirements of Amherst. This substation also includes a ring bus and complete sectionalizing switches for the transmission line. The company has built and now has in operation at Chicopee Falls a substation equipped with one 4500-kw bank of outdoor oil-cooled transformers and complete outdoor switching station for 66,000 volts; inside the station a 13,200-volt concrete bus structure and distributing switchboard has been placed. Current is transmitted from this station at 13,200 volts. This station is also equipped with motor-generator set to supply energy to the Springfield St. Ry. Co. at Chicopee Falls. A duplicate of this station has been built in Agawam and will be in operation within another month. In addition to the equipment at Chicopee, this station contains a 2300-volt switchboard for local distribution in Agawam, energy to be sold to the Agawam El. Co. F. L. Hunt is chief engineer. The office of general manager and engineering department is at Greenfield.

GREENFIELD, MASS.—Contracts were awarded early in the summer by the Greenfield El. Lt. & Pwr. Co. for extensive additions and remodeling of its Gardner Falls water-power plant near Shelburne Falls. An extension has been erected to the power house (about 68 ft., with the side walls raised). New equipment will be added to the plant, consisting of two 1170-kva, 2300-volt vertical generators with two 1400-hp single-runner waterwheels, one 60-kw vertical waterwheel-driven exciter set, one 60-kw motor-driven exciter set, and complete new switchboard with switches in concrete cell structure. The old generators will be changed to 2300 volts and three 1200-kva, three-phase, water-cooled transformers, 2300 volts to 13,200 volts, will be installed. The waterwheel equipment has been purchased from the S. Morgan Smith Co., of York, Pa.; electrical equipment from the General Electric Co., and the governors from the Woodward Governor Co. The plant originally contained two 400-kw horizontal wheels and generators, generating current at 11,000 volts. A small amount of current was stepped down to 2300 volts for local distribution. It is expected to have the new equipment in operation by Jan. 1, 1914. The company has also recently awarded contracts for rebuilding an old dam on the Green River, opposite its steam plant in Greenfield. The dam will be of concrete and is built primarily to supply a condenser pond for the steam plant. The company is installing a small horizontal wheel and induction generator which will have an output of 75 kva and will generate energy and feed into its system when no water is available. Bids are now being received on transformers to replace those now in the present Greenfield station in order to increase the output so that the transformer voltage between Gardner Falls and Greenfield, between Turner's Falls and Greenfield and between Northfield and Greenfield will be changed from 11,000 volts to 13,000 volts; the output in Greenfield will be approximately doubled. F. L. Hunt is chief engineer.

HUDSON, MASS.—Right-of-way, it is reported, is being secured by the Connecticut River Pwr. Co., of Brattleboro, Vt., for the erection of a transmission line into Hudson. The company is said to be negotiating [illegible] Hudson, it is rumored, [illegible] plant of the latter.

[illegible] equip the Tariffsville branch of the Hartford & Connecticut Western Railroad for electrical operation. Overhead wires will be erected between Tariffsville and Springfield.

WAKEFIELD, MASS.—The town of Wakefield expects to build an underground conduit system through the center of the town in connection with the municipal electric-lighting system. S. L. Cole is manager.

## Middle Atlantic

BINGHAMTON, N. Y.—Bids will be received by the Board of Contract and Supply of the city of Binghamton until Oct. 15 for the construction of a high school building and a heating and power plant, building to be erected on the site of the present high school. Plans and specifications may be seen at the office of the city clerk, Municipal Building, Binghamton, and at the office of C. Edward Vosbury, architect, Binghamton Savings Bank Building, Binghamton. Copies of plans and specifications may be obtained upon application to the architect.

BROOKLYN, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 7 for the installation of a complete new electric elevator plant and a hydraulic pumping plant in the United States post office in Brooklyn, in accordance with drawings and specifications copies of which may be obtained at the above office or at the office of the supervising chief engineer. O. Wenderoth is supervising engineer.

CHITTENANGO, N. Y.—At a special election held Sept. 13 the proposition to light the streets of the village with electricity was carried.

GLENS FALLS, N. Y.—The State Conservation Commission has given its approval of the plans for the construction of a multiple-arch concrete dam in the Hudson River at Palmer Falls, to cost $250,000, and a concrete dam at Glen Street, Glens Falls, to cost $100,000, by the International Paper Co. These will replace wooden structures and the water will be used in operating pulp mills.

GOUVERNEUR, N. Y.—The Northern New York Marble Co., of Gouverneur, is erecting a new mill on the site of the old mill burned last winter. An electric generator will be installed to supply electricity to operate the machinery and for lighting the mill.

NEW BERLIN, N. Y.—The New Berlin Lt. & Pwr. Co. expects to purchase within the next two months a 100-hp boiler and 75-hp engine. G. H. Butterfield is treasurer.

PORT HENRY, N. Y.—The State Conservation Commission has approved plans and specifications of the Port Henry Lt., Ht. & Pwr. Co. to build a dam at North Bend, in the town of Moriah.

SCHENECTADY, N. Y.—The Schenectady Illg. Co. has recently signed a contract with the city of Schenectady to furnish an ornamental street-lighting system, beginning Oct. 24. The contract provides for 60 6-amp inverted magnetite-arc lamps on ornamental iron posts, placed approximately 100 ft. apart, with staggered arrangement through the business section of State Street. The lamps and station equipment are to be furnished by the General Electric Co. and the ornamental posts by the Ornamental Pole Ltg. Co. C. S. Van Dyke is superintendent of operating department.

WATERTOWN, N. Y.—The New York Utilities, Inc., of Watertown, has applied to the Public Service Commission for permission to construct a hydroelectric plant and to issue bonds and stock for the purpose of purchasing water rights and land located on the Beaver River near the hamlet of Belfort, Lewis County. The present plans provide for the construction of a dam at Violet Falls over 1000 ft. long, the water to pass through three waterwheel units of about 1800 hp each. About three-fourths of the work has been done and it is expected to complete the entire project by Jan. 1, 1914. C. C. Burns is president of the company, and J. B. Taylor is treasurer.

WAYLAND, N. Y.—The Wayland El. Lt. & Pwr. Co. expects to purchase within the next three months one 100-kw, three-phase, 2200-volt generator and within the next 10 days some transformers and No. 4 and 8 wire.

ALBURTIS, PA.—The Borough Council is reported to have accepted the proposition of the Allentown El. Lt. & Pwr. Co., of Allentown, to furnish electrical service here.

CHAMBERSBURG, PA.—Bids will be asked in the near future for the construction of a one-story brick addition to the municipal electric-light plant, to cost about $3,000.

CHAMBERSBURG, PA.—Plans are being prepared by W. R. Rhoads, 476 Broad Street, Chambersburg, for the construction of a one-story brick, concrete and steel power plant for Wilson College, Chambersburg. George Barlett, of Chambersburg, is director.

EAGLES MERE, PA.—The Eagles Mere Lt. Co. expects to purchase within the next three months two automatic feeder regulators, 5 kva each, 60 cycles, 2200 volts. R. D. Kehrer is general manager.

EVERETT, PA.—The property of the Everett Lt., Ht. & Pwr. Co. has been purchased by H. G. Frederick and F. S. Bradenbaugh, of Millersburg, who own and operate five other water plants in this State.

MEDIA, PA.—The municipal electric light committee will install an additional 100-kw alternating-current generator directly connected to an engine (either steam or internal combustion) and will also make extensions to transmission lines. Bids for the work will probably be received in January, 1914. P. E. Ahearn is superintendent.

PITTSBURGH, PA.—The Armstrong Cork Co., of Pittsburgh, does not contemplate making any extensions to the electrical equipment of its plant. The proposed improvement consists only of replacing two boilers.

STEELTON, PA.—The Borough Council has authorized the finance committee of the Council to secure estimates for the installation of a municipal electric-light plant, and also on the cost of securing energy from the York Haven plant.

WARREN, PA.—The contract for furnishing material and construction of power house at the Pennsylvania State Hospital at Warren has been awarded to the Henry Shenk Co., of Erie, Pa., for $36,946. The Alphons Custodis Chimney Const. Co., of New York, N. Y., was awarded a contract for brick chimney for this power house. L. E. Marks and J. E. Woodwell, 103 Park Avenue, New York, N. Y., are engineers.

CAMDEN, N. J.—The Public Service Corpn. has submitted a proposition to the street committee of the City Council to place its wires underground. The cost of the work is estimated at about $250,000.

SOUTH BOUND BROOK, N. J.—Bids will be received by the Mayor and the Borough Council until Oct. 1 for lighting the streets of the borough for a period of five years. Peter Merlett is borough clerk.

BLUEFIELD, W. VA.—The stockholders of the Appalachian Pwr. Co. have approved an issue of $3,000,000 in bonds, the proceeds to be used for taking up floating indebtedness and for improvements and extensions to its property. Robert C. Moore was elected president.

BLUEFIELD, W. VA.—The Appalachian Pwr. Co., of Bluefield, has awarded the contract for construction of a power house at Bluestone Junction to C. H. Hancock, of Lynchburg. The proposed power plant will furnish energy to operate the Norfolk & Western Railroad between this city and Vivian.

WHEELING, W. VA.—The West Virginia Trac. & El. Co. is reported to have placed orders for a 5000-hp engine for the Elm Grove plant, to replace the one which recently broke down.

CLINTWOOD, VA.—Arrangements are being made for the installation of an electric-light plant in Clintwood. Harman and John Mullins are reported to be interested in the project.

MILLBORO, VA.—The Millboro Lumber Co. is contemplating the installation of an electric-light plant and water system in connection with its proposed single-band mill. J. M. Murdock, of Johnstown, Pa., is president.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Oct. 7 for furnishing at the various navy yards and naval stations supplies as follows: Washington, D. C., Schedule 5867—repairing and converting batteries. Brooklyn, N. Y., Schedule 5853—140,000 ft. silicon bronze aerial wire, miscellaneous annealed brass wire and copper binding wire. Bids will also be received until Oct. 14 as follows: Eastern yards, Schedule 5863—10 sets turbine-driven, circulating pumps, complete with turbines; Boston, Mass., Schedule 5862—two electrically operated deck winches; Brooklyn, N. Y., Schedule 5878—two three-motor (electric) traveling wall cranes. Bids will also be received until Oct. 21 as follows: Puget Sound, Wash., Schedule 5864—one motor-driven grinding machine. Norfolk, Va., Schedule 5887—one motor-driven spiral disk grinder. Boston, Mass., Schedule 5888—one motor-generator set. Bids will also be received until Oct. 28 for the following supplies: Mare Island, Cal., Schedule 5879—one electrolytic, oxygen-hydrogen generating plant. Puget Sound, Wash., Schedule 5869—one three-drum sander, complete with motor, etc.; Schedule 5882—one 10-ft. power squaring shears; Schedule 5869—one 8-in. by 30-in. double surfacer, complete with motor, etc. Bids also will be received until Nov. 4 as follows: Pearl Harbor, Hawaii, Schedule 5871—12,000 ft. three-conductor, paper-insulated, lead-covered cable; miscellaneous fiber conduit; Schedule 5872—telephone switchboard, etc., and 50 common-battery telephones. T. J. Cowie is paymaster general United States Navy.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until Sept. 30 for the following supplies under Proposal No. 679: (1) For 15,000 ft. of molding, type A; (2) 250 heat coils for Cook lightning arresters (composition); (3) 36 one-strip terminal boxes (new model); (4) 42 two-strip terminal boxes (new model); (5) 12-four strip terminal boxes; (6) 100 (1-lb.) cans of chromate for Fuller cells; (7) 50 30-amp fuses, type 3; (8) 200 1-amp fuses, type 9; (9) 200 lb. insulating; (10) 50 binding posts for carbon plates for Fuller cells; (11) 10,000 paper sleeves (3/16 in. by 1 in.); (12) 18 hard-rubber battery syringes; (13) 1500 lb. bluestone in 1-lb. boxes; (14) 24 Eldridge battery voltmeters, 0-6 volt (Advance) in cases; (15) six syringe hydrometers, type V; (16) 50 spiral springs for telegraph keys; (17) 12 10-pair, S-8 Cook terminals; (18) 6000 12-in. oak insulator brackets; (19) 20 pay-out reels with shoulder carrying straps; (20) 700 19-point studs for model A connectors; (21) 250 self-soldering heat coils for Cook No. 8 protectors; (22) 150 cases for batteries; (23) standard binding posts, flat base, wingnut, nickeled, type A; (24) single binding posts, machine screw base, American style, nickeled, type C; (25) 50 frames for type V cells; (26) 12 Hubble porcelain, separable attachment plugs; (27) 400 Mason fused lightning arresters; (28) 100 pairs choke coils for Mason arresters, with carbon blocks and brass insulators; (29) one Western Electric No. 4a 60-pair protector strip, complete with carbons, mica and heat coils; (30) six 20-pair, S-8, fused, 2-top Cook terminals; (31) six 50-pair, S-8, fused, can-top Cook terminals; (32) 24 corrugated, rod-type No. 17, electrose insulators; (33) 50 No. 306, AX, roof-type electrose insulators. Major W. L. Clarke is disbursing officer.

## North Central

BAY CITY, MICH.—The Electric Light Department expects to purchase within the next four months two 75-lamp and two 100-lamp, 4-amp. constant-current transformers with direct-current reactance and 200 arc lamps. William H. Fitzhugh is superintendent of the municipal electric-light plant.

BLISSFIELD, MICH.—The electric-light committee expects to erect an addition to the municipal electric-light plant and to purchase a 150-kw or 200-kw engine-driven or turbine-driven generating unit within the next six months. R. H. Ellis is superintendent.

CRYSTAL FALLS, MICH.—The city of Crystal Falls has recently installed a new luminous-arc lamp (50 lamps) street-lighting system. J. H. Sanders is superintendent.

HOUGHTON, MICH.—The Houghton County El. Lt. Co., of Houghton, expects to erect within the next three months an addition to the substation building of the Houghton County Trac. Co. in Laurium. The company has purchased a new 13-panel switchboard for its substation and is making some changes in its high-tension lines. Gardner Rogers is manager.

PELLSTON, MICH.—The Cheyboygan El. Lt. & Pwr. Co., of Cheyboygan, has applied to the State Railroad Commission for permission to purchase the property of the Pellston Lt. & Pwr. Co.

SAULT STE. MARIE, MICH.—The Lake Superior Corpn. has awarded a contract for the deepening of its power canal from 18 ft. to 24 ft. to the Soo Dredging & Const. Co. for $300,000. This work is preliminary to a general extension of its steel mill on the Canadian Soo, the cost of which will aggregate $15,000,000.

TRAVERSE CITY, MICH.—The contract for construction of the dam for the Boardman River Lt. & Pwr. Co., of Traverse City, has been awarded to C. H. Smith, of Eaton Rapids.

BELLEFONTAINE, OHIO.—The City Council has decided to recommend a bond issue for improvements to the municipal electric light plant.

LANCASTER, OHIO.—The proposition to construct a municipal electric-light plant in Lancaster will be submitted to the voters at the November election.

McCOMB, OHIO.—The Board of Public Affairs expects to purchase within the next month one 150-hp tubular boiler, 140 lb. pressure, for the municipal electric-light plant. A. Keel is clerk of board of public affairs.

OAK HARBOR, OHIO.—At an election held Sept. 16 the proposition to issue $20,000 in bonds for the installation of a municipal electric light plant was carried.

WELLINGTON, OHIO.—The municipal electric light commission expects to purchase within the next six months a gas engine with a rating of about 100 hp to carry the day load. A. R. Branson is clerk.

CATLETTSBURG, KY.—The local electric light plant recently purchased by the Ohio Valley El. Ry. Co., of Huntington, W. Va., will be discontinued, and energy for operating the local system will be supplied from the power house of the Ohio Valley company at Kenova, 2 miles distant. A three-phase, 60-cycle, 2200-volt system will be used and 75 4-amp magnetite arc lamps will be installed in Catlettsburg, operated by 250 arc rectifiers in the Kenova plant. The name of the local company has not yet been decided upon. W. W. Magoon, of Huntington, W. Va., is general manager.

FULTON, KY.—Work has begun on remodeling the plant of the Fulton El. Lt. & Pwr. Co. The output of the plant will be increased by the installation of a 250-hp battery of boilers, replacing the present 100-hp boiler.

LAKELAND, KY.—We are informed that the power house was damaged by the fire recently, but little injury was done to the equipment of the power plant of the Central State Hospital at Lakeland, which in the issue of Sept. 13 was reported to have been destroyed. W. C. Gardner is superintendent.

LOUISVILLE, KY.—The new addition being erected to the plant of William Schuff & Co., of Louisville, will be equipped with electrically operated cutting machinery. The company may generate its own energy, although this has not yet been determined upon.

LOUISVILLE, KY.—The American Oak Leather Co. is equipping the cutting room of its Louisville plant with electrically operated cutting machinery. Other machinery will also be equipped for electrical operation. Preparations are being made by the company to install a generator to furnish energy to operate the plant.

PERRYVILLE, KY.—W. J. Debaun, owner of the local electric-light and ice plant, is contemplating increasing the output of both plants. Equipment for the plants, it is understood, will be purchased at once.

PIKEVILLE, KY.—The Sandy Valley Lt. & Pwr. Co., successor to the Pike Lt. & Pwr. Co., of Pikeville, has contracted with the Consol. Coal Co. for energy to be transmitted from Jenkins, Ky., at 40,000 volts. The company will close down its present plant (220-volt, direct-current) and use alternating current, 2200-110-volt, 60-cycle, and will establish a 24-hour service. L. L. Stone is manager.

ARGOS, IND.—The City Council has entered into a contract with the Rochester Lt., Ht. & Fuel Co., of Rochester, for energy to operate the municipal electric-light plant for a period of 20 years, beginning Oct. 1, 1913. E. E. Willsey is town clerk.

CENTERVILLE, IND.—The Power Light, [illegible] an issue of [illegible] for the [illegible] installation of a municipal electric light plant. Bids have already been [illegible]

PAXTON, ILL.—The Central Illinois Utilities Co., of Paxton, is [illegible] generating unit, Stirling boilers, etc.; also a 600-kva outdoor transformer [illegible]

[illegible] installing a municipal lighting system and water-works.

EAU CLAIRE, WIS.—Bids will be received by J. C. Fennesey, city clerk, until Sept. 30 for lighting the streets of the city by electricity.

GRANTSBURG, WIS.—Bonds to the amount of $9,000 have been [illegible]

RACINE, WIS.—The Milwaukee El. Ry. & Lt. Co. is planning to place its wires in the business district underground.

BIRD ISLAND, MINN.—The Village Board has awarded the Minnesota Central Lt. & Pwr. Co., of Glencoe, a contract for street lighting. The Council has passed a resolution authorizing cluster lamps on three blocks on Seventh Avenue. The company is erecting a new plant here and also proposes to supply energy for lamps and motors in Hector and Buffalo Lake.

MADISON LAKE, MINN.—A committee has been appointed by the Commercial Club to investigate the advisability of installing a municipal electric-light plant in connection with the water-works system. F. B. Knoff, Lewis Fitcher and C. E. Bush are members of the committee.

MORA, MINN.—Preparations are being made by the Mora El. Co. to enlarge its plant in order to establish a 24-hour service. The company was recently granted a 20-year franchise.

OLIVIA, MINN.—The Village Council expects to erect within the next two months a transmission line to transmit alternating current at 2300 volts; also to purchase within the next three months some electrical appliances, including heating and cooking apparatus, vacuum cleaners, washing machines, etc., in connection with the municipal electric-light plant. M. J. Dowling is president of the Village Council.

SPRING VALLEY, MINN.—Arrangements are being made by the Spring Valley El. Lt. & Investment Co. to rebuild its entire plant, changing the system from direct current to alternating current. New generators and boilers will replace those now in use, new wires will be erected and the wires on Broadway will be removed and placed in alleys. A transmission line will be erected to Grand Meadow to furnish electrical service in that village. Steps have been taken by the business men in Dexter to have a transmission line extended to that village.

BATTLE CREEK, IA.—The proposition to install an electric-lighting system in Battle Creek will soon be submitted to the voters.

DES MOINES, IA.—The Des Moines El. Co., it is reported, is planning to build a large power plant on the Des Moines River in this city to furnish electricity to surrounding cities and towns. The electric light and power plants at Colfax and Prairie City, it is said, will be taken over by the company, which already owns the systems at Oskaloosa, New Sharon and Montezuma. W. H. Thompson, Jr., is general manager of the company.

GARNER, IA.—The Enterprise El. Lt., Ht. & Pwr. Co. expects to purchase within the next six months one 100-hp engine and generator; also heating and cooking apparatus, vacuum cleaners, washing machines, etc. H. F. Kellogg is superintendent.

JEFFERSON CITY, MO.—The City Council is reported to have engaged an engineer to prepare plans and estimates for the installation of a municipal electric light plant.

LINN CREEK, MO.—Contracts have been awarded by the Niangua Heights Devel. Co., of Linn Creek, for the construction of dam and power house for hydroelectric power plant at the mouth of Linn Creek. The plans provide for the development of 300 hp at a cost of about $5,000. It is understood that the equipment has not yet been purchased. R. G. Scott & Sons are engineers.

MEXICO, MO.—The Mexico Pwr. Co. has agreed to erect four iron lamp standards, equipped with various styles of lamps, to enable the Council to decide upon the style of lamps for the new street-lighting system. E. R. Locke is manager.

MONTGOMERY CITY, MO.—The Montgomery Ice & El. Co. expects to remodel its ice plant during October and November and to increase the output from 5 tons to 10 tons per day; also to purchase water heater for a 100-hp boiler and skimmer for same. E. H. Algermissen is proprietor.

MOUND CITY, MO.—The Mound City El. Lt. & Ice Co. expects to erect within the next few months 10 miles of 6600-volt transmission line and two steel towers crossing the Missouri River. R. W. Neill is superintendent.

PLATTE CITY, MO.—The Platte City El. Lt. & Pwr. Co. expects to purchase within the next six months one 50-hp to 60-hp Corliss engine, and within the next two months a water pump; also within the next 30 days some incandescent lamps and electrical appliances and supplies, [illegible] etc. Smith Clemings is manager.

RAPID CITY, S. D.—Bids will be received by J. S. Woodward, secretary board of education, until Oct. 11 for the installation of electric [illegible] system and program clock system in the high school building.

SPRINGFIELD, S. D.—A petition, it is reported, will be presented to the City Council in the near future asking that an election be called to submit the proposition to issue $15,000 in bonds for the installation of a municipal electric-light and power plant to the voters.

RAVENNA, NEB.—The Ravenna El. Lt., Ht. & Pwr. Co. expects to purchase within the next six months electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, etc. A. T. Shellarbarge is superintendent.

SALEM, NEB.—At an election held Sept. 15 the proposition to con[illegible] light plant was carried. R. B. Huston is village clerk.

## Southern States

CHERRYVILLE, N. C.—Bids will be received by the Mayor and Board of Commissioners, Cherryville, until Sept. 30, for furnishing material for constructing complete water-works system, consisting of laying 5 miles of pipe, erection of pumping station, reservoir, steel tank and tower, deep wells, electric-driven pumping machinery, air compressors, etc. Plans and specifications may be obtained on application to J. Newton Johnston, engineer, Box 165, McColl, S. C. Plans are on file and may be seen at the office of J. B. Houser, Mayor.

SCOTLAND NECK, N. C.—Extensive additions are contemplated to the municipal electric-light plant, but as yet details have not been decided upon. L. R. Mills, Jr., is superintendent.

WILSON, N. C.—The city of Wilson expects to erect within the next twelve months a new power plant and to purchase two 500-hp turbines or engines, generators, boilers, exciters, pumps, condensers, oiling system, switchboard and 2½ miles of 0000 cable. R. J. Grantham is superintendent of water and lights.

CHARLOTTE, S. C.—The Southern Pwr. Co., of Charlotte, is reported to be contemplating the construction of another large power plant at Fishing Creek, on Broad River, about 15 miles from Rock Hill.

LANCASTER, S. C.—The Lancaster Lt. & Pwr. Co. expects to purchase within the next two months a few transformers and poles. J. T. Woodward is manager.

ATLANTA, GA.—The City Council has appointed a committee of five to look into the matter of the advisability of establishing a municipal electric-light plant and cost of same and report to the Council not later than the first Monday in December.

AUGUSTA, GA.—Contracts to build an electric railway between Augusta, Ga., and Columbia, S. C., have been awarded by the Carolina & Georgia Ry. Co. to M. P. McGrath, of New York, N. Y. The proposed railway will be 110 miles in length and will connect with the traction system in the Piedmont district built by James B. Duke.

GAINESVILLE, FLA.—Bids are being asked for the installation of an ornamental street-lighting system in the business district. The plans provide for 88 standards carrying five-lamp clusters (one 100-watt and four 60-watt tungsten lamps). The lamps will be maintained by underground wires (steel taped cable is to be used). G. H. Cairns is city engineer.

HOMESTEAD, FLA.—Application has been made to the City Council by F. J. Powers for a franchise to construct an electric-light plant and ice factory.

LARGO, FLA.—The installation of an electric-light plant is under consideration. J. N. McClung is reported to be interested in the project.

PENSACOLA, FLA.—The Pensacola El. Co. expects to complete within the next two months the construction of an addition to its power station and have in operation a 600-hp boiler, an 1875-kva Allis-Chalmers turbo-generator, a 500-kw-motor-generator set, a 50-kw Terry turbine exciter, a Westinghouse Le Blanc condenser and necessary switchboard panels for the above apparatus, (all additional equipment). Stone & Webster Engineering Corp., Boston, Mass., is engineer. Alba H. Warren is manager.

JACKSON, TENN.—The Jackson Ry. & Lt. Co. has applied to the City Council for a new franchise. If granted, it is understood that the company will make extensions and improvements to its property. S. S. Bush, Columbia Building, Louisville, Ky., is manager.

RIPLEY, TENN.—The Ripley Lt., Wtr. & Ice Co. expects to purchase within the next six months one three-phase generator and a series street-lighting system. W. A. McCallum is superintendent.

ROANOKE, ALA.—The Council is considering the question of issuing $20,000 in bonds for the municipal electric light and water plant. W. Y. Chewning is Mayor.

OKOLONA, MISS.—The managers of the municipal electric-light and water plant expect to purchase a deep-well pump within the next four months. T. M. Beaty is manager.

MARKSVILLE, LA.—The Town Council has awarded the contract for the construction of an electric-light plant and water-works system [illegible]

BLACKWELL, OKLA.—Improvements are being made to the municip

electric-light plant, including the installation of a 300-hp water-tube boiler. R. C. Morris is electrician.

GRANDFIELD, OKLA.—The Town Council has granted an electric-lighting franchise to Messrs. Brabham and Edwards, of Frederick.

BEEVILLE, TEX.—The Beeville Pwr. & Lt. Co., recently organized, it is understood, will take over the properties of the Beeville Ice & Pwr. Co., the Beeville Mfg. Co. and the Beeville Wtr. Co. and will supply water, electricity for lamps, heat and motors, ice and cold-storage service in Beeville, and probably in other places in this vicinity. J. W. Greer is general manager.

DUBLIN, TEX.—The Dublin Gas & El. Co. is planning to erect a transmission line from Dublin to Hamilton. It is now erecting a transmission line from Dublin to Hico, a distance of 22 miles. The company also proposes to build a new central power station to furnish energy for the three systems, to be located in one of the three towns, the location to be decided upon later.

EAGLE PASS, TEX.—The International El. Co., of Eagle Pass, has entered into a contract with the Rio Grande Valley Land Co. and the Indio Cattle Co. to supply energy for operating a number of irrigation pumping plants upon lands which the two companies are developing. The International El. Co. will erect a system of distribution lines to points in this section and to the ranches of the two companies with which it has made contracts. The company will also enlarge its power station in Eagle Pass at a cost of about $55,000.

GALVESTON, TEX.—A special meeting of the stockholders of the Galveston-Houston El. Co. has been called for Oct. 6 to vote on the proposition of increasing the capital stock by $2,000,000 to provide funds for extensions and improvements to the street railway service in Galveston and Houston, as well as the interurban line between the two cities. Among the proposed improvements is included an increase of power facilities, purchase of new equipment, construction of carhouses and extensions of track.

GATESVILLE, TEX.—The Gatesville El. Lt. & Pwr. Co. expects to erect within the next six months a power house and to purchase a generator, a 200-hp Diesel engine (gas) and a gas producer. C. F. Caruth is secretary.

HEREFORD, TEX.—The Hereford El. Lt. & Pwr. Co. expects to install a 10-ton ice plant within the next six months; also to purchase one 125-hp return tubular boiler. F. H. Oberthier is owner and manager.

PALESTINE, TEX.—Work will soon begin on construction of plant of the Texas Lt. & Pwr. Co., to replace the one recently destroyed by fire.

SEQUIN, TEX.—The Hamilton Townsite Co., which proposes to develop 225 acres for townsite and 10,000 acres for farming at junction of Nueces, Frio and Atascosa Rivers, contemplates the installation of an electric-light plant, water-works, ice factory, hotel, etc. Bids for artesian wells, dams, hotel and ice plants are now being received. Charles R. Tips is general manager.

## Pacific States

ELMA, WASH.—The Elma Lt. & Pwr. Co. has applied to the County Commissioners for a franchise to erect transmission lines along the county road between Montesano and Satsop, and also from Elma south to the Chehalis River.

PE ELL, WASH.—The Central Pwr. Co., of Pe Ell, has applied to the Commissioners of Pe Ell County for a franchise to extend its transmission lines to Frances and Lebam.

NEWBERG, ORE.—The Yamhill El. Co. is erecting a 4-mile transmission line for rural service to furnish electricity to farmers and fruit driers. The company has completed a transmission line (4 miles long) and a distributing system in St. Paul, Ore. C. J. Edwards is manager.

SHERIDAN, ORE.—Preparations are being made by the Sheridan Lt. & Pwr. Co. for the installation of two feeder panels, one synchroscope, etc., the erection of a transmission line connecting Willamina and Sheridan, 5 miles long, connecting the plants in the two towns, and reconstructing lines in Sheridan, work on which will begin Oct. 1. The company has recently installed a new boiler and six transformers. O. L. Davis, foreman, will have charge of the work. J. L. Thompson is general manager.

RANDSBURG, CAL.—The Yellow Aster Mining & Milling Co. has entered into a long-term contract with the Southern Sierras Pwr. Co., of San Bernardino, whereby the latter agrees to furnish energy to operate the machinery in the Yellow Aster mine and mills and various pumping plants. It is estimated that about 1200 hp will be required.

PRESCOTT, ARIZ.—A syndicate of Bangor (Maine) men, represented by J. Barton Nealey, has secured an option on the holdings of the Cataract Canyon Pwr. Co. If taken over, the purchasers propose to construct a large hydroelectric power plant in Cataract Canyon. The water has a drop of 1800 ft. in a distance of 6 miles. The proposed plant will have an output of 12,000 hp, which will be transmitted to a number of mining camps and towns in this part of Arizona.

CARTERSVILLE, MONT.—Plans are being prepared by the Cartersville Land & Irrig. Co., of Minneapolis, Minn., for the construction of two irrigating projects to irrigate 15,000 acres of land. Three pumping stations will be erected, requiring a total of 3000 hp, to be developed from coal mines owned by the company. Steam and gas producer units are being considered. Bids for construction of the work will be received about April 1. J. H. Cunningham, Lumberman Building, Portland, Ore., is chief engineer.

RED LODGE, MONT.—Members of the Commercial Club of Red Lodge have organized a company under the name of the Red Lodge El. Ry. Co. to build an electric railway to Bear Creek, a distance of 9 miles. It is understood that work will begin on the proposed railway this fall.

DOUGLAS, WYO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 29 for construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Douglas, Wyo. Drawings and specifications may be obtained from the custodian of the site at Douglas, Wyo., or from the above office. O. Wenderoth is supervising architect.

BEOWAWE, NEV.—Plans are being considered for the installation of an electric-light system in Beowawe, energy to be supplied from the proposed new plant to be located in the Humboldt Mountains. George Wingfield is reported to be interested in the project.

BUCKHORN, NEV.—The installation of an electric-light system in Buckhorn is under consideration. Energy for operating the system is to be secured from the proposed new plant to be located in the Humboldt Mountains. George Wingfield is reported to be interested in the enterprise.

## Canada

VANCOUVER, B. C.—The British Columbia El. Ry. Co. has submitted a proposition for furnishing electricity to light the municipality of Saanich. The company offers to furnish energy at 3½ cents per kw-hr. if a minimum of 500 80-watt lamps are used, or at 3 cents per kw-hr. if 1000 lamps are used.

VANCOUVER, B. C.—We are informed that the city of Vancouver does not contemplate the construction of a hydroelectric plant as reported in the issue of Sept. 6. The city will not be in a position to consider the question of municipal ownership of a lighting plant until the expiration of the franchise of the British Columbia El. Ry. Co.

PORTAGE LA PRAIRIE, MAN.—Plans are being considered for the erection of a transmission line from Winnipeg to Portage la Prairie to supply energy for lamps and motors. The cost of the line is estimated at $250,000. D. Deacon is Mayor.

SOURIS, MAN.—A by-law was passed on Sept. 2 authorizing the expenditure of $40,000 for the installation of an electric-light and power plant.

TRURO, N. S.—The Town Council, it is reported, has decided to install a municipal electric-light plant. Generating machinery with necessary auxiliary equipment and also a complete outfit for ornamental street-lighting system will be required.

BRAMPTON, ONT.—The Council has passed a by-law authorizing an issue of $15,000 in debenture bonds to provide funds for an extension to the Hydro-Electric Power Commission system.

FOREST, ONT.—The town of Forest has recently purchased the local electric-light plant (by expropriation) and is now building a new power station near the town hall. The generating equipment (a 70-kva Westinghouse unit) in the present plant will be transferred to the new building. Extensions will be made to the distribution system and concrete poles erected. The streets will be illuminated by 100-watt tungsten lamps. H. A. McLean, town engineer of Sarnia, is supervising the work.

GALT, ONT.—The illumination of Jackson Park with cluster-lamps erected on ornamental standards is under consideration by the City Council.

KINGSTON, ONT.—Tenders have been called for furnishing and installing approximately 20,000 ft. of underground conduit. C. C. Folger is general manager of the Light, Heat and Power Department.

LINDSAY, ONT.—A by-law was passed on Sept. 3 authorizing a contract with the Lt., Ht. & Pwr. Co. of Lindsay to light the streets of the city. The contract provides for magnetite-arc lamps, erected on ornamental standards on Main Street, to be maintained by underground wires.

OWEN SOUND, ONT.—The Hydro-Electric Power Commission has submitted estimates to the town of Owen Sound showing that Eugenia Falls on the Beaver River will develop 1400 hp. without the use of a storage basin and 4000 hp with a storage basin. The commission last spring offered to furnish energy in Owen Sound to the amount of 1500 hp at $29 per hp per year or 800 hp at $31 per hp per year. The town decided upon the latter quantity provided it could be shown that the river at the dry season would develop that amount. The length of the transmission line will be under 30 miles.

WESTBORO, ONT.—The Ottawa El. Co. has been awarded the contract for lighting the streets of the village with 50 100-watt tungsten lamps, at $13 each per year, for a period of 10 years.

GRANBY, QUE.—A syndicate in which McQuaig Brothers are interested is reported to have purchased power sites on St. Francis River near Drummondville, where it is estimated that 8000 hp can be developed. It is proposed to transmit energy developed at the plant to Granby provided an agreement can be made with the municipality.

ornamental street-lighting system in Regina.

take over the plant as soon as possible and it will make the improvements that have been recommended by the engineer in charge, which include the installation of a 30-kw generator immediately and a suction producer gas equipment next year.

## Mexico

MAZATLAN, SINALOA, MEXICO.—The Empresa de Corriente Electrica, S. A., of Mazatlan, expects to install within the next four months a 165-hp suction gas-producer plant, a 120-kw, two-phase, 60-cycle, 1100-volt Westinghouse alternator to be driven by gas engine, switchboard and instruments for above unit. The above equipment has already been purchased. If results are favorable, the entire plant will be changed over. Arthur de Cima is general manager.

TAMPICO, MEX.—The Standard Oil Co. is preparing the site and doing other preliminary work toward the erection of a large oil refinery at a point on the Panuco River about 6 miles below Tampico. The company will erect an electric light and power plant, a water-works system and lay out a model town for its employees. It is said that the project will involve an expenditure of more than $2,000,000.

## Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Oct. 8 for furnishing oil-burning forges and furnaces and thermoelectric pyrometer. Blanks and general information relating to this circular (No. 800) may be obtained from the above office or at the offices of the assisting purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

# New Incorporations

MARSEILLES, ILL.—The Consumers' Wtr. & Lt. Co. has been incorporated with a capital stock of $50,000 by W. H. Carnahan, H. J. Vance

FORT BRANCH, IND.—The El. Lt. Co. of Fort Branch has been incorporated by Walter C. Polk, Homer T. Genung and William A. Polk. The company is capitalized at $20,000 and proposes to furnish electricity

NEW RICHMOND, IND.—The Montgomery Lt. & Pwr. Co. has been chartered with a capital stock of $24,000 to construct and operate an electric plant. The directors are: O. W. Mason, Charles Haywood, R. N. Carding, H. C. Shobe, A. S. Fraley and J. C. Wingate.

NORRIDGEWOCK, MAINE.—The Bombazee Pwr. Co. has been incorporated with a capital stock of $50,000 for the purpose of buying and developing water rights along the Kennebec River. The directors of the company are: Charles H. Hussey, president; Eben S. Miller, treasurer; G. C. Wing, William Ayer, William Brackett and Frank W. Spaulding.

KEARNEY, MO.—The Kearney El. Lt. Co. has been incorporated with a capital stock of $5,000 by Thomas H. Henderson, Lee Major and John A. E. Eby.

LINDSAY, MONT.—The Mutual Tel. Co. has been organized with a capital stock of $20,000 by W. C. Fellows, P. J. Noe, C. E. Rainey, L. D. Richards and others.

WATERVILLE, N. Y.—The Tri-County El. Co. has been incorporated by E. G. Morris, George P. Conkling and Thomas F. Barrett, of Utica.

VALLEY FORGE, PA.—Application will be made to the Governor of the State of Pennsylvania on Oct. 6 for a charter for the Valley Forge El. Lt. & Pwr. Co. by Thomas E. O'Connell, V. N. Shaffer, I. E. Miller, H. D. White and M. F. Hackett. The company proposes to generate and distribute electricity in Valley Forge.

BEEVILLE, TEX.—The Beeville Pwr. & Lt. Co. has been incorporated with a capital stock of $150,000 by T. W. Robertson, A. H. Murris

BOERNE, TEX.—The Boerne Lt. & Ice Co. has been incorporated with a capital stock of $15,000 by George H. Cushman, E. J. Altgelt and Henry C. King, Jr., all of San Antonio.

LOGAN, W. VA.—The Logan Ltg. Co. has been granted a charter with a capital stock of $200,000. The incorporators are Henry C. Finkel, 106 G Street, N. W.; Gillbank Twigg and others, all of Washington, D. C.

# Weekly Record of Electrical Patents

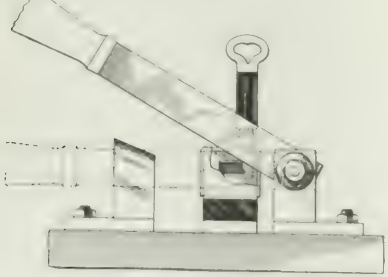
UNITED STATES PATENTS ISSUED SEPT. 16, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,073,098. ELECTRICAL MEASURING INSTRUMENT; C. M. Crook, Chicago, Ill. App. filed Nov. 27, 1908. Wattmeter constructed to maintain a constant adjustment of parts.

1,073,113. INCANDESCENT-LAMP LOCK; J. H. A. Gardiner, Downers Grove, Ill. App. filed July 11, 1912. Split-ring, screw-actuated clamp; secures lamp in the socket.

1,073,130. SIGNAL SYSTEM; A. N. Hovland, Stakke, Norway. App. filed Jan. 27, 1909. For effecting control of apparatus at a distant point.



1,073,289.—Electric Switch.

1,073,173. RHEOSTAT; D. P. Ruger, Chicago, Ill. App. filed July 22, 1910. The contact member has a rolling engagement over the contact pieces of the resistance element.

1,073,175. FLUID-PRESSURE SWITCH; J. A. Schadel, Pittsburgh, Pa. App. filed Feb. 14, 1911. Governor for compressed-air systems.

1,073,192. ELECTRIC SIGNALING DEVICE; W. J. Warder, Jr., Chicago, Ill. App. filed Nov. 6, 1911. When the lamp of the signal device burns out or becomes inoperative a new lamp is automatically shifted into its place.

Winter, Vienna, Austria-Hungary, and F. Eichberg, Berlin, Germany. App. filed March 7, 1903. The number of transformer turns connected to the motor circuit is enlarged to increase the speed and dimirished to reduce the speed.

1,073,201. DYNAMO-ELECTRIC MACHINE; G. Winter, Vienna, Austria-Hungary, and F. Eichberg, Berlin, Germany. App. filed June 11, 1902. Commutator-type alternating-current machine with magnetizing winding on the rotor, and brushes of the secondary winding short-circuited.

1,073,263. ELECTRIC VULCANIZER; F. Martin, Pomona, Cal. App. filed July 25, 1912. Has thermostatic control to maintain a proper heat.

1,073,281. SERVICE-SWITCH MECHANISM; G. E. Palmer, Brookline, Mass. App. filed Dec. 16, 1912. Customer is able to open the switch for inspecting or replacing the fuse, but the live lugs or contacts are sealed so as to be inaccessible to the customer.

1,073,289. ELECTRIC SWITCH; F. J. Robinson, Lackawanna, N. Y. App. filed June 17, 1912. A key-opened lock prevents unwarranted closing movement of the switch blade.

1,073,295. COMBINATION LOCK FOR PLUG-AND-SOCKET FIXTURES; G. I. Silbert, Chicago, Ill. App. filed Feb. 20, 1911. Combination tumbler lock in which the need for a dial and co-operating indicator is done away with.

1,073,303. TROLLEY GUARD; M. Szwargulski, St. Louis, Mo. App. filed Jan. 27, 1913. Weight-actuated pivoted guard fingers prevent disengagement of the trolley and serve as bridging contacts at crossovers and switches.

1,073,311. DYNAMO-ELECTRIC MACHINE; G. Winter, Vienna, Austria-Hungary, and F. Eichberg, Berlin, Germany. App. filed June 11, 1902. Alternating-current machine of commutator type in which the exciting winding is in series with the rotor-working winding so that the current is in phase with the working current.

1,073,320. RESISTANCE UNIT; W. L. Bliss, Niagara Falls, N. Y. App. filed Jan. 6, 1911. Resistance unit provided with terminals adapted to engage terminal clips detachably.

1,073,335. SIGNALING SYSTEM; H. W. Doughty, Binghamton, N. Y. App. filed April 9, 1912. Fire-alarm system in which the tower service may be disconnected at the central station.

1,073,336. ELECTRICALLY HEATED CURLING IRON; F. A. English, Chicago, Ill. App. filed April 14, 1913. Terminals on the handle capable of rotative adjustment permit turning of the iron to curl the hair.

1,073,397. CONTROLLER; C. E. Cochran, Cleveland, Ohio. App. filed July 22, 1912. The controller is operable only when the motorman is at his station.

1,073,510. SAFETY AND-SIGNALING DEVICE FOR RAILROADS; D. C. Newton, Owego, N. Y. App. filed Feb. 20, 1913. Contact shoes on the engine engage contact rails on the track-bed.

1,073,582. ALARM SYSTEM; O. B. Kaiser, Ramona, Ohio. App. filed Oct. 17, 1910. For the supervision of automatic sprinkler systems.

# Electrical World

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The consolidation of Electrical World and Engineer and American Electrician.

Vol. 62 NEW YORK, SATURDAY, OCTOBER 4, 1913 No. 14

**The Tariff and the Electrical Industry**

The new tariff bill is of interest to the electrical industry because national legislation on this subject may affect prosperity. There is a possible direct effect on manufacturers through the encouragement presented to foreign makers to compete in home markets. There is a possible indirect effect from disturbance in the general business situation of the country. While there may be isolated cases where the effect of competition from foreign makers will be felt, we believe that they will be few in number and negligible in comparison with the great totals of output of electrical machinery and apparatus. In other words, so far as the whole electrical manufacturing industry is concerned, the direct effect will not be appreciable. The manufacturers have long known that changes were coming and they have shaped their courses to that end. It is less easy to predict the effect of the law upon general business conditions and through them upon the electrical industry. If industrial paralysis should develop, of course, the effect would be felt by all lines of activity. However, dire suggestions are not justified. The Washington government is trying only to reduce the cost of living for the masses, and it realizes as keenly as anyone else that it cannot do this by destroying business. The strong safeguard of the electrical industry is its great diversity of application. Its foundation on this rock supports it creditably when general trade conditions hesitate. Certainly while the country lives and progresses there is no reason for gloom, and there is reason to believe that the electrical industry will do as it has in the past, continue to make steady strides toward a still greater future.

**Studying the Electric Sign**

Few energy-consuming devices will better repay initial study at present than the all-conquering electric sign, and particularly the sign of the fixed type. In many towns the idea seems to prevail that any bell-hanging electrician or tinsmith can design and build a sign which will easily meet a wide range of service requirements, and as a result of this notion the fair face of the land is not seldom encumbered by hybrid installations which are not only ugly by daylight but which violate all the commandments of illuminating engineering by night, and at the same time break through the canons of sound mechanics by their inferior type of construction. As in most other matters, the production of an efficient, safe and effective sign is a problem for fairly expert treatment. Such questions as the location of outlets, the supply of energy, provision for replacing burned-out lamps, support of the sign structure, ease of erection, concealment of lamps in reflector types of signs to avoid glare, reduction of fire risks, protection of leads and sockets from the weather, use of templets in drilling outlet holes, accessibility for repairs, and relation between lamp spacing and legibility at stated distances, need to be worked out by more experienced heads and hands than can be found in the ordinary tin shop. Competition is close in this field, and the exaction of thorough mechanical standards by the central station, combined with pretty severe electrical inspection, will gradually rid the industry of inferior equipment which is of doubtful benefit to the cause of permanently successful display lighting.

**Intolerable Vandalism**

As a result of labor troubles, important telegraph cables have been cut in Chicago and the transmission lines of the Pacific Gas & Electric Company have been severed. The frequent recurrence of vandalism of this character has reached a point where it involves danger of serious interference with some of the most valuable services furnished by private investment for public use. The telegraph and the telephone rank next in importance as means of communication to the United States mail service. Whenever occasion arises, the United States government takes rigorous steps to avoid interference with mail service, and the question of whether a federal statute should not be enacted authorizing the government to take similar steps in the event of interruption of telephone, telegraph and electric service is worth careful consideration. Whole communities are dependent on transmitted electrical energy for lighting, railway and industrial service, and municipalities employ it for pumping water and other purposes. These facilities, although owned and managed by corporations subject to public control instead of directly by the public, are necessities of home and business life, and interference with them means distress and loss that should not be tolerated.

**The Arc as a Light Standard**

Mr. Forrest's British Association paper, abstracted elsewhere in this issue, represents an interesting study of a difficult matter. To secure such uniformity in the crater of a carbon arc as to give it even a remote claim to consideration as a standard of light is in itself a formidable task. The platinum standard, abandoned as impracticable by general consent, involves less of practical uncertainties, yet so carefully has Mr. Forrest worked that he has been able to secure reasonably precise results even when utilizing a rather wide range of current in the arc. At a certain current density the crater seems to reach what is practically the boiling point of carbon and to remain at this temperature under rather uniform average conditions. The crater sur-

face, indeed, is not of the same brilliancy all over, yet upon the whole it [illegible] in a uniform and exceptionally good grade of carbon. Considered as a light standard the source is practically a carbon surface at its vaporization temperature shielded by a Methven screen of very minute dimensions.

The last-mentioned feature seems to be the really serious objection to the arc as a light standard. Under uniform conditions one may be able to obtain great steadiness, as the experiments well show, but the apparatus appears to be of dubious value with reference to reproducibility that is so vital in a primary standard. The area of the screen in this case is well below 1 sq. mm, and hence even the minutest variations in the real or effective size of the hole become significant. With so small a screen hole, corrosion, dust and variation of reflection from the edges rise to importance, as do also probable variations in the actual size of the hole at the start or possible variations in its distance from the floor to the crater. Apparently the device will serve better as a powerful secondary standard than as a primary standard in which reproducibility and certain regularity in action are of fundamental importance. In the former rôle it may prove quite useful.

## Hydroelectric Energy for Massachusetts Railways

Elsewhere in this issue is given an account of the extensive use of hydroelectric energy on the Worcester Consolidated Street Railway system, which covers a large part of east central Massachusetts, supplying the needs of local and interurban transportation in an area of some 1200 square miles. The article is of interest to our readers chiefly on account of its illustration of the possibilities of hydroelectric service in a growing system covering many municipalities and facing the limitations of economical steam-plant generation at most points formerly devoted to the production of "home-made" electric energy. The Worcester County industrial situation has literally been revolutionized by the entrance of the 66,000-volt lines of the Connecticut River Transmission Company into this district, and the large energy consumption of such an electric railway network makes the system a desirable customer for the supply company, especially as the demand for service extends over about eighteen hours of each day.

The installations described clearly show the comparative ease with which energy distribution for electric-railway service may be handled. In fact, it is little less than surprising how extensive an area can be served in country districts by one or two 300-kw rotary-converters. The contrast is striking between a compact substation, often requiring only two or three attendants on its payroll, and the small, complicated and comparatively inefficient steam generating station which such an installation supersedes. In fact, the labor cost in some of these installations is almost nominal, since they are combined with the large substations of the Connecticut River company and receive such attention as is needed from the regular operating force on duty in the latter.

Among the interesting features are the enlargement of the railway company's turbine plant at Millbury, the establishment on a neighboring site of a switching station which is now the operating center of the entire Connecticut River transmission system, including the control of 66,000-volt lines from Vernon, Vt., and of lines built for 120,000-volt transmission service from the plants in the Deerfield Valley of western Massachusetts planned for ultimate extension to Providence, R. I., and the use of 2000-kw, 60-cycle rotary converters in the Madison Square substation of the railway company. The design of the Millbury switching station, which is one of the largest of the outdoor type thus far completed in the East, affords an interesting illustration of the requirements of modern extra high-tension control. The tying together of the systems through a frequency changer at Millbury is also a feature of note, but one cannot help wishing that the Millbury turbine plant might originally have been designed for 60-cycle service in the interests of greater flexibility of operation.

## Confusion in Nomenclature

The committee on nomenclature of the British Association for the Advancement of Science is a distinguished body, and its suggestions are therefore worthy of serious consideration, but we shudder in contemplation of the results that would follow if every national scientific body should do as it has done recently. It is really a pity that with a carefully organized international body striving to bring order out of chaos and to secure uniformity in at least a few simple matters any national body whatever should think it expedient to introduce conventions of its own. The system of symbols proposed by the British association is not greatly different from that adopted by the International Electrotechnical Commission. It merely varies enough to be confusing at times without thereby gaining in any material particular. The British proposals for symbols are based on the fiction that total quantities and their differentials should be designated by the same letters but in different type, while the I. E. C. scheme makes this same distinction between correlated electric and magnetic quantities. Now, in this whole matter of units and symbols the one thing practically important is that fundamentals all over the world should be expressed in exactly the same terms. It does not make the least difference whether a consistent theory or any theory at all lies behind the international conventions. In fact, as a rule the same general theory of construction would not hold in different countries taking different viewpoints and with mnemonic values never coinciding. It was an immense stride forward when $I$ became the symbol for current and $R$ that for resistance, thus breaking through the international wall. But two Phœnician characters would have done as well, if not better, once they were really put into use.

The trouble at the root of the whole matter lies in a certain selfish indolence that impels those who write or lecture on technical topics to avoid writing or speaking a few plain words at the cost to the world of forcing tens of thousands to think about and learn a new word and a new notation, for which there is no real use whatever. In fact, the British association committee frankly notes that

there are several derelict names which could advantageously be dropped. Even with the elimination of freaks the number of things to be named or noted in allied sciences rises to a figure inconveniently great. The fact is that there is genuine need for fully twice the number of letters available for symbols, even in two fonts of type, when one eliminates the letters already pre-empted for the connotation of general conventions.

The remedy for the present confusion, it seems to us, is twofold. First, avoid special names and symbols unless they are really necessary to large branches of science or technology. It is not sufficient that they should save the lecturer's fingers from wielding the chalk ten extra minutes per year. Second, use not only the Roman characters in two fonts well distinguished, but use the Greek letters, and if necessary others, more freely than at present. Besides, we have subscripts to fall back upon in case of need, and these are especially useful in noting correlated ideas. The chief thing, however, is to stop making futile efforts at a correct theory of notation in favor of establishing international practice. We hope that the British association report will be for all practical purposes laid on the table until the next I. E. C. meeting and will then be amended to agree therewith, so that it may not further confuse scientific literature. A few books printed in an unusual or experimental notation constitute an international nuisance until they are out of date and forgotten.

## Interest Rates for Electrical Capital

As a result of conditions in the money market that are felt by all borrowers, high rates of interest on new loans are now being paid by some of the public-utility operating and holding companies. Taking the nature of the loans into consideration, the rates are not out of proportion to those open in these times to older established properties in other lines of industry. Some of the capital issues are offered for public sale by bankers at a net interest yield of about 7 per cent. Of course, the full cost of the money including the discounts of underwriters and incidental expenses connected with financing is higher than the net yield to public retail buyers, but it is doubtful if borrowers representing few companies in other avenues of industry could obtain capital on terms as advantageous. The new consolidations of the electrical industry have a standing as borrowers that is colored by the fact that they are composed of tried operating properties with an established business to which the benefits of combined production and management are to be applied. It is true that no one can foretell accurately what the saving in the cost of production and total operation will be when a single operating unit takes the place of many separated units. Neither can any one prophesy infallibly as to the additional amount of business obtainable in a given territory by the introduction of advanced commercial methods of sale to supplant indifferent methods, but this is a material consideration.

The economic advantages of a consolidation of electrical plants appeal to bankers, who realize the profitable possibilities in such situations. The bankers, however, are really agents in the transfer of the obligations or stock of a public-utility company from that company to the permanent holders, the investing public. They make large profits on some transactions, particularly when an unexpected change in the money market or the public demand for securities enables them to mark up prices so that their margin of gain is increased. In all their transactions, however, they are guided by the temper of the investing public, which always has the last word. If the public cannot be tempted to buy except by offers of securities yielding uncommonly high rates of interest, as at the present time, the bankers in turn buy cautiously and only such securities as they feel will "go" quickly. They do not desire to hold the securities for a long time; they are merchants, not investors.

In view of the conditions which have generally governed the 1913 money market, it is clear that a large amount of public-utility financing is awaiting the restoration of a normal absorbing demand for securities. Some of the companies have provided for their needs by the issue of stock at par when this meant rights of material value to their shareholders. Others have declared stock dividends as a means of capitalizing accumulated surplus. Either of these means, or the similar one of an increase in the dividend rate if such action is warranted, is likely to attract and retain public interest in the stock. Perhaps a resort to a reasonable step of this character is not criticisable when one considers the fact that, if it is done in a period of tight money and is justifiable, the company is likely thereby to improve its standing with stockholders and therefore its general credit position. Certainly at such a period borrowing through the usual banking channels is difficult and expensive; and if the stockholders can be used in reasonable ways to better the credit of the company or to provide the funds for the necessary capital expenditures by subscriptions to new stock issues, the interests of the company are well served.

Companies that have not been able to meet their capital needs by the issue of securities but have had to borrow moderate amounts of money have done so largely through their local bankers. Although the discount rates on such loans are high now, local bankers usually provide the best means for temporary financing, provided, of course, they are sufficiently interested in the property, either financially or because it is a local enterprise, to protect it until such time as permanent financing can be arranged. It is wise, of course, for the company to restrict its capital expenditures, if possible, so that the banker may be able to protect not only it but his other customers. If the loans become so large that the utility has to deal with outside lenders of money, it is likely to find that its temporary financing is attended with greater expense than it thought possible. Ordinarily the operating central station can control satisfactorily the main part of its capital expenditures, so as to avoid undue commitments in an inopportune borrowing season, but an extensive program of reconstruction requires capital at whatever price the market may exact. One act of borrowing by the issue of long-term bonds, if they are salable, is much cheaper than several loans at equivalent rates because of the difference in the banker's commissions involved. On account of this fact much permanent financing will be postponed until conditions change so that the lender, instead of the borrower, is the seeker.

# The News of the Week

**Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.**

## Cleveland Bonds for Municipal Plant Held Valid

The Ohio Supreme Court has decided that the city of Cleveland may issue bonds for the construction of a municipal light plant. A suit to test the validity of the issue was brought some time ago by a man connected with C. A. Otis & Company, a bond house in this city, and the decision was handed down in this case.

The sinking fund commission of the city of Cleveland has purchased $200,000 of the bonds, and this will enable the city to proceed with the construction work on the plant. It has been delayed because of the litigation over the bonds.

## Large Hydroelectric Plant for Connecticut Valley

The Turner's Falls Power Company is planning to build a 50,000-hp hydroelectric station at Montague City, Mass., within the next few years. The initial development will total 30,000 hp and is to be completed early in 1915. The plant will cover half an acre of ground and will utilize water from a canal 1.5 miles in length, requiring the excavation of 500,000 cu. yd. of material, of which 100,000 cu. yd. will be rock excavation from a ledge 30 ft. to 50 ft. deep. William B. Durant is in charge of the engineering for the Turner's Falls company.

## Boston Electric Motor Car Club Election

The Electric Motor Car Club of Boston held a regular meeting on Sept. 24 at the Engineers' Club, at which the nominating committee reported the following list of officers for election at the annual meeting: President, Mr. Day Baker; vice-president, Mr. E. S. Mansfield; treasurer, Mr. J. S. Codman, and secretary, Mr. L. L. Edgar. Following the usual luncheon it was announced that in the coming spring the club will entertain a delegation of European electrical men by electric automobile trips in eastern Massachusetts on the occasion of the convention of the Association of Municipal Electricians at Boston. The annual meeting of the club will be held on Oct. 8 at the Hotel Thorndike, Boston.

## Possible Use of Oxygen in the Fixation of Nitrogen

During a lecture on "Liquid Air and Its Uses" delivered before the recent International Congress of Refrigeration at Chicago, M. Georges Claude, of Paris, described the method of producing oxygen by the liquid-air apparatus. He told of various uses to which the oxygen could be put, as, for instance, the cutting of metals. Oxygen appears also to be on the eve of entering the field of another great application, according to Mr. Claude, and that is the fixation of nitrogen. The manufacture of nitric acid by the electrification of the air is done on a large scale in Norway by the company that is exploiting the patents of Birkeland and Eyde. The author said that more than 200,000 hp is at present employed in the manufacture of nitrate of lime needed for agriculture. He continued: "Now in regard to the product NO, which we are concerned in obtaining, the gas which we electrify is a dilute product. If in place of air we electrify a mixture of air and oxygen, corresponding exactly to $N_2O$—that is to say, if we electrify with 50 per cent of oxygen—theory and experience agree in finding that the formation of nitrous vapors will be much more abundant. The improvement will be, without doubt, to the extent of 30 per cent, and the cost of manufacturing the oxygen will absorb but very little of the improvement."

## Plans of Commercial Section of the N. E. L. A.

The executive committee of the Commercial Section of the National Electric Light Association will hold a meeting at the associaton headquarters in New York on Oct. In laying plans for the work of the section at next year's convention in Philadelphia it has been decided to limit the number of papers to be presented at a session to two, so that ample time will be given for discussion. Moreover, the papers will be very broad in scope so as to cover the commercial work of the entire central-station industry regardless of the size of the company. It is expected that by Jan. 1, 1914, the revised edition of the "Electrical Solicitors' Handbook" will be issued. The revision will be in the shape of detachable leaves to be issued quarterly and contained in a leather binder. Included in the work will be data heretofore appearing in the "Digest." The work of revision is now in the hands of experts in lighting, heating, cooking, industrial applications of motors, etc.

## Non-Political State Commission Requested

At the meeting of the Electric Club of Chicago on Sept. 25 Mr. Samuel Insull was the speaker of the day. In opening, Mr. Insull dwelt on the enthusiasm with which young men are solving the problems in the electrical field. But in the end, whatever electrical men may do, the prosperity of the industry as a whole depends upon the success of the consumer. No doubt great economies are possible through the concentration of production, and this phase of the industry is being rapidly developed.

Financial conditions during the last year have made it difficult to secure new capital for development work. Consequently development has been retarded, but the electrical industries have not felt the restraint as much as other sound legitimate propositions. Conservative proposals for the development of electrical industries have met a more ready response than others of equal merit.

Mr. Insull, in discussing the political situation in the State of Illinois as regards public utilities, said that there is a possibility of serious conditions arising in the near future, owing to the public utilities law placing under the control of the Governor all the public utilities in the State. Unless great care be exercised in making the appointments to the Public Utilities Commission of the State, with a view of protecting not the public alone but the utility companies as well, a turmoil, he said, is certain to result. If the appointments are made on a basis of political reward it will result in great harm to the utilities of the State. The speaker declared, however, that he had confidence in Governor Dunne and felt sure that he would exercise

ient and appoint men of fairness and ability, and thus the law a benefit to all concerned. Owners and oper- of public utility properties stand ready to do all ir power to make the commission a success, and it is hoped that the quality of men appointed will be such make co-operation possible.

Bion J. Arnold followed with a few remarks and on record as favoring state commission control if the issioners will not lose sight of the fact that the in- r must not only have a fair return on his money in r as it is evidenced physically, but also a fair pro- 's profit.

## Meeting of New York Section, A. E. S.

e first meeting of the season of the New York Sec- of the American Electrochemical Society will be held e Chemists' Club Oct. 17. The subject for discussion be "Some Applications of the Microscope to Indus- Work," and the program is as follows:

etallography of Carbon": The application of the iples of metallography and petrography to the identi- on and analysis of carbon products, showing the de- ment of characteristic structures and the utilization ese structures in identification and analysis. By Mr. A. Roush, assistant professor metallurgy, Lehigh ersity.

he Microstructure of Raw and Manufactured Copper": ries of pictures showing structure of cast copper and this structure is altered by rolling, etc. By Mr. W. assett, technical superintendent and metallurgist of American Brass Company.

he Microscope in Mineralogical Analysis": A series imière plates showing microphotographs of zinc ores resolution of the minerals present. By Mr. Gilbert research engineer of the New Jersey Zinc Company.

me Remarks on Micrometry as Applied to Alloys": use of micrographic methods in investigating ques- of constitution, qualitative and semi-quantitative inter- ions; structural relations which are favorable to the pment of micrometric methods; advantages and comings of such methods in ordinary analytical prac- the determination of cuprous oxide in copper and of n zinc. By Dr. C. H. Mathewson, assistant professor stry and metallography, Yale University.

## Preparations for the Chicago Electric-Vehicle Convention

enumerated in the *Electrical World* of Sept. 27, page here will be ten or eleven papers presented at the l meeting of the Electric Vehicle Association of ica, to be held in the Hotel LaSalle, Chicago, on Oct. d 28. These, with the presidential address of Mr. r Williams and other business that will come before eeting, will be considered in four sessions, one each in renoon and afternoon of the two convention days.

Well-attended, snappy convention is anticipated. It is ed that about 100 visitors and guests will attend from work and its vicinity and about twenty-five from Bos- The attendance from Chicago and other points in the le West will be large. The New England Section of ectric Vehicle Association has appointed a Chicago ation committee consisting of Messrs. Day Baker, J. Clman and O. G. Draper. Mr. F. N. Carle, of New rk and Mr. C. B. Frayer, of Chicago, are looking after transportation arrangements.

Convention sessions will be held in the Red Room on the eenth floor of the hotel. The eighteenth floor will be oted largely to exhibits. At 6 p. m. on Monday, Oct. isitors and invited guests will be entertained at a beefsteak dinner given by the Chicago Section. At 8 p. m. there will be an automobile parade during which the visitors will be taken to inspect South Side electric garages in Chicago. Returning to the hotel at 10:30 p. m., the convention party will be entertained at a vaudeville show in the Red Room. On Tuesday noon the members of the association and others will be the guests of the Commonwealth Edison Company at a luncheon at the Hotel LaSalle.

## Uniform Electric Rate Association

A committee appointed by manufacturers of apparatus for isolated power plants has formed the Uniform Electric Rate Association and has issued a circular calling attention to the purpose of the movement. The first annual meeting of the association will be held on Oct. 20, 1913, but the meeting place has not yet been determined. At this session it is proposed to elect officers and frame a general policy for the work of the association.

In connection with the call for the meeting, the association has issued a pamphlet giving the legal opinion of Mr. Louis D. Brandeis, of Boston, Mass., on the subject of central-power-station rates. Mr. Brandeis discusses in his opinion the subject of variable rates and points out various court decisions bearing on the matter. He specifically answers questions based on the statement that there is a general movement in this country to secure for some electric light and power company of each city a substantial monopoly of the electric business in that city.

Mr. Brandeis declares that, assuming that there is a difference between the cost of energy for the wholesale and the cost for the retail consumer, a public-service corporation can, in the absence of any statute regulating or limiting the price at which it shall be sold, make a higher price to the retail consumer, but the difference in the selling price may not be substantially greater than the difference in cost.

## Boston Development Association Disbands in Favor of National Body

Owing to the fact that the Society for Electrical Development has been incorporated and is now being underwritten by subscriptions from the electrical industry at large to carry forward and accomplish for the entire country what it was proposed by the Electrical Development Association of Boston, Mass., to do for New England alone, the latter body has voted unanimously to discontinue further activity as an association. The executive committee of the association feels that the national movement in its broader and larger spirit of co-operation merits the support of the electrical industry of New England as well as elsewhere and in notices to its members urges them to lend their support to the national movement.

## New York Electrical Show

The Electrical Exposition and Motor Show to be opened at Grand Central Palace in New York on Oct. 15 is to be primarily of an educational nature, and each display is being arranged with an eye toward teaching the visiting manufacturer just how much he is sacrificing by not adopting electricity as his motive power. The motor vehicle is to have a more prominent place than ever, and arrangements have been made to devote almost an entire floor of the palace to the electric automobile manufacturer. One of the features of the exposition will be an "Electric Farm" occupying 90 ft. or more of show space and including every kind of farmwork into which electricity has been introduced. Two interesting canal displays have been arranged. One, provided by the State of New York, is a

large model of the [illegible] locks in connection with this motion pictures of the canal in use will probably be displayed. The other canal exhibit is a 20-ft. by 4-ft. model of the Pedro Miguel locks of the Panama Canal. There are a variety of other government exhibitions, including a money-making exhibit, provided by the Treasury Department; a coal-mine breaker in action, provided by the Bureau of Mines; a forestry display, and an army and navy signal service outfit.

Two of the newest features of the exposition will be an electrical clinic, where all of the latest electro-therapeutic appliances will be on display, and "talking movies," where Edison's latest invention, motion pictures that talk, will be exhibited.

Large models of the new and not yet entirely perfected nitrogen-filled lamp will be exhibited. The new lamps at Grand Central Palace are rated at 5000 cp and are suspended from the four corners of the big central well. These lamps will be lighted for five minutes at stated intervals every day. All of the electric light companies in New York City will make special exhibits.

## Additional Power for Los Angeles

Secretary Houston has just granted a permit to the Southern California Edison Company for the development of additional electric power in the Kern national forest to supply Los Angeles, Pasadena and neighboring towns. The Southern California Edison Company operates seven hydroelectric plants, one of which is in the Kern and five others in the Angeles national forest. The six plants in the national forests are capable of developing 37,000 hp, although there is not sufficient water in the streams to develop such an amount of power continuously. The company has installed, therefore, a number of auxiliary steam plants, which have a total rating of about 54,000 hp.

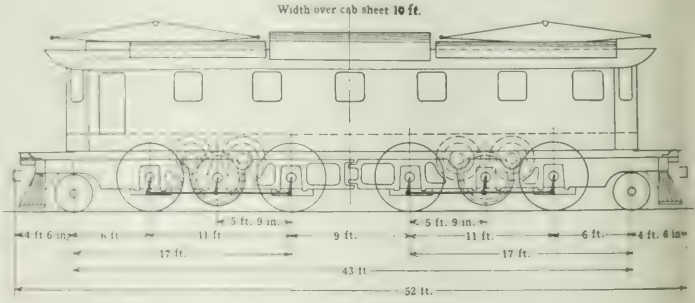
While it might be supposed that with such an amount of power at the company's command there would be little need of an additional supply, especially with other companies operating the same territory, the Edison company was convinced several years ago that it would eventually need more power in order to supply its market. The four water-power sites which seemed to be the most valuable for development are in the Kern forest, so application for a permit was made through the Forest Service in order that the company might develop these sites. It was the permit for this development which was granted by the Secretary of Agriculture.

The four projects mentioned in the permit are designated by the company as Kern River Plants Nos. 2, 3, 4 and 5. It is expected that Plant No. 3 will be the first to be put into operation, with Plants Nos. 4, 5 and 2 following in the order given as the demands of the market increase. It is stated by the company that expensive dams will not be needed but that the construction of some of the conduits will be difficult and will require a considerable amount of time. Because of this, and also because of the large investment required and the large amount of power that is involved in the development, the Department of Agriculture allows a period of almost twelve years before the plants will have to be in complete operation.

According to the estimates of the government's engineers, the four new projects of the company will be able to supply almost 33,000 hp, except for a few days in a period of five years. Through the use of its steam auxiliary plants, however, the company will be able to obtain considerably more than that amount, and it is planned to install machinery which will have a total rating of more than 80,000 hp. This will be transmitted at high tension by means of poles and steel towers over a maximum distance of about 155 miles from the plants to the city of Los Angeles.

## Locomotives for the Norfolk & Western

The locomotives for the most recent electrification project, that of the Norfolk & Western Railway, will be the first to be commercially used in this country with a combined jack-shaft and gear drive. These machines will have articulated trucks and will weigh complete approximately 130 tons each. As shown in the accompanying illustration, four driving axles and two carrying axles are used, the wheelbase being divided into two separate units or trucks, connected at adjacent ends by a hinge coupling. The carrying axles are mounted radially, and each main truck has two driving axles and one radial axle. The outer ends of the trucks are fitted with standard buffers and friction draft gear with standard coupler, the drawbar pull being transmitted through the truck frames to the train. The weight does not exceed 57,000 lb. per pair of drivers and is sufficient to produce a tractive adhesion for a maxi-




ELECTRIC LOCOMOTIVE FOR NORFOLK & WESTERN RAILWAY

mum effort of 62,500 lb. per locomotive, the weight on each radial axle being not less than 20,000 lb. at the rail. The locomotive will, with forced ventilation, have sufficient capacity to exert continuously a tractive effort of 33,600 lb.

A single cab supported on the trucks at suitable bearing points contains the operating and control apparatus of the locomotive. The cab is of the box form, provided with end doors and platforms for convenient passage between two or more locomotives when coupled together, and between the locomotive and train; in addition, side doors are provided at diagonally opposite corners. There are also side and end windows for lighting the cab. The apparatus is arranged along the center of the cab, making it conveniently accessible and leaving a clear, unobstructed passage way at either side.

The control apparatus, both air and electric, is located at one end of the cab, in such a manner as to leave an unobstructed view along the track. The operator's seat is placed so that there will be a clear view of the signals.

Each locomotive is provided with two overhead pantograph trolleys having automatic self-adjusting action and arranged for a working height of 16 ft. under bridges and other permanent structures and a normal height of 24 ft. along the open line, the trolleys being controlled by air pressure.

The motors, which are of Westinghouse make, will be connected through twin gearing to a jack shaft. They are

to be of the polyphase, 25-cycle induction type with wound secondaries, which are connected in cascade for producing low speed in starting and switching. There are two running speeds, 28 and 14 m.p.h., and a switching speed of 7 m.p.h., as described on page 367 of our issue dated Aug. 23, 1913.

A multiple-unit system of control is to be provided for the independent operation of each locomotive, or for the operation of two units simultaneously from the control end of either locomotive in whatever order or arrangement the locomotive may be coupled together. The control equipment is arranged to provide for the use of single-phase current from the pantograph trolley which is connected to the primary winding of the main transformer through a suitable line switch, and from the secondary of the transformer circuits will be established through and in connection with the phase converter in such a manner as to deliver polyphase current to the main motors.

Each locomotive is to be provided with an air compressor driven from the phase converter through a multiple-disk friction clutch. This clutch is controlled by the main reservoir pressure so that the compressor is operated only as required. Straight-air and automatic air brakes will be installed together with the necessary ventilating apparatus for the motor equipment, transformers, sander and cab-heating equipment. The electrical equipment has been designed with special consideration for regeneration and electric braking at grades, both for the purpose of safety and for economy of operation, the local conditions being very favorable for this type of operation.

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## British Association for the Advancement of Science

*By Special Correspondent*

The interest of those sessions of the British Association for the Advancement of Science which were held on Monday and Tuesday, Sept. 15 and 16, centered largely about Sections A and B. On Monday a particularly striking paper on the solar origin of variations in terrestrial magnetism was read by Father Cortie.

### Electromagnetic Effects of Sun

The action of the sun is, of course, well known, and there has been much discussion as to how the effect reaches the earth, thereby producing magnetic storms with great variations of earth currents and such allied phenomena. Help in the solution of the problem came from an unexpected quarter in the measurement by Hale of the actual magnetic field active in the sun through investigation of the Zeeman phenomenon. The results showed that the maximum intensity of the magnetic fields, even in regions of intense solar activity, is very moderate, indeed, far below the fields obtainable in the laboratory. Their effect seems to be quite inadequate to account for the terrestrial phenomena, and Father Cortie turned therefore to the conception of electron streams spouting from the sun and swept up by the earth in its motion. A single stream is inadequate to produce the variation in time shown by the consecutive terrestrial effects, and he therefore presented the hypothesis of an irregular sheaf of streams projected from the disturbed solar area and encountered successively by the earth, and drove home the lesson by similar appearances in the solar corona at the time of an eclipse during a time of violent sun-storms.

### Utilization Versus Waste of Coal

In Section B (chemistry) most of the session was devoted to the extremely important matter of the utilization of coal, and there was general concurrence in the opinion that the present condition was one of gross misuse. Professor Armstrong, who opened the discussion, very pointedly said that while the president of the British Association was considering the possibility of entering into communication with the dead, there was obvious need of the association getting into near touch with the living. We must mend our ways if we were not to perish economically in the near future. Dr. Beilby brought to the front the low-temperature distillation of coal, which is coked at temperatures of 400 deg. to 450 deg. C., thus furnishing valuable products now consumed to small purpose, while yet leaving the most valuable part of the fuel for its ordinary use. It was the task of the gas works to organize the market for this low-temperature coke. Dr. Colman called attenton to the fact that 25 per cent of the heat units in the coal could be obtained as gas, 5 per cent as tar, and 50 per cent left as coke, while expending 20 per cent in carrying on the process, and noted the fact that the tar is worth more for its products than as fuel, while 20 per cent of the nitrogen in the coal is recovered as ammonia.

Dr. Lessing hammered in Dr. Beilby's lesson by showing that in England there is an annual loss of more than 200,000 tons of liquid fuel carried away as soot, enough to supply the whole fuel oil demand of the British Navy. The fuel oil recoverable from house coals by low-temperature coking would amount to some 3,000,000 tons a year. The whole discussion left a powerful impression of the awakening to the possibilities of the coal supply. It is worth noting in this connection that the use of water gas is declining in England owing to better methods of coal distillation.

### Polarized Light and Stresses

In the engineering section Professor Cokes gave an extension of his previous fine work in the investigation of stresses by examining in polarized light the strains produced in transparent models. He had evolved thus the experimental investigation of the stresses in forms too complicated for mathematical treatment, and the results were applicable to materials in general. The method and its applications were splendidly illustrated, the stress distributions taken being those of thick cylinders and rings, both with and without discontinuities.

### A New Gas

The sensation of Tuesday morning was a paper by Sir Joseph Thomson on his discovery of a new gas of which something has been heard already. By the application of his extraordinary method of analysis by the deflection of positive rays in the magnetic field he some time ago found in various cases of an apparently new gas which he provisionally called $X_3$. His later work indicated that this was not really new but that it was an allotropic form of hydrogen, so to speak, forming a triatomic molecule, in other words $H_3$ instead of $X_3$. It appears as a product of the bombardment of various substances in a vacuum, and its character has been pretty clearly made out.

This discovery was of itself sufficiently striking, but the speaker followed it with one even more notable. In bombarding pure potassium iodide he obtained not only much $X_3$ but also a considerable evolution of helium and possible traces of another of the rare gases. Now, helium is well known as one of the breakdown products of substances undergoing radioactive disintegration—in fact, it is the final product—so that the real fact brought out was the forcing by the bombardment process of the same kind of atomic disintegration that occurs in spontaneous radioactivity. This puts a new face on experimental methods that can be brought to bear on atomic constitution.

### Radioactivity

Radioactivity was discussed in Section B, when Mr. Saddy brought out some very sensational suggestions,

have precisely the same chemical character and even identical spectra while differing in atomic weight. Further, he went to the length of pointing out that by certain changes familiar in radioactivity which he described in detail it should be possible to change lead into gold with bismuth as an intermediary product. To change thallium or mercury into gold would appear to be relatively easy if certain conditions could be attained.

It may be a comfort to the holders of Rand shares that Mme. Curie, who knows a bit about radioactivity, is said to differ from Mr. Soddy's views in some vital points.

### X-Rays and Crystals

On Tuesday afternoon a special session for the discussion of Professor Brogg's paper on X-rays and crystals was held. It was specially notable for some added details given by the author and for a strong indorsement of the work of Professor Arrhenius. Nobody, in fact, seemed inclined to undertake the somewhat serious task of criticism, and the general view seemed to be that an exceedingly important method of studying atomic structure had been revealed and put into practice.

### Concluding Sessions

Meanwhile the combined sections on physiology, zoology and botany, with most of the chemists, had devoted a long morning session to a vigorous contest over the possible chemical origin of life. Sir Oliver Lodge strongly objected to his doctrine of continuity being put to any such application.

On Wednesday the engineering section had a long discussion of the Panama Canal, opening with a paper by Mr. Cornish on the landslides in the Culebra cut. He especially referred to the curious bulging upward of the bottom rock, sometimes to the height of 20 ft. or more. In one case a 10-ft. bulge had risen in ten minutes, and the upheavals were generally rather rapid. He considered that the filling of the canal might help or hurt according to circumstances, but did not think that slides and upheavals were likely now to occur on a scale to interfere with navigation. Confidence was expressed in the future of the canal in its influence on the world's commerce.

The final sessions in the other sections disclosed little of technical interest, and only a minority stayed through to the final closing meeting of the association in the afternoon. The meeting as a whole was a very important one with some revelations of great interest in relation to future progress and some prophecies that may or may not be fulfilled. Prophecy after the fact is the only safe kind in which to indulge. British Association meetings usually leave some landmarks on the pathway of science, and this particular one has doubtless set up a few that will be long remembered by those who pass.

## Pittsburgh I. E. S. Convention

An account of the opening sessions of the convention of the Illuminating Engineering Society at Pittsburgh, Sept. 22 to 25, was given on page 619 of our issue dated Sept. 27. In many respects this was the most successful convention during the seven years of the society's existence. The attendance reached the unexpected total of nearly 500, while the papers read were of an unusually high order of merit.

Perhaps no feature of the convention stands out more prominently in the memory of those present than the [illegible]t held at the Hotel Schenley on Wednesday eve[illegible]pt. 24, with General George H. Harries as toast[illegible]. The speakers were President P. S. Millar, who responded to the toast "Old Standards of Illumination"; President-elect Charles O. Bond, "New Standards of Illumination"; Mr. Charles M. Bregg, dramatic editor of the Pittsburgh *Gazette-Times*, "The Illumination of the Stage," and Dr. John A. Brashear, "Light." Considerable humor was injected by those at different tables giving their college yells and singing impromptu songs appropriate for the occasion.

Although not on the official program, a noteworthy feature of the convention was a lunch meeting on Thursday under the auspices of the Jovian Order, with Statesman M. Frank Knapp as the presiding officer. The speakers included Mr. C. A. Littlefield, chairman of the convention committee. President P. S. Millar, Vice-president Norman Macbeth and Ex-president L. B. Marks.

At the business session on Thursday afternoon Secretary Joseph D. Israel stated that the society has a membership of 1350, the net gain during the year having been sixty-two. There are now twenty-three sustaining members.

Below are given abstracts of certain of the papers presented during the sessions on Tuesday, Wednesday and Thursday, together with the discussions thereon.

### Factory Lighting

The importance of factory lighting as a load for the central station was well brought out in a paper by Messrs. M. H. Flexner and A. O. Decker, Chicago. The authors stated that ever since the realization of the good and bad effects of illumination there has always been a great field in factories for better lighting conditions. Better light is as necessary as any sanitary requirements, and with these it should rank among the first. Foreign countries have taken better illumination a little more seriously than America has. They have had committees appointed by the government, whose duties are to study the effects of good and bad light upon the general health and report upon methods of bettering conditions. Although the importance of good lighting is generally understood, managers of factories are never willing to make any decided changes from present operating conditions. No matter how forcible the arguments, the first cost of the installation of a lighting system seems to retard any change for better illumination.

The authors outlined the offer made by the Commonwealth Edison Company to introduce proper lighting service in factories in the Chicago territory. The company decided that the best way to make the offer attractive was to do away with the first cost of equipment. To insure most efficient operation the company includes in its offer the cleaning and renewing of all fixtures and lamps. The customer is asked to sign a contract for a period of twenty-four consecutive months. After the expiration of this period the wiring and fixtures become the property of the consumer. The charges for this service are made up on the following basis: rental charge, maintenance charge and electricity charge.

*Rental Charge.*—The rental charge is 25 cents per fixture per month, allowing the consumer to use either 100-watt, 150-watt or 250-watt units in each fixture. At the end of the two-year period this equipment becomes the property of the consumer and this charge is discontinued.

*Maintenance Charge.*—The consumer pays the company 25 cents per fixture per month, except during the months of June, July and August. At the end of the two-year period the consumer may elect to discontinue paying this charge and take care of this equipment himself.

*Electricity Charge.*—For this service the consumer pays the regular schedule rate of 10 cents net per kw-hr. for the first thirty hours' use of the maximum demand per month and 5 cents net per kw-hr. for all energy used in excess of this amount.

The fixture supplied under this contract is one that was especially designed for this class of service. It consists of a shallow reflector with a collar containing a lock socket, the conduit serving as a stem. The reflector is so designed

at the filament does not extend below the bottom of the eflector. Photometric curves show extensive characteristics. The idea throughout was to make a reflector that as efficient, plain, and easily cleaned. The company confidently expects to install 10,000 of these fixtures within ne next year, and a report of the first few months gives eason for the confidence expressed.

The author stated that the campaign for good factory ghting has just begun and that the best argument in favor f better illumination is a statement showing the benefits erived from an efficient lighting system and the experinces of others. There is no longer any excuse for poor ghting; the necessity, the practicability and the economy f good illumination have been demonstrated beyond uestion, and if the strides in this direction which have een made in the recent past may be taken as an index of nose which will be made in the future, there is no doubt nat very soon the time-worn phrase "a badly lighted shop" ill have disappeared from the vocabulary of those conected with the lighting industry.

*Discussion*

The paper was discussed by Messrs. F. W. Lloyd, Chiago; V. R. Lansingh, Cleveland; G. W. Roosa, Wilkinsurg, Pa.; H. H. Magdsick, Cleveland; S. L. E. Rose, chenectady, N. Y.; R. B. Ely, Philadelphia; Ward Harris, leveland; G. H. Stickney, Harrison, N. J., and M. H. lexner, Chicago.

Mr. Lloyd called attention to the fact that while electric otors are now freely used in industrial establishments, ne lighting of factories has been practically neglected. It as this condition which caused the Commonwealth Edison ompany to offer to install lighting equipment in factories its own expense and allow the factory owners to pay or the equipment in instalments. In work of this nature ne illuminating engineers can render excellent service to oth the lighting company and the factory owner.

Mr. Roosa claimed that the flickering in arc lamps is not bjectionable because each point receives light from many mps and the resultant illumination is quite steady. lthough the intrinsic brilliancy of the arc is very high, et by means of inclosing diffusing glassware the exposed rface brilliancy becomes, say, 15 cp per sq. in. instead of )00.

Mr. Magdsick cited a case of good industrial lighting here the cost of the lighting service did not exceed that f one helper for each 150 men, and said that no manager ould hesitate to incur so small a relative expense for the rcellent results obtained. He remarked that many of the d carbon lamps are still in use in steel mills, but are being pidly replaced with modern high-efficiency units. He id that fully two-thirds of the amount now spent for the ghting of steel mills is wasted.

Mr. Chapin stated that the light emitted by "yellowme" arc lamps is much more penetrating than white ght, which is largely absorbed by smoke.

Mr. Ely claimed that it is unnecessary to give away wirg and fixtures in order to insure adequate lighting in ctories. The result can be accomplished by competent umination engineering departments of the central station.

Mr. Stickney said that central stations are just beginning appreciate the desirable features of factory lighting, nich is of much importance as a source of revenue.

### Show Window Lighting

In a paper by Mr. H. B. Wheeler, Chicago, were deribed numerous show windows with special reference to e illumination intensity required along the line of trim, e relation of reflectors, their spacings and methods of stallation. The author remarked that it is always posble to interest a merchant in the true advertising value a well-illuminated window display, because he can see creased business. It is a monetary consideration with m. He is open to conviction when the question of increasing sales is under consideration. Moreover, beautifully illuminated show windows enhance the beauty of a city and thus receive the indorsement of the citizens.

*Discussion*

This paper was discussed by Messrs. W. F. Little, New York; J. R. Cravath, Chicago, and H. B. Wheeler, Chicago. Attention was called to the desirability of arranging the show window architecturally, so as to conform to the requirements of good artificial illumination. Much difficulty is encountered in lighting show windows by reason of the lack of provision for the lighting requirements. The author claimed that his paper was based on tests of average show windows which can well be considered representative of modern practice. He announced his intention of preparing data by means of which architects and contractors may easily select suitable fixtures for store-window lighting.

### Inclosing Glassware

Some instructive relations concerning the service characteristics of inclosing glassware were disclosed in a paper by Mr. V. R. Lansingh, Cleveland. Glassware for inclosing incandescent lamps was divided into two distinct classes, one purely transmitting and diffusing, such as ground glass, opal glass, etc., and the other prismatic glass, where the principle of specular reflection is employed. The author stated that with glassware of the first type little except good diffusion and low absorption can be expected, the redistribution of light being negligible. In the case, however, of prismatic glass, it is possible to vary the distribution in accordance with the wishes of the engineer. It is to be noted further that the absorption of light is about the same in one class as in the other.

*Discussion*

In the discussion, which was participated in by Messrs. S. G. Hibben, Pittsburgh; A. J. Sweet, Milwaukee; J. R. Cravath, Chicago, and the author, Mr. Hibben remarked that a distinction should be made between opal and opalescent glass and said that the conclusions derived by the author were applicable only to spherical globes.

Mr. Sweet reported the results of certain tests of lighting equipments in railway coaches, showing that so far as concerns the redirection of the light the several classes of reflectors can be arranged in the following order: Mirror, prismatic, dense opal, medium opal and light opal.

The proper classification of glassware having been discussed by Messrs. Cravath, Ives and Lansingh, it was voted to refer the subject to the committee on nomenclature and standards of consideration, together with the subject of the classification of illumination systems.

### The Pentane Lamp as a Working Standard

The use of tested pentane lamps as secondary standards of candle-power when electric standards are not available was recommended in a paper by Messrs. E. C. Crittenden and A. H. Taylor, Washington, D. C. The authors gave a detailed statement of the method of testing followed at the Bureau of Standards, with general directions for the use of the lamps. The effects of variation in pentane and in atmospheric conditions were discussed, a correction for the former being proposed and new determinations of the humidity correction factor were given, a chart being provided to facilitate the reduction of observations to normal candle-power.

*Discussion*

Mr. C. O. Bond, Philadelphia, discussed the paper at some length, bringing out several points of importance. He called attention to the variation in candle-power values depending on the temperature, different values being obtained from solid and hollow rods on account of different conductivity. The shape of the flame changes and the candle-power therefore varies.

My [illegible] also to the rapidity with which the pentane seems to vary in density.

Mr. H. P. Gage, Corning, N. Y., remarked that as the lamp is used the fuel gradually changes chemically from pure pentane toward petrol.

Dr. Crittenden, in closing the discussion, expressed the hope that it may be possible to make a pentane lamp that will compare favorably with the electric lamp as a primary standard.

Abstracts of other papers and discussion will be given in a later issue.

## Illinois State Electric Association at Quincy

All the business and discussions of the annual meeting of the Illinois State Electric Association were conducted on one day, Sept. 25, but the convention visitors assembled at Quincy on the preceding day and enjoyed a steamboat excursion on the Mississippi River to Keokuk, where the hydroelectric plant of the Mississippi River Power Company was visited. The weather was ideal for such a trip, and the members of the party, about 200 in number, enjoyed themselves thoroughly. Luncheon was served on the boat. On the evening of Sept. 24 the "Leather Luggers," otherwise the supply men connected with the association, gave a smoker-cabaret entertainment in the hotel at Quincy which served as convention headquarters. The central-station men were the guests of the supply men.

President J. J. Frey, of Hillsboro, occupied the chair at the two sessions of Sept. 25. In a brief opening address he praised the work of Secretary H. E. Chubbuck, of Peoria, who has been connected with the association for fourteen years. He alluded briefly to the tendency toward centralization and concentration in the business of producing and selling electrical energy. He said that central-station men must study economies and mentioned the tendency toward the lowering of rates.

### Illinois Public Utility Laws

Mr. William J. Norton, of Chicago, secretary of the rate research committee of the National Electric Light Association, analyzed the recent laws in Illinois providing for a state public utility commission and authorizing cities to acquire and operate utility plants. Mr. Norton said that thirty-six states of the Union now have state regulation of public utilities in some form. Regulation is particularly a state function. If temporarily delegated to municipalities, that fact does not invalidate the prior right of the state; there is no foundation for the "home-rule" cry. Mr. Norton remarked that the public utility commission law and the municipal-ownership law should always be considered together. Taking the two laws into consideration, it may be stated that Illinois has all the bad features of the indeterminate-franchise provision without any of the compensating advantages. There is not much in the two laws that favors privately owned utilities. The public utility commission law is complex and will be difficult to administer.

Messrs. E. D. Alexander and L. E. Marshall, of Dixon; G. R. Jones, S. B. Cushing and A. S. Scott, of Chicago; J. S. Reesman, of Waukegan; E. L. Brown, of Elmwood; O. C. Macy, of Alton; F. W. Reimers, of Rock Island, and others propounded questions to Mr. Norton in relation to the new laws. Some of the points brought out in answer to these queries may be briefly summarized.

The public utility commission law gives eminent domain to privately owned utilities under some of its provisions; it is fair in this respect. Many state laws providing for regulation of utilities include municipal utilities, although they are excepted in Illinois and Missouri and partially excepted from state regulation in Pennsylvania, Washington and California. Almost all other states having public-utility regulation give the state commission full control over municipal utilities. Mr. Norton cited Mr. Erickson, of the Wisconsin commission, who, in a public address, declared that twice as many complaints have been received by the commission in relation to municipal utilities as in the case of privately owned utilities. Mr. Norton said that more complexities would attend the issuing of stocks and bonds of utilities after Jan. 1, 1914, when the law goes into effect, and he advised his hearers to issue before that time any new securities that may be contemplated. He remarked, however, that if the municipal-ownership law is strictly enforced the rates for municipal service will be at least as high as those of privately owned utilities. In relation to competition the speaker said that a certificate of convenience and necessity must be secured from the state commission before one privately owned utility can enter the territory of an existing utility. This does not apply, however, to municipal competition. The commission has no authority to go into a city and demand that justice be done to all concerned. When a franchise expires and the city refuses to renew it the commission cannot step in and issue a franchise, but as a matter of law it is probable that the privately owned utility can keep on operating, although doubtful if it can make extensions.

### Tendencies in Switchboard Design

Mr. Stephen Q. Hayes, of the engineering department of the Westinghouse Electric & Manufacturing Company, Pittsburgh, read an instructive paper entitled "Tendencies in Switchboard Design." He described panels, frames, distant control, desk boards, oil circuit-breakers and typical Illinois installations in a concise and interesting manner. Mr. Reimers, of Rock Island, inquired about the cost of hand versus electrical operation of switches in plants of small or moderate size. Mr. Hayes said that it was impossible to make more than a very general estimate owing to the variations in local conditions, but he might say in an approximate way that it would cost $25 more per switch for remote-control operation as compared with hand operation in a plant of 8000 kw.

### Transformers and Lightning Arresters

Mr. John L. Buchanan, electrical engineer for the General Electric Company in the Chicago office, gave a talk on transformers and lightning arresters. He asked operators to limit the number of transformers and increase their unit capacity as much as possible. "Be a little generous," he said, "in secondary copper." The proper loading of transformers should be studied. Maximum-demand meters may be used to check up the loading. The tendency is to use transformers a little too large, and this results in inefficient operation. Taking up high-voltage transmission lines, Mr. Buchanan said that open-delta operation has certain advantages on distributing systems, but above 10,000 volts he believed it to be bad practice to connect two transformers in open delta. Surges and other troubles may destroy the transformers. Neither are "Y" connections on both sides of a bank of transformers to be recommended. There should be a closed delta somewhere in the transmission. The speaker referred favorably to the new 8000-volt transmissions in northern Illinois. This voltage fits into the 2200-4400-volt distribution; it is more logical than 6600-volt transmission. In relation to the 13,200-volt transmission which is used largely, the speaker said that it "just grew." He advocated standard voltages and also the standardization of transformers.

Speaking of the addition of single-phase load to a three-phase system (as, for instance, where an electric-furnace load is added), Mr. Buchanan said that this cannot properly be done in practice, although there were several theoretical schemes for accomplishing the result. The best plan is to use single-phase transformers. The speaker recommended auto-transformers to change three-phase to two-phase energy.

Considering protection from lightning, Mr. Buchanan made the point that the operator of a system should put the lightning arrester where the protection is needed, say at the transformer banks, and preferably on every distributing transformer. Generally speaking, the money will be well spent if an aluminum-cell lightning arrester is arranged on the station busbars. The speaker referred briefly to a new device known as the arcing ground suppressor, which has been devised to stop high-frequency disturbances on overhead lines carrying 33,000 volts or upward or underground transmissions of 13,200 volts or upward.

### Handling Freight Bills

Mr. A. S. Scott, of the Public Service Company of Northern Illinois, read a paper on "The Handling of Freight Bills." He advocated the paying of freight bills by draft and described the forms and details of this method in a large system having a home office and a number of district offices.

### Proper Use of Incandescent Lamps

In a talk on the proper use of incandescent lamps Mr. Fred T. Benson, of the Chicago office of the General Electric Company, made several interesting statements. The main purpose of his talk was to plead with central-station men to operate tungsten lamps at the exact rated voltage, thus securing the highest efficiency. He said that the tungsten lamps now produced are practically as rugged as the old carbon lamps. Soon they will be sent out with only a single-voltage label instead of with a range of three voltages as at present. By operating lamps at the highest efficiency the consumer will get 100 per cent candle-power and the central-station company will get 100 per cent revenue from the wattage consumed. At the present time lamps are being used in many cases that are rated from 2 volts to 5 volts above the line voltage. One objection to this plan is that the tungsten lamp does not get the reputation for brilliant illumination to which it is entitled. The General Electric Company sends out investigators to make reports on lamp-burning conditions on the central-station systems of Illinois. Sixteen of these investigations have been made up to the present time.

A tendency in present-day lamp manufacture is to reduce the size of the bulb. This results from a shorter filament made possible by the new "Concentrated" filament, which has many turns of microscopic fineness.

At this time the 0.5-watt lamp apparently is applicable only to low voltages, not more than 33 volts; therefore, its present use is seemingly confined to series street lighting. It is probable that this lamp can be developed for multiple operation for very large units, say of 1000 cp or over. Apparently the advent of this lamp will mean that central-station companies will sell electric lighting on the basis of illuminating service rather than kilowatt-hours consumed. The new 0.5-watt series street-lighting lamps (which are filled with nitrogen) may be on the market in five or six months.

Considering the complaint against packing of lamps in five-lamp cartons, Mr. Benson contended that this style of package would result in the customer buying more lamps at a time. If the customer has a reserve of lamps, he will substitute a good lamp for a burned-out one at once, and thus the central-station company will not lose the demand from that socket.

The lamp manufacturers are now training women solicitors to sell incandescent lamps and other appliances from door to door. It is probable that the manufacturers will be able to supply women solicitors to central-station companies on request at an early date. Mr. Benson also spoke of the training school at Harrison, N. J., for sales agents, and said that no fee is required there.

In the brief discussion Mr. C. W. King, of Lewistown, suggested that if the 0.5-watt lamp is to come into commercial service the label on it should be expressed in terms of candle-power rather than terms of watts. In answer to a question Mr. Benson said that the tungsten lamp operated at its highest efficiency on a circuit of the same voltage as the lamp rating will have no tendency to blacken. Good voltage regulation should be used, of course, where tungsten lamps are operated at their highest efficiency.

### Street-Lighting Rates

Mr. S. B. Cushing, of the Public Service Company of Northern Illinois, read an instructive paper on "Cost of Operating and Rates to Municipalities for Series Street Lighting." He dwelt particularly on the items of cost that enter into incandescent street lighting and told how they should be ascertained. He recommended that all lighting companies abandon as far as possible the arc-lamp system of street illumination.

### Concluding Business

The committee on resolutions, of which Mr. M. L. Harry, of Decatur, was chairman, presented a report, which was adopted, extending the thanks of the association to Mr. H. O. Channon, general manager of the Quincy Gas & Electric Company; Mr. W. A. Martin, general superintendent of the Quincy Railway Company; the supply men of the association for the smoker-cabaret of the night of Sept. 24; the Mississippi River Power Company, for courtesies, and the Masons of Quincy for the use of the Masonic Temple, where the sessions of the convention were held.

Officers were elected as follows: President, Mr. E. MacDonald, Lincoln; first vice-president, Mr. F. W. Reimers, Rock Island; second vice-president, Mr. E. H. Negley, Canton; third vice-president, Mr. R. H. Abbott, Petersburg; fourth vice-president, Mr. H. O. Channon, Quincy; treasurer, Mr. C. W. King, Lewistown; secretary, Mr. H. E. Chubbuck, Peoria; assistant secretary, Mr. C. A. Willoughby, Peoria; executive committee, Messrs. W. B. McKinley, Champaign; Frank J. Baker, Chicago; R. S. Wallace, Peoria; E. W. Smith, Kewanee; J. J. Frey, Hillsboro, and the president and secretary. The committee which placed in nomination the officers named above consisted of Messrs. J. G. Learned, of Chicago; H. J. Pepper, of Champaign, and B. H. Walcher, of Hillsboro.

## Indiana Electric Association at Indianapolis

What proved to be the best attended convention which the Indiana Electric Light Association has ever held was that at the new Canoe Club in Indianapolis on Sept. 24 and 25. One hundred and eighty-seven were registered at the close of the convention, the nearest approach to this number being 136 at last year's convention. The new Public Service Commission of Indiana and public-utility regulation in general were the main subjects of discussion, but much attention was also given to the discussion of accounting methods.

### Governor Ralston's Views

Governor Samuel L. Ralston of Indiana was present to give an address of welcome. After extending a cordial greeting, he brought the members of the association face to face with his opinions on utility regulation. Additional elements are entering the business of operating a public utility, and corporations must adjust themselves to new conditions. Under the old methods considerable waste took place, and it is the purpose of the public-service commissions to reduce expenses without depreciating the service. The Governor is a firm advocate of local self-government, and he also believes in capital earning a fair increment if it is in the service of the public. He expressed himself as favoring a slightly larger increment than absolutely justifiable rather than one which is too low, as under the latter condition the public cannot receive the best service. In

closing, in [illegible] the Indiana commissioners [illegible] of honest, fair-minded men and that by co-operating with them the association can derive benefit.

### President Robb's Address

In his annual address President J. W. Robb, of Clinton, announced that fifty companies in Indiana are members of the association, but Secretary J. V. Zartman informed the convention at a later session that about twenty additional members had been secured recently. Mr. Robb told of meeting the Indiana commissioners and spoke in high terms of them all. Among suggestions which he made for the following administration to carry out were these: Appointment of a committee to revise constitution and by-laws; increase in membership; facilities for more revenue; separation of secretary's and treasurer's duties, and weekly or bi-weekly reports of commission decisions. There are a large number of companies in Indiana, said the president, which are controlled by holding companies outside of the State. Since these parent companies are financially interested in the State, he believes they should take out membership for each plant.

In his report Mr. J. V. Zartman, secretary-treasurer of the association, drew attention to the fact that out of 210 central stations in Indiana 150 are privately owned, and of these only fifty are members.

### The Indeterminate Permit

The afternoon session was opened by a comprehensive discussion of the indeterminate permit by Mr. J. L. Clark, member of the Indiana commission. The indeterminate permit, which is indorsed by economists in general, according to the speaker, is the most satisfactory solution of the utility problem. Mr. Clark went into detail on the provisions which are made in the state utility bill for granting franchises, all of which must be in the nature of an indeterminate permit. Under the permit no amortization fund is necessary to reimburse the stockholders when the plant is abandoned at the expiration of the franchise, as was formerly necessary.

Speaking of accounting, Mr. Clark said that if a consideration is given for a franchise it should be capitalized, and if annual tax is paid on this value it should be charged as an operating expense. The ideal condition for a utility to operate under is to possess an indeterminate permit for which no consideration has been paid and on which no tax is levied. The company is then in a position to offer the best services at the lowest rates and pay a fair income to stockholders.

The Indiana law (see *Electrical World*, March 15, 1913) is different from the Wisconsin statute in that a municipally controlled or privately owned utility cannot compete with an existing similar utility without the necessity of such added service being recognized by the commission. Speaking of drastic franchises, Mr. Clark closed his remarks by saying that no service can be obtained from a dead utility and only poor service can be secured from a crippled one.

### Aspects of Rate Regulation

Mr. W. J. Norton, of Chicago, read his paper on "The Two Epochs of Rate Regulation," which was originally delivered at the last Michigan convention. An abstract of this paper was published in the *Electrical World* of Aug. 30 last.

In the discussion Mr. T. C. McReynolds, of Kokomo, said that all companies in the State have gradually reduced their rates. In addition, he said that the commissions have a great opportunity to show their usefulness by assuring the public of the fairness of corporations.

Mr. F. A. Bryan, of South Bend, asked if the commission would object if a distribution line were extended to some commercial establishment and energy furnished at only a small profit, if the new load increased the load-factor and efficiency of operation of the station.

In answer, Mr. A. H. Kennedy, of Rockport, said that the Massachusetts commission would not allow the smaller consumers to pay for energy supplied to larger ones. Mr. Norton added that to his knowledge only three commissions had given any decision on such special rates. One of the New York commissions (First District) declares that cost of service is not so important as value of service in determining rates. The Wisconsin commission, on the other hand, has held that a company is justified in making special rates where it does not reduce income or increase cost of production. It requires that such special rates be filed so that under similar conditions identical rates may be obtained.

Mr. T. W. McNamee, of Wabash, asked if, in regulating rates, the commissions take cognizance of the growing period of a utility when no profit is made. Mr. Norton answered that Commissioner Maltbie, of New York, had allowed a 15 per cent development charge and a capitalization of early losses to cover this period. Mr. W. M. Wherry, of New York, added that the Wisconsin, Pennsylvania and New Jersey commissions also recognize this provision.

Mr. E. J. Condon, of Angola, told of conditions where several competing companies existed in one city and were finally merged. During competition they all suffered losses as a result of low rates, and on consolidation were allowed to capitalize these early losses. He added that commissioners in Massachusetts ruled that municipal plants cannot furnish energy below cost, as the expense of operation which finally falls on the city is not prorated among those receiving the service.

### Practice Before Commissions

Mr. W. M. Wherry, of New York, who is a utility legal expert and who advised the Governor of Indiana at the time the new utility law was being considered, addressed the convention. He spoke on the practice before commissions and remarked that the success of a commission lies in its ability to reconcile opinions. Common-sense ideas are what is wanted, and not so much the power to act. There is a tendency, Mr. Wherry said, for municipal plants to make too low rates. In this way it becomes necessary for the utility to receive support from the cities' funds. It is not equitable to tax those who do not use energy to make up for those who do. Watered stock should be prevented rather than punished. If a rate for service is so low that it disturbs security of outstanding stock, it should not be made. Changes in conditions have made it necessary for commissions to attack problems gradually. The proper solution of a case will benefit both sides, as the public and the corporation are not two distinct bodies.

Mr. Thomas H. Bibber, of New York, spoke on the Jovian Order, describing it as the social co-operative end of the electrical fraternity.

### Electric-Vehicle Situation

Mr. George D. Smith, of Long Island City, spoke briefly on the opportunity for central stations in selling off-peak energy if they would only push the sale of electric vehicles. Hartford and Baltimore were cited as cities in which the central stations had taken advantage of such business.

Mr. E. Darrow, of Indianapolis, said that the Merchants' Heat & Light Company of that city is charging 250 electric vehicles from its lines and all of its trucking is being done by electric vehicles.

In answer to a question put by Mr. Thomas Donahue, of Lafayette, in regard to the rate at which energy must be sold in order that electric cars may compete with gasoline cars, Mr. Smith said that it depends on contour of land and radius of travel. In New York City a maximum rate of 5 cents and a minimum rate of 3 cents per kw-hr. is charged to compete with gasoline.

### Methods of Accounting

Thursday morning's accounting session was opened with Mr. F. L. Dennis, of South Bend, in charge. Mr. Dennis

solicited questions from many different companies in the State relative to accounting and distributed printed pamphlets containing them. Many accountants were present and the discussion of the various questions was entered into informally. It is Mr. Dennis' purpose to thresh out the questions in an accounting committee, after which they will be referred to the state commission for final decision. Sixty-six questions were contained in the pamphlet, some of which were solved by the same answer.

### Joint Ownership of Poles

An interesting discussion arose over the joint ownership of poles. Mr. Bryan informed the members that the city of South Bend requires his company to occupy poles jointly with the Bell telephone system. As the latter has poles too short for energy distribution, the central-station company has been required to replace the poles by higher ones and deed the entire pole line, exclusive of conductors, over to the telephone company. The question arose whether the state commission would allow the central-station company to earn money on the amount invested in the pole line but which is no longer represented as property.

Mr. Donahue said that it was more of a legal question whether the electric-service company could be compelled to deed over the poles without consideration. Mr. Dennis said that such an investment could be capitalized under intangible investments, according to the Wisconsin law. Mr. W. H. Palmer, of Zionsville, said that in St. Louis such matters were settled by allowing one company to own property and the second one to pay rental. Analogous conditions were described by Mr. Kennedy, of Rockport, who tore down one plant to build nearer a clean water supply, the expense being about the same as if he had installed a filtering plant at the original station.

### The Chairman of the State Commission Talks

Mr. Thomas C. Duncan, chairman of the Public Service Commission of Indiana, was the next speaker. He opened his remarks by saying that no department of state government has held greater responsibilities since the civil war than the Public Service Commission, as it has the power to make or break the great utility organizations. While conforming to new conditions, mistakes are liable to be made by the commissions, and the Indiana commission will always be ready to receive advice. In his study of the utility situation the chairman was surprised to find so much money invested in electric-service properties. The enormous debts under which these companies are growing are also remarkable. Interest obligations must be met and cannot be paid if the rates are too low. While some communities are receiving energy at too low rates, others are being overcharged, and it is the purpose of the commission to equalize these conditions.

Incivility of utility companies' employees to the consumers was cited as the best ground for public clamor against corporations. Mr. Duncan stated with emphasis that the good will of the public can be secured if the employees are schooled in courtesy, and he suggested that the larger companies establish schools for this purpose. Reducing the penalty on customers who are delinquent in paying their bills was cited as another method of securing the co-operation of the public. "If there must be a penalty, let it be as light as possible." In regulating rates and service the commission intends to give justice to both sides. The speaker suggested that it would be well for utility managers to consider a public-utility corporation as a trusteeship rather than a privately owned property.

### Street-Lighting Rectifiers in Accounts

Mr. Dennis took the floor at the end of the address and proceeded with the accounting session. Mr. T. F. Grover, of Terre Haute, raised the question as to what account mercury-arc rectifier tubes should be charged to where they are used exclusively for street lighting. He said that breakage of such tubes necessitates an expenditure which is greatly in excess of all other repair and maintenance charges in a station and should therefore be charged to street lighting and not be divided up among station expenses. By doing the latter, he said, the city does not bear its share of the expense and other users are burdened with a heavy charge.

This question was discussed by several, among whom were Messrs. W. H. Palmer, of Zionsvile; Eugene Holcomb, of Lansing, Mich.; L. H. Heinke, of Grand Rapids, Mich.; E. J. Condon, of Angola, and Thomas Donahue, of Lafayette. Diversity of opinions existed and the matter will be referred to an accounting committee, which will bring the subject before the state commission. Mr. Bryan added that the account entitled "miscellaneous station electrical equipment" covers a multitude of sins, and he believes that segregation of accounts should be made. Mr. Dennis said that the statistical department can segregate station accounts so that any information that may be desired can be readily obtained.

### Adequate Service

The meeting of Thursday afternoon, which was the last session, was opened by an address by Mr. R. C. Huddel, of Madison, Wis., on "Service." He said that in regulating



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utilities the first thing which should be considered is the service rendered. Secondary in importance are the rates. Accuracy of meters, uniformity of voltage and continuity of service are items which affect service. A live management should not have to be told what adequate service is. The commission's purpose is primarily to advise the smaller companies.

### Optional Rates

Mr. F. A. Newton, of Detroit, who was formerly employed by the Wisconsin commission, delivered a paper on "Rates." Determination of rates, he said, should be based upon the results obtained from a careful analysis of original investment and cost of operation. Rates should be dependent on two things outside of those mentioned: first, the expense incident to distribution and generation, which is independent of output; second, the expense dependent on the output. Individual consumption data also are necessary, as total earnings do not fix the determination of rates. Rates based entirely on energy consumed have been found inequitable. The type of load, time of demand and cost of supplying service must all be considered. The classification of consumers requires the most study, Mr. Newton believes. Demand devices have been of considerable value in cities where they are used in proportioning rates. Active load and unit cost are other items of importance.

### Liability Insurance

The last paper of the convention was read by Mr. L. T. Block, of St. Louis. It was entitled "Utilities Indemnity Exchange." Since the time has passed when a technical defense can be made against paying a damage suit, and since a workman's compensation act is being adopted in many states, liability insurance is necessary. Inter-insurance among the utilities, which means a sharing of losses and a division of profits, was advocated by him as a means toward securing protection at actual cost.

Mr. E. J. Condon spoke highly of the Utilities Indemnity Exchange plan, and emphasized the fact that liability insurance companies are increasing rates periodically.

### Concluding Business

Several committees made their reports following the discussion of Mr. Block's paper. The executive committee, whose chairman was Mr. T. F. English, of Muncie, Ind., made three recommendations which were accepted as amendments to the constitution. By these recommendations committees on utility-commission decisions, accounting and membership will be appointed by the new president. President Robb appointed a committee to revise the constitution and by-laws. The recommendations of the nominating committee, of which Mr. T. A. Wynne, of Indianapolis, was chairman, were accepted and the following men were elected: President, Mr. Thomas F. English, of Muncie; vice-president, Mr. W. D. Ray, of Hammond; secretary, Mr. Thomas Donahue, of Lafayette; treasurer, Mr. J. C. Kester, of Noblesville. Mr. J. W. Robb, past-president, was elected chairman of the executive committee.

Mr. English, who was elected president, is at present vice-president and general manager of the Muncie (Ind.) Electric Light Company. He has held that position since January, 1910, and prior to that time he was connected with the Cincinnati, Covington & Newport Light & Traction Company and the New York Edison Company. Mr. English also served as state engineer in New York.

## Iron and Steel Electrical Engineers

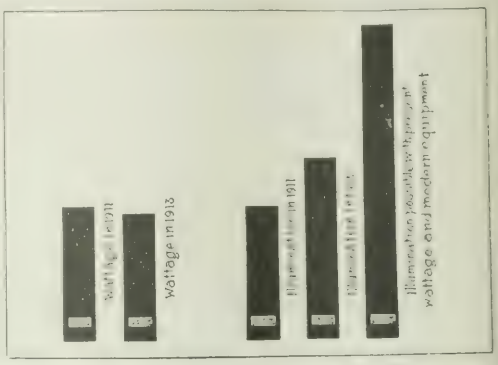
The first sessions of the convention of the Association of Iron and Steel Electrical Engineers, held in New York City, Sept. 22 to 27, were reported in last week's issue. Following are abstracts of papers presented at the later meetings and of the discussions on them.

### Motor Drive for Main Rolls

In discussing the present status of motor drive for the main rolls of steel mills, Mr. Brant Wiley, Pittsburgh, Pa., stated that, from records kept during eight years of operation, the delays chargeable to motors at the Edward Thompson Works of the Carnegie Steel Company, Bessemer, Pa., had been practically negligible. The estimate of two hundred dollars per year per motor, including labor and material for repairs but excluding attendance, was given as an average figure for the 1500-hp, 220-volt direct-current motors in that plant. Tables accompanying Mr. Wiley's paper set forth many interesting data concerning American and European electrically driven steel mills. Cost data appended showed the remarkable advantages of motor drive, and in many instances central-station energy was recommended as being more economical than the operation of a private plant at the mill.

A short paper by Mr. E. Friedlaender, Braddock, Pa., in which questions on motor drive for main rolls were also answered, was next presented by the author, and discussion of the two papers was taken up jointly. One of the points brought out was the fact that roll breakage had been reduced 90 per cent in several mills following the installation of motor drive, owing to the application of graphic instruments to show conditions of undue friction and wrong sections in rolling.

Among those who took part in the discussion of these two papers were Messrs. R. Tschentscher, South Chicago, Ill.; J. M. Andrews, Schenectady, N. Y.; B. G. Beck, Gary, Ind.; C. S. Langton, W. D. Stevenson and Wilfred Sykes, Pittsburgh, Pa.; F. H. Woodhull, Coatesville, Pa.; F. B. Crosby, Schenectady, N. Y.; J. H. Wilson, Middletown, Ohio; G. M. Petty, Bethlehem, Pa.; E. Friedlaender, Braddock, Pa.; T. E. Tynes, Buffalo, N. Y., and A. G. Ahrens. One of the big items of advantage of the motor over the steam-driven mill is shown in the attendance charges. Data presented by one operator showed the total cost of attendance for steam and electric operation to be respectively $293 and $65 per year. The statement of these concise facts caused several of the members to agree that at the next convention similar figures should be prepared and presented in a paper giving comparative cost data for all operations. The use of graphic instruments in connection with electric drive for reducing friction and roll breakage was also cited as a strong point in favor of the motor-driven mill.




CONNECTED LIGHTING LOAD AND ILLUMINATION IN STEEL MILLS

### Progress in Illumination

The progress report on illumination, comprehending both a discussion of developments in light sources and accessories and a review of the practice and utilization of these units for steel-mill service, was presented by Messrs. Ward Harrison and H. H. Magdsick, Cleveland, Ohio. The accompanying illustration shows the changes in wattage and illumination which the last two years have brought about, as well as the illumination which could be obtained with modern lighting methods. The report stated that the steel industry is annually losing $1,000,000 through its failure to install modern lighting installations. In the ensuing discussion the following men took part: Messrs. B. W. Gilson, Youngstown, Ohio; J. H. Wilson, Middletown, Ohio; J. C. Reed, Steelton, Pa.; I. S. Iremonger, Harrison, N. J.; C. W. Parkhurst, Johnstown, Pa.; E. Friedlaender, Braddock, Pa.; G. W. Richardson, Philadelphia; F. D. Egan, Midland, Pa.; C. E. Bedell, Wheeling, W. Va.; F. W. Detwiler, Tarentum, Pa.; J. Farrington, Steubenville, Ohio; C. T. Henderson, Milwaukee, Wis.; B. G. Beck, Gary, Ind., and O. R. Jones, Youngstown, Ohio. Where tungsten units are used on 25-cycle circuits it has been found advantageous to employ units of 100 watts or larger, in order to do away with flicker. The design of lighting systems, it was stated, should take into account the coming of the half-watt lamp, and the use of standard bases which will accommodate this new unit was strongly recommended for future lighting installations.

### Variable-Speed Drives

Mr. K. A. Pauly, Schenectady, N. Y., presented a paper dealing with variable-speed motor drive for the main rolls of steel mills. In this he discussed briefly the advantages and disadvantages of a few types of motors which have been proposed for this service and gave a description of some of the methods suggested to provide an efficient and adjustable speed control for induction motors. The paper was discussed by Mr. W. Sykes, of Pittsburgh, Pa., and Mr. J. C. Reed, of Steelton, Pa.

### Electric Furnaces

The present status of the electric furnace was touched upon in a short paper by Mr. Wilfred Sykes, Pittsburgh, Pa. For handling large quantities of material it would appear that the ideal arrangement consists in a Bessemer or open-hearth plant for main refining and an electric furnace for the elimination of the occulted gases and the reduction of phosphorus and sulphur to negligible values. The various points in favor of the arc-type and induction-type furnaces were reviewed. In Germany, it is said, the electric furnace when used with the Bessemer is now able to compete with the open-hearth furnace. Data were given showing the production of iron and steel from electric furnaces in the United States and in Germany from 1908 to 1912.

A written discussion from Mr. William B. Jörkstedt, of New York City, read by Mr. J. Farrington, commented upon the thermal efficiency of the Frick furnace, which it is said will produce high-grade steel with an energy consumption of 90 kw-hr. per metric ton. Other speakers in the discussion included Dr. Richard Amberg, Messrs. R. B. Williamson, Milwaukee, Wis.; J. H. Reniers, Pittsburgh, and E. Friedlaender, Braddock, Pa.

### Question Box

The opening of the question box following this discussion precipitated a lively debate among Messrs. J. H. Wilson, Middletown, Ohio; E. Friedlaender, Braddock, Pa.; C. E. Bedell, Wheeling, W. Va.; T. T. Tynes, Buffalo; F. H. Woodhull, Coatesville, Pa.; M. Pfatischer, Bayonne, N. J.; K. H. Cederlund, Duquesne, Pa.; F. A. Wiley, Chicago; W. T. Snyder, McKeesport, Pa.; E. H. Wentz, Lorain, Ohio, and F. D. Egan, Midland, Pa.

A question on ball-bearing motors elicited from Mr. M. Pfatischer the information that the idea is very practicable except for motors with exceptionally heavy bearing pressure. Mr. Cederlund, answering a question concerning the lighting of slag pits, stated that by taking an ordinary tungsten lamp, inverting it and pouring paraffine around the metal parts a fixture is formed capable of withstanding the acid fumes and steam arising from the pits. The question of inclosing all switches carrying pressures as low as 250 volts and 110 volts brought out the fact that it is nearly as cheap to buy a switch installed in a box and thus obtain the added advantage of freedom from dirt.

### Standardization Meetings

At the standardization meetings which occupied much of the time on Friday the discussion seemed to indicate that the majority of smaller details in specifications would be left to the manufacturer and that the standardization rules of the A. I. E. E. would be adhered to in drafting specifications for steel-mill apparatus. The manufacturers indicated a desire to meet the demands of the steel-mill operators, whatever they might be, but suggested close adherence to the A. I. E. E. rules.

### Herringbone Gears

The paper on "Herringbone Gears for Steel Mills" was presented by Mr. P. C. Day, following his arrival from Europe on the *Mauretania*. The author pointed out the advantages of herringbone gears for noiseless transmission of power at high velocities. The difference between the action of herringbone gears and spur gears he likened to that between a series of hammer blows and a series of successive, continuous pushes. In conclusion, the author advised that overhung pinions and gears be avoided as much as possible, that high ratios be used where necessary and that a speed of 1500 linear ft. per minute be the aim, although any speed up to 3000 ft. per minute is entirely practicable for open gears. Those who spoke in the discussion were Messrs. H. H. Salander, Youngstown, Ohio; W. Sykes, Pittsburgh; K. H. Cederlund, Duquesne, Pa.; E. Friedlaender, Braddock, Pa.; F. E. Egan, Midland, Pa.; B. W. Gilson, Youngstown, Ohio; B. G. Beck, Gary, Ind., and H. B. Conover, Mingo Junction, Ohio.

Among the members who have been using herringbone gears the sentiment was strongly in favor of their almost universal adoption. Mr. K. H. Cederlund cited several instances where their use had reduced commutator and motor troubles to a minimum.

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## Public Service Commission News

### New York Commissions

The New York Public Service Commission, Second District, has authorized the issue of $400,000 capital stock and $100,000 of ten-year debentures by the Corning Light & Power Corporation. The stock is to be sold at not less than par and the debentures at not less than 90. The corporation is to acquire the property and franchises of the Corning Gas & Electric Company and to make extensions and improvements to the property. The latter company has $375,000 stock and $363,000 bonds outstanding. It has gross earnings of about $75,000 a year and net earnings of $47,000.

### California Commission

The Oro Electric Corporation, which was refused permission by the California Railroad Commission to transact business in Stockton, Cal., and vicinity, in competition with the Western States Gas & Electric Company, has carried the case to the courts. In doing so the corporation takes the ground that when the city of Stockton granted a franchise the commission had no right to refuse to permit operation under the franchise.

The California Railroad Commission has been asked to approve the consolidation of the Coalinga Water & Electric Company, the Midland Counties Gas & Electric Company, the Paso-Robles Light & Water Company and the Russel-Robinson Water and Electric Company. The title of the consolidated company would be the Midland Counties Public Service Corporation.

### West Virginia Commission

Rules have been issued by the Public Service Commission of West Virginia for the guidance of companies which desire a permit to develop hydroelectric power. The rules are designed to make companies show that they are not seeking the permit for speculative purposes or to monopolize the power of streams. The companies are required to give full information in reference to physical matters incident to construction work and also in regard to their financial resources. Copies of the application and of all other information furnished to the commission must be filed with the clerk of the county in which the development is to be made.

### Wisconsin Commission

The Wisconsin Railroad Commission held a hearing recently to discuss the proposed rules and regulations affecting telephone service with a view of revision before the standards of telephone service are prescribed. The meeting was attended by representatives of all the large telephone companies as well as of many of the small independent companies. The proposed rules are essentially the same as the tentative rules proposed during the meeting of the State Telephone Association last year. Among the

service, line construction, limitation of the number of telephones on a line, testing and maintenance of lines and equipment, issue of directories and publication of all rules affecting the public, records of complaints, etc.

The Chippewa Valley Railway, Light & Power Company has been empowered to increase its minimum bill for electric lighting in the city of Spring Valley from 75 cents to $1 per month.

# Current News Notes

Wireless Amateurs Listed.—The extent to which wireless telegraphy has been taken up by amateurs is disclosed in a list of radio stations in the United States issued by the Commerce Department's Bureau of Navigation. Almost 1300 amateurs had been granted licenses up to July 1.

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Home for Disabled Electricians.—At the recent international convention of the Brotherhood of Electrical Workers at Boston, Mass., a resolution for devising means to establish a home for disabled members was approved, and committees from several sections of the country were named to work out recommendations to be submitted to the next general convention.

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Temperatures Within Two Degrees of Absolute Zero Reached.—It was announced at the recent International Congress of Refrigeration held in Chicago that Dr. Kanerlingh Onnes had produced a temperature of 426 deg. Fahr. below zero. At that temperature it is declared metals lose their electrical resistance so that minute wires can carry any distance all of the energy generated at Niagara Falls.

* * *

Electricity Thieves in Fort Wayne.—Some trouble has been experienced recently by the Fort Wayne & Northern Indiana Traction Company, of Fort Wayne, Ind., which sells electricity for commercial purposes in that city, by the activities of electricity thieves. In one case the culprit made a connection with the service wires on the wrong side of the meter. Evidence was furnished to the prosecuting attorney of the county, who took charge of the case. On arraignment the defendant pleaded guilty and received a sentence of $10 and costs, the latter amounting to about $25.

* * *

Chicago Jovians Promoting Electrical Development.—To help in the membership campaign of the Society for Electrical Development the Chicago Jovian Club has offered a prize of $100 to the member of the club who secures the largest number of members for the society before Oct. 10. The society has already offered large prizes for the Jovian club obtaining the most members, and this additional reward is an evidence of the Chicago Jovians' cordial cooperation. The local prize was voted at a luncheon given by the Chicago Jovian Club on Sept. 16, following a talk by Mr. A. A. Gray.

* * *

Mexican Northern Power Company Stops Work.—We have been informed by the Mexican Northern Power Company that the announcement made in these columns on Aug. 23 with reference to the company's hydroelectric development on the Conchos River is erroneous. The company has decided to suspend all constructive operations until the political disturbances affecting its work have ceased, and not because of government intervention as stated. Under the prevailing conditions it is impossible to transport to the dam the necessary supplies to finish the work.

Electric Signs for Railroad Crossings.—At the meeting of the American Railway Safety Association held in Chicago on Sept. 22 the subject of grade-crossing accidents was discussed. It was proposed that electric signs be erected on highways at a little distance from railroad crossings so that the drivers of automobiles could see the signs at night and bring their vehicles to a stop before the crossing was reached. Electric signs at railroad crossings are in use to some extent in California but are not common in the East.

* * *

Cloudburst and Lightning Interrupt Service in Nevada.—Mr. F. B. Mechling, district manager of the Nevada-California Power Company, in Goldfield, Nev., reports that the greater part of the company's distributing system in Nevada was affected by an electric storm on Sept. 15. On that date electric service was interrupted for approximately two hours. In Goldfield conditions were worse, the lighting service being interrupted for twenty hours by a flood caused by a cloudburst. With the exception of having a few oil switches burned out and transformer terminals burned off, the company suffered only a slight loss.

* * *

Civic Federation to Frame Compensation Act.—The joint commission on the operation of workmen's compensation acts in the various states which was created at the National Civic Federation has decided to make a personal investigation of the operation of the Washington act, inasmuch as that state is the only one in which compulsory state workmen's compensation insurance is enforced. Ohio has an amended law which will take effect on Jan. 1, 1914, and the elective law enacted in California in 1911 will become effective on that date also. Twenty-two states have adopted workmen's compensation acts, and the investigations made by the committee are to be utilized by the workmen's compensation department of the Civic Federation in formulating a new model law for uniform state legislation.

* * *

## SOCIETY MEETINGS

Electric-Vehicle Prospects in Philadelphia.—Mr. Harry Lasher, of the Philadelphia *Press*, spoke briefly of the electric-vehicle situation in Philadelphia at a recent meeting of the Chicago Section of the Electric Vehicle Association. The trend of the automobile situation in Philadelphia is toward the electric vehicle, he said, and the Philadelphia Electric Company is helping the good work. The use of electric gear shifts and other electrical improvements on gasoline cars was also mentioned. One need in Philadelphia is the erection of suburban electric garages. There is a very large downtown garage, but the facilities for the storage and care of electric vehicles in Philadelphia's extensive suburbs are inadequate. There is talk of organizing a Philadelphia section of the Electric Vehicle Association.

* * *

Meeting of the Philadelphia A. I. E. E.—The Philadelphia Section of the American Institute of Electrical Engineers will hold afternoon and evening meetings on Oct. 13 at the Drexel Institute, Thirty-second and Chestnut Streets. At the afternoon session Mr. Charles Fair will present a paper on "Electric Drive in Machine Shops" and Mr. H. P. Liversidge will speak on "Industrial Substations." During the evening session Mr. Paul M. Lincoln will present a paper on the "Relation of Plant Size to Power Cost." Visits will be made to the engineering laboratories and shops of the Drexel Institute and to the electrical engineering laboratories of the Towne Scientific School of the University of Pennsylvania. Dinner in the evening will be served at the Normandie. Mr. Joseph D. Israel, 1000 Chestnut Street, Philadelphia, is chairman of the local arrangements committee.

# Hydroelectric Energy for Worcester Railway System—I

**Features of Connecticut River Transmission Company's 120,000-volt lines and substations—Outdoor switching installation—Additions to Millbury plant**

THE Worcester Consolidated Street Railway serves the second largest city in Massachusetts and a tributary suburban and rural district extending from Fitchburg on the north to the Rhode Island state line on the south. It operates about 90 miles of track in the city of Worcester and 170 miles outside, its schedules demanding the daily rush-hour use of about 400 cars and meeting the traffic requirements of a territory about 40 miles long by 30 miles in width.

On its lines are operated both a passenger service, varying in density from that required in the most congested city street to that suitable for cross-country or interurban patronage, and a rapidly growing electric express business of far-reaching possibilities On such a system, largely made up of what were formerly separate railways now assembled under a single management, the problems of power supply in the face of rapid population increase are of much engineering interest.

For many years the principal source of power on the Worcester system was the Fremont Street station at Worcester, supplemented by various steam plants of moderate capacity in the outlying portions of the area served by the company. About two years ago an important change in policy was inaugurated by the building of a 5000-kw steam-turbine station at Millbury, 6 miles south of Worcester; the construction of a 3000-kw rotary-converter substation on Madison Street, in the heart of the city of Worcester, and the building of a 13,200-volt, 25-cycle steel-tower line between these points. The Fremont Street station was then retained as an auxiliary plant and connected with the Madison Street substation by direct-current tie lines. The Millbury station was planned for the ultimate addition of several units of the capacity initially installed and a second 5000-kw turbo-generator set is now being added.

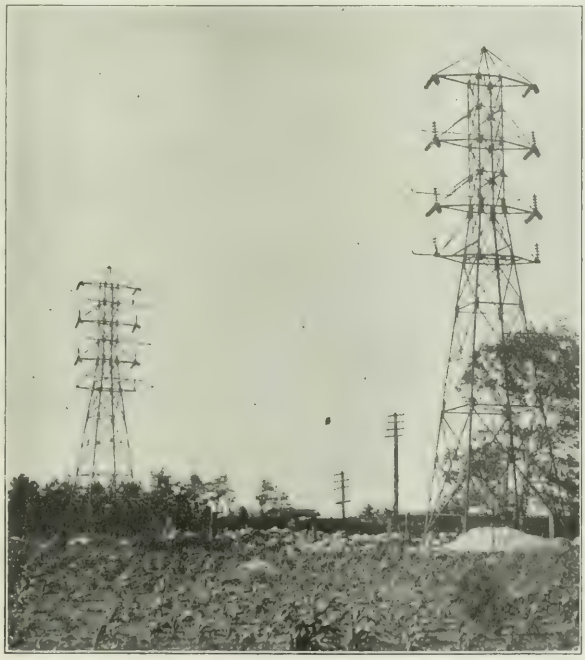


FIG. 1—66,000-VOLT TRANSMISSION LINE CROSSING AT MILLBURY JUNCTION

### Introduction of Hydroelectric Power

Since the Millbury steam station was first placed in operation the high-tension hydroelectric transmission system of the Connecticut River Transmission Company has been extended into southern Worcester County, and a contract has been signed for the supply of energy to the Consolidated company at a number of points, the most important of these being at Millbury, which has become the operating headquarters of the Connecticut River Transmission Company's system.

A few lines upon the general features of the Connecticut River company's service will therefore be included, in view of its importance in the wholesale electric service supply of central New England.

The present yearly output of the plants connected with the Connecticut River company's lines exceeds that of the combined central stations of Massachusetts with the exception of the Boston Edison company. The water-power generating stations of this organization are located on the Connecticut River at Vernon, Vt., and on the Deerfield River in the Shelburne Falls district. A small amount of hydroelectric power is purchased by the company from the Clinton Dam station of the Boston Metropolitan Water and Sewerage Board, and by reciprocal contracts between the transmission company and various customers the generating plants of the latter are available in case of shortage to feed energy back into the system and thus assist in maintaining high standards of service. The present rating of the hydroelectric station of the Connnecticut company and its affiliated interests on the Connecticut and Deerfield rivers is about 35,000 kw.

The transmission lines, as shown by the accompanying map of the system, form a loop from Vernon to Shelburne Falls and back through the Fitchburg, Clinton, Worcester, Millbury and Brookfield districts, with various branch lines and a proposed extension loop through Rhode Island to Providence and thence back to Millbury via northeastern Connecticut. On the north side of the system the lines between Vernon and Millbury are designed for 66,000 volts and are operated at this pressure, while on the south the lines from Shellburne Falls to Millbury and thence to

Providence are designed for operation at 120,000 volts. The frequency is 60 cycles.

The system has been developed under the general direction of the Chace-Harriman interests of Boston, and its influence in the electric-service situation in this territory is rapidly increasing. It is already the most extensive power system in New England, deriving its energy from waterwheels, and its line arrangements are being carried out with the object of providing continuous service in face of every emergency which can be foreseen. Each of the main lines carries two three-phase transmission circuits. Steel-tower construction is employed on all the high-tension trunks. On the Deerfield River development reservoir capacities aggregating 7,000,000,000 cut. ft. are planned to insure uniformity in the water supply.

### Location of Substations

Energy is supplied to the Worcester Consolidated Street Railway system from the Connecticut River Transmission lines through substations at Millbury, Greendale, Fitchburg, Leominster, West Berlin, Northboro and West Boylston, Mass., the attendance at the Greendale and Fitchburg installations being provided by the transmission company in connection with the operation of adjoining substations for its own commercial customers' service. In addition to the Madison Street substation in Worcester, the railway company operates distributing substations at Oxford (Texas substation), Webster, Leicester and Sturbridge. In the fall a substation will be established in the old Charlton City steam plant of the former Worcester & Southbridge Street Railway. A list of these substations with their equipment capacities in rotary converters is given in the accompanying table.

The Consolidated company's steam generating plants will have an aggregate capacity of 18,300 kw upon the installation of the second 5000-kw turbine set at Millbury. The company also purchases about 330 kw from the Worcester Suburban Electric Companies at the Uxbridge generating station of the latter. Generators belted to waterwheels and having a combined capacity of 500 kw are installed in the Leominster power station of the railway company, so that the total amount of auxiliary steam power available is 18,800 kw. The rotary converters now connected to the

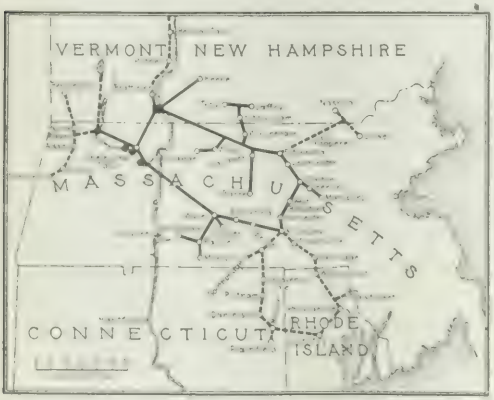



FIG. 2—[illegible] CONNECTICUT RIVER TRANSMISSION COMPANY AND ITS CONNECTING AND PROPOSED LINES

Connecticut River company's system have an aggregate capacity of 3300 kw, exclusive of the machines at the Madison Street substation. At Millbury a 3000-kva frequency-changer set has been installed to furnish 25-cycle current to the railway company from the Connecticut River system.

In general the substations on the south side of the Consolidated system are equipped with 25-cycle rotaries, while those on the north side are 60-cycle machines. At Millbury 13,200-volt lines between the Connecticut River system and the Consolidated plant provide for the supply of current at both frequencies from the former. The Madison Street substation contains two 1500-kw, 25-cycle rotaries and two 2000-kw, 60-cycle rotaries, each pair being sup-



FIGS. 3 AND 4—WORCESTER CONSOLIDATED SWITCHING STATION AT MILLBURY, MASS., AND 120,000-VOLT LINE OF CONNECTICUT RIVER TRANSMISSION COMPANY ENTERING STATION

plied with energy through appropriate transformer banks and an independent three-phase No. 0 copper line 6 miles long between Millbury and the former point.

### Steam Generating Plants

The steam generating plants of the company are as follows: Millbury, 10,000 kw; Fremont Street, Worcester, 5650 kw; Unionville, 800 kw; Charlton City, 400 kw (as planned for the coming fall); Northboro, 650 kw; West Berlin, 225 kw; Leominster, 800 kw (not including 500 kw installed waterwheel-driven generators). The Millbury station is the only one of these which measures up to the most modern standards, and the smaller plants are useful in their reserve capacity only in relation to the present plans for power supply throughout the system. The

SUBSTATIONS OF WORCESTER SYSTEM, WITH THEIR RATING

| Location | Rotary Converters | | Total Kw |
|---|---|---|---|
| | No. | Rating, Kw | |
| [illegible] | 2 | 1,500 | 3,000 |
| [illegible] | 2 | 2,000 | 4,000 |
| [illegible] | 1 | [illegible] | 300 |
| [illegible] | 2 | [illegible] | 600 |
| [illegible] | 2 | 300 | 660 |
| [illegible] | 2 | 300 | 600 |
| [illegible] | 2 | [illegible] | 600 |
| [illegible] | 2 | 300 | 600 |
| [illegible] | 2 | 200 | [illegible] |
| [illegible] | 2 | 225 | 450 |
| [illegible] | 2 | 400 | 800 |
| [illegible] | 2 | 300 | 600 |
| [illegible] | 2 | 200 | 400 |
| [illegible] | 2 | 300 | 600 |
| [illegible] | 21 | | [illegible] |

smaller stations contain generating units of moderate capacity, frequently belt-driven, and their boilers are hand-fired. While most of the engines are of the condensing type, the local load-factors are not favorable to high steam economy, and the facilities for coal supply are expensive. With the exception of the Fremont Street station, most of these smaller plants were built either to operate interurban and suburban lines with cars run on long headways or to supplement the generating facilities at Worcester. Their sites and frequently their building interiors provide space

for substation equipment in localities easily served from these centers, and by including one or two licensed engineers and firemen in these revised installations a flexible arrangement of personnel results.

The addition of a second turbine to the Millbury station is being made without the installation of more boilers, as sufficient steam-generating capacity is to be secured through the erection of a Sturtevant economizer of 10,000-sq. ft. heating surface in connection with the existing four 820-hp Edgeworth water-tube boilers. These are each equipped with Murphy stokers and are operated at 200 lb. steam pressure. The draft is supplied by a Kellogg circular brick stack, 225 ft. high and 12 ft. in inside diameter. An interesting feature of the plant is the handling of its circulating water for condensing service, this being effected entirely by gravity from the Blackstone Canal. Two 225-kw engine-driven, direct-current generating sets have been removed from the engine room in connection with the installation of the second turbine, which is a General Electric machine of the Curtis horizontal type, equipped with Worthington surface condensing apparatus and similar to the first machine installed two years ago.

The foundations of the unit are of concrete and are 18 ft. deep, 30 ft. 8 in. long at the bottom and 15 ft. wide. The turbine room, 96 ft. long by 52 ft. wide, now has



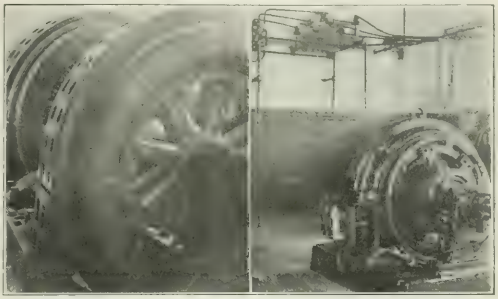
FIGS. 5 AND 6—MAIN TRANSFORMERS IN GLENDALE SUBSTATION, AND THREE-PHASE TRANSFORMER AND 66-000-VOLT OIL SWITCHES, MILLBURY OPEN-AIR STATION, CONNECTICUT RIVER TRANSMISSION COMPANY

space for three 5000-kw units and two 300-kw rotaries which are shortly to be transferred from a temporary wooden structure at the front of the company's premises to the interior of the station. The turbine takes steam from a 14-in. header in the boiler room through a 10-in. supply pipe and discharges its exhaust into the condenser directly beneath the machine. The circulating-water intake pipe is 24 in. in diameter and drops about 6 ft. between the canal and the bottom of the condenser, running through the basement on a cinder concrete foundation. The turbine is provided with a 30-in. atmospheric exhaust connection leading to a Blake automatic relief valve and thence to the roof. The circulating water from the condenser is discharged through a 24-in. pipe into a 4-ft. by 5-ft. tunnel of concrete passing longitudinally through the basement and leading to the Blackstone River.

### Lay-Out of High-Tension Equipment

An accompanying drawing illustrates the general scheme of connections at the Millbury switching and substation of the Connecticut River Transmission Company, the arrangement and spacing of high-tension lines, location of transformers, air and oil switches, and other details of interest. The present installation at Millbury includes the Consolidated company's power house, a switch house for the railway company's 13,200-volt service lines on the further side of the Blackstone Canal, the transmission company's substation, and in connection with this, one of the most advanced out-door types of switching and transformer installations for high-voltage service thus far entered.

The entire high-tension equipment, including transformers, oil switches and lightning arresters connected with the



FIGS. 7 AND 8—FREQUENCY CHANGER, MILLBURY STATION, CONNECTICUT RIVER COMPANY, AND A 200-KW ROTARY, NORTHBORO SUBSTATION, WORCESTER CONSOLIDATED COMPANY

66,000-volt and 120,000-volt lines of the transmission company, is located in the open at the rear of the substation building shown in an accompanying illustration. The transformers here will eventually have three independent windings, of 120,000, 66,000 and 13,200 volts respectively, and the station will serve as a tie-in and equalizing center between the 66,000-volt and 120,000-volt systems, and also as a step-down substation, taking energy from either or both systems and delivering it at 13,200 volts. The ultimate capacity will be about 20,000 kva.

There is now also being installed a complete switching equipment for the control and interchange of two 120,000-volt lines and two 66,000-volt lines, with the usual protective apparatus. Space is provided for four, and possibly six, 120,000-volt lines for future service. A special steel structure illustrated by the accompanying construction photograph has been designed by the engineers of the hydroelectric organization for the support of outdoor

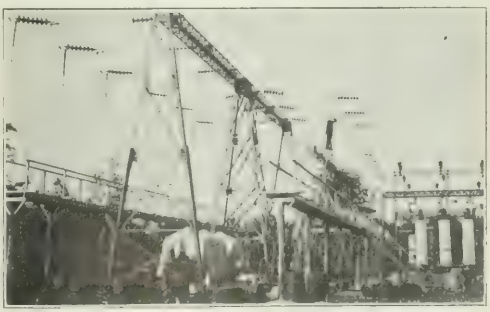


FIG. 9—STEEL BRIDGES UNDER CONSTRUCTION FOR 120,000-VOLT LINES AT MILLBURY SWITCHING STATION, CONNECTICUT RIVER TRANSMISSION COMPANY

buses. It consists of square towers, A-frames and latticed girders, assembled in combinations to suit the various requirements. In the brick building shown is now installed the 3000-kva, 60-to-25-cycle frequency-changer set mentioned before, all the control panels for the Connecticut River Company's high-tension and low-tension apparatus, the bus structures for the 13,200-volt, 60-cycle and 25-cycle

service, and low-tension lightning arresters. The stations will have a capacity of twelve 13,200-volt feeders, six of each frequency, and the present installation will consist of six 2000-kva, 66,000/13,200-volt transformers of the water-cooled type, the frequency-changer set with a 3000-kva, three-phase transformer, and a portion of the switching apparatus.

### 120,000-Volt Transmission Line to Millbury

The 120,000-volt lines between Shelburne Falls and Millbury are carried on a single line of American Bridge square, double-circuit steel towers, measuring 50 ft. to the lowest cross-arm and 75 ft. over all. The line is 60 miles long between the nearest generating station and Millbury, and the towers are spaced about ten to the mile. The power conductors are of No. 2/0 medium hard-drawn seven-strand copper and a ground wire of ⅜-in. double-galvanized Siemens-Martin steel strand. Suspension insulators are used, the number of disks being six in suspension and seven on strain. The line is transposed once

carrying three 66,000-volt oil switches is 16.5 ft. long, 4 ft wide and 3 ft. high above the ground. A typical transformer pier consists of two concrete beams 20 in. wide and 22 in. high above the ground in each case, carrying two 4-in. T-rails 3 ft. 6 in. apart, upon which rests a set of wheels permitting the more rapid movement of the transformer in case its location has to be changed quickly. Circulating water from the Blackstone River is supplied to the transformers through a system of 3-in. pipes by two triplex vertical pumps, each geared to a 5-hp, 110-volt three-phase induction motor. The water is filtered and is drawn from a well at the pump house. Wooden galleries are being erected to facilitate the opening and closing of disconnecting switches from below, as illustrated in the accompanying photograph. The disconnecting switches are composed of suspension insulators with a hinged blade at one end and a Y-shaped spring clip at the other and are simple and effective in service. Several 13,200-volt, 60-cycle feeders connect the Consolidated company's switching station with the Connecticut River company's substation

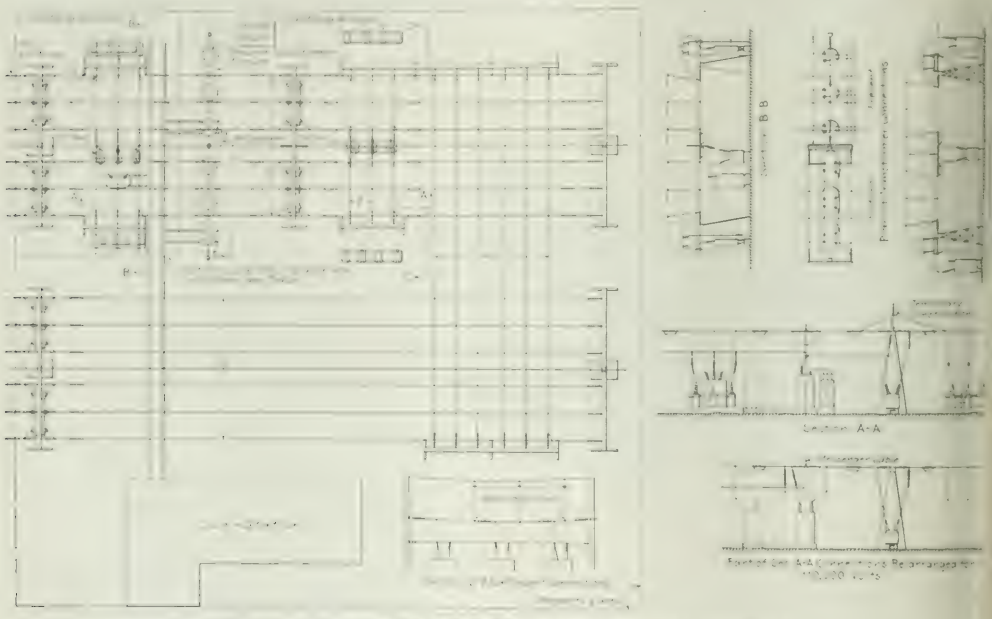


FIG. 10—ARRANGEMENT OF OUTDOOR EQUIPMENT, MILLBURY SUBSTATION

every 20 miles, and the company's telephone circuit is carried on a separate pole line. In connection with the Millbury installation a tie-line has been constructed between the Greendale substation and the former point around Lake Quinsigamond, a distance of about 11 miles, two three-phase circuits of No. 2 three-strand copper being used. The distance from the Vernon station to Millbury is about 80 miles, and No. 2 copper is used throughout, the line being carried on steel towers and pin-type insulators.

The steel bridges supporting the bus conductors at the Millbury switching station are in general carried 30 ft. above the ground and are about 60 ft. long. Disconnecting switches are installed on each side of every oil switch. All transformers, high-tension lightning arresters and oil switches are mounted upon concrete foundations, and the lightning arresters are installed with tanks coated with white paint to keep the electrolyte cooler when in the sun's rays than is feasible with the ordinary dark-colored tank. The equipment of this outdoor switching station is of General Electric make throughout. A typical concrete pier

besides a feeder of this voltage leading from the frequency changer. The minimum spacing between high-tension conductors in the open-air switching station is 8 ft. and in most cases 10 ft. Choke coils are placed in series with high-tension oil switch leads, and horn-gap and electrolyte arresters are liberally provided.

The frequency changer consists of a three-phase, 2-pole, 2300-volt, 60-cycle synchronous motor rated at 42 hp and directly connected to a 10-pole, 3000-kva, 25-cycle 13,200-volt generator with auto-transformer, the speed of the unit being 300 r.p.m. A 100-kw, 125-volt exciter is provided for the synchronous motor, the former being of the motor-driven type. It is housed on the ground floor of the transmission company's substation. The two machines composing the unit are mounted on a common bed-plate with three bearings.

A succeeding article will describe the distribution practice, railway-substation construction features and system operating methods of the Worcester Consolidated Street Railway Company.

# The Uniflow Cylinder Adapted to Locomobiles

**Utilization of the unidirectional steam-flow scheme for minimizing cylinder condensation in self-contained units using saturated or superheated steam. By Warren H. Miller**

THE amazing progress made with the reciprocating engine since the competition of the turbine became so formidable as to threaten its very existence is est exemplified by the strides taken by the locomobile in ne last decade. Since Josse's tests of the first locomobiles n 1901 this type has been developed and the possibilities of uperheated steam have been further and further realized,

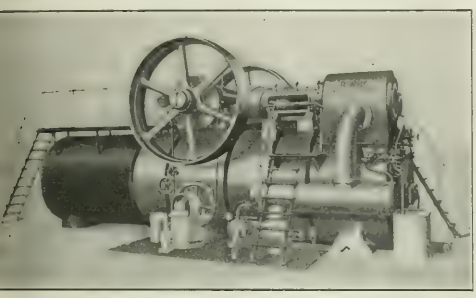


FIG. 1—UNIFLOW LOCOMOBILE

ntil an ultimate coal consumption of 0.83 lb. and steam onsumption of 7.02 lb. per brake-hp-hr. was attained with ocomobiles in daily service in the years 1909 and 1910. Articles by the present writer relating to the early and ore recent developments in the locomobile appeared in the *lectrical World* as follows: June 2, 1910, page 1442; pril 6, 1911, page 842, and Aug. 16, 1913. Following s an outline of the most recent improvements in this achine in America and Germany.

Professor Strumpf's uniflow cylinder engine, developed uring the last few years at Charlottenburg, Germany, romises much in the way of improved economy. The rrangement is employed to eliminate cylinder condensaon by passing the steam through the cylinder in only one rection, so that during expansion the steam will find self in contact with walls approximately of its own temrature at any given part of the stroke. This is accomished either by using a central exhaust port and a long ston which uncovers the port at the proper instant in e stroke or else by placing an exhaust port near the end the sweep of the piston and controlling it by a separate haust valve. In either case the long period of cooling the cylinder walls during an exhaust stroke is avoided d cylinder condensation from this cause is much reduced. It was the excessive cylinder condensation caused by the eeping out of cold exhaust steam that resulted in the mise of the low-speed long-stroke mill engine just as on as boiler pressures rose much above 100 lb. in general ractice. For thirty years use had been made of the shortroke, high-speed, "square-cylindered" high-pressure enne, and it proved satisfactory until the turbine was deoped. Now comes the uniflow equipment, which represents an improvement on the two-cycle gas engine, getting of all the exhaust except that reserved for compression means of a central port, thereby abolishing at once a nsance that has been endured for thirty years.

While the locomobile has been developed in America along the lines of double superheat and tandem compound cylinders jacketed by the waste gases, the Wolf company in Magdeburg has applied the uniflow cylinder principle to a new line of large locomobiles of from 300 hp to 800 hp. It may seem like duplication to use both superheated steam and the uniflow principle in the same engine with the ultimate object of reducing the cylinder condensation, but this plan is quite simple and defensible.

There will always be a considerable range of temperature in the steam, whether superheated or not, between admission and exhaust. Any exhaust stroke lengthens the time during which the low-temperature exhaust steam can act on the high-temperature walls of the cylinder and steam ports, thereby cooling them below the temperature of admission. Good and efficient heat jacketing may compensate in a measure for this loss by reheating part of the steam during expansion, but in the uniflow machine any jacketing beyond that needed to take care of plain radiation is unnecessary. Each annular section of the cylinder wall area is in contact with steam of approximately its own temperature as the piston sweeps past during the stroke, and hence the temperature difference is small and the tendency to condense limited. While this is approximately true over limited ranges of steam temperature, a certain amount of exhaust steam must be reserved for compression, and this steam will exercise a certain cooling effect on the walls even though it is receiving heat from the work of compression. It therefore follows that for high-temperature admission it is best to divide the expansion between high-pressure and low-pressure cylinders, as is done by the Wolf company.

Another feature of the uniflow machine used for either saturated or superheated steam is the avoidance of preliminary condensation in the port between the valve and

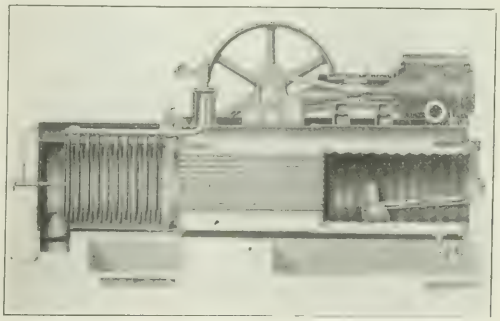


FIG. 2—LONGITUDINAL SECTION OF UNIFLOW LOCOMOBILE

the cylinder. Here, in the saturated steam engine of the single valve type, is an unavoidable passage, often long and constricted, which must be used alternately by exhaust and live steam, the former chilling the metal walls, the latter reheating them. Aside from the volume of these ports, which forms no small percentage of the total clearance, the total condensation from the contact of all the steam

with the [illegible] at the port is [illegible] and this is connected to the [illegible] arrangement with the other port [illegible]

The mechanical construction of the Wolf locomobile is shown herewith. A light piston valve admits steam superheated to about 650 deg. Fahr. through ports in the sides of the cylinder walls. On the opposite side the exhaust port is controlled by a similar and larger piston valve which admits it to alternate ends of the low-pressure cylinder, whence it rejects to the condenser by means of central ports arranged in a ring around the cylinder walls. These are uncovered by the piston near the end of the stroke, the cylinder and piston being made long enough to permit nearly all the stroke to be made without uncovering the central ports. Wire-drawing is avoided by cutting the ports diagonally with rounded corners. The long piston must, of course, appear also in the high-pressure cylinder, which accounts for the position of the two high-pressure exhaust ports as shown in Fig. 3

High-pressure and low-pressure indicator cards are reproduced in Fig. 4. Note that, as in the simple uniflow engine, admission is instantaneous, expansion beginning at once, the governor controlling the amount of steam admitted instead of the time of admission. A certain amount of reheating is noticeable in the expansion line, as is also a sudden drop as the exhaust port is uncovered. Compression begins to show at about two-thirds of the exhaust stroke.

The superheater employed is of a new design with sets of double-spiral coils connecting two manifold headers. Steam of about 216 lb. pressure is taken from a small steam dome near the superheater end of the boiler, enters one header and crosses to the other through the spirals of small pipe, arranged in "multiple," so to speak. A more efficient heat interchange between the hot flue gases and the non-absorptive superheated steam is claimed for this arrangement than could be had with the older continuous spiral type. The friction loss due to passing through some 300 linear feet of spiral superheater pipe is avoided, but at overloads this multiple type of superheater seems liable to pass saturated steam across the first few spirals without there being sufficient time for complete superheating to take place. No provision seems to have been made for cleaning out the entrained cylinder oil.

The engine frame contains several features developed independently by the American locomobile builders, the Buckeye Engine Company, Salem, Ohio. All engine

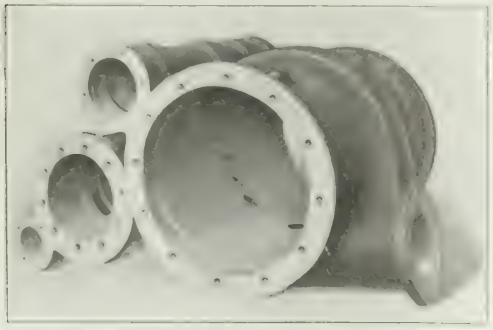


FIG. 3—HIGH-PRESSURE AND LOW-PRESSURE CYLINDER [illegible]

stresses have been removed from the boiler shell. In the earlier German locomobile the crank shaft and its bearings were mounted on a saddle riveted to the boiler shell, with the cylinders on a separate saddle, the boiler shell forming the engine bed. The American builders did not take kindly to this construction, for it introduced at least three distinct disadvantages: (1) Engine stresses had to pass through the boiler shell, crossing at least two rivet joints; (2) to allow for expansion changes the engine had to be aligned and valves set under full steam pressure; (3) a copper gasket about 0.25 in. thick had to be put under the flange of all combination steam dome and cylinder castings, where the cylinders were jacketed by live boiler steam, and

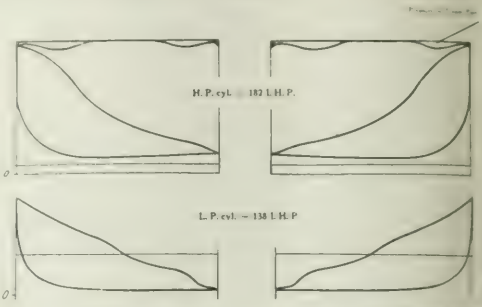



FIG. 4—INDICATOR CARDS

this gasket could then be calked tight whenever leaks developed under working stresses.

The American builders have adopted a horizontal box A-frame, connecting the crank-shaft bearings and cylinders. The latter merely rest on the rear saddle, and all stresses pass through the A-frame, which is also the cross-head guide on the usual bored American construction. The above-described feature has either been adopted from American practice or else developed independently in Germany in the latest Wolf locomobile, as will be noted from an inspection of the accompanying illustrations.

It is interesting to observe the sweeping simplifications made by the German engineers in this locomobile over their earlier types as justified by the presumably greater efficiency of the uniflow cylinder when using superheated steam. They have discarded the flue-gas jacketing of their tandem-compound unit, discarded the second superheater before the low-pressure cylinder, returned to the cross-compound type of unit with direct passage of the steam through both cylinders, and in every way simplified the steam cycle. The results thus far have been below the best that can be done with the tandem compound arrangement with two superheaters, such as American engineers adopted as the best type of locomobile.

As tested by Professor Durfner, of the University of Prague, the steam consumption of the uniflow cylinder locomobile is 8.05 lb. per brake-hp-hr. at 644 deg. Fahr steam temperature. This has been nearly equaled by the small 40-hp "Russian" type with double superheat and low-pressure cylinder jacketed in the steam dome and the high-pressure cylinder jacketed in the smoke box, and exceeded by the larger "THC" type, double-superheat tandem compound, both cylinders jacketed in the chimney uptake (the type adopted by the American locomobile builders). The former showed 4.67 kg. steam and 0.56 kg. coal per brake hp-hr. as tested by Professor Josse in 1904, the load on the locomobile being 55.1 hp, and the latter as tested by the Magdeburg Boiler Association in 1910 consumed 0.3 kg. coal and 3.21 kg. steam per brake-hp-hr. on the 138-hp load. This latter test was with a very high superheat of 806 deg. Fahr. and constitutes the world's record in steam economy. With the usual superheat temperature of around 750 deg. Fahr. about 9 lb. is the common value of steam consumption. This record has been duplicated in our own country by the first American locomobile ever built. The output ratings of the new Wolf uniflow locomobiles run from 250 hp to 600 hp in six units, and the floor area necessary are from 20 ft. 5 in. by 8 ft. 9 in. for the 250-hp unit up to 30 ft. 3 in. by 12 ft. 9 in. for the 600-hp unit.

## The Arc as a Standard of Light

At the recent Birmingham convention of the British Association for the Advancement of Science Mr. J. F. Forrest presented a paper relating to certain researches on the carbon electric arc as a standard of light. The experiments were based on the fact noticed by Violle and Blondel that the intrinsic brilliancy is independent of the current and the arc length although affected by impurities in the carbon. The lamp is so arranged that an image of the bed of the positive carbon is thrown upon the screen in front of the operator.

Use is made of a three-carbon combination with the electrodes so positioned as to eliminate the tendency of the arcs to climb up the negative electrodes, of which there are two.

The appearance of the crater is most interesting. It is mottled, there being a large number of irregular areas which are brighter than the background. A bright patch appears to spring from a dark patch, to spread out, star-fashion, and finally to merge into the background. The edges of a minute crack are always the source of a bright area, which sometimes moves quite slowly over the face of the crater. Everywhere over the crater, but particularly near the edges in the centers of bright stars there can be seen tiny black dots, which appear and disappear with great rapidity, giving the patch a suggestion of winking. These finally fly away. They may be impurities or, it is just possible, bubbles of liquid carbon; they are only of the order of 3/40 mm in diameter.

When the arcs are hissing the crater is no longer quiescent, but suffers violent changes of temperature and of configuration which it is impossible to describe. While hissing is actually heard a bright revolving line or comma can readily be seen by using a stroboscopic method of observation, but it almost certainly disappears with the silencing of the arc. A telephone, connected across the terminals of a low-resistance resistor, carrying all the current, affords a ready means of listening to the note emitted, without the distraction of outside noises. Starting with a loud, high-pitched note, the volume of sound and the pitch of the note become less and less until the limit of audibility is reached. At the same time the speed of rotation of the arc becomes lower and lower until it is visible to the naked eye. The cessation of sound and of rotation of the crater are apparently simultaneous. The area of the crater is approximately proportional to the current. The current density is 1.5 amp per sq. mm. This uniformity is what one would expect.

Photometric observations showed results close enough together, even including the differences in the experimenter on five different evenings and the various experimental errors which only great elaboration would eliminate, to encourage one to investigate further with those grades of carbons which are found most suitable.

## Erection of Municipal Plant at Budapest

Among the social reforms undertaken by the recently elected Mayor of Budapest was the construction of a municipal power station which is to be in operation by next December. The prime-mover equipment comprises two 5000-kw Melms-Pfenninger turbines driving Blathy 10,000-volt, 50-cycle alternators. Steam will be furnished by one pair of Garbe boilers and one pair of Babcock & Wilcox units. Motor drive is to be employed for the condenser pumps and other auxiliaries. Complete protective equipment is installed on the high-tension circuits, and both hand-operated and automatic oil switches will be used.

In the congested districts of the city the substations will be installed in public and private buildings, while for the outlying regions small transformer houses are provided. Automatic oil switches are also so arranged that in case of accident to one of a pair of duplicate lines feeding an important distribution center the load will be automatically transferred to the second unimpaired cable. Four of these automatic switching centers are provided, two of them being underground installations in prominent public squares. Mr. Leopold Stark is the director in charge of construction of the new plant at Budapest.

## The Photo-Electric Cell in Photometry

At the Pittsburgh convention of the Illuminating Engineering Society a paper by Prof. F. K. Richtmyer, of Cornell University, relating to the photo-electric cell in photometry was read and discussed. The following paragraphs present an abstract of it:

Since the discovery of the so-called photo-electric phenomenon in 1888 the process of manufacture of the cells has been so perfected that cells of sodium, potassium or rubidium, sensitive to light from the visible spectrum, are readily obtainable on the market. Since the intensity of the current furnished by these cells is strictly proportional to the intensity of illumination on the sensitive metal surface, the cells may be used for intensity measurements over a very great range.

In using the cell the negative pole of a battery the positive of which is grounded is connected to the alkali metal contained in the cell. A wire sealed through the glass of the cell is connected through an electrometer or galvanometer to the earth. When a beam of light is allowed to fall on the metal surface a current of electricity is produced in the circuit.

The strength of the current will depend on several things: It increases as the electromotive force of the battery is increased up to a certain point—at least, this is true for most cells obtainable on the market. It depends very greatly on the color (wave-length) of the incident light. But if these two are maintained constant the strength of the current is absolutely proportional to the intensity of illumination on the metal surface over an enormous range of intensities.

The currents furnished are in most cases comparatively small. Only the higher illuminations (say 20 or 30 ft.-candles for white light) produce currents large enough to be measured by a sensitive galvanometer. These currents are of the order of magnitude of $10^{-9}$ amperes. For the more common illuminations (say from 0.0005 ft.-candle up) a sensitive electrometer is necessary. Although the latter instrument is somewhat more troublesome to handle than a galvanometer, the possibilities of this method of measurement more than justify its use.

One may use an electrometer in either of two ways. If the illuminations are very small, the electrometer should be connected directly in circuit, the electrometer replacing the galvanometer of the previous connection. A key makes it possible to discharge or insulate the pair of quadrants to which it is connected. A condenser may be used in parallel with the electrometer to vary its current sensibility as required. One of the several types of air condensers is most successfully used.

With this arrangement the procedure is essentially as follows: The illumination to be measured is allowed to fall on the cell and the key is kept closed until stationary conditions have been reached. The key is then opened and the rate of drift of the electrometer is measured by a stop watch or chronograph. If $C$ is the capacity of the electrometer system, $K$ its constant (that is, the number of volts necessary to deflect it one scale division) and $R$ the measured rate of drift in divisions per second, then the current $I$ is given by $I = CKR$. The capacity used with the electrometer should be such that the rate of drift does not exceed 2 mm or 3 mm per second. However, with a good telescope and scale and proper insulation and screening for the electrometer rates of drift as low as a few

hundredths of a millimeter per second can be accurately measured.

This "rate of drift" method has its objections, partly owing to the fact that a comparatively long time is required for each observation. The writer used, as a substitute for it in some cases, the "ballistic" method. This requires in front of the cell a shutter which can be opened, mechanically or otherwise, for a definite time interval. In this method, having previously opened the key, the shutter in front of the cell is opened, allowing the illumination to fall on the cell for the desired time interval, which must be accurately measured. During this interval the electrometer has been given a certain charge, in consequence of which a permanent deflection is observed after the shutter is closed. If $S$ is this deflection, $T$ the time of exposure, and $C$ and $K$ have the same values as before, the current is given by $I = CKS/T$.

The ballistic method is useful for a great variety of laboratory measurements. Experiment seems to show that at least for moderate illuminations the quantity of electricity discharged by such a cell, subjected to a constant illumination, is accurately proportional to the time of exposure, even when the duration of the illumination is only a small fraction of a second. This makes it possible to make "snapshot" measurements of the candle-power of a fluctuating light source. The magnitude of the quantities concerned was indicated by an experiment in which a deflection of several centimeters was obtained by an exposure to a Nernst glower of 0.001 second. The glower was two or three feet from the cell. It is unnecessary to emphasize further the possibilities in this direction, for there are numerous experiments where instantaneous candle-powers are desirable under conditions where measurement by eye is almost impossible. Also, one may easily reverse the process and measure a time interval, as, for example, the speed of a photographic shutter.

When used with the ballistic method the photo-electric cell acts as a time integrator of light intensity, in much the same way as the electrolytic cell acts as a time integrator for the electric current. In other words, suppose it is desired to find the average intensity of a fluctuating light source over a certain time interval, long or short. One would simply have to expose the cell to the light source for the desired interval and read the resulting deflection. This divided by the time gives the average rate of deflection. By comparing this rate with that produced by a known light source the average candle-power of the first source is at once obtained.

A second method of using the electrometer in connection with the photo-electric cell is to connect the instrument to the terminals of a high resistance, through which the current flows on its way to earth. The principle of this method is, of course, identical with the method of measuring current by a voltmeter and resistance. Using this device Professors Nichols and Merritt have with great rapidity measured the densities of a series of photographic negatives. While this method has the advantage of giving the current directly by the steady deflection of the electrometer, its use is limited to cases where fairly high intensities are available.

The manner in which the photo-electric current depends on the wave-length or wave-length composition of the incident light is a crucial question when considering the application of the photo-electric cell to photometry. Numerous investigators seem to agree that as ordinarily used the cell obtainable on the market has a wave-length sensibility curve which, while agreeing fairly well in shape with the luminosity curve of the human eye, is nevertheless quite different in position, having its maximum much farther toward the violet end of the spectrum. The sensibility curve as determined some time ago by the writer for one of the cells then obtainable had its maximum at about 0.46 μ, although its exact position is in some doubt on account of the difficulty of obtaining a satisfactory curve for the energy distribution of acetylene, the source used, in the blue and violet. Later experiments by other investigators seem to show that the maximum is even farther toward shorter wave-lengths than here indicated.

The high sensibility to blue and violet constitutes the chief objection to the general use of the photo-electric cell for all photometric measurements. One can readily see that a slight preponderance of blue in the light as measured by eye would make a vast difference in the measurement by the photo-electric cell, unless the latter measurement were made by use of a very carefully selected set of absorbing screens, so chosen as to give the cell a sensibility curve approximating that of the human eye. On account of the high absorbing power which such a set of screens must necessarily have, the sensibility of the device would be greatly reduced.

For this reason it seems probable that the most useful applications of the photo-electric cell at the present time must be limited either to cases involving monochromatic or isochromatic light sources, or else to investigations where the actual intensity, photometrically measured, is of only secondary importance. If, for example, one were making a series of "stroboscopic" snap-shots of an alternating-current arc over one cycle, he would not expect the resulting curve to agree, either in magnitude or position of its maximum, with the curve obtained by ordinary means. It is possible, however, to isolate any wave-length from such an arc by means of a spectrometer, and by means of the photo-electric cell follow it during one cycle under conditions of intensity and color which would render eye measurement impossible. Furthermore, it is to be remembered that in the blue and violet region, where eye measurement becomes very difficult, the cell becomes most sensitive.

In addition to the difficulties previously mentioned, namely, the great care which must be exercised in studying differently colored illuminations and also the fact that the electrometer is somewhat more troublesome to handle than a galvanometer, there exists one great source of trouble, due apparently to the fact that a photo-electric cell, even in the dark, will allow a small current to flow if an electromotive force be impressed on its terminals. This seems to be caused by the walls of the cell possessing a resistance which is, of course, not infinite. This leakage current is fortunately too small to be of serious disturbance when one is measuring intensities of several foot-candles. But when working with lower illuminations of a few hundredths of a foot-candle the leakage current becomes a serious source of error. In fact, it may become much greater than the photo-electric current itself. In any event, either it must be determined and a corresponding correction made, or it must be eliminated by charging the cell to such a potential that the difference of potential between the alkali surface and the receiving wire is zero, in which case there is no leakage current. Later cells of improved construction have reduced this difficulty very greatly.

Although the proportionality between photo-electric current and intensity of illumination seems to hold over a very great range of intensities, it is probably not safe to expose any cell, for any length of time at least, to the very high illuminations (several hundred foot-candles). A cell used by the writer gave consistent and reproducible results for months when used only on moderate illuminations, until in one experiment it was exposed at intervals, totaling perhaps thirty minutes, to a 2000-cp arc two or three feet away. For weeks afterward this cell gave very erratic readings when used again on lower illuminations, the currents being not only not reproducible, but even varying with a constant illumination, as if to indicate that some sort of instability had been produced by the very high intensity.

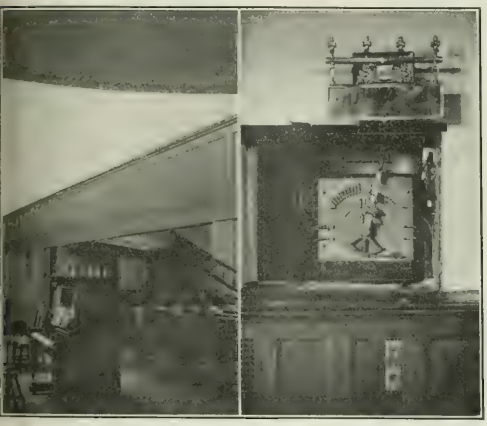
The writer stated that, in spite of some serious difficulties the photo-electric cell is being used more and more as a photometric device for special purposes.

# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Novel Motor Application in a Church

From the standpoint of electric-motor application, the First Baptist Church of Worcester, Mass., is one of the most completely equipped edifices devoted to religious purposes in the East. In addition to the usual motor-driven vacuum-cleaning, organ-blowing, ventilating and exhaust fan equipments, the auditorium is provided with a motor-



FIGS. 1 AND 2—MOTOR-DRIVEN CURTAIN AND MOTOR-CONTROL RHEOSTAT, FIRST BAPTIST CHURCH, WORCESTER, MASS.

operated curtain illustrated in the accompanying photograph, which separates the main body of the church from the Sunday-school room. The curtain is of wooden construction, 8 in. thick, and is 36 ft. long, its height being about 30 ft. It weighs about 6000 lb., but through the use of counterweights it is easily run up and down by a 4-hp, 550-volt direct-current motor placed among the rafters of the church. The curtain can be raised or lowered in thirty-eight seconds without the slightest noise, the motor being controlled at a starting box at one side, as shown in Fig. 2. It is customary to raise the curtain during the singing of the final hymn, if the Sunday-school room has been isolated during the remainder of the service, and the majority of the congregation, whose backs are turned to the curtain, do not become aware of the change unless the day is dark enough for the additional supply of natural light to attract attention. Service is supplied by the Worcester Electric Light Company.

## Development in Baltimore

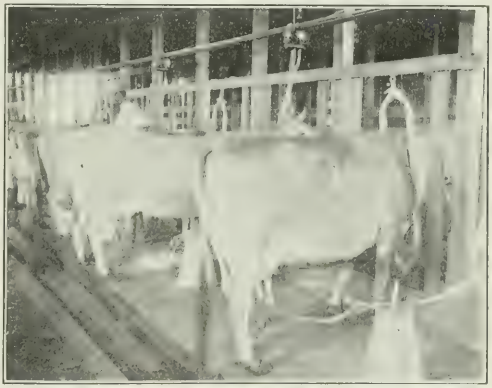
A booklet showing the development of the Consolidated Gas, Electric Light & Power Company of Baltimore refers to the existing field for the increased use of gas and electricity, particularly for motors, in Baltimore. The company has made a canvass to reveal the use of steam in power plants and factories in Baltimore and vicinity. The canvass showed that there were 433 steam plants, with an installation of 76,000 hp, where electricity could be used economically as a substitute. As compared with this, the company has 1617 motor installations on its circuits, while the motors in use have an aggregate rating of 50,800 hp. If the business in sight could be obtained at the average rate of $25.50 per hp-yr., it would add over $2,000,000 a year to the company's earnings.

Before a commercial department was established by the company the increase in electric output was much smaller than it is now. The increase in kilowatt-hours sold in 1904 compared with 1900 was 15.1 per cent. In the nine years following the establishment of a commercial department, from 1904 to 1913, the increase was 661.6 per cent. The number of electric meters in 1913 was 31,292, as compared with 3613 in 1903. The number of square miles of territory served was 270 in 1913, as compared with 30 in 1903. The average selling price in 1913 was 2.5 cents per kilowatt-hour, as compared with 6 cents in 1903.

## Dairyman's Saving with Electric Milkers

One dollar per month for each cow milked is the saving which the dairyman can accomplish by the use of an electric milking machine, according to Mr. James E. Davidson, vice-president and general manager of the Pacific Power & Light Company, Portland, Ore., who presented a paper on electrified farming before the recent Seattle convention of the Northwest Electric Light & Power Association.

Roughly, one man with a four-unit milking machine can milk four times as many cows as he can by hand in the same length of time. Incidentally, the central station obtains a load that is guaranteed for every day in the year,



MILKING COWS BY ELECTRICITY NEAR PORTLAND, ORE.

with an early-morning load that is of special benefit. Every cow milked by the machine earns for the company $1.75 per year, figuring that one four-unit machine will handle a herd of twenty-eight cows.

"Eight times out of ten," said Mr. Davidson, "the salesman who is trying to sell an electric milking machine will accomplish his result if he directs attention to the facts

that with electric milking 75 per cent of the cost of milking is given back to the dairyman in net profits; that the output of milk is cleaner and better because of the decreased number of bacteria, and that the use of the machine dissipates the nightmare of always trying to find a reliable, cleanly, gentle and efficient man who will stay right on the job twice a day, 365 days in the year, who has a disposition so patient that he will gently milk a cow while she slaps her tail around his neck and places her foot in the bucket, or who will coolly sit down beside a hot cow and milk her in fly-time with the thermometer 100 deg. in the shade.

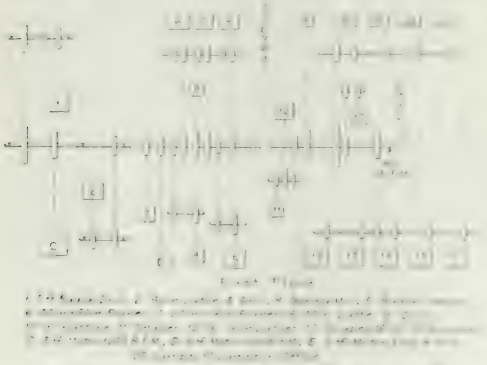
"The point is, don't talk technicalities; talk sense with cents."

## State Fair Electrical Exhibits for Farmers

Year by year, state fairs are becoming more and more important to electrical manufacturers as mediums for introducing electrical appliances among farmers. The increase over last year in the number of companies which exhibited small gasoline-engine-driven electric-generating plants during the recent Wisconsin State Fair at Milwaukee shows, for example, that these companies have realized the opportunity afforded for exhibiting their products to a class of citizens heretofore reached in only a casual way. And, on the other hand, the eagerness with which the rural visitors viewed the newly developed electric-lighting plants and motor-driven farm appliances should prove the receptive attitude of the farmer as a user of electricity. Of the four thoroughfares which extended the length of the fair grounds at Milwaukee, two were devoted almost entirely to the exhibit of machinery. Among these displays were many internal-combustion engine-driven generating plants and various motor-operated farm appliances, such as cream separators, automatic milkers, refrigerating plants, milk-bottle fillers, water-pumping systems, washers and wringers, tool grinders, etc.

## Electrifying a Water-Meter Factory

In the following paragraphs are given the essentials of a motor-service survey lately made by a central-station company in a water-meter factory operated by steam and containing nearly 170 productive machines. The equipment



TYPICAL LAYOUT SHEET FOR FIRST FLOOR

consisted mainly of machine tools common to iron-working establishments, including many lathes, grinders, blowers, planers, drills, milling machines and other appliances of moderate size. On account of the first cost of individual motor drive it was considered desirable to figure the installation on a group-drive basis, leaving to the owners such gradual change to direct-connected motors as might be found desirable in the future. The data obtained are representative of conditions in small machine shops where group driving is the line of attack on behalf of the installation of central-station service to take the place of mechanical drive by steam or other power.

The plant was driven by shafting and belts from a simple non-condensing engine of about 100-hp rating, steam at

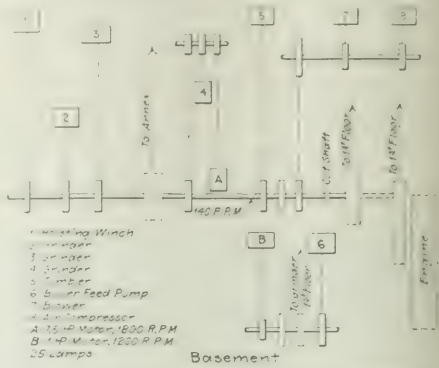



FIG. 2—TYPICAL LAYOUT SHEET FOR BASEMENT

90-lb. pressure being supplied from a boiler with a 66-in. shell. The size of the building was too great for the needs of the factory owners, so the motor service included an allowance for electricity resold to tenants, which resulted in an estimated saving of 13 per cent over present costs, by the installation of central-station service. In assembling the data secured, the central station's engineers plotted on 8-in. by 10-in. tracing cloth, for each floor of the building and its annex, the machine layouts existing and proposed. The location of all shafting, pulleys, belts and other equipment which would be eliminated by the installation of central-station service was shown in dotted lines. On each sheet below the machine layout diagram a 4-in. by 8-in. space was left blank, upon which the key to machine numbers, motors, etc., could be typewritten when the tracing was blueprinted. The reduction in shafting and belting could thus be seen at a glance, as shown in the accompanying typical layout sheet for the basement. In this case a hoisting winch, three grinders, a tumbler, a blower, a boiler-feed pump and an air compressor would be driven in two groups, motor A, of 7.5-hp rating, caring for all tools except the boiler-feed pump, which is scheduled for operation by motor B, of 1-hp rating. The speed of the main shafting is also indicated.

As an instance of the improvements to be effected by the use even of group motor driving, the sheet shows that with this installation the former steam engine would be eliminated, with the two pulleys, shafting and two belts which run the machinery on the first floor, besides a large pulley and belt required by the shop annex. The withdrawal of this equipment would result in a cut in the basement shafting as indicated on the print and consequent improvement in the driving conditions from the friction standpoint.

On account of the large number of small machines in the plant, space need not be taken here to reproduce the complete list, but some of the features of the proposed installation deserve mention, especially in connnection with the capabilities of electric service in simplifying the driving conditions. On the first floor three motors, aggregating 1 hp, are required to drive the various drills, boring mills planers and lathes in three groups.

The survey indicated that here the shafting could be cu in three places, establishing a convenient sectionalizatio for sub-department overtime service. Five pulleys and belt serving other floors are eliminated by the introduction

the electric drive. On the other floors the proposed layout for electric service does away with long runs of shafting transmitting power to distant departments, notably in the supply of service to a few machines located in the basement annex and in the removal of quarter-turn belts and other inefficient arrangements. On the first floor annex, for example, a group of three planers formerly driven by a quarter-turn belt would be operated by a 5-hp motor independently of the main shafting in this portion of the building. Elsewhere the study showed that different motors could be arranged to divide loads between them, enabling the overload characteristics of individual machines to be utilized in emergencies.

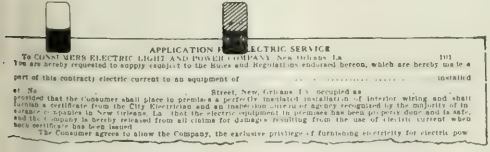
By actual test it was found that the friction load in the building was 30.4 hp, or 55 per cent of the maximum power demand. The relative cost of steam and electric operation was estimated as follows:

| | |
|---|---|
| Cost of steam operation (average hp, 45; hours per week, 55; hp-hr. per year, 128,700; maximum, 55 hp): | |
| 288 tons of coal, at $4.85 | $1,396.80 |
| Engineer, at $15 per week | 780.00 |
| Oil, waste and supplies | 75.00 |
| Repairs | 75.00 |
| Insurance (boiler and accident) | 20.00 |
| Interest (5 per cent), depreciation (6 per cent) on investment of $4,000 | 440.00 |
| Removal of ashes | 50.00 |
| Gas and supplies for gas (owner and tenants) | 120.00 |
| Net steam drive cost | $2,956.80 |
| Cost of operation as estimated (average hp, 35; hours per week, 55; maximum, 50 hp): | |
| Electrical service from local central station | $2,057.40 |
| Coal for heating, 75 tons, at $4.85 per ton | 363.75 |
| Labor, lamps, renewals and motor oil | 225.00 |
| Interest (5 per cent), depreciation (6 per cent) on investment of $3,200 (67 hp in motors, lighting transformers and meters, $2,400; 230 lamps, wiring and installation of apparatus and shafting overhauling, $800) | 352.00 |
| Gross cost of electrical service | $2,998.15 |

The investigation showed that the owners of the factory could count upon a net sale of electricity amounting to $415.48 to tenants, leaving a net cost of installing and operating the electric drive of $2,582.67 and giving an estimated annual saving of $374.13 over present costs.

## Colored-Tab System of Customers' Records

A contract-card file of all its customers, both past and present, is kept by the Consumers' Electric Light & Power Company, of New Orleans, and with the aid of a simple system of color tabs devised by the manager, Mr. Thomas Rhodes, is of the greatest service in tracing the history of any given customer, character of his service, etc. The card form of contract is used by the company, these cards being filed in cases in the order of streets and street numbers.


APPLICATION FOR ELECTRIC SERVICE

To CONSUMERS ELECTRIC LIGHT AND POWER COMPANY, New Orleans, La. 191

You are hereby requested to supply, subject to the Rules and Regulations endorsed hereon, which are hereby made a part of this contract, electric current to an equipment of installed

at No. Street, New Orleans, La., occupied as

provided that the Consumer shall place in premises a perfectly insulated installation of interior wiring and shall furnish a certificate from the City Electrician and an inspection of same by agency recognized by the majority of insurance companies in New Orleans, La., that the electric equipment in premises has been properly done and is safe, and the Company is hereby released from all claims for damages resulting from the use of electric current where such certificate has been issued.

The Consumer agrees to allow the Company, the exclusive privilege of furnishing electricity for electric pow

COLORED-TAB SYSTEM OF CUSTOMERS' RECORDS

The name of the salesman securing the business is indicated by affixing red, white and green clip-tabs temporarily to the right-hand side of the corresponding contract card. Under the city electrical ordinances installations may be made and temporarily continued in service three months, during which period an inspection must be made before the final approval for continued service is given. Condition of inspection is therefore indicated on the contract cards by the position of the salesmen's credit tabs. A tab on the right shows that the installation has not yet been noted, but as soon as approval is conferred the clip is transferred to the left side, completing the record. At the center of the "disconnected" cards (filed with the rest) are affixed the master tabs which give information concerning former customers not now connected to the company's lines. A yellow clip shows that the house is vacant; blue, customer using gas; pink. customer using competitive electric service, and double clips, disconnected for non-payment of bill. Some of the earlier contracts were taken in standard sheet form, but these are also represented by card duplicates in the customer's file, the same system of tabs being applied.

## "It Is as Easy to Start an Electric Motor as to Stop a Gas Engine"

In going after motor load at Arlington, Wash., population 2000, the Jim Creek Water, Light & Power Company has adopted the telling slogan: "It is as easy to start an electric motor as it is to stop a gas engine." Already the company has eight motor users, besides a 600-hp motor in service seven hours daily pumping the city water.

Recently Mr. E. G. Robinson, local manager, ran an effective advertisement in the two local newspapers which gave good results, as it was especially adapted for use in a small community where all know one another. At the top of a three-column display space appeared the line "Electric Power," and below at the right was a list of satisfied motor users. Paralleling this on the left was a second column headed "List of Dissatisfied Motor Users," the space beneath being, of course, blank. "This gave every prospective patron a list of our motor-service customers," said Mr. Robinson, "so that he could make a personal investigation to see if it was hot air we were handing out."

## Ice-Making and Refrigeration from the Central Station Viewpoint

Mr. C. H. Stevens, manager of the power engineering bureau of the Edison Electric Illuminating Company of Brooklyn, contributed a paper to the recent International Congress of Refrigeration in Chicago which is of interest to electrical men. It is entitled "Artificial Ice-Making and Refrigeration from the Standpoint of the Central Station." The author said that it has only been within a comparatively short time that the field of refrigeration has received the specialized treatment from electric-service companies that it deserves. At the present time, however, several companies have reached the point where the word "superspecialization" would best apply as expressing the intensive manner in which they are going after the business. Some of the larger companies now employ refrigerating engineers to advise customers so that the best economy and efficiency may be obtained. Mr. Stevens gave three reasons why these efforts are made. The first is the load-factor of refrigeration and ice-making, which is materially higher than that of the average business. In the second place electric-service companies believe that before long artificial refrigeration will be used, at least to some degree, in practically all types of buildings. They also believe that natural ice will soon be entirely superseded by artificial ice, in the cities at least. This development will require a tremendous amount of energy, and it therefore opens up an almost unlimited field for the use of electricity. As the central stations are, as a rule, in a position to produce energy more cheaply than individuals, they should be able to get this business if they are willing to sell the energy at a small margin of profit. This constitutes the third reason for the interest in the subject by central-station managers.

The author explained some of the systems of charging for central-station energy and pointed out how the long-hour service and high load-factor of refrigeration and ice-making enabled this class of business to earn a cheaper rate than the average manufacturing process.

### Data on Electrically Operated Refrigeration Plants

Data on twenty-five electrically driven refrigerating plants supplied with central-station energy were given, as in Table I. These figures were summarized in relation to consumption of energy as shown in Table II.

In general the energy consumption per cubic foot of storage room increases as the volume of the rooms and size of plants decrease. The fur-storage plant is an exception, and this can be explained by the fact that the contents of the room are changed but once a year.

Up to about two years ago practically all ice plants of large size were operated by steam engines. This was due to the fact that usually the plants were making ice from distilled water, obtaining the greater part of the distillate from the exhaust from their engines. With this handicap of the engine exhaust to overcome, the central station did not consider the field of sufficient importance to adopt new rates to apply directly to this business.

At the present time, however, there are in this country at least twelve artificial ice plants of over 90 tons rating

TABLE I—DATA ON REFRIGERATING PLANTS

| Name | City | Connected Hp. | Tons | Cu. Ft. | Kw.-hr. | Kw.-hr. per Cu. Ft. | Temperature Carried, F. |
|---|---|---|---|---|---|---|---|
| Wholesale meat markets: | | | | | | | |
| Swift & Co. | Philadelphia | 15 | 8 | 22,980 | 25,728 | 1.12 | |
| Schwarzschild & Sulzberger | Philadelphia | 10 | 6 | 45,342 | 90,448 | 1.93 | |
| Armour & Co. | Philadelphia | 25 | 15 | 21,384 | 42,768 | 2.00 | |
| [illegible] | [illegible] | 30 | 12½ | 23,190 | 30,456 | 1.31 | 20 |
| Lake Superior Fish Co. | Chicago | 10 | 7 | 7,690 | 14,880 | 1.93 | 20 |
| Withheld | Pittsburgh | 80 | 20 | 94,000 | 159,250 | 1.69 | 30 |
| Packers: | | | | | | | |
| Vienna Sausage Co. | Chicago | 30 | 15 | 4,340 | 6,000 | 1.38 | 36 |
| Sulzberger & Sons | Pittsburgh | 30 | 15 | 39,680 | 76,292 | 1.93 | 36 |
| Kingan & Co. | Pittsburgh | 30 | 15 | 37,450 | 171,144* | 4.61 | 10 |
| Schwarzschild & Sulzberger | New Orleans | 30 | 15 | 51,500 | 51,372 | 0.941 | 36 |
| Provisions: | | | | | | | |
| S. Rothschild | New York | 15 | 8 | 10,505 | 23,412 | 2.24 | 36 |
| P. Ohl | New York | 7½ | 4 | 2,004 | 10,503 | 5.2 | 34 |
| John J. Pelon & Co. | New York | 10 | 4 | 38,880 | 25,783 | 0.66 | 36 |
| C. Sehnck & Co. | New York | 5 | 2 | 994 | 2,215 | 11.1 | 36 |
| George S. Sloan | Chicago | 10 | 6 | 2,600 | 10,620 | 4.1 | 36 |
| George Middendorf & Co. | Chicago | 15 | 8 | 8,820 | 12,204 | 1.38 | 11 |
| Retail meat: | | | | | | | |
| J. J. Schnitzius | Philadelphia | 15 | 8 | 3,600 | 9,949 | 2.8 | 36 |
| N. Frey | New Orleans | 7 | 2 | 1,490 | 4,600 | 3.1 | 36 |
| Klee Bros. | Cincinnati | 15 | 8 | 4,629 | 26,808 | 5.8 | 36 |
| Zambreno Bros. | Chicago | 5 | 2 | 1,706 | 3,408 | 2.0 | 36 |
| F. P. Bell | Philadelphia | 7½ | 4 | 2,500 | 11,000 | 4.4 | 36 |
| Fur storage: | | | | | | | |
| Balch, Price & Co. | Brooklyn | 35 | 20 | 56,775 | 19,760 | 0.35 | 36 |
| Julius Klugman | New York | 7½ | 4 | 5,722 | 1,931 | 0.34 | 36 |
| H. [illegible] & Co. | New York | 15 | 10 | 33,120 | 23,000 | 0.70 | 36 |
| C. G. Gunther's Sons | New York | 30 | 15 | 40,500 | 27,321 | 0.67 | 2 |

*[illegible]

which are operating exclusively on lighting circuits. They give the highest satisfaction, both as to efficiency and economy. The determining factors which brought about this change were the use of multiple-effect evaporators in connection with the distilled-water plants and the advent of the raw-water system of making ice, central-station rates applying directly to the latter system. The mutliple-effect evaporator is an efficient piece of apparatus. Very high evaporations are obtained, in some cases as high as 50 tons of distillate per ton of coal with an eight-effect evaporator. This makes it entirely feasible to drive the compresssors and pumps electrically and to produce the distilled water economically direct from the evaporators. The advent of the raw-water system was a still further advantage. In this system the obtaining of distilled water is a secondary and unimportant item, and with it the question of energy becomes simply a matter of rates, comparing various sources of energy.

Mr. Stevens explained the off-peak system of charging to show that this plan offers a method of obtaining still lower rates for the energy needed in refrigeration and ice-making. If the manufacturers of ice will shut down their

TABLE II—ENERGY CONSUMPTION OF ICE-MAKING PLANTS

| Kind of Plant | Number Plants Averaged | Average Kw.-Yr. per Cu. Ft. |
|---|---|---|
| Fur storage | 4 | 0.51 |
| Packers' meat | 4 | 1.41 |
| Provisions (large dealers) | 3 | 1.43 |
| Wholesale meat (Middle West) | 3 | 1.64 |
| Wholesale meat (Philadelphia) | 3 | 1.68 |
| Retail meat | 5 | 3.73 |
| Provisions (small dealers) | 3 | 6.80 |

compressors during the months from November to February between the hours of say 3 to 9 p. m., the electric-service companies will be enabled to make rates that will make the operation of the electrically driven ice plant economical.

Ice plants electrically driven from central stations have several advantages. These are enumerated by the author as follows: First, continuity of service; second, saving in initial plant investment, ranging as high as 70 per cent in raw-water plants; third, increased facility for economical expansion of the plant; fourth, location of the plant at any point desired independent of fuel supply; fifth, saving of space devoted to boiler-house equipment and coal storage; sixth, entire elimination of the appearance of oil in the product; seventh, freedom from the worry and trouble of power-plant operation.

The majority of motors used are of the alternating-current type, and their economical life is longer than that of any other prime mover. Variable-speed motors have been used with success, but general practice seems to indicate that the greatest over-all efficiency, even at varying loads, is obtained by using a constant-speed motor. For driving the auxiliary apparatus electric motors are ideal

TABLE III—SUMMARY OF REPRESENTATIVE ICE PLANTS USING CENTRAL-STATION POWER

| Plant | Rated Capacity per Day, Tons | Total Connected Load, Hp. | Yearly Ice Output, Tons | Annual Kw-hr. | Average Kw-hr. per Ton of Ice | Months of Operation |
|---|---|---|---|---|---|---|
| Knickerbocker Ice Co., 61st St. plant, Chicago | 120 | 564 | 37,205 | 1,457,912 | 44.7 | 8 |
| Webster-Citizens' Co., Buffalo, N.Y. | 90 | 427 | 33,002 | 1,444,608 | 43.7 | 12 |
| Lincoln Ice Co., [illegible] | 120 | 511 | 27,839 | 1,455,012 | 52.2 | 12 |

because of their compactness, freedom from vibration and general adaptability to widely varying conditions.

In conclusion Mr. Stevens gave some data on three electrically driven ice plants which have been described in the *Electrical World*. These plants are supplied with electrical energy by the Commonwealth Edison Company of Chicago and the Cataract Power & Conduit Company, of Buffalo. These figures are summarized in Table III.

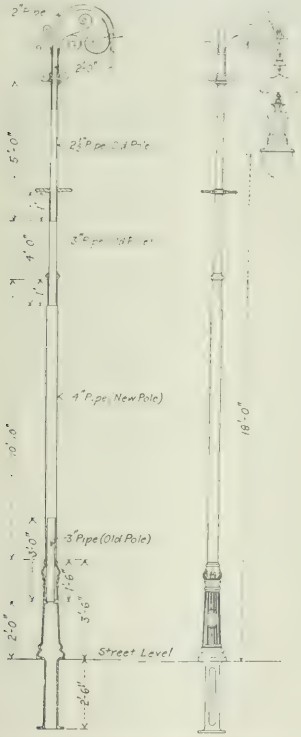
The average energy consumption for the three plants given is 46.89 kw-hr. per ton of ice produced, and this has been found typical of American practice in modern electrically driven plants.

# Illumination and Wiring

## Raising the Height of Old Inclosed-Arc Lamp-Posts at Cincinnati, Ohio

The large number of inclosed-arc lamps which formerly lighted the streets of Cincinnati, Ohio, were recently replaced with 6000 4-amp magnetite units, but the new high-powered illuminants when hung from the posts which carried the older lamps were found to give trouble and even discomfort from glare in the eyes of passers-by. This difficulty had not been apparent with the former low-powered units, but became so critical with the initial trial installations of the magnetite lamps that it was found necessary to raise the posts by about 7 ft. 6 in. and so increase the visual angle.

The sketches herewith show how this change was accomplished by first sawing in two the old shanks and then socketing these stumps into pieces of 4-in. pipe, 10 ft.




FIGS. 1 AND 2—RECONSTRUCTED LAMP-POSTS AT CINCINNATI, OHIO

10 in. in length. The original standards were of 3-in. pipe, which was found to fit snugly inside the 4-in. extension piece. An ornamental cap was added at the top of the extension to make a neat-fitting joint. Above this point the old poles were tapered into 2.5-in. pipe, and again to 2-in. pipe to form the curved neck.

The reconstructed poles place the point of lamp suspension at a height of 21.6 ft. above the pavement level, bringing the arc itself at a height of approximately 18 ft., well out of the way of direct vision.

The accompanying illustrations show respectively the sectional construction of the rehabilitated posts and their appearance when the work of raising and reconstructing them had been completed.

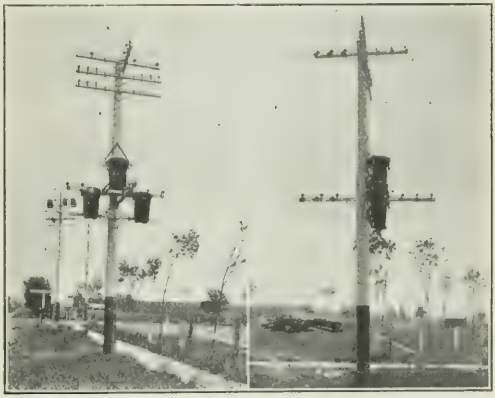
## Tacks and Nails as Linemen's Hazards

There is a great need in most states of an amendment to the criminal code making it an offense to drive nails or tacks in poles which men have to climb, declared Mr. John B. Fisken, superintendent of light and power for the Washington Water Power Company, Spokane, Wash., in an address before the recent Northwest Electric Association convention at Seattle. Many a man, he added, has been injured by coming in contact with a rusty tack or nail sticking out from a pole. Sometimes tacks are used with heads ½ in. in diameter. If a lineman should happen to strike one of these with his spur, it would very likely cause him to fall. The city of Spokane has an ordinance making it an offense to tack signs on a pole, although it has not always been enforced.

## Construction Practice on 13,200-Volt Transmission Lines in Wisconsin

Among the line extensions and newly constructed transmission circuits which The Milwaukee Electric Railway & Light Company has under way in the State of Wisconsin is the 13,200-volt, 60-cycle, three-phase line which is to connect Racine with Kenosha. No. 0 stranded-copper conductor is being used, and, except for ground wires, the construction follows the standard employed elsewhere by the company on its other extensions.

Although the line will not be finished until next spring, two large industries between South Milwaukee and Racine are already being furnished with energy from it. One customer is the Case Thrashing Machine Company at Racine, and the other is the Ives quarry of the Universal Crushed Stone Company, north of Racine. The former load is supplied through a 400-kw transformer, while the latter



FIGS. 1 AND 2—FRONT AND SIDE VIEWS OF POLE SUPPORTING TRANSFORMERS AT WATERFORD, WIS.

customer purchases his energy at 13,200 volts, stepping it down to 488 volts through one 400-kw and one 200-kw, three-phase transformer installed in a special small building. The crushed-stone company uses electricity exclusively for operating all its machinery.

Waterford, Wis., a town of about 1500 population, which is on the Milwaukee company's 13,200-volt line between West Allis and Burlington, is now supplied with transmitted energy. The local plant was recently taken over by the central-station company and is now being used as a substation. On the pole where the line feeding Waterford taps onto the main line Matthews fuse switches are installed, and a lightning arrester is connected onto one phase.

Running at right angles to the 13,200-volt line is the transmission line supplying the town. At the first pole from the main line nearest the town there are mounted three transformers which step the pressure down to 3300 volts, at which it is transmitted to the substation previously mentioned. Two of the transformers have a rating of 15 kw and the other is rated at 25 kw. The group is connected in delta so as to feed both the local three-phase motor circuit and a single-phase lighting circuit.

The upper cross-arm of the pole on which the transformers are mounted supports a short jumper line which connects with the 13,200-volt main transmission line. The two cross-arms below it support 3300-volt lines. The primary drops are carried down to the transformers on the opposite side from the 3300-volt drops, in order that linemen may not come in contact with them when inspecting the transformers. Rochester, Wis., a town of some 500 population, which is about two miles from Waterford, is also supplied with energy from this line.

## The Value of Proper Show-Window Lighting

The Public Service Electric Company, of Newark, N. J., has just issued an attractively printed booklet on show-window lighting, containing both striking photographs and telling text. The value of window displays is attested by several actual incidents, and some of the paragraphs are reproduced herewith:

"A department store in Baltimore has a men's hat department. As is customary, this department formerly received only its pro-rata share of the newspaper advertising and show-window display. The department buyer, being dissatisfied with the amount of sales, offered to give up his share of the newspaper advertising if he could have instead a permanent window display. In six months, without any change in sales force and with no other form of advertising, the sales of that hat department had doubled, and today it is one of the best-paying departments in the store. The increase in its sales was due entirely to the selling power of constant, effective window displays."

"The most important part of the construction of a show

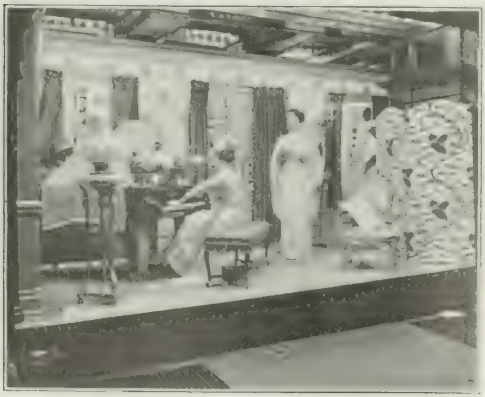


FIG. 1 [illegible] ILLUMINATION [illegible] WINDOW

window is the lighting equipment. Even the best display will fail to attract attention if it is not properly lighted, and correct lighting will increase the attractiveness of any display.

"To prove the value of lighting alone, the manager of a store on Forty-second Street, New York City, recently removed all the goods from his show windows. Then he covered the ceiling of each window with 100-watt tungsten lamps equipped with focusing reflectors. That evening he placed men behind screens to count the number of people who stopped to look at the windows. He wanted to test the attractive power of light.

"By actual count no one passed the windows without looking at them, and during the early part of the evening there

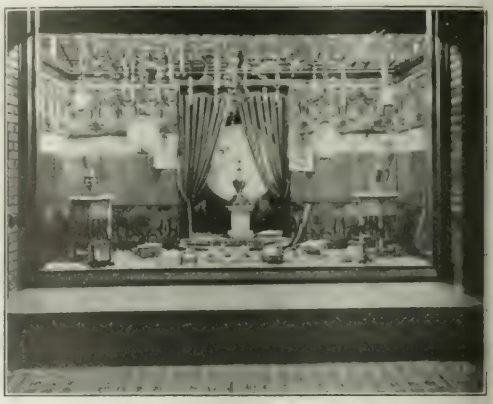


FIG. 2 A DISPLAY THAT ATTRACTED 72 PER CENT OF THE PASSERS-BY

were always from three to five people standing in front of the windows, wondering at the intensity of the light. Here is proof that light alone will attract attention on one of the most brightly lighted streets of the world, and proof that brilliant illumination will increase the attractiveness of show-window displays."

"With the right equipment it is possible to produce in the average show window the unusual and beautiful lighting effects that are produced upon the stage. When these lighting effects are added to or made a part of the display, a show window attains its greatest power to attract attention."

"By actual count, extending over four nights, a certain show window attracted the attention of 12 per cent of the passers-by. Then the lighting equipment was changed, and light was used in a decorative way as a part of the display. (See Fig. 2.) By actual count the window then attracted the attention of 72 per cent of the passers-by—an increase in value of 500 per cent, due to the attractive power of light. The difference in the cost of energy was only 2 cents an hour."

"A show window, then, is given its maximum advertising and selling values through the use of artificial light. It is fortunate that show windows are most attractive at night, because then the people on the street are less hurried and they are in a receptive mood. What they see makes a deep impression that lingers in their memory. Up-to-date merchants realize this and keep their windows lighted long after their stores are closed. The merchant who does not have his windows brightly lighted at night loses a good opportunity to increase his sales and gives his competitor a great advantage."

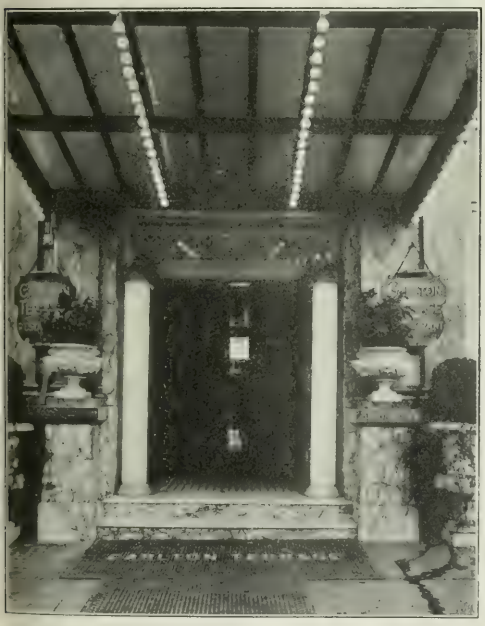
Fig. 1 herewith shows a recent window display of one of the John Wanamaker stores, reproduced from the Public Service booklet. The rear of the window was reconstructed to form part of the display, giving the effect of a lighted porch outside the music room. This window might have been made even more effective, suggests Mr. F. D. Pembleton, of the Public Service Electric Company's sales department, which is pushing the window campaign, if the equipment had been arranged to give a moonlight effect outside the lattice. Then by putting the window circuits on

flasher the window lamps and piano lanterns might have been extinguished at intervals, leaving alternately the effect of moonlight streaming through the windows.

By actual count, as mentioned above, 72 per cent of the passers-by were attracted by the display illustrated in Fig. 2. The lanterns and parasols were made luminous, and blue light gave the effect of sky seen through the lattice.

### A Pioneer Exterior Illumination Installation

The entrance to the Carlton Terrace Restaurant, Broadway and 100th Street, New York City, embodies a unique and striking lighting installation which presents a new avenue of possibilities for future progress in the science of exterior illumination. The accompanying picture gives only a faint idea of this installation's appearance at night when lighted. The two columns shown are hollow and of glass, fluted, and finished on the outside to a "near-marble" appearance, which, while not exactly deceptive in that respect, lends an attractive effect to the doorway in the daytime. Inside these columns are placed tungsten lamps, affording a large volume of soft light and brilliantly illuminating the entrance. A point worthy of consideration is



ILLUMINATION OF ENTRANCE TO CARLTON TERRACE RESTAURANT

the fact that the lighting system here installed makes use of an architectural unit not primarily associated in any way with the subject of illumination. The column has always been linked essentially with the idea of a supporting medium, and even these columns might be so used judging from their appearance in the daytime. Following along the line of thought thus opened up, if the column is adaptable to this treatment, it has been suggested that the idea be more extensively applied to stairways, vases, wall and ceiling panels, sidewalks and a variety of other units, both interior and exterior, which are not primarily associated with the idea of illumination but which are placed where illumination is desired. The Carlton Terrace, of which Slavin & Pike are proprietors, was designed by S. B. Eisendrath, of 500 Fifth Avenue, New York. The Lighting Studios Company, of 16 East Thirty-third Street, made this lighting installation.

### Recent Telephone Patents

The prepayment plan of measured service has been applied to the automatic system by Mr. J. Erickson, of Chicago, Ill., who has assigned his patent to the Automatic Electric Company. After all the operations of making a call are completed the calling party is left in condition to hear the called party, but he cannot transmit his message until he has placed two coins in the coin box in succession. This releases a transmitter switch and conversation begins.

Mr. P. E. Erickson, of New York City, is the patentee of a protector of the open-space type which uses metal plates for the sparking surface. One plate of metal alloy and one of metal is used, the combination being such that little arcing occurs and the tendency to fuse is overcome. The patent is assigned to the Western Electric Company.

A glass mouthpiece is preferred by some for telephone transmitters. Such a mouthpiece has been patented by Mr. M. Rossenwald, of New York City, and Mr. J. C. Doran, of Danbury, Conn., the patent being assigned to the F. A. Weeks Manufacturing Company. A metal mouthpiece holder screws into the face of the transmitter. The glass mouthpiece proper carries an external ring molded at its base, and this ring is engaged securely by the metal mouthpiece holder after the fashion of a lamp chimney.

Mr. I. S. Rosenblat, of San Francisco, Cal., has invented an antiseptic mouthpiece, which has at its base a large circular case concentric with the sound passage. This case divides at a screw joint in its cylindrical wall. Antiseptic material is placed within the case.

## Letter to the Editors

### Strength of Transmission Towers

*To the Editors of the Electrical World:*

Sirs:—The comments of Mr. J. B. Leeper and of Mr. R. D. Coombs upon the tower design described by Mr. K. Nogami in your issue of Aug. 9 are very much to the point. There is no question among transmission-line engineers and construction men that designers of towers very often "go the limit" in order to make up a winning design.

Supplementary to the statements of Mr. Coombs in regard to the custom of using compression members with too great a ratio between $l$ and $r$, the writer begs to call attention to the danger of going into extremes in decreasing this ratio and thus defeating one of the fundamental objects leading to the use of steel construction in the first place, namely, that of obtaining a low maintenance and depreciation cost. The writer refers to the dangerous practice of bringing down the $l/r$ ratio and the weight of the structure by using members of fair size but of excessively thin metal. It is generally agreed that ¼ in. for the legs and 3/16 in. for the secondary members should be the minimum thicknesses of sections used in towers if an economical "expectation of life"—to borrow a life-insurance term—is to be realized. Towers have been used with corner posts having a thickness, or rather thinness, of only ⅛ in. It does not require even a rudimentary structural knowledge to appreciate the effect of the corrosion of a year or two on such members.

Mr. Coombs rightfully analyzes the situation when he states that the causes of such faulty design are unrestricted competitive bidding and the general custom of taking care of the transmission-line end of a "job" after everything else has been provided for.

*Minneapolis, Minn.* R. A. Lundquist.

# Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

## Indicators Showing Condition of Screens in Condensing Water Intake

Where condensing water is obtained from lakes or rivers the screens in the intake pipes are liable to become covered with weeds and debris, thus reducing the amount of water supplied to the condensers and consequently the vacuum. Even where the screens are inspected periodically this trouble is liable to occur. A simple indicating mechanism is used by the Louisville (Ky.) Gas & Electric Company for ascertaining the free level in the intake and discharge tunnels from the condensers.

At its Waterside generating station the company obtains

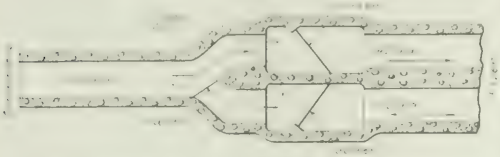


FIG. 1—PLAN OF CROSS SECTION OF SCREEN WELL

the condensing water supply from the Ohio River through two 42-in. concrete pipes so located that they supply water to a screen well at all stages of the river. Fig. 1 shows a plan cross-section of the screen well with the concrete pipes from the river entering on the right and the intake and discharge tunnels leading to the condensers in the generating station opening to the left. The discharge tunnel is superimposed upon the intake tunnel, both of which can be connected with either compartment of the screen well. The screens in the well are placed diagonally so that as much surface as possible is presented to the incoming water. Fig. 2 is an elevation cross-section of the same well.

At the condenser end of the discharge and intake tunnels two open pipes communicate with the intake and discharge tubes, as shown in Fig. 3. In each pipe is a float connected to a tape running over a pulley and counterbalanced

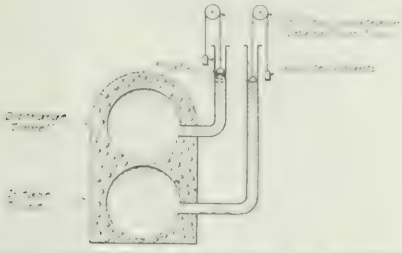


FIG. 2—ELEVATION CROSS-SECTION OF TUNNELS

at the other end. These pulleys are located on the engine-room floor, and any change in the free level of the water in the tunnels causes a corresponding rise or lowering of the float. The tapes attached to them being graduated in feet and inches are read at the same level periodically and the difference in readings represents the head of water required to force the water through the screens plus the friction loss in the pipes. When the screens are cleaned the difference in readings between the tapes can be taken as normal, and an increased difference shows that these screens need attention.

As these readings are recorded on the station log sheets the engine-room attendant is always informed as to the condition of the screens, and the operating engineer is able to tell whether the screen receives the proper attention. An

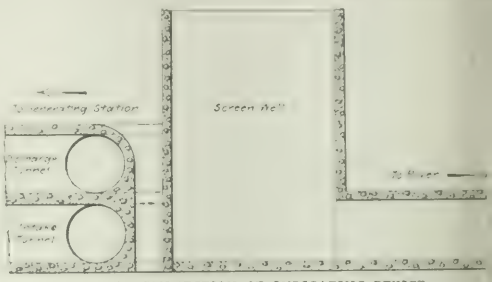



FIG. 3—CONNECTION OF INDICATING DEVICE

improvement of this indicating device is contemplated whereby the difference in free water level will be recorded on a roll of paper.

## Oil Fuel for Steam Boilers

By R. T. Strohm

At the rate at which oil fuel is being produced at the present time, there is no danger that it will supplant coal as a boiler fuel, except in a few localities. For if all the oil produced throughout the world in a year were used for the purpose of steam generation, it would furnish an amount of power equal to only about one-thirtieth of that annually required by the power and manufacturing plants of the globe. Therefore, unless far greater oil fields are discovered and the yearly yield of the wells is enormously increased, there is no danger that oil will become a general competitor of solid fuel in steam-boiler plants.

Nevertheless, there are localities in which oil forms a useful, economical and desirable fuel, and in which it is used to the exclusion of coal. Such localities are the regions in which the oil is produced. Yet there are oil fields in which little oil is used for steam-boiler fuel, because of the fact that the oil is more valuable for other purposes. Consequently, the factors that determine whether oil shall be used for fuel in preference to coal are as follows:

The price of the oil must be low enough to enable it to compete with coal in that particular neighborhood; the supply must be continuous and ample, so as to prevent shut-downs, and it must be of a quality that can be used without unusual difficulties in the furnace.

In the United States the greatest oil fields are located in three regions. The first of these embraces western Pennsylvania, Ohio and West Virginia. The second includes portions of Texas, Louisiana and Oklahoma. The third is in southern California. The oil that is produced in the first of these regions, however, is not used to any great

extent as a fuel for steam boilers, for the simple reason that it is of such quality and composition that it is more valuable for refining. Also, this same region contains great deposits of bituminous coal, so that it is more economical to use this solid fuel for power plants.

The oil produced in the second and third fields named above is also used in refineries, but a moderate proportion is employed for fuel in boiler furnaces. The reason lies in the fact that coal is scarce in either of these fields. That is, all coal used in these districts must be brought by rail or water from some distant point or points, with the natural result that the cost per ton is greatly increased. Because of this fact, it is far cheaper to use oil as the fuel, as it is found in the immediate vicinity and does not need to be transported over such great distances.

The oils that are used for fuel are forms of petroleum, which is the term that includes all the mineral oils derived from the earth. The characteristics of petroleum, such as color, density and odor, vary according to the region in which the oil is obtained. In some parts of the world petroleum is clear and without color, like water, and in other parts of the world it is black. The petroleum found




FIG. 1—HYDROMETER FOR DETERMINING DENSITY OF AN OIL

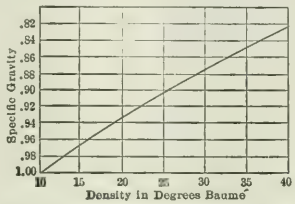



FIG. 2—CURVE USED TO FIND SPECIFIC GRAVITY FOR ANY BAUMÉ READING

in the United States is brown or reddish brown in color, as a rule, when in a tank or other vessel. But if a sample is poured into a glass or a bottle and is then held up so that the light can pass through it, the oil will appear to have a dark green color.

In spite of the differences in color and other characteristics, however, all petroleums are very much alike in composition; that is, they are all liquid hydrocarbons. The principal elements of which they are composed, and which make them valuable as fuel, are about the same as those in coal, namely, carbon and hydrogen; also, like coal, petroleum contains oxygen, nitrogen and moisture. The relative percentages of these constituents vary somewhat according to the locality from which the oil is derived. For example, an average Texas petroleum has 84.6 per cent of carbon, 10.9 per cent of hydrogen, 1.6 per cent of sulphur and 2.9 per cent of nitrogen. A sample of California petroleum, on the other hand, contains 85 per cent of carbon, 12 per cent of hydrogen, 0.8 per cent of sulphur, 1 per cent of oxygen, 0.2 per cent of nitrogen and 1 per cent of moisture. Thus, petroleum may be taken as having from 83 to 87 per cent of carbon, from 10 to 16 per cent of hydrogen, and trifling percentages of sulphur, oxygen and nitrogen. Those oils that contain sulphur usually have a disagreeable smell, due to the presence of the sulphur.

Although all oil used for fuel is derived primarily from petroleum, it may be obtained commercially in either of two forms, namely, crude oil and fuel oil. Crude oil is simply raw petroleum, in the condition in which it is obtained from the oil well, and is not subjected to any treatment. Fuel oil, on the other hand, is a residue; that is, it is the oil that remains when petroleum is subjected to a partial distillation.

The distillation process just referred to drives off the lighter oils contained in petroleum and leaves the heavier ones. The crude oil is put in closed tanks called stills and is slowly heated. Now, the crude oil consists of a mixture of a large number of liquid hydrocarbons having different densities and boiling points. Consequently, as the temperature in the still rises, these various oils are brought to the boiling point, one after another, and escape from the still in the form of vapor. The vapor is led through pipe coils and is chilled, whereupon it condenses and becomes liquid again.

At first, while the temperature rises from about 100 deg. Fahr. to 160 deg. Fahr., petroleum ether will be boiled off, this being a very light oil. From a temperature of 160 deg. Fahr. to about 175 deg. Fahr. gasoline will be distilled. Naphtha will be driven off while the temperature changes from about 175 deg. Fahr. to about 300 deg. Fahr., and from 300 deg. Fahr. to 570 deg. Fahr. the oil driven off will be what is commercially known as kerosene. The oil that remains in the still after the temperature has reached 570 deg. Fahr. consists of lubricating oils, paraffin and coke or asphalt. The crude oils found in the region of western Pennsylvania have a coke base, whereas those from Texas and California have an asphalt base.

The residue, or oil remaining in the still after the petroleum ether, gasoline, benzine and kerosene have been distilled, is what is frequently used as fuel for steam boilers and sold under the name of fuel oil. It is simply the oil remaining after the lighter oils have been driven off from the crude petroleum. The effect of the heating and driving off of the lighter constituents is to leave a residue that weighs more per cubic foot than the original petroleum; in other words, the density of fuel oil is greater than that of the crude oil from which it is obtained. Moreover, the distilling process causes a change in the composition of the oil. The percentages of carbon and sulphur are decreased slightly and those of hydrogen and oxygen are increased.

As the constituents of liquid fuel are the same as those of coal, the same formula may be used to calculate the heat values, or calorific values, of the two kinds of fuels; that is,

$$Q = 14{,}600\,C + 62{,}000\,(H - \frac{O}{8}) + 4000\,S,$$

in which $Q$ = calorific value, in heat units per pound;
$C$ = percentage of carbon, expressed decimally;
$H$ = percentage of hydrogen, expressed decimally;
$O$ = percentage of oxygen, expressed decimally;
$S$ = percentage of sulphur, expressed decimally.

Thus, if a fuel oil has 83.3 per cent of carbon, 12.5 per cent of hydrogen, 0.5 per cent of sulphur and 3.7 per cent of oxygen its theoretical calorific value is:

$$Q = 14{,}600 \times 0.833 + 62{,}000\,(0.125 - \frac{0.037}{8}) + 4000 \times 0.005 = 19{,}845 \text{ heat units.}$$

This, it must be remembered, is but the approximate heat value, based on the chemical composition of the oil. A more reliable estimate of the heat value may be obtained by making a calorimetric test of a sample of the fuel oil.

The calorific values of oils vary according to the localities from which they are derived and range from about 17,000 to 21,000 heat units per pound. The Texas and California crude oils used in power-plant work seem to have a calorific value averaging about 18,600 heat units per pound.

Fuel oil and crude oil are usually not quite so heavy as water, bulk for bulk; that is, the specific gravity of oil is ordinarily less than that of water. As a general rule, however, in the purchase and sale of oil fuel the specific gravity is not directly mentioned; instead, it is implied by stating the density in degrees Baumé, or the reading of a Baumé hydrometer allowed to float in the oil.

The method of determining the density of an oil by means of the hydrometer is shown in Fig. 1. A sample of the oil is put into the deep glass *a*, and the hydrometer is lowered into the oil, in which it will float and soon come to rest. The hydrometer consists of a glass tube *b*, at the

lower end of which are the chamber *c* and the bulb *d*. The large part *c* is filled with air, and the bulb *d* is filled with quicksilver. The former causes the hydrometer to float, and the latter keeps it in an upright position.

The stem *b* is graduated with a series of divisions, the lowest one being marked 10. When the hydrometer is put in a vessel of pure distilled water, it sinks until the graduation marked 10 is even with the surface of the water. In other words, 10 deg. Baumé, or 10 deg. B., as it is usually abbreviated, corresponds to a specific gravity of 1, or the specific gravity of pure water.

When the hydrometer is put into a vessel containing oil that is lighter than water, it sinks farther than it did in water, and some other graduation greater than 10 comes even with the surface of the oil. The number of this graduation then indicates the density of that particular oil, in degrees Baumé. For example, if the graduation marked 26 came level with the surface of the oil, the density of the oil would be 26 deg. Baumé.

If the density of an oil lighter than water is given in degrees Baumé, the corresponding specific gravity may be found by using the formula

$$G = \frac{140}{130 + B}$$

in which $G$ = specific gravity of oil;
$B$ = density, in degrees Baumé.

For instance, if an oil has a density of 20 deg. Baumé its specific gravity is

$$G = \frac{140}{130 + 20} = 0.933.$$

To enable the specific gravity for any Baumé reading to be found quickly, without any calculations, the curve shown in Fig. 2 is given. For example, suppose that it is desired to find the specific gravity of an oil having a density of 19 deg. Baumé. On the horizontal scale locate the division corresponding to 19, which is the first vertical line to the left of that marked 25. From the point where this vertical line meets the curve follow horizontally to the scale at the left-hand edge of the diagram. It will meet the scale between 0.90 and 0.92, at a point that corresponds to about 0.905. This is the desired specific gravity. In other words, a Baumé reading of 25 deg. corresponds to a specific gravity of about 0.905.

The same diagram may be used to find a Baumé reading corresponding to a given specific gravity, by reversing the foregoing method. Suppose that it is desired to find the Baumé reading of an oil having a specific gravity of 0.91. Having located the point corresponding to 0.91, midway between 0.90 and 0.92 on the left-hand scale, follow horizontally to the curve and then down to the bottom scale. The point thus reached will be slightly to the left of 25, corresponding to 24. Hence, a specific gravity of 0.91 corresponds to a Baumé reading of 24 deg.

## No Reason Why Hydroelectric Plants Should Suffer from Ice Troubles

In a paper on Ice Formation presented to the International Congress of Refrigeration in Chicago on Sept. 17-24 Dr. H. T. Barnes, professor of physics in McGill University, Montreal, makes this statement: "Frazil is formed most rapidly on the surface, but it appears also throughout the body of the river when the water is supercooled. The supercooling is never more than a few thousandths of a degree, but notwithstanding this, it produces great physical effects. It is during such a time that the ice becomes adhesive, agglomerated, and produces trouble to the operators of water-powers. The strength and tenacity of the frazil as long as the temperature remains below the freezing point is enormous. It wants but the very smallest change of temperature in the water, however, to make it soft and spongelike and easily disintegrated. The sun is the most powerful agent in imparting the necessary small fraction of temperature to the water to relieve ice troubles. Thus waterwheels which have been securely cemented during the night are soon running again the next day when the sun comes out. Artificial methods of heating have been developed which have proved remarkably successful. The most effective methods are those of Mr. John Murphy, of Ottawa, who has been studying the problem for many years. There is now no reason why any power plant operated by hydraulic means should suffer from ice troubles."

## Rules for Installation of Suction Gas Producers

[illegible] regulations hindering the installation of suction gas producers in buildings? D. W. E.

The Fire Underwriters permit the installation of suction gas producers of approved make having a maximum rating of 250 hp inside a building, provided the apparatus for preparing the gas is installed in a separate, inclosed, well-ventilated fireproof room. The installation of producers in cellars, basements, etc., requiring artificial light will not be countenanced except by special permission from the underwriters having jurisdiction.

## Linemen's Gloves and Safety Belts

Should a company furnish its linemen with rubber gloves and safety belts or should a lineman be expected to supply these articles? I note from a recent discussion that the practice differs, some companies supplying them and others requiring the linemen to have pliers and belts. S. A.

The electric-light company should always supply the rubber gloves and insist on their being worn by men at work on lines. Inasmuch as the employers' liability laws of various states class the work of linemen as hazardous, in which class recovery is allowed in all cases irrespective of negligence, it is well for the company to supply belts and pliers also. A lineman might purchase an inferior belt because it is cheap; the company in whose employ he is cannot afford to do so.

## Strength of Cross-Arms and Poles

Where can I obtain information concerning the relative strength of cross-arms of various common woods? Will the average arm break under the strain imposed by broken wires before the pole relieves the stress by [illegible]? W. K. M.

Results of recent tests conducted by the Forest Service on six-pin 6-ft. cross-arms, 3.25 in. by 4.25 in. in section show that the ordinary woods range themselves in the following order as regards relative strength:

| | Average Maximum Load |
|---|---|
| [illegible] | 10,180 |
| [illegible] | 9,780 |
| Shortleaf pine | 9,260 |
| Longleaf pine, 50 per cent heart | 8,980 |
| Shortleaf pine, creosoted | 7,650 |
| Douglas fir | 7,590 |
| White cedar | 5,200 |

In nearly all cases where cross-arms are tested under conditions approximating actual service failure occurs at the first pin-hole from the center. Knots and other defects at these points, especially on the upper side, are therefore to be avoided. The figures above quoted were for tests with downward loading, but careful estimates of side-tension, such as would be caused by broken wires, etc., show that the weakest cross-arm of the lot, white cedar, is capable of withstanding lateral pulls of over 4000 lb., which is far greater than any side loading that could be resisted by a pole. A 25-ft. pole with 7-in. top will withstand from 1300 lb. to 2200 lb. side pull applied at the top. A 35-ft. pole with 9-in. top is able to resist about 3000 lb.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*Single-Phase Commutator Motor.*—E. F. W. Alexanderson.—An illustrated article on his single-phase commutator motor for trunk railways, which is a combination of the repulsion motor and the series motor with commutation poles. Illustrations are given showing the construction of the motor and the attention which has been paid to effective cooling. The armature acts as a blower, sucking the air through openings in the side of the frame. The motors of this kind which are in use on the New Canaan line of the New Haven Railroad assume in spite of the heavy traffic a temperature rise of only 60 deg. C. This is about one-half of the temperature rise attained by the old series motors which were replaced by the new type of motor. The weight of the motor is not greater than that of "certain direct-current motors which are in use on similar lines." A locomotive equipped with four 400-hp motors is also illustrated.—*Elek. Zeit.,* Sept. 4, 1913.

*Synchronous and Non-Synchronous Reactance.*—J. Rezelman.—A continuation of his long illustrated series. In this instalment the author deals with the reactance of a turbo-alternator having a solid cylindrical rotor and summarizes the results obtained for various machines which had been previously analyzed.—London *Electrician,* Sept. 12, 1913.

*Effect of Vibrations on the Magnetic Properties of Sheet Iron.*—E. Gumlich and W. Steinhaus.—An account of an experimental investigation in which it was found that continuous vibrations such as are unavoidable on railroads are liable to cause considerable deterioration in the magnetic properties of newly annealed dynamo sheets, decreasing the permeability and increasing the hysteresis loss.—*Elek. Zeit.,* Sept. 4, 1913.

### Lamps and Lighting

*Drawn-Tungsten Filament.*—O. Kruh.—An English translation in abstract of his German paper noticed recently in the *Digest.*—London *Electrician,* Aug. 29, 1913.

*Effect of Inclosing Globes on the Life of Metallic-Filament Lamps.*—Gustaf Sunden.—An article on the way in which the life of metallic-filament lamps is affected by outside globes. The author has found by experiment that metallic-filament lamps should be subjected to the effect of air-cooling and should therefore not be used with inclosing globes. Fittings for metallic-filament lamps should be without an outside globe and reflector. In this way the life of the lamp is considerably extended.—*Elek. Zeit.,* Aug. 28, 1913.

*Metallic-Filament Lamps.*—A note on a recent British patent (No. 14,048, 1913) of the Allgemeine Elektricitäts Gesellschaft. To improve the efficiency of metallic-filament lamps a substance capable of giving off oxygen at low pressure when the lamp is burning is introduced in the bulb before exhaustion. Suitable substances are oxides, peroxides, nitrates, nitrites, chlorates, perchlorates, chromates, bichromates, etc., but manganese superoxide and barium chlorate are found specially suitable. The only reaction product is tungsten trioxide, which is practically colorless and even when deposited on the bulb cuts off little light. As it is non-volatile, no increase in pressure takes place in the lamp.—London *Elec. Eng'ing,* Sept. 4, 1913.

### Generation, Transmission and Distribution

*Upper Silesia.*—W. Vogel.—In connection with the recent meeting of the German Association of Mining Engineers in Breslau an illustrated description is given of the development of electric power installations in the mines of Upper Silesia. The article contains historical notes. A résumé is given of the problems solved in this mining district on the use of electricity for mining, together with statistical data on the increase of these installations, which have resulted in making Upper Silesia an important electrical district of Germany. At the day of lowest load in 1912 the lowest consumption in Upper Silesia was 6800 kw; the highest consumption was 14,800 kw. At the day of highest load of 1912 the lowest consumption was 13,500 kw, and the highest consumption 34,100 kw. The load-factor is therefore good. There were imported into Upper Silesia during the last year electric products having a value of $4,000,000.—*Elek. Zeit.,* Aug. 28 and Sept. 4, 1913.

### Traction

*Electric Traction.*—G. Kapp.—His address to Section G of the British Association for the Advancement of Science. The advantages of the various systems of electric traction, three-phase, single-phase and continuous current, are first dealt with, some details being given of lines which have actually been electrified on one or other of these systems. Figures with regard to electric traction on the main lines of the Italian State Railways are set out, while some information about the St. Gothard line is also given.—London *Electrician,* Sept. 12, 1913.

### Installations, Systems and Appliances

*Cost of Manufacturing Electricity.*—H. M. Hobart.—The author presents the subject of the cost of producing electrical energy by first taking up in sequence the physical and chemical changes whereby the production is secured. Then he goes on to illustrate how great is the simplicity secured by the substitution of electrical units, in the early calculations, for those of the thermal-unit type. A direct comparison is made, item for item, of the costs of manufacturing electricity as generated by a steam-turbine-driven plant and by an internal-combustion-engine-driven plant. The costs are segregated according to the most approved methods of accounting, viz., production, investment and administration costs. A dissertation follows on the cost as influenced by load-factor, power-factor and character of the electricity demanded.—*Gen. Elec. Review,* September, 1913.

*Paris.*—J. Reyval.—A fully illustrated description of the Northern and Southwestern central stations of the Paris Electricity Supply Company.—*La Lumière Elec.,* Aug. 21, 1913.

### Wires, Wiring and Conduits

*Free Wiring.*—K. Eiler.—An article describing the conditions under which the small central station in Gronau in Germany carries out electric installations with a system of free wiring. It is shown that the capital invested in this work yields a satisfactory interest. The new installations obtained in this way have been able to compensate the loss of energy consumption due to the introduction of metallic-filament lamps. The author thinks that a system of free wiring will be advisable in some cases where it is important

to increase the consumption of energy.—*Elek. Zeit.*, Sept. 4, 1913.

*Rules for Insulated Conductors.*—A translation in abstract of the 1912 rules of the German Association of Electrical Engineers for the construction, testing and application of rubber-insulated conductors, tested or not tested in water, and for lead-covered cables.—London *Elec. Review*, Sept. 5, 1913.

### Electrophysics and Magnetism

*Continuity.*—Oliver Lodge.—His presidential address to the British Association for the Advancement of Science.—London *Electrician*, Sept. 12, 1913.

*Constitution of Atoms and Molecules.*—N. Bohr.—A second mathematical paper on this subject. The author endeavors to show that the application of Planck's theory of radiation to Rutherford's atom model through the introduction of the hypothesis of the universal constancy of the angular momentum of the bound electrons leads to results which seem to be in agreement with experiments.—*Philos. Mag.*, September, 1913.

*Ions from Hot Salts.*—O. W. Richardson.—An account of an extended investigation the chief object of which was the measurement of the specific charge or the electrical molecular weight of the emitted ions; but in certain cases other points which seemed to be of interest or importance were examined and recorded. The salts which were tested are iodides of zinc, cadmium, calcium, strontium, barium, ferric chloride, manganous chloride, calcium chloride and calcium fluoride. The salts of the alkali and alkaline earth metals emit in appreciable quantity only univalent ions Li, Na, K, Rb, Cs, Ca, Sr and Ba. However, zinc iodide and cadmium iodide emit bivalent zinc and cadmium ions respectively. Most substances, if not all, emit negative electrons when they are heated to a sufficiently high temperature. Certain salts possess the property of emitting negative ions at relatively low temperatures. In addition to the oxides, the following salts have this power: the iodides of calcium, strontium, barium and cadmium, calcium fluoride, calcium bromide, manganous chloride and ferric chloride. In general, the negative ions emitted by these substances are not all electrons but consist of a mixture of electrons and heavy ions. Calcium iodide appears to exhibit this property in a typical manner.—*Philos. Mag.*, September, 1913.

*Absorption of Heat Produced by Emission of Ions.*—H. L. Cooke and O. W. Richardson.—In a recent paper the authors have shown that when a current of negative electrons is allowed to flow from a heated filament of osmium there is an absorption of heat which is equal in amount to the energy required to drive the escaping electrons through a potential difference of 4.7 volts. The present paper deals with similar experiments which they have made with lime-coated platinum wires and with tungsten wires. The phenomena exhibited by lime-coated platinum wires do not exhibit any evident relationship with the theory of these effects. Their behavior is quite different from that of the osmium and tungsten wires. In the case of the latter substances the thermal changes which take place when the thermionic current is turned on or off all occur within a few seconds. With the lime-coated platinum wires, under otherwise identical circumstances, it was questionable whether the changes were complete in a time comparable with ten minutes. The precise nature of the changes also depended rather definitely on the mode of preparation of the lime-coated surface. The authors conclude that with lime-coated platinum wires the cooling effect sought, if present, is masked by a larger cumulative effect.—*Philos. Mag.*, September, 1913.

*Heating Effect at the Cathode in Vacuum Tubes.*—B. Hodgson and P. A. Mainstone.—An account of a careful investigation of the well-known effect that in vacuum-tube work the electrodes become heated during the discharge and that the cathode becomes hotter than the anode. The authors investigated the heating effect at the cathode. With normal glow the heat energy communicated to the cathode is proportional to the current. When the abnormal glow sets in, the heat given to the cathode increases more rapidly as the current increases. The authors also determined a certain ratio $a/b$. The maximum value that this ratio can assume is 1.0, when the current is carried by positive ions only. Should each positive ion in striking the cathode ionize and produce only one negative carrier, then the ratio 0.5 would exist. If more than one negative carrier resulted from each collision, the value of the ratio would be still smaller. According to measurements of the authors the ratio $a/b$ is approximately 1.0, showing that at the cathode surface only a few corpuscles are engaged in carrying the current.—*Philos. Mag.*, September, 1913.

### Electrochemistry and Batteries

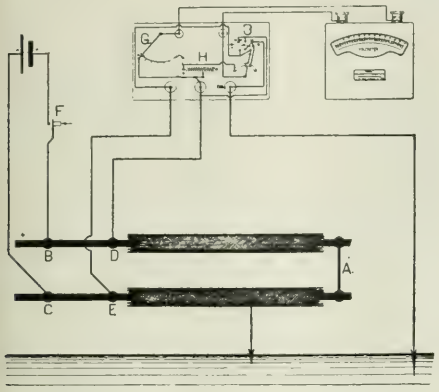
*Smelting Copper Ores in the Electric Furnace.*—D. A. Lyon and R. M. Keeney.—A paper read before the American Institute of Mining Engineers on the possibilities of the electric furnace in copper metallurgy. The authors conclude that the electric smelting of copper ores is nothing more than the substitution of electric heat for the heat derived from the combustion of carbon. Inasmuch as the carbon which is used either in the reverberatory furnace or in the blast furnace plays no important part in the necessary reactions which take place in these furnaces, there is no reason metallurgically why electric heat may not be substituted for the heat derived from the combustion of carbon. In some cases the reactions would take place to better advantage in the neutral atmosphere of the electric furnace than in the reducing or partially reducing atmosphere of the combustion furnace. Therefore, whether the electric furnace should be used for the smelting of copper ores would largely depend upon the relative cost of coke and electrical energy. The electric furnace for iron-ore reduction has been introduced as a matter of necessity on account of particular local conditions. The chances in favor of the electric furnace for the treatment of copper ores are greater than those for the treatment of iron ores, because there is not so great a difference in the cost of coke and electrical energy in copper-mining districts as in iron-smelting centers. Also the cost of electrical energy is constantly becoming less, owing to improvements in gas engines and steam turbines, so that in districts where water-power is not plentiful but cheap fuels unsuited to coking purposes are available it may be found more advantageous to use electric heat than the heat derived from the combustion of coke.—*Metall. and Chem. Eng'ing*, September, 1913.

### Units, Measurements and Instruments

*Magnetic Tests.*—Friedrich Goltze.—In determining the watt losses in dynamo examinations it is desirable that the voltage curve used with the Epstein apparatus should approximate as closely as possible a sine wave. For this purpose the voltage drops in the whole alternating-current circuit must be made as small as possible. In the present paper, which is illustrated by numerous diagrams, the results of tests are given showing the magnitude of the voltage drops in the alternating-current circuit of a steel-testing plant and their effect on the wave-form of the magnetizing emf in the Epstein apparatus. Since a large part of all the voltage drops in the alternating-current circuit are due to the wattmeter used, measurements were made with different wattmeters which showed clearly the influence of the voltage drop in the wattmeter on the wave-form of the emf in the Epstein apparatus.—*Elek. Zeit.* Aug. 21, 1913.

*Location of Cable Faults.*—An illustrated description of a very simple instrument for determining cable faults. If one of two cables placed side by side has somewhere in each fault, this is located as shown in the cut. The two cables are short-circuited somewhere at $A$ so that a continuous cable from $D$ to $E$ is obtained. If the cable length

from $D$ to $A$ is, for instance, 84 m (277 ft.), the cable length from $D$ to $E$ will be 168 m (554 ft.). If now current is sent into the cable from a storage battery connected to the cable at the points $B$ and $C$, the voltage drop from $D$ to $E$ is first measured. It is also possible to obtain the voltage drop from $D$ to earth by turning a switch in the instrument. The ratio of the two readings gives the ratio of the total length of the cable to the distance of $D$ from the




INSTRUMENT FOR DETERMINING CABLE FAULTS

earth fault. A control measurement is obtained by determining the voltage from $E$ to the earth fault. The two distances determined in this way must then give the total length of the cable. A storage battery of high rating is used in order to get a current of 10 amp to 15 amp. For very low cable resistances it is necessary to insert a series resistance in the circuit. The connections of the instrument are self-explanatory from the diagram. The connection to earth is made, for instance, to the lead cover of the cable. A simple graphical method is used to find directly the distance in meters from the ratio of distances given by the instrument.—*Elek. Zeit.*, Aug. 21, 1913.

*Testing Potential Transformers.*—H. B. Brooks.—A note on an investigation carried out in the Bureau of Standards. The commercial importance of instrument transformers has stimulated the development of accurate methods for the determination of their ratio and phase angle. A method is wanted which, while giving all needed accuracy, can be carried out at the point of installation, using commercial instruments and the ordinary supply voltage. Such a method of testing potential transformers is as follows: The primary windings of a standard transformer and the transformer to be tested are connected to the same supply. The secondary windings are connected in series so that their voltages are opposed. The small difference between the two secondary voltages is measured by means of an indicating wattmeter whose current coil is separately excited by a current in phase with the supply voltage. The ratio of the transformer under test may then be readily calculated. By making the above test with the primaries connected to a two-phase circuit, a measurement of the difference of the phase angles of the two transformers may be made by exciting the current coil of the wattmeter from the second phase. If a two-phase circuit is not available, the test for phase angle may be made by exciting the wattmeter current coil from another phase of a three-phase circuit and applying a simple correction factor. A comparison of the above method and a standard laboratory method gave values for ratio agreeing within less than 0.1 per cent, and of phase angle within one minute.—*Journal Franklin Inst.*, August, 1913.

*Analysis of Periodic Curves.*—S. Silbermann.—An article illustrated by diagrams in which the author develops the equations into which the Fourier series are changed when the periodic curves are plotted on so-called sine or cosine paper. The author then shows how the periodic curves can be resolved into single symmetric curves and the latter can be easily resolved into the fundamental wave and the harmonies. Numerical results are given to show the simplicity of this method of analysis.—*Elek. Zeit.*, Aug. 14, 1913.

### Telegraphy, Telephony and Signals

*Electric Fire Alarms.*—W. Fellenberg.—A continuation and the conclusion of his illustrated serial describing various types of fire alarms.—*Elek. Zeit.*, Aug. 28 and Sept. 4, 1913.

### Miscellaneous

*Aron.*—An obituary sketch, written by Gottschalk, of the life and work of the late Hermann Aron, the inventor of the Aron electric pendulum meter.—*Elek. Zeit.*, Sept. 12, 1913.

## Book Review

Alternating Currents Simplified. By Elmer E. Burns. Chicago: The Joseph G. Branch Publishing Company. Cloth, 200 pages. Illustrated. Price, $1.50.

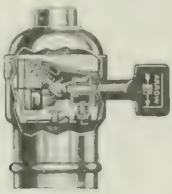
The subject of alternating currents is usually dealt with in mathematical language. Even in the few readable books on this subject where mathematical symbols and formulas are sparingly used, the author—either consciously or unconsciously—assumes the reader to be familiar with mathematical reasoning. In other words, the scientifically trained mind, capable of abstract reasoning, must be brought to the study of most books treating of alternating currents. Although he makes no direct statement to the effect that he is addressing the non-mathematical reader, the author of the book under review obviously wrote for the electrical worker who has not had the advantages of a university training or its equivalent. He has endeavored to present, in simple language, pictures of what is going on in the electric circuit under various conditions, and he treats of the elementary principles underlying the production and utilization of alternating currents. Mechanical and hydraulic analogies are given to illustrate inductance, capacity, phase differences and power-factor, while various appliances and systems of working are referred to and explained. There is no more difficult task than to produce a successful book on these lines, and there is no easier task than to criticise it by picking out the many points in which it fails of scientific accuracy. The author is certainly to be congratulated on having presented many apt and original illustrations of the actions taking place in alternating-current circuits, and on having done his work carefully and earnestly, with his fundamental purpose constantly in view; but it is not easy to estimate the real value of his book. It is undoubtedly difficult to know how far it is advisable to go in the popular presentation of this difficult subject, and it is just possible that Mr. Burns has gone too far in one or two directions. As previously stated, to dissect a book of this nature in order to expose minor inaccuracies would savor of quibbling; but the idea of any one conductor in a polyphase system acting as the return for all the others is certainly not clearly presented, and on page 143 the statement is made that in a two-phase circuit it is impossible to make one wire serve as the return circuit for the other two. The statement is enlarged upon, and the reason given has no reference to the upsetting of phase relations owing to the resistance of the common conductor; it is simply that the relation between the currents in the different wires is such that the thing cannot be done. In this matter of polyphase transmission the author has perhaps attempted rather more than could successfully be accomplished by his method of treatment.

# New Apparatus and Appliances

**An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers**

## 660-Watt Key Socket

The Arrow Electric Company, Hartford, Conn., has placed on the market a 660-watt key socket, with a quick-make-and-break mechanism. The accompanying illustration shows a sectional view of the socket, laying bare the

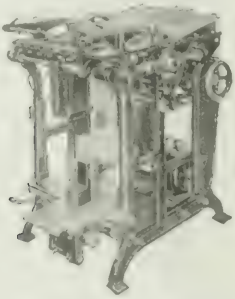


SECTIONAL VIEW OF 660-WATT KEY SOCKET

operating features of the device. The rapid development of energy-consuming devices has brought about the need of a socket with a higher rating than the ordinary key socket, and it is said that the new socket has been designed to meet the requirements of heating, cooking and other domestic service.

## Rapid Folding Machine

The folding machine illustrated herewith folds paper three times in one operation and can make any of nine styles of parallel folds and three styles of right-angle folds. It can handle stock ranging in size from 18 in. by 24 in. to 25 in. by 5 in., and in grade from coated book paper to onion skin. The folded stock is automatically packed so that only one operator is required. The machine is capable



of handling from 1500 to 7000 pieces per hour or from eight to ten times the output of a hand folder. The speed is adjustable to suit the work being done. The floor space occupied is 3 ft. by 4 ft.

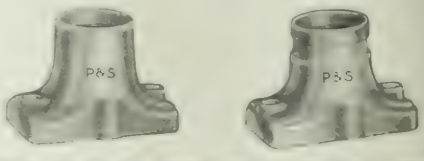
The device is made by the American Folding Machine Company, Warren, Ohio, and is operated by a 0.25-hp Westinghouse motor.

## Inductive Carrier System

At a demonstration in Paterson, N. J., Sept. 25, the Electric Carrier Company, of New York City, showed a model carrier system for transporting mail or packages in tubes without resorting to wheel traction. The driving equipment consisted of a three-phase induction motor, the secondary bar winding of which was extended the full length of the track. Two conductors of the system were carried in the tube above the cars. By means of these and the rails energy was supplied to a developed primary winding hung beneath the car at a distance of 0.375 in. from the bar winding. The tubes in the model system are 36 in. in diameter and the track contains one 20 per cent grade. The cars, weighing 1200 lb., carry 1000 lb. of sand over this grade at nearly synchronous speed.

## Receptacles for Use on Wooden Molding and Pipe Taplets

The two receptacles shown herewith, which were primarily intended for use on wooden molding, have been changed so that they now may be used on pipe taplets as well. The change will in many cases simplify construction by allow-




RECEPTACLES FOR WOODEN MOLDING AND PIPE TAPLETS

ing the same type of receptacle to be used throughout the installation. The forming of the bases of the receptacles constitutes the only change which has been made from the standard line of their manufacturers, Pass & Seymour Inc., Solvay, N. Y.

## Oil-Engine-Driven Electric Welding Apparatus

A very interesting branch of the electrical business carried on in New York Harbor, as well as in other important ports on the Atlantic and Pacific coasts and abroad, is that of repairing steamship boilers, plates, sternposts and other parts by means of the electric welding process. These repairs are made without placing the vessel in dry dock which would involve heavy expense and loss of time. A barge carrying the necessary equipment is placed alongside the injured vessel, and the repairs are made in most cases while the ship is loading or unloading passengers and freight at her own dock. The advantages of this arrangement as compared with the old methods are obvious.

This business is carried on by the Siemund Wenzel Electric Welding Company, of 30 Church Street, New York which has a fleet of barges busy day and night in New York Harbor and vicinity, making repairs of the above character at comparatively low cost. The deposition method which is used is the invention of Mr. H. L. J

Siemund. The process consists in bringing the material to be welded to a pasty condition and simultaneously depositing metal from the fused metallic electrode. Since no preheating is necessary and practically no heating of plates occurs, this method is particularly suitable for high-class welding. An additional advantage claimed for this process is that the welded sections can be made of any desired strength by simply building up a thicker layer of metal.

In the accompanying cut is shown an interior view of the barge used in the above service. Its equipment consists of two welding generators each belt-connected to a 30-hp Remington oil engine. Each generator is of capacity sufficient to operate a single welding set, this arrangement being considered advisable in view of the character of the work in which it is employed. For stationary and shop outfits a larger size unit is generally used, with a capacity sufficient to care for half a dozen welding sets at once.

The vertical, two-stroke-cycle, semi-Diesel-type engine used in this service was selected for it because of its reduced cost of operation over steam or gasoline engine drive and because it is able to give close speed regulation under conditions of extremely variable load, such as the service involves. This is an oil engine in the strictest sense of the word, the oil consumed being introduced into the combustion chamber as a liquid and gasified within this chamber. The fuels used are kerosene, fuel oil and several kinds of low-grade oils sold under a variety of names. On the

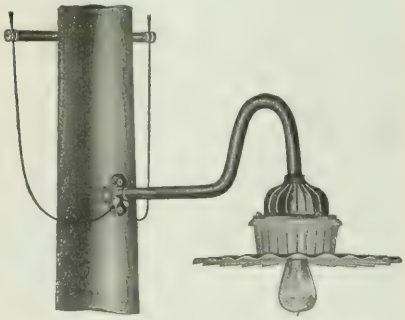


ELECTRIC-WELDING APPARATUS DRIVEN BY OIL ENGINE

crank shaft of the engine between the forward cylinder and the flywheel there is a cam which operates a set of fuel pumps, one for each cylinder. A centrifugal governor attached to the flywheel controls this cam, which turns with the shaft but slides back and forth upon it. This governor automatically sets the cam in a position which will adjust the stroke of the pumps according to the load on the engine. The fuel is sprayed into the combustion chamber under pressure, and into an atmosphere of compressed air of temperature sufficiently high to vaporize the charge. Comparatively low compression is used, which adds much to the life of the machine, and since combustion is less rapid than in gasoline engines, the machine is subjected to less severe shocks. It runs with little or no vibration, is good for continuous operation over a period of twenty-four hours if desired, and is easy to handle. The engine was built by the Remington Oil Engine Company, 120 Broad Street, New York.

## Outdoor Lighting Fixture

The Line Material Company, of South Milwaukee, Wis., has placed on the market a street fixture which can be supported by gooseneck or straight pipe bracket, by rope or span suspension clamp. The casing consists of a heavy piece of porcelain with an iron top, and because of this heavy insulating casing the fixture, without the addition of another insulator, can be used for series circuits or multiple circuits. The casing is so arranged as to provide ample interior space for the socket; provision is made for an inner-wired or outer-wired fixture. For inner-wired fixtures the leads are brought through the iron casing at the top; for others the wires are placed through holes in the porcelain casing provided for the purpose.

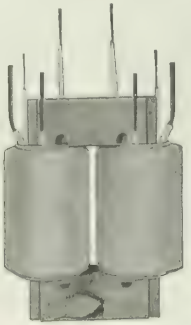


STREET FIXTURE WITH GOOSENECK SUPPORT

The porcelain-enameled fluted reflector is bolted to the porcelain casing, which in turn is secured by means of another set of bolts to the top iron casing. The reflectors are furnished in three standard sizes, of which the dimensions are respectively 18 in., 20 in. and 22 in.

## Oil-Insulated Pole-Type Transformers

Four extra oil ducts have been provided for ventilating the interior of the transformers recently placed on the market by the Packard Electric Company, Warren, Ohio. The cruciform core used in all core-type transformers has four oil ducts on each core, but two of these are ordidinarily closed up by the yokes at the top and bottom. This difficulty has been avoided in the new product by giving the yokes the peculiar form shown in the illustration, which makes the four inside ducts available for ventilation purposes and insures a supply of cool oil in the interior of



TRANSFORMER WITH CASE REMOVED

the transformer where it is most needed. A special form of core is also used in the manufacture of these transformers which is designed to eliminate cross-magnetization. All secondary leads are brought out through a single strong porcelain bushing in order to reduce stray magnetism in the iron cases and improve the copper loss and regulation characteristics.

## Portable High-Voltage Testing Sets

A portable high-voltage testing set which contains a 50,000-volt transformer, a variable resistance of the potentiometer type, electrodes, voltmeter, circuit breaker, switch and pilot lamp is now being put on the market by the American Transformer Company, Newark, N. J. The transformer has a continuous rating of 2 kva and an overload rating of 5 kva for five minutes and may be operated at any frequency from 50 cycles to 125 cycles. The low-tension voltage is 100-200. A voltmeter coil with a ratio of 1 to 500 is placed in the center of the high-tension winding, and leads from the coil are brought out to binding posts on the cover of the transformer. The transformer is oil-insulated and is mounted in a sheet-metal case, this construction affording minimum weight and maximum mechanical strength. The case is mounted on a removable truck provided with large swivel casters. The high-tension terminals are brought directly from the winding through heavily insulated bushings in the cover. The voltage-varying device used with this outfit consists of a fixed shunt resistance and a variable series resistance. The shunt resistance consists of a number of metallic resistance units connected across the low-tension terminals of the testing transformer. The terminals of this resistance are brought out to a connection board in such a way that they may be entirely disconnected from the circuit if desired. The variable resistance is of the compression type, operated by a hand-wheel. There are two distinct types of electrodes suitable for use with the standard testing outfit, either one of which is supplied as part of the necessary equipment. One form of electrode is suitable for testing oils and other liquids, while the other form is intended for testing samples of sheet insulation.

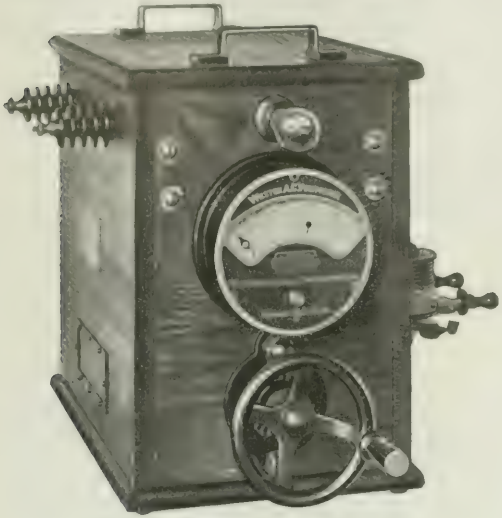
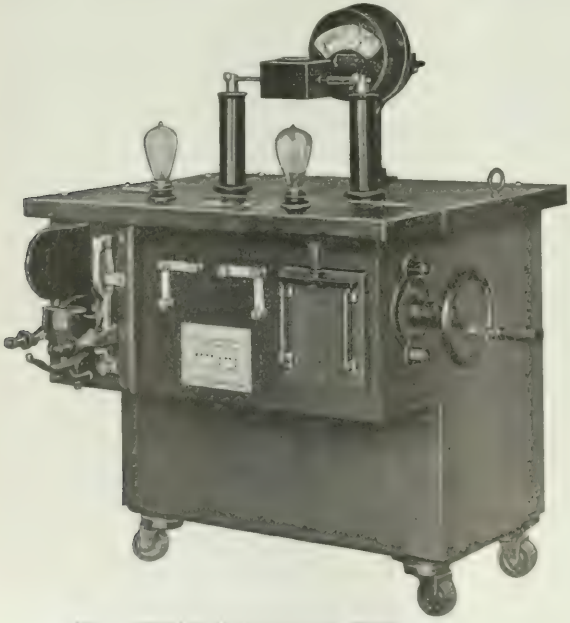


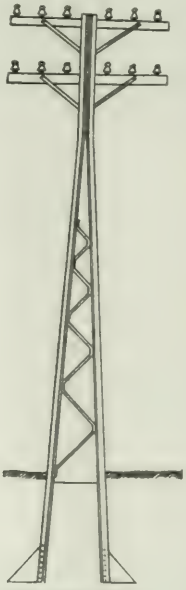
FIG. 1—PORTABLE VOLTAGE TESTING SET



[illegible] SET ON TRUCK

## Steel Poles for Distribution Lines

The Carbo Steel Post Company, Chicago Heights, Ill., has recently put upon the market two types of steel poles which are held to be practicable for use on central-station distribution lines and on telephone lines. The two styles are known as the uniped and the biped types. The biped pole, illustrated herewith, is used where leads are heavy, and it is said that a 30-ft. pole of this type when properly set will withstand a 1000-lb. pull at the top, although it weighs only 130 lb. The uniped poles are smaller and are used on light lines where there are few wires and where the height desired is less than 20 ft.



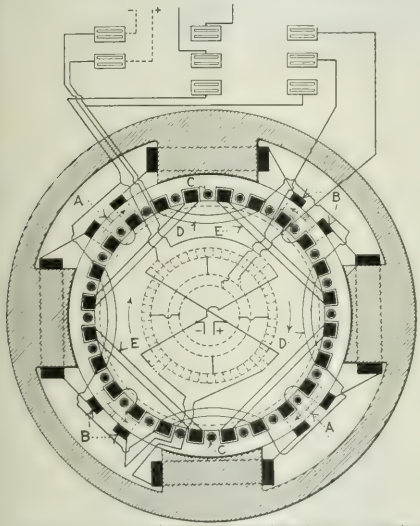
BIPED STEEL POLE

The claim is made by the manufacturers of these poles that, if all costs are considered, steel poles will be found cheaper than good wooden poles for any pole-line con

struction. No concrete is used for setting the poles, and the depth of excavation recommended by the manufacturers is only two-thirds of that used in standard practice for wooden poles of the same height. The construction of the steel poles renders them easy to climb so that overhead work may be done without the aid of ladders or towers. The web at the base of the pole is said to eliminate the necessity for anchoring in many places.

## Combination Rotary Converter and Synchronous Motors

Small rotary converters for charging storage batteries and furnishing energy to moving-picture arc lamps, which will operate at a reasonably high power-factor and efficiency without sacrificing the regulation, are being manufactured by the Northwestern Electric Company, Chicago. Several innovations have been made in the design of the converter, chief among which is the use of an improved form of magnetic damping ring inside of the pole pieces, which will prevent high voltages being induced




A- Slot milled in damper ring to reduce cross section and increase mag reluctance.
B- Portion of shunt field wound on ring to improve magnetic conditions in commutation.
C- Squirrel Cage Bars. E- Starting Coils.
D- Compensating Coils.

FIG. 1—DIAGRAMATIC SECTION OF SINGLE-PHASE MACHINE

in the field coils on starting, without increasing the magnetic leakage when running and thereby reducing the power-factor at which the machine operates. Because of the use of this magnetic damper, it is possible to connect the shunt-field windings permanently on to the direct-current brushes.

In Fig. 1 is given a diagrammatic section of a single-phase machine showing the starting switch and magnetic screen, which is slotted in order that coils may be wound on it to improve the characteristics of the machine. The machines are designed to operate on single-phase and three-phase energy as rotary converters or synchronous motors. Both the single-phase and three-phase converters are provided with compensating windings placed on a magnetic screen to improve the regulation and increase the starting torque. When designed to operate as motors, however, the compensating coil is omitted on the three-phase machines. The rotaries which are designed for operating on three-phase energy can be started from their alternating-current or direct-current terminals, but the single-phase units are started as series alternating-current motors.

In addition to the compensating coils, the single-phase machines are equipped with starting windings which are connected in series with the armature circuit when starting and are short-circuited when the machine reaches synchronous speed. This arrangement assists the compen-

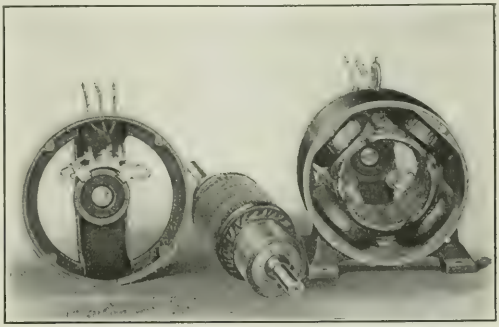


FIG. 2—DETACHED PARTS OF ROTARY CONVERTER AND SYNCHRONOUS MOTOR

sating coils and the squirrel-cage bars, which form the clamping rivets of the magnetic damper, in preventing surging of the magnetic flux, thereby maintaining practically constant speed.

Used without some sort of an auxiliary device, the advantage of the magnetic screen as a preventive of high-potential induced voltages in the shunt-field windings would be offset by the increased magnetic leakage occasioned by its inherent design. To improve magnetic conditions the damping screen is slotted midway between poles to reduce the cross-section and a coil of a few turns of wire is wound on either side of the slot so as to oppose the flux which tends to flow across the gap. These coils, which are connected in series with the shunt-field coils, do not prevent the flux from flowing through the damping ring during the period of starting. Where the over-compounding is required in special machines additional turns which are in series with the direct-current circuit may be wound over these coils and the desired regulation obtained.

The compensating and starting coils are arranged so as to assist each other in regulation, and when the starting

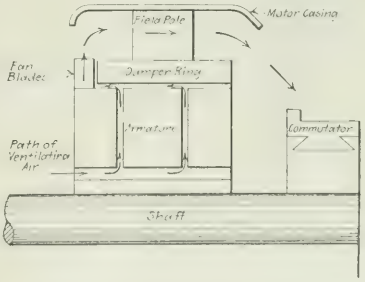



FIG. 3—DIAGRAM SHOWING PATH OF VENTILATING AIR

coils are short-circuited the pole-face area of the stator is increased thereby eliminating the necessity of working the pole pieces at a high density.

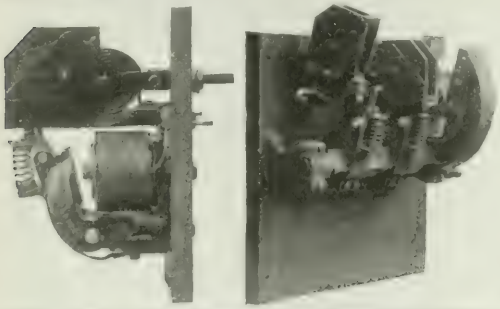
One of the peculiarities of this machine is that with lagging power-factors hunting can be eliminated, but with excessively high leading power-factors it has a tendency to hunt. Semi-closed skewed slots are employed in the

armature to insure quiet running. In addition to the features mentioned these machines are provided with a new type of forced ventilation, and the conductors connecting the direct-current brushes of like polarity are arranged to assist in supporting the brush holders. The diagram (Fig. 3) shows the direction which the air used in ventilating is forced to take.

Open-delta-connected auto-transformers are furnished with machines having ratings up to 10 kw and closed-delta auto-transformers are supplied with machines having larger ratings. Five taps are provided on the low-tension or rotary-converter side of the transformers for the purpose of regulating the voltage generated on the direct-current side of the machines.

## Magnet Switches

The direct-current and alternating-current magnet switches for automatic controllers recently put on the market by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., are of the clapper type arranged to be opened by gravity assisted by a spring. The direct-current switches are single-pole and the alternating-current switches are multipolar. Each switch is mounted on an individual slate base so that in case of accident an injured switch can be replaced immediately. The wearing parts, such as contacts, arc shields, etc., are in general the same in



FIGS. 1 AND 2—DIRECT-CURRENT AND ALTERNATING-CURRENT MAGNET SWITCHES

both alternating-current and direct-current switches of the same rating, thus reducing to a minimum the number of necessary repair parts.

The arc when formed is not blown sidewise against the arc shield, but is guided upward by an arcing horn and is then extinguished by the blow-out coil. This arrangement preserves both the contacts and the arc shields. In switches of 250-amp rating and larger the circuit is made and broken between copper and carbon, but in all cases the final contact is between copper pieces.

## Electric Signs to Advertise Vehicles

When the Meridian (Miss.) Light & Railway Company recently placed in service several General Vehicle trucks for its construction and maintenance work, Mr. C. A. Knight of the central-station company conceived the idea of placing small electric signs on the sides of one of the 1000-lb. vehicles. These signs are supplied with energy from the truck battery and advertise the central station, the electric-vehicle business and use of electric displays.

The signs were made in small panels 4 ft. long and 20 in. wide, reading, in two lines of 6-in. raised electric letters, "Use the Electric." The letters are fitted with candelabra receptacles and small tungsten lamps, the switch being controlled by the driver of the car.

Mr. Knight is quoted, however, as saying that the next vehicle signs installed will carry fewer lamps if possible, since the only drawback to the scheme has been its analogy to the famous small Mississippi River steamboat with the big whistle. When the boat ran they couldn't blow the whistle, and when they blew the whistle they couldn't run the boat. This difficulty has been overcome, however, in

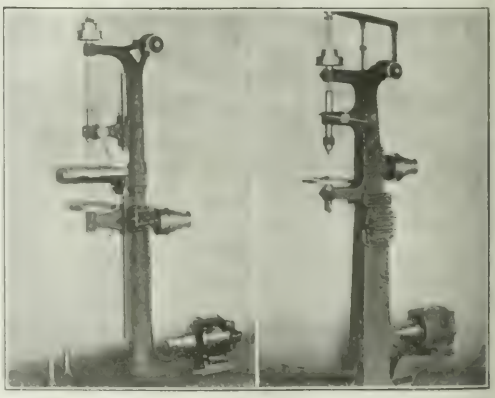



ELECTRIC SIGN ON TRUCK AT MERIDIAN, MISS.

the case of the electric truck by lighting the signs when the truck stops and turning them off again at starting. The signs are also lighted and used when coasting. The signs were furnished by the Greenwood Advertising Company of Knoxville, Tenn., and in finish match the maroon body of the truck.

## Motor-Driven Drills

The two drills shown in the illustration herewith are modernized designs of machines that have been on the market for many years. Motor drive is one of their conspicuous features. The addition of the motor makes the drill an independent unit which can be installed wherever



NEW DESIGNS OF DRILLS DRIVEN BY MOTORS

desired without reference to line shafts. The motor is stopped and started by a switch convenient to the operator. Each drill has six speeds obtained through cone pulleys, giving a range of from 600 r.p.m. to 2,400 r.p.m. The spindle has a ball thrust bearing. The drills are made by the Francis Reed Company, Worcester, Mass., and are driven by Westinghouse motors.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Electric Drive for Pickle Works.**—The plant of the Calumet Pickle Works at Hammond, Ind., has recently been remodeled and completely equipped with direct drive by motors. The Bell polyphase slow-speed motors for this installation were furnished by the Illinois Electric Company, of Chicago, Ill.

**Connecticut Company Has Prosperous Year.**—The past year has been for the Hart Manufacturing Company, of Hartford, Conn., the biggest and most prosperous in its history. At present all departments are running to full capacity. Among the largest installations of Diamond H switches and receptacles made recently in New York City were those in the Architects' Building and in the Biltmore Hotel.

**Central-Station Energy for Dredgers.**—The San Diego Consolidated Gas & Electric Company has made a contract with the city of San Diego to supply 1000 hp in electrical energy to operate a dredger to be used in excavating in the bay in connection with the municipal docks now under construction. The central-station company has supplied electricity for the operation of dredges in the bay for some time previous to the execution of this contract.

**New Company Formed to Handle Public Utility Issues.**—Effective Oct. 1, H. F. McConnell has withdrawn from the firm of Williams, McConnell & Coleman, of 60 Wall Street, New York, and formed a copartnership with W. F. Preston and F. W. Langhorst, former employees of the old organization, under the name of H. F. McConnell & Company, 25 Pine Street, New York, for the purpose of buying and selling investment securities, particularly public utility issues.

**Allis-Chalmers Removal.**—Supplementing a note in the Aug. 23 issue of the *Electrical World* on the plans of the Allis-Chalmers Manufacturing Company for moving its Chicago plant and offices to West Allis, Wis., word has come to the effect that on or before Oct. 6 the sales and engineering offices of the mining machinery department will be changed, followed in the near future by the shops. The advantages to be gained by concentrating all departments, both commercial and manufacturing, at one plant are given by the company as an explanation of this step.

**Activity of a Boston Jobbing House.**—The Stuart-Howland Company, of Boston, Mass., reports that in spite of the generally dull season it has enjoyed a substantial increase in its sales during this year. The company is making an effort to obtain greater efficiency and team work in its sales system, and to this end a dinner was given by it at the City Club in Boston on Sept. 26 to thirty-five members of the Eastern sales force. The dinner was served promptly at 6.15 o'clock, and after it a meeting was held, under the leadership of George H. Hahn, sales manager. Messrs. Stuart and McDonald, respectively president and secretary of the company, delivered addresses, as did several of the salesmen, and the meeting served to show that the company is receiving loyal and friendly co-operation from its sales force.

**Oil Engines Sold for Electric Drive.**—The De La Vergne Machine Company, of New York, is doing a good business in its line of oil engines and has recently sold two large engines of this type for electric-drive purposes. The first of these was one of 100-hp capacity which was sold to Doubleday, Page & Company for their new plant at Garden City, Long Island. This unit will be directly connected to a 240-volt Crocker-Wheeler generator, providing energy for lighting and power service. The second unit was sold to Sholtz & Atkinson, real estate agents, of Brooklyn, N. Y., who intend to use it at their property in Daytona, Fla. It will be belted to a direct-current generator for charging storage-battery cars, and also to a small generator of 5-kw capacity which will supply lighting current for the illumination of a bridge in that vicinity.

**Electric Vehicle Situation in New York.**—A new count has just recently been completed, showing the number of electric vehicles garaged and in operation on Manhattan Island to be 1944 (on Sept. 27). This includes both passenger and commercial cars, and as yet the statistics on the number of commercial cars in use are not available. The New York Railways Company, which several months ago ordered twenty-five electric trucks of various sizes from 1 ton up for use as emergency, repair and supply wagons, now has fifteen of these running. Among the novel electric trucks in operation in the city is a converted horse-drawn vehicle used by the National Fireproofing Company with good results. The front axle and wheels of this wagon were removed and replaced by the two-motor front-wheel drive made by the Couple Gear Company, of New York.

**Large Steam Boiler Installation at the Plant of the Solvay Process Company.**—Among a number of large boiler installations recently made by the Babcock & Wilcox Company, of 85 Liberty Street, New York, aggregating in capacity nearly 27,000 hp, the most notable was that made at the Syracuse (N. Y.) plant of the Solvay Process Company, where 11,365 hp in boilers was put in, together with superheater equipment. Several of the larger sales reported were to public utility companies, among them the United Illuminating Company, of Bridgeport, Conn., which purchased 1208 hp; the Trumbull Public Service Company, of Warren, Ohio, with 1206 hp, and the People's Gas & Electric Company, Mason City, Ia., to which 1004 hp in boilers was sold. The only foreign sale reported was 1236 hp of boiler equipment with bagasse burners, which went to the Ingenio Santa Gertrudis, of Cardenas, Cuba.

**Tariff Bill Passes the House.**—By a vote of 254 to 103 the new tariff measure passed the House of Representatives on Sept. 30. Few changes were made by the conference committee, and there is little doubt that the Senate will give its approval to the measure as it stands, while the President is reported to be pleased with the bill in its present form. The rates of particular interest to the electrical industry—namely, those on mica and on carbons—are as follows: Mica, value 15 cents per lb. or under, 4 cents per lb.; between 15 and 75 cents, 25 per cent.; over 75 cents per lb., 20 per cent.; cut mica, 30 per cent.; carbons, if made entirely from petroleum coke, 15 cents per 100 ft.; if made chiefly from lampblack or retort carbon, 40 cents per 100 ft.; carbons for flaming-arc lamps not especially provided for, 30 per cent. It is stated that English manufacturers expect to be greatly benefited by the general change of rates and that a number of them are getting ready to establish branch offices in this country in anticipation of a large increase in business. Discussing the new tariff measure, a representative of Dick, Kerr & Company, electrical engineers of Preston, England, who send machinery to all parts of the world, stated that as far as the electrical industry is concerned the revised rates will produce little increase of business.

**A Good Export Trade in Heating Appliances Enjoyed.**—The Hughes Electric Heating Company, of Chicago, Ill., is at present giving some attention to the development of a line of bakers' ovens electrically operated. One of the officials stated recently to an *Electrical World* representative that the company is doing a large business in the West and in Canada, having 900 of its electric ranges in operation in Winnipeg, Manitoba, and 600 in Billings, Mont. About one-third of the total sales were stated to be for export, and it was claimed that, because of the prevailing motor-service rates in most of the large Eastern and Central cities, the

company's sales in those cities amount to less than in some smaller municipalities in India and South Africa. The 3-cent rate obtaining in Boston, Mass., was stated to be the most favorable one in the East for the appliance trade.

**Chicago Mail Order House Increasing Its Generating Equipment.**—Because of the increasing demand for electrical energy during the winter months, and in order to provide reserve generating capacity, Sears, Roebuck & Company, the big Chicago mail order house, is installing a large turbo-generating unit. The generator is rated at 1500 kw, 220 volts, and wound for direct current. It will be driven by a non-condensing steam turbine of the horizontal type. A 500-hp Babcock & Wilcox boiler will be added to the steam generating equipment, and there is also being installed a steam-turbine-driven centrifugal boiler-feed pump which is capable of delivering 300 gal. per minute. The existing generating equipment consists of three 750-kw generators, one 500-kw machine and one 100-kw unit driven by reciprocating engines. The Westinghouse Electric & Manufacturing Company is installing the new generating unit. Martin C. Schwab, of Chicago, is consulting engineer for Sears, Roebuck & Company and A. F. Wright is chief engineer.

**Mutual Protection Against Fraud.**—The Electrical Protective League of Chicago held its annual meeting at the Chicago Athletic Club on Sept. 25. After dining together the members of the league listened to the report of a committee on the work which has been accomplished during the past year and elected a new board of directors which will hold office during the ensuing year. James Wolff presided at the meeting and Franklin Overbagh was the secretary. The Protective League was organized three years ago, and since that time has been influential in protecting manufacturers, jobbers and dealers in electrical apparatus against fictitious orders by following up any evidence which may lead to the recovery of stolen goods and by prosecuting those who have made a business of obtaining goods under false pretences. It employs the services of a detective agency and attorneys who prosecute the cases. The directors meet once a month or oftener and discuss methods of protection. The society is operated along the lines of a mutual insurance organization, each business house being assessed according to its yearly sales. No assessments are made except when money is required to investigate cases or to prosecute those where evidence has been obtained. Organizations similar to this one have been founded in other cities and have been effective in reducing losses due to theft or illegitimate orders. It is asserted by one of the representatives of a manufacturing house in Chicago that the loss due to these causes has been reduced in its territory about 85 per cent since the organization of the Protective League.

**Work of the Geological Survey and Its Bearing on Electrical Engineering.**—Some idea of the immense scope of its work and the bearing of this work, among other things, on the electrical engineering field is contained in a general report recently issued by the United States Geological Survey. This department of the government service, which occupies a pioneer position with respect to much of the material and industrial development of the country, is divided into three branches. The topographic corps has completed the mapping of contours over a large section of the United States and is each year adding to the folio. These maps are of large service in the preliminary work of laying out railway routes, roads and transmission lines, and they save to a large extent the time and money necessary in making reconnaissance surveys for special projects of this nature. The geologic corps is making an exhaustive study of the natural resources of the country. Fuels, metallic ores, chemical deposits and building materials are being located and classified and the information recorded so as to be available for reference in the building up of present and future industries. Another corps of engineers is busy with the study of the water resources of the country, investigating both underground and surface waters, determining their rate and volume of flow, their fitness for domestic use and irrigation, and their availability for power development. A very good idea of the importance of this work is given by the statement that more than 11,000,000 maps and reports are distributed each year in response to requests for information concerning the above subjects. About 25,000 inquiries per year are received from the General Land Office alone as to the character of lands which it is proposed to open for mining or agricultural purposes. In view of the large and increasing use of electricity for mining, manufacturing and agricultural power and for transportation on urban, interurban and main-line railways, carrying both passengers and freight, and also in view of the rapidly spreading network of wires for power, lighting and communication service, it is apparent that the work of the survey in opening up fields for this advance, while involving no large amount of electrical engineering in itself, is of paramount importance to that profession and to the electrical industry as a whole.

**Addition to the American Can Company's Plant at Joliet, Ill.**—The American Can Company has practically completed a new one-story brick addition to its factory at Joliet, Ill. This structure is built in the shape of a T with its main portion measuring 580 ft. by 200 ft. on the ground. The part of the building corresponding to the vertical part of the T measures 144 ft. by 34 ft. In this new factory building, which will supplement the old factory already in operation, all machinery will be electrically driven and electric illumination will be used. The motor equipment will be operated on direct current at 220 volts and the lighting will be done largely with 220-volt multiple tungsten lamps although some Cooper Hewitt lamps are also to be used. The glue-heating pots and drying motors will serve as an additional electrical load. About 6000 sq. ft. of floor area will be devoted to the generating equipment. The generating room has been laid out so as to accommodate four steam-driven units, only two of which will be installed at present. One of these generators is rated at 150 kw and will be belt-driven; the other is a 60-kw machine and will be directly connected to its prime mover. These are both Allis-Chalmers generators and are wound for 220 volts, the steam engines being of the reciprocating type in each case. When the two additional units are added they will be driven in the same manner. A slate switchboard is also being installed which will be 6 ft. 8 in. high and 7 ft. 4 in. long. It consists of five panels, two of which will be generator panels. One will be used to distribute energy to the motors used in the new factory, one will distribute energy for lamps, and the fifth will be used to distribute energy to the older factory building. The panels are mounted on angle-iron frames fastened to channels in the concrete floor and braced from the wall. A two-wire circuit is being installed to connect the main power-feeder panel with fifteen sub-motor feeder panels at different places in the building. The main motor-feeder circuit consists of two 1,000,000-circular mil cables ingeniously supported from brackets on I-beams and fastened to them by Minerallac clamps. Two No. 0000 cables connect the main lighting feeder panel with twelve lighting sub-feeder panels placed at convenient distributing points throughout the building. Four or five cabinets are supplied with energy direct from the main switchboard. Steam will be supplied by a battery of four water-tube boilers equipped with Jones underfeed stokers. Henry Newgard & Company, of Chicago, have the wiring contract.

NEW YORK METAL MARKET PRICES

| | | |
|---|---|---|
| Standard, spot* | | |
| | 16.75 | |
| | 16.40 | to 16.[illegible] |
| | 16.30 | to 16.[illegible] |
| | 17.75 | |
| | 40.00 | to 45.00 |
| Sheet zinc, f. o. b. smelter | 8.00 | 8.00 |
| | 5.65 | to 5.70 |

*OLD METALS

| | | |
|---|---|---|
| | 15.00 | |
| | 9.75 | |
| | 8.50 | |
| Lead, heavy | | |

*COPPER EXPORTS

*Quotations as per the New York Metal Exchange

# Corporate and Financial

**Western United Gas & Electric Company Bonds.**—The Western United Gas & Electric Company has sold $1,000,000 of 6 per cent general mortgage bonds to Chicago bankers, and these are being offered to the public on a 6 per cent interest basis.

**Atlantic Gas & Electric Company Earnings.**—The Atlantic Gas & Electric Company, which owns several operating properties, has issued a report for the year ended July 31, 1913. It shows a consolidated income of subsidiary gas and electric properties amounting to $1,117,539. The net surplus from the subsidiary companies, constituting income resources held available for the Atlantic Gas & Electric Company, amounted to $208,643. Other income aggregated $65,497, making a total of $274,140. Expenses were $28,415, leaving a net income of $245,725. Interest was $100,000, and preferred dividends amounted to $105,000, leaving a surplus of $40,725.

**Improvements in Philadelphia.**—It is reported in Philadelphia that the Philadelphia Electric Company will issue a call for an additional payment of $5 per share on its stock, and that at the same time a special dividend of $1.50 per share will be declared, with the object of reducing the net payment on the assessment to $3.50 per share. This plan would make the total payment on the stock of the company $22.50. The par value per share is $25. The company is planning important improvements if its negotiations with the Pennsylvania Railroad for power to be used in connection with the proposed electrification in the suburban district are carried through.

**Development in Stockton, Cal.**—The California Railroad Commission has approved the request of the Western States Gas & Electric Company to issue $354,000 bonds. This company is a subsidiary of the Standard Gas & Electric Company, and is managed by H. M. Byllesby & Company. Proceeds of the bonds will pay for improvements and additions already made, principally to the gas and electric property at Stockton. During the year ended Aug. 1, 1913, the Stockton company's number of electric customers increased 1678, or 29 per cent; power business connected increased 4664 hp, or 40 per cent, and the number of gas customers increased 686, or 12 per cent.

**Pacific Gas & Electric Company Matters.**—The Pacific Gas & Electric Company has started court action against the Secretary of Agriculture and officers of the Forestry Division to enjoin them from interfering with work in the Tahoe National Forest, which is a part of the Lake Spaulding project. The position of the company is that it has procured rights from the State and that the matter is not under the jurisdiction of the national government. At a meeting of stockholders on Sept. 12 the issue of $7,000,000 of one-year 6 per cent notes was authorized. Of this issue $4,500,000 have been sold to Harris, Forbes & Company and N. W. Halsey & Company, of New York. The notes will be secured by $5,000,000 general and refunding 5 per cent bonds and $5,000,000 general lien 6 per cent bonds.

**Indianapolis Company Bonds.**—An issue of $325,000 refunding mortgage 5 per cent ten-year gold bonds of the Merchants' Heat & Light Company of Indianapolis has been sold by Harris, Forbes & Company, New York. The bonds were issued in connection with $250,000 stock as consideration for the property of the People's Heat & Light Company. The gross earnings of the combined properties during the fiscal year ended July 31, 1913, were $722,303; operating expenses and taxes were $403,853, leaving net earnings of $318,450. Interest on the outstanding bonds amounted to $143,000, leaving a surplus of $175,450. The company has recently surrendered its franchise and accepted an indeterminate permit of the State. It states that the similar indeterminate permit law existing in Wisconsin has proved more satisfactory than a municipal grant.

**Readjustment of British Westinghouse Company.**—Plans for the readjustment of the British Westinghouse Company have been issued in London. It is proposed to reduce the capital from £1,875,000 to £1,150,000. The £3 preference shares will be written down £1 per share, and the £5 ordinary shares will be reduced £3 per share. Of the £725,000 of capital to be extinguished in this manner, £225,000 will be devoted to the writing down of patents and good will to a value of £150,000, while the remaining £500,000, together with the balance at the credit of the profit and loss account, will be used to depreciate other assets, to write off expenses in connection with the issue of prior lien debentures and the loss of £52,049 sustained in connection with the litigation with the Underground Electric Railways. It is proposed to increase the rate of dividend on the preference shares from 10 per cent to 15 per cent and on the ordinary shares from 12 per cent to 30 per cent.

**Virginian Power Company Bonds.**—An issue of $1,250,000 of first lien 6 per cent gold notes of the Virginian Power Company is offered by A. B. Leach & Company, New York. The notes are offered at a net interest yield of 7 per cent. They are dated Aug. 1, 1913, and are due Feb. 1, 1915, but are redeemable at any time at par and interest. The purchaser of each $1,000 note will receive as a bonus one $100 share of common stock and also rights to subscribe to $1,000 of first and collateral trust mortgage 5 per cent bonds at the underwriting price, with, in case of such subscription, an additional bonus of one share of common stock with each $1,000 bond so taken. The company is erecting a steam power station at Cabin Creek Junction, W. Va., of 26,666-hp capacity and transmission lines in the Kanawha-New River coal fields. It has acquired the physical properties and water rights of the Dominion Power Company of West Virginia and owns all the outstanding stock of the Dominion Power Company of Virginia and of the New River Power Company of West Virginia. The bonds are secured by a deposit of $2,500,000 first and collateral trust mortgage 5 per cent bonds and by other securities. The estimated annual income from contracts now signed is $298,300. Contracts are under negotiation for $187,000, indicating an estimated income of $485,300.

**Mr. Insull and Associates Acquire People's Gas Company.**—Much attention was aroused in financial circles, as indicated in the *Electrical World* of Sept. 20, by the announcement that Mr. Samuel Insull, president of the Commonweath Edison Company of Chicago, and his associates had secured a large interest in the stock of the People's Gas Light & Coke Company of that city. Three new members of the board of directors of the gas company have been elected. They are Mr. Insull, Mr. John J. Mitchell, president of the Illinois Trust & Savings Bank, and Mr. James A. Patten, capitalist and formerly prominent on the Chicago Board of Trade. Mr. Insull, Mr. Mitchell and Mr. Patten are directors of the Commonwealth Edison Company. They constitute a majority of the directors of the People's Gas Light & Coke Company, and Mr. Insull has been made chairman of the board of directors of that company. Mr. James F. Meagher, formerly vice-president and long the chief legal adviser of the company, has been made president of the People's Gas Light & Coke Company. The remaining director is Mr. E. G. Cowdery, vice-president and operating head of the company. The official announcement of the change is in part as follows: "This completes a transaction that brings home to Chicago one of its leading enterprises, which will in future be managed and directed by Chicago men. Mr. Insull stated that the present situation had come about consequent upon the death of Anthony N. Brady and the desire of C. K. G. Billings to withdraw from a management he had so long and so successfully held. The changes made are entirely friendly and the result of negotiations between Mr. Billings and Mr. Insull, and they are peculiarly appropriate in view of the very large proportion of the company's stock that is now owned by residents of Chicago and vicinity. The next quarterly dividend on People's Gas stock will be at the rate of 8 per cent per annum. It is the intention to call a special meeting of the stockholders to increase the authorized capital stock of the company from $35,000,000 to $50,000,000 and to offer to stockholders toward the close of the year 10 per cent additional stock at par. It should be said the transaction in no way, shape or manner involves a consolidation or merger with the Commonwealth Edison Company, either directly or by means of a holding company or association of any sort, nor the creation of any such company or association."

## Business Notes

**The Best Manufacturing Company,** not the Best Engineering Company, as stated in the Sept. 20 issue, was deprived of its president when George Best resigned to organize another company.

**The R. Thomas & Sons Company,** because of the increase in its business, has been forced to remove to larger quarters. The company's office address remains, however, as before, Old Colony Building, Chicago, Ill.

**Kilbourne & Clark Manufacturing Company.**—The Kilbourne & Clark Manufacturing Company, engineer and manufacturer of electrical apparatus, has moved from 407 First Avenue, South, to 71 Columbia Street, Seattle, Wash.

**The Lighting Studios Company,** formerly at 16 West Thirty-third Street, New York, has removed its offices and showroom to 132 Madison Avenue. This company is busy on some unusual designs for interior and exterior lighting glassware.

**Lockwood, Greene & Company,** 60 Federal Street, Boston, architects and engineers for industrial plants, have established a Canadian office under the name of Lockwood, Greene & Company of Canada, Ltd., with headquarters in the McGill Building, Montreal.

**Moore & Clarke,** patent trade-mark and copyright attorneys, announce the establishment of their partnership and of offices at 2 Rector Street, New York, and in the Barrister Building, Washington, D. C. The firm is made up of Edward B. Moore, former United States Commissioner of Patents, and H. H. C. Clarke, a member of the United States Supreme Court bar.

**Verne W. Shear,** formerly associated with the Westinghouse Electric & Manufacturing Company and the Northern Ohio Traction & Light Company, is now established as commercial engineer and manufacturers' agent with offices at 609 Flatiron Building, Akron, Ohio. The Condit Electrical Manufacturing Company and the Pittsburgh Transformer Company are among the firms represented.

## New Industrial Companies

**The Utility Electrical Signal Company,** of Kittery, Maine, has been incorporated with a capital stock of $100,000 to manufacture and deal in electrical signals. Horace Mitchell is president and H. A. Paul treasurer.

**The Petschel Storage Battery Company,** of Chicago, Ill., has been incorporated with a capital stock of $75,000 by H. T. Scarrett, N. E. Cole and R. T. Jefferson, of Chicago, Ill. The company proposes to manufacture electrical supplies.

**The Johnson Electric Appliance Company,** of Chicago, Ill., has been incorporated by H. B. Johnson, T. B. Dockson and J. F. Williams, of Chicago, Ill. The company is capitalized at $25,000 and proposes to manufacture electric appliances.

**The G. & W. Electric Specialty Company,** of Chicago, Ill., has been granted a charter with a capital stock of $250,000 for the purpose of manufacturing electric specialties. The incorporators are: H. T. Haines, W. G. Colvin and R. F. Carter, of Chicago.

## Trade Publications

**Motors.**—Polyphase motors are fully described and illustrated in Bulletin No. 102 of the Wagner Electric Manufacturing Company, St. Louis, Mo.

**Clay Products.**—In a folder recently issued by the Laclede-Christy Clay Products Company, Manchester and Sulphur Avenues, St. Louis, Mo., are some pertinent paragraphs relating to its clay products.

**Vacuum Cleaners.**—The Federal Sign System (Electric), Lake and Desplaines Streets, Chicago, gives a brief talk on the Federal vacuum cleaner in a small folder recently distributed, emphasizing its special features.

**Valves.**—Jenkins Brothers, 80 White Street, New York, in a large four-page folder illustrate many types of valves. Sectional views of their brass-globe valve and iron-body globe valve are shown, and a general description is given.

**Electrical Specialties.**—Attachment plugs, rosettes, receptacles and other devices are illustrated and briefly described in Bulletin No. 5, recently issued by the Tregoning Electric Manufacturing Company, Cleveland, Ohio. A discount sheet is included.

**Paint.**—The United States Gutta Percha Paint Company, Providence, R. I., in a pamphlet entitled 'Claims Versus Tests," gives a report of the test of its mill-white paint made at the Electrical Testing Laboratories, together with two testimonial letters from satisfied users of Rice's Mill White.

**Plugs.**—The Yost "Lockfast" plug is effectively illustrated and described in a booklet recently published by the Yost Electric Manufacturing Company, Toledo, Ohio. The new and distinctive features of this device are set forth clearly, and the simplicity and ease of operation are graphically shown.

**Elevators.**—The Otis Elevator Company, 17 Battery Place, New York, has published a series of booklets on its various types of elevators. These pamphlets are well printed and attractively illustrated, and are inclosed within dignified covers. They relate to traction elevators, inclined elevators, residence elevators, escalators and inclined railways, a separate publication being devoted to each subject.

**Lamp Coloring.**—In a little four-page folder the Wesco Supply Company, St. Louis, Mo., refers to its new brand of lamp coloring for outdoor use—Cefco—a weatherproof coloring which, it is claimed, will not chip, blister or wash off during the life of any lamp outdoors. This brand is made in six colorings. The Wesco brand of coloring for use on indoor lamps is also referred to, and prices are given.

**Motors.**—"Electricity in the Manufacture of Jewelry" forms the subject of Circular 30,701 issued by the Holtzer-Cabot Electric Company, Boston, Mass. It contains an interesting talk on the practical advantages of electric drive in the jewelry industry, based on results from actual experience. Some excellent illustrations fittingly illustrate the text. Motor-driven polishing benches, buffing and grinding motors, scratch brushes, hot-blast drying apparatus and other motor-driven devices used in the jewelry industry are illustrated.

**Control Apparatus in Chicago.**—The Cutler-Hammer Manufacturing Company, Milwaukee, has published an attractive eighty-page brochure whose title, "Cutler-Hammer Control in Chicago," only partially suggests its interesting contents. The booklet was published as a souvenir of the 1913 N. E. L. A. convention, but its contents are of permanent interest. The object of the book was to illustrate some of the notable buildings of Chicago and to show how many of the buildings there are equipped with C-H controllers. A "Handy Guide" to the business section of Chicago makes a useful supplement.

**Thirty-fifth Edition of "Steam."**—The Babcock & Wilcox Company, 85 Liberty Street, New York, has issued the thirty-fifth edition of "Steam: Its Generation and Use." This is a handsomely printed 336-page publication, size 10¼ by 7¼ in., and differs much from the ordinary trade catalog. It is arranged in the manner of a textbook and contains material and data of much value. Beginning with the early history of the generation and use of steam, the reader's interest is sustained throughout the entire work by the practical, interesting and well-arranged information, lavishly and excellently illustrated. The subject matter is comprehensively treated.

**Boiler Performance.**—The engineering department of the Edge Moor Iron Company, Edge Moor, Del., has published, as Bulletin 51, a report of tests of a steam boiler at high rates of evaporation made at the Westport generating station of the Consolidated Gas, Electric Light & Power Company of Baltimore. The pamphlet contains within its fourteen pages the results of three tests made on a 736-hp Edge Moor water-tube boiler at different rates of evaporation. One of these tests was at 318 per cent load. The bulletin will interest managers of lighting plants who have to consider problems of providing for peak loads. A complete record of the results is given.

# Personal Mention

**Mr. Lamar Lyndon,** of New York, has been retained by the city of Houston, Tex., as its electrical expert.

**Mr. D. F. Finn** has been elected electric-light commissioner of Norwich, Conn., for a term of three years.

**Mr. G. K. Dustin** has resigned as general manager of the Columbia (S. C.) Railway, Gas & Electric Company.

**Mr. A. R. Happoldt** has been appointed manager of the Central Illinois Utilities Company property at Milford, Ill.

**Mr. O. W. Watson** has been appointed superintendent of the Leicester plant of the Worcester (Mass.) Electric Light Company.

**Mr. E. M. Westhoven** has been appointed superintendent of the Woodlake station of the Mount Whitney Power & Electric Company of Visalia, Cal.

**Mr. Robert E. Hughes,** former president of the Kentucky Electric Company, of Louisville, is touring the Orient with his wife and daughter. He is at present in Japan.

**Mr. E. F. Putnam,** commercial manager of the United Electric Light & Water Company, of Greenwich, Conn., has also been appointed contract agent of the Norwalk division for the company.

**Mr. Stanley H. Mosher,** manager of the Leitchfield (Ky.) Light, Heat & Power Company, has been transferred to Petersburg, Ind., where he will take charge of the McCaskey properties.

**Mr. W. H. Rolinson,** who has been for some years chief lamp inspector of the Electrical Testing Laboratories, has accepted the position of commercial engineer with the Westinghouse Lamp Company.

**Mr. G. A. Cook,** of Milwaukee, has been appointed local manager of the Kenosha plant of the Wisconsin Gas & Electric Company, succeeding Mr. P. E. Cowles, who has been transferred to Racine.

**Mr. Gano Dunn,** president of the J. G. White Engineering Corporation and past-president of the American Institute of Electrical Engineers, has been elected a member of the Simplified Spelling Board.

**President C. O. Mailloux** of the American Institute of Electrical Engineers has been honored by the President of France, who has conferred upon him the decoration of Chevalier of the Legion of Honor.

**Mr. P. E. Cowles,** manager of the Kenosha plant of the Wisconsin Gas & Electric Company, has been transferred to the Racine plant, where he will have charge of the electrical department as successor to Mr. Weiss, who recently resigned.

**Mr. L. H. Provine,** formerly superintendent of construction of the Stone & Webster Engineering Corporation at Seattle, Wash., and recently in charge of its Los Angeles (Cal.) office, has been appointed professor of architectural engineering at the University of Illinois.

**Mr. Franklin Thomas,** for the past year connected with the Alabama Power Company, Birmingham, Ala., and previously a member of the teaching staff of the University of Michigan, has been appointed instructor in civil engineering at the Throop College of Technology, Pasadena, Cal.

**Mr. M. Webb Offutt,** formerly manager of the Schenectady Illuminating Company, Schenectady, N. Y., and more recently with the Electric Bond & Share Company, has resigned as assistant to the vice-president and general manager of the Alabama Power Company, of Birmingham, Ala.

**Mr. L. J. Hanna,** formerly in charge of the new-business department of the Kentucky Electric Company, of Louisville, is now acting manager of the corresponding department of the Louisville Gas & Electric Company, formed by the merger of the Kentucky Electric Company, the Louisville Lighting Company and other concerns.

**Mr. A. R. Knight,** until recently instructor in electrical engineering at the University of Pennsylvania, has been appointed instructor in electrical engineering at the University of Illinois. Mr. Knight is a graduate of the Ohio State University and for a time was engaged in practical work with the Columbus (Ohio) Public Service Company, the Dayton (Ohio) Lighting Company and the Springfield (Ohio) Light, Heat & Power Company.

**Mr. P. S. Biegler** has been appointed associate professor in electrical engineering in the University of Illinois. Mr. Biegler, who is a graduate of the University of Wisconsin, was for two years connected with the Commonwealth Edison Company and served as an assistant to the electrical engineer of the Washington Water Power Company. He was assistant professor of electrical engineering at Purdue University in 1910-1911, and until his present appointment was professor of electrical engineering at the University of Montana.

**Mr. W. W. Freeman,** for many years vice-president and general manager of the Edison Electric Illuminating Company of Brooklyn, has severed his connections with the Sperlings of London and resigned as vice-president and general manager of the Alabama Traction, Light & Power Company, Ltd., of Birmingham, Ala., to become associated with Messrs. A. B. Leach & Company, bankers, of New York. Mr. Freeman will become vice-president of the Columbia Gas & Electric Company and associated companies operating in Cincinnati, Ohio.

**Mr. Edward J. Nally,** until recently vice-president and general manager of the Postal Telegraph & Cable Company, has been appointed vice-president and general manager of the Marconi Wireless Telegraph Company of America. Mr. Nally has been connected with the telegraph business for more than thirty-five years, starting with the Western Union Telegraph Company and afterward entering the service of the Postal Telegraph & Cable Company, with which he has been connected for nearly twenty-five years. Mr. Nally sailed for England on the *Mauretania* on Oct. 1 to familiarize himself with the details of the wireless business abroad.

**Mr. Thomas H. Arnold,** formerly electrical engineer for the Southwestern Portland Cement Company, of El Paso, Tex., has accepted the position of district engineer in the Lehigh Cement district for Sellers & Rippey, consulting engineers, Philadelphia, Pa. Mr. Arnold will open an office in Allentown and take active charge for Sellers & Rippey of their work in cement-mill electrification. Mr. Arnold was graduated from Pennsylvania State College in 1905 and since that time has had a wide experience in mill electrification under widely differing conditions. He has worked as operator for the Northern California Power Company, as superintendent of the Pass Power & Lighting Company at Frank, Alberta; as assistant electrical engineer for the Nevada Consolidated Copper Company in the construction of the Steptoe Valley concentrator and smelter at McGill, Nev., and as electrical engineer for the Southwestern Portand Cement Company at El Paso, Tex. While with the latter company Mr. Arnold carried through considerable experimental work toward perfecting electrical apparatus for operation under cement-mill conditions.

**Dr. Rudolph Diesel,** inventor of the Diesel oil engine, mysteriously disappeared from an English Channel steamer on Sept. 29, while on his way to attend the business meeting of the Diesel company in London. When the steamship reached Harwich Dr. Diesel was missing, and it is conjectured that he fell overboard between Antwerp and that place. Dr. Diesel was born in Paris in 1858 and was educated there, in Augsburg, Germany, and at the Polyclinic College in Munich, where he was much interested in thermodynamics. After obtaining some practical experience in Switzerland, Dr. Diesel went to Paris as a consulting engineer. Ever since he left college he had been experimenting with the internal-combustion type of engine. His publication of the pamphlet "Theory and Construction of a Rational Heat Motor" was not very well received, but the Augsburg Machine Company and A. Krupp arranged to give him a free hand in carrying out his ideas. He built an engine in 1893, but this model never worked. In 1898 he exhibited his first commercial engine, and at present his engines are largely employed in Europe and in marine work.

# Construction

## New England

PITTSFIELD, MASS.—We are informed that the Housatonic Co. has [illegible] the construction of [illegible] Falls for some years at least. The company was reported in the issue of Sept. 27 to be planning the construction of a concrete dam at Union Falls.

ISLAND POND, VT.—The Island El. Co. expects to make some changes in its waterwheel equipment during the coming year. J. S. Sweeney is manager.

ROWLEY, MASS.—The electric-light commission expects to purchase within the next 12 months meters, lightning arresters, incandescent lamps, etc.; also electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, etc., within the next two months. S. O. Kent is manager of the municipal electric-light plant.

NEW BRITAIN, CONN.—D. McMillan, Main Street, is reported to be contemplating the installation of an electric generating plant to furnish energy for lamps and motors for his block on Main Street.

## Middle Atlantic

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner Park Avenue and Fifty-ninth Street, New York, until Oct. 6, for installing electric equipment in the Bay Ridge High School on Fourth Avenue, between Sixty-seventh and Senator Streets. Blank forms, plans and specifications may be obtained or seen at the above office, and also at the branch office, 131 Livingston Street, borough of Brooklyn.

CORNING, N. Y.—The Corning Lt. & Pwr. Corpn. has been granted permission by the Public Service Commission to issue $400,000 in capital stock and $100,000 in 10-year debentures, the proceeds to be used to acquire the property and franchises of the Corning Gas & El. Co. and to make extensions and improvements to its property.

ESSEX, N. Y.—The Bouquet El. Pwr. Co., of Essex, expects to purchase within the next few months cross-arms, braces, through-bolt washers, etc. F. W. Barber is manager.

LYONS, N. Y.—The Board of Village Trustees has entered into a contract with the Central New York Gas & El. Co. for lighting the streets of the village for a period of five years. Under the terms of the new contract the company will furnish 11 new flame-arc lamps, 15 five-lamp clusters and 130 single lamps scattered throughout the village. The new lamps are to be installed by Nov. 1.

MIDDLETOWN, N. Y.—Merchants on North Street are contemplating the installation of ornamental lamp standards. Stanley Millspaugh is getting data on posts and would be glad to receive catalogs, prices, etc. The street-lighting service is furnished by the Orange County Ltg. Co. Laurent Heaton is manager of the company.

NEW YORK, N. Y.—Bids will be received by the commissioner of bridges, Department of Bridges, Municipal Building, New York, until Oct. 9, for furnishing and installing lighting fixtures in the municipal building. Blank forms and specifications may be obtained at the above office. Arthur J. O'Keeffe is commissioner of bridges.

NIAGARA FALLS, N. Y.—A final report on the cost of the installation of a municipal electric-light plant has been submitted to the Business Men's Association by Horace G. Sweet, electrical engineer, of Utica, N. Y., which states that a plant could be installed for $65,000.

WEST STOCKHOLM, N. Y.—George N. Gibson & Son, owners of the local electric-light plant, expect to purchase next season a 50-hp waterwheel to operate under a 10-ft. head.

EASTON, PA.—The Eastern Pennsylvania Pwr. Co., of Easton, is reported to be preparing plans for alterations and additions to several of its large power plants.

PHILADELPHIA, PA.—The Department of Public Works will receive bids until Oct. 6 for furnishing illumination next year for 20,000 street lamps now lighted by gasoline. The bids will be strictly for illumination irrespective of the source of light to be used. The city's gasoline lighting bill for this year represents about $550,000. No bids were offered under the new specifications last month.

PHILADELPHIA, PA.—Bids will be received by George W. Norris, director, at the office of the Department of Wharves, Docks and Ferries, 555 Bourse Building, Philadelphia, Pa., until Oct. 6 as follows: Schedule A—For the installation of an electric lighting and power system at Dock Street pier, Delaware River; Schedule B—for installation of wharf drop mechanism at Dock Street pier; Schedule C—for repairs to Reed Street bulkhead, Delaware River. Plans, specifications and blank forms can be obtained at the above office.

WELLSBORO, PA.—The Wellsboro El. Co. is contemplating the purchase of one 300-hp water-tube boiler. W. S. Culver is superintendent.

CAMDEN, N. J.—The United El. Construction Co., of Philadelphia, Pa., has been awarded the contract for the electrical equipment for the plant of the Armstrong Cork Co., of Camden, at $15,000.

CUMBERLAND, MD.—The City Council has instructed the electric light and water commissioner to engage an engineer to make investigations relative to the installation of a municipal electric light and power plant.

WHEELING, W. VA.—The Wheeling Valley Lt. & Pwr. Co., which was recently granted a franchise by the County Commissioners to erect transmission lines through the Wheeling district, will erect a power station at Woodsdale, a suburb of Wheeling. Details have not yet been decided. [illegible] Bethell, of Wheeling, is engineer in charge.

CHARLOTTESVILLE, VA.—The Redland Lumber Co., it is reported, contemplates the installation of an electric-light plant in Charlottesville.

HOUSTON, VA.—The Houston El. Lt. Co. is erecting a large flour mill to be operated in connection with and by energy generated by its electric plant. To meet the extra demand for energy the company will soon install another generator; other improvements will be made in the near future, including the construction of a new concrete dam. L. M. Thayer is manager.

WASHINGTON, D. C.—The contract for furnishing lighting fixtures for the new building of the Bureau of Engraving and Printing has been awarded to C. A. Muddiman & Co., of Washington, D. C., for $17,[illegible].

WASHINGTON, D. C.—Bids will be received at the office of the Coast and Geodetic Survey, No. 205 New Jersey Avenue S. E., Washington, D. C., until Oct. 11, for an electric freight elevator [illegible] Richards Building, in accordance with specifications, copies of which may be obtained by addressing the superintendent of Coast and Geodetic Survey, Washington, D. C.

WASHINGTON BARRACKS, D. C.—Bids will be received by the Engineer Depot, United States Army, Washington, D. C., until [illegible] for furnishing 13 direct-current switchboards, etc. For further information address Lt. Col. Joseph E. Kuhn.

## North Central

ATHENS, MICH.—The Athens Mill & Pwr. Co. has recently installed a 50-hp kerosene engine to use in case of emergency in connection with its water-power. The Village Council and the merchants are considering the installation of an ornamental street-lighting system in the business district. E. K. Mason is secretary and manager.

BANGOR, MICH.—The managers of the municipal electric-light plant expect to purchase within the next few months wiring supplies, etc., and the village will carry supplies and do the wiring in connection with the municipal plant, beginning at once. P. M. Gross is superintendent.

DETROIT, MICH.—The Public Lighting Commission has authorized the installation of 70 new street lamps in the Seventeenth Ward. The commissioners, it is said, are contemplating replacing the present arc lamps with tungsten lamps throughout the city in the near future.

HOUGHTON, MICH.—The Houghton County El. Lt. Co. is constructing a transmission line to Dollar Bay to furnish energy to the new wire mill projected by John A. Roebling's Sons Co. The Houghton company has recently completed the erection of a line to the Superior [illegible] location and will supply electricity for lighting the residences there.

STURGIS, MICH.—The Board of Public Works expects to purchase within the next six months 30 ornamental lamp standards. Single lamps and two-lamp clusters are under consideration. J. S. Flanders is manager.

TECUMSEH, MICH.—The Tecumseh El. Co. is extending its line to Britton to furnish energy for lamps and motors. The company has been awarded a contract for street lighting in Britton, consisting of 50 100-watt tungsten lamps.

CLEVELAND, OHIO.—The Supreme Court has dismissed an [illegible] brought by W. H. Deuss, of Cleveland, to restrain the city from issuing $1,000,000 in bonds for the installation of a municipal electric light plant. Under the ruling the city can now proceed with the bond issue and the construction of the plant.

MANTUA, OHIO.—The Mantua Lt., Ht. & Pwr. Co. is contemplating purchasing energy from an outside source. E. P. Williams is secretary.

WARREN, OHIO.—The Trumbull Pub. Ser. Co., of Warren, expects to purchase within the next six months a full line of electrical appliances, including heating and cooking apparatus, vacuum cleaners, washing machines, etc. George Dougherty is manager.

CLOVERPORT, KY.—The Cloverport Ice Co. is installing an electric light plant in connection with its ice plant to furnish energy for lamps and industrial purposes. The equipment will consist of two 60-hp horizontal tubular boilers, manufactured by the Henry Vogt Mch. Co., Louisville (with provision for additional installation as needed); one 160-hp non-condensing Erie Victor engine directly connected to a 100-kva, three-phase, 60-cycle, 2300-volt Fairbanks-Morse generator; 30-ft. poles and 115,000 ft. of wire will be used in connection with the distribution system. The street-lighting system will consist of 52 200-c.p. 4-amp lamps, 15 of which will be cable suspension, the rest goosenecks. [illegible] electrical supplies. Ira D. Behen, of Cloverport, is engineer in charge of the work. A. A. Simons is president of the company.

FORT BRANCH, IND.—The Fort Branch El. Lt. & Pwr. Co. has filed articles of incorporation changing its name to the El. Lt. Co.

t Branch. The company is capitalized at $20,000. The street-lighting rem will be changed over to series tungsten in October, for which erials have already been purchased. Homer T. Genung is secre- r and manager.

GOSHEN, IND.—The Goshen Lt. & Pwr. Co. has purchased a site r Slate Hill cemetery on which it will erect a transformer station. rge Krom is superintendent.

EVANSTON, ILL.—Bids will be received at the office of the super- ng architect, Treasury Department, Washington, D. C., until Oct. for the extension and remodeling, etc., including mechanical equip- nt, interior lighting fixtures and approaches, of the United States t office at Evanston, Ill. Drawings and specifications may be ob- ed from the above office or from the custodian at Evanston. O. nderoth is supervising architect.

GENEVA, ILL.—Steps have been taken by the merchants and property ers on West State Stret for the installation of an ornamental street- ting system.

NAUVOO, ILL.—The Nauvoo El. Lt. & Pwr. Co. has closed a con- ct with the Mississippi River Pwr. Co. for energy from the Keokuk nt. An entire new plant will be built at a cost of $14,000. The n will be rewired and a new street-lighting system installed. John son, Sr., is president and manager of the Nauvoo El. Lt. & Pwr. Co.

STERLING, ILL.—The Rock River Lt. & Pwr. Co., of Sterling, which building a new power plant on the government dam in Sterling, has tracted with the Illinois Northern Utilities Co., of Chicago, for the re output. The company is now installing five 560-hp Allis-Chalmers erwheels, three waterwheel governors, five 469-kva Allis-Chalmers ubrella-type) generators, a nine-panel Allis-Chalmers switchboard for rnating-current, 60 cycles. H. S. Green is general manager.

ELLSWORTH, WIS.—The electric plants of the Ellsworth Ht., Lt. & r. Co. are reported to have been purchased by the Chippewa Valley , Lt. & Pwr. Co., of Eau Claire. The deal includes the steam plant Ellsworth and the one on Rush River. Both plants will be discon- ued and a transmission line will be erected from Ellsworth to Hart- d, which will connect with the Menomonie-Red Wing line. Right-of- r, it is understood, has already been purchased.

MAUSTON, WIS.—The Mauston El. Ser. Co. expects to purchase hin the next six months a boiler and engine with possibly a rating of hp. H. F. Schroeder is secretary.

MENOMONEE FALLS, WIS.—The Menomonee Falls El. Lt. Co. ex- ts to purchase within the next three months one 35-kw generator. A. Pratt is secretary.

MERRILL, WIS.—The Merrill Ry. & Ltg. Co. expects to purchase hin the next few months 50 or more lightning arresters. E. S. King ecretary.

PRAIRIE DU CHIEN, WIS.—The Prairie City El. Co., of Prairie du en, expects to erect within the next 30 days a new power house eproof) and a 125-ft. concrete stack. L. F. Haupt is superintendent.

SUPERIOR, WIS.—The United Steel Corpn. is planning the erection a new steel plant at the head of the lakes, involving an expenditure $30,000,000. The first unit, it is said, will be completed within a year. ater-power from the St. Louis River will be developed to generate ctrical energy for the proposed plant. The company will use the ently invented electric process in the manufacture of steel at this nt.

BIRD ISLAND, MINN.—The Central Minnesota Lt. & Pwr. Co., of ncoe, will install an ornamental street-lighting system in Bird Island, sisting of 20 ornamental lamp standards carrying one 60-watt lamp d four 40-watt lamps, 2200 ft. of curb three-wire conductor, either nored cable or conduit work. Bids for the work have already been eived. H. B. Rutledge, of Glencoe, is president of the company.

MINNEAPOLIS, MINN.—The City Council has authorized the con- uction of a municipal street-car line to extend from Thirty-seventh enue northeast to the filtration plant, work on which is to begin imme- tely. The cost is estimated at $26,000.

BAGLEY, IA.—The City Council has engaged W. H. Grover, of nes, Ia., to take charge of the engineering work in connection with proposed municipal electric-light plant, for which $6,000 in bonds re recently voted.

DUBUQUE, IA.—The Union El. Co., of Dubuque, has awarded the ntract for construction of power house to Anton Zwack, of Dubuque. e building is to be of reinforced construction and to cost about $30,000.

STRAWBERRY POINT, IA.—Contracts have recently been awarded the Minneapolis Steel & Machinery Co. for one 65-hp Munzel pro- cer-gas engine and one 100-hp gas producer, to the Fort Wayne El. orks for one 40-kw, 220-volt generator with switchboard, all to be talled during the month of October. A. Steil is superintendent.

ALBANY, MO.—Bids will be received by the city of Albany until t. 7 for construction of new power plant. Plans and specifications ay be obtained from Rollins & Westover, Midland Building, Kansas y, Mo. W. E. Noonan is superintendent.

ELMO, MO.—At an election held recently the proposition to make rangements with the Lee El. Co., of Clarinda, Ia., for the installa- n of an electric-light system in Elmo was carried.

JEFFERSON CITY, MO.—Bids will be received at the office of the ate Capitol Commission Board, Jefferson City, Mo., until Nov. 18 for the construction, including mechanical equipment, of the Missouri State Capitol at Jefferson City, in accordance with drawings and specifications, copies of which may be obtained at the above office or at the office of Tracy & Swartwout, architects, 244 Fifth Avenue, New York, N. Y. J. Kelly Pool is secretary of board.

KANSAS CITY, MO.—The Kansas City El. Lt. Co., it is reported, will take over the management of the electric light plants in the R. A. Long Building, the Bryant Building, the Hall Building, the Taylor Building and other buildings having their own electric generating plants.

MONROE CITY, MO.—The managers of the municipal electric light plant expect to erect within the next two months an extension to the engine and boiler room and 1½ miles of transmission line to the pumping station, and also to install an engine, boiler and two generators (one of 100 kw and one of 60 kw). All material and equipment has been purchased. O. R. Emerson is superintendent.

SEDALIA, MO.—The City Lt. & Trac. Co., it is reported, contemplates the erection of an addition to its Broadway power house and the installation of a 400-hp boiler.

DONIPHAN, NEB.—Plans have been completed whereby energy to light the village of Doniphan will be secured from the plant of the Grand Island El. Co., of Grand Island. The company will erect a transmission line from its plant to the village, which will be distributed by the Doniphan El. Lt. & Pwr. Co., recently incorporated with a capital stock of $10,000. Charles T. Young, B. F. Scudder and C. A. Stone are interested in the company.

ONAGA, KAN.—The capital stock of the Onaga Lt., Ht. & Pwr. Co. has been increased from $6,500 to $10,000.

PRATT, KAN.—Bonds to the amount of $50,000 have been voted for the installation of a municipal electric-light plant. Electrical service in Pratt is now furnished by a private company.

WHITING, KAN.—The city of Whiting is erecting a 10-mile transmission line to secure energy to operate the municipal electric-light system. Henrici, Kent & Low, of Kansas City, Mo., are engineers in charge of the work. F. G. Todd is city clerk.

## Southern States

CHARLOTTE, N. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 1 for alterations, new roof, floors, etc., including mechanical equipment, interior lighting fixtures and approaches, in the present assay office building in Charlotte, N. C. Drawings and specifications may be obtained from the above office or from the custodian at Charlotte. O. Wenderoth is supervising architect.

HENDERSONVILLE, N. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 15 for the construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Hendersonville, N. C. Drawings and specifications may be obtained from the above office or from the custodian of site. O. Wenderoth is supervising architect.

MONROE, N. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 7 for construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office in Monroe. Drawings and specifications may be obtained at the above office or from the custodian of site at Monroe. O. Wenderoth is supervising architect.

WASHINGTON, N. C.—The managers of the municipal electric-light plant expect to purchase within the next four months three 150-hp water-tube boilers, one 360-kva, 60-cycle, three-phase, 2300-volt turbo-generator unit; one 40-kw motor-generator exciter, one 40-kw turbo-generator exciter, one surface condenser with air pump, one six-panel switchboard to control two generators, three feeder circuits and two exciters. H. B. Charles is superintendent.

WALHALLA, S. C.—The Linler Pwr. Co., recently incorporated with a capital stock of $40,000, proposes to construct a dam and power house at old Mauldin Mill Shoals, 7½ miles from Walhalla. John J. Linler, of Walhalla, and Marcellus E. Thornton, of Hickory, N. C., are interested in the company.

PLAINS, GA.—The Town Council is considering the question of installing an electric-light plant and water-works system in Plains.

AUBURNDALE, FLA.—The installation of an electric-light plant in Auburndale is reported to be under consideration.

HIGH SPRINGS, FLA.—Bonds to the amount of $35,000 have been voted for the installation of a municipal electric-light plant and water-works system in High Springs.

LAFAYETTE, LA.—Improvements are contemplated to the municipal electric-light plant, involving an expenditure from $7,000 to $10,000.

DARLINGTON, OKLA.—Arrangements are being made to install an electric-light and power system at the Masonic Orphans' Home near Darlington. It is proposed to erect a pole line to maintain a four-wire, two-phase, 60-cycle system. Energy is to be transmitted from the generating station at El Reno, 4½ miles distant.

GRANDFIELD, OKLA.—J. A. Brabham and L. E. Edwars, who were recently granted a franchise to construct and operate an electric-light system in Grandfield, are now installing a plant.

TULSA, OKLA.—The Public Service Co. of Oklahoma, a subsidiary of the Tulsa Corpn. for increasing the output of its electric plant. Sargent & [illegible] engineers.

WATONGA, OKLA.—The Board of Light [illegible] purchase within the next 30 days one Corliss engine and within the next two months one carload of poles, lightning arresters and wire for extension line. A triplex motor-driven pump is now being installed at the plant. Bonds to the amount of $35,000 have been voted for improvements in city. O. W. Hunt is superintendent of municipal electric plant.

BLOOMINGTON, TEX.—The installation of an electric-light plant and water-works system in Bloomington is under consideration. The Commercial Club is promoting the project.

BROWNWOOD, TEX.—The City Council is considering the question of installing a municipal electric-light plant.

GOLIAD, TEX.—The Goliad Supply Co. has just completed the installation of a 60-hp Snow crude-oil engine and a 37½-kw General Electric generator, changing from steam to an oil-burning engine. Edward F. Glaize is owner and manager.

HONESDALE, TEX.—The Honesdale Lt., Ht. & Pwr. Co. has recently purchased a 26-lamp Pittsburgh series incandescent lighting system for lighting Texas Township, adjoining this borough. F. H. Eisele is superintendent.

MISSION, TEX.—The construction of a municipal electric-light plant is contemplated by the city of Mission.

MOODY, TEX.—The Home Lt. & Pwr. Co. expects to erect a transmission line from Eddy, Tex., and secure energy from the plant of the Texas Pwr. & Lt. Co. within the next 12 months; also to purchase wire, poles, transformers, lamps, etc. The company proposes to change its system from direct current to alternating current as soon as possible and rewire the whole town. C. Canuteson is owner and manager.

QUANAH, TEX.—A new 130-hp Snow crude-oil engine has recently been installed in the plant of the Quanah light and ice works. E. A. [illegible] and manager.

ROYSE CITY, TEX.—The Royse Milling & Lt. Co. expects to make improvements to its system within the next three months. Details have not yet been decided upon. A. Hurst is manager.

TEMPLE, TEX.—The Southwestern Trac. Co., of Temple, will soon file an amendment to its charter with the Secretary of State increasing its capital stock to $3,500,000, the proceeds to be used for extending the railway from Temple to Waco, a distance of about 30 miles, and from Temple south to Austin, about 80 miles. A. F. Bentley is president.

TYLER, TEX.—The Tyler Pwr. & Lt. Co. is installing new machinery in its plant here, preparatory to furnishing energy to operate the local street railway system. The entire North Bois d'Arc line is being rebuilt now, poles and wire being erected.

## Pacific States

BELLINGHAM, WASH.—Preparations are being made by the Puget Sound Trac. Lt. & Pwr. Co. of Seattle to extend its transmission lines into Skagit and La Connor valleys for the purpose of furnishing the smaller towns and farmers with energy for lamps and motors.

CHEHALIS, WASH.—The Washington-Oregon Corpn. has recently filed with the county auditor of Thurston a mortgage to the amount of $1,000,000 to secure a bond issue. Of the proceeds of the bond issue, $300,000 will be used in making extensions to its various properties in Washington and Oregon, consisting of steam-heating plants, power plants, street railways and water systems, located in Chehalis, Centralia, Tenino, Vancouver, Wash., and other cities. The company is contemplating the construction of an electric railway from Vancouver, Wash., to Olympia and Seattle, via Tacoma.

SEATTLE, WASH.—The Stimson Mill Co., of Ballard, has submitted a proposition to the City Council offering to furnish the city with energy to the amount of from 8000 kw to 10,000 kw (continuous service) for the municipal electric-light plant. The City Council is now considering a proposition to secure energy from the Tacoma municipal electric plant. J. D. Ross is superintendent.

SPOKANE, WASH.—The Washington Wtr. Pwr. Co., it is reported, has made arrangements to erect a 60,000-volt transmission line from Spokane into the towns of Wilbur, Creston, Hartline and Almira.

GLADSTONE, ORE.—Plans have been submitted to the City Council by the Gladstone Commercial Club for the installation of an ornamental street-lighting system. General improvements to the entire lighting system are also recommended.

MEDFORD, ORE.—The California-Oregon Pwr. Co., of Medford, expects to change within the next two months all voltage of its lines from Grant's Pass, Ore., to Dunsmuir, Cal., from 20,000 volts to 34,000 [illegible]

STAYTON, ORE.—The West Stayton Pwr. & Ry. Co., of Stayton, recently incorporated, is planning to erect a power plant on the north fork of the Santiam River, near Stayton, to furnish energy for lamps, industrial purposes and street railway. Estimates are now being received by the company on equipment for proposed plant, including waterwheels, waterwheel governors, generators, switchboard equipment, transformers, material for distribution system meters, arc lamps, incandescent lamps, etc. S. N. Arnold, Wilcox Building, Portland, is engineer in charge of the work. The office of the company is located at 418 Yeon Building, Portland.

VALE, ORE.—The Vale Lt. & Wtr. Co. expects to erect within the next 30 days a 300-kw transformer station. A 24-hour service will be established upon connection with the transmission line of the Beaver River Pwr. Co., of Boise, Idaho. E. A. Boyd is superintendent.

LOS ANGELES, CAL.—The Southern California Edison Co., of Los Angeles, has been granted a permit by Secretary Houston of the Department of Agriculture for the development of additional hydroelectric power in the Kern national forest. The permit covers four water-power sites, from which it is estimated that 33,000 hp can be developed. The projects will involve the construction of four dams and considerable conduit work, power plants and high-tension transmission lines, etc.

RED BLUFF, CAL.—A permit has been signed by Secretary Houston of the Department of Agriculture giving the Sierra El. Pwr. Co. permission to develop the water-power in the Lassen national forest on Mill Creek, 25 miles east of Red Bluff. The work includes the construction of a conduit, 16 miles long, to a concrete power house capable of developing 23,500 kw. The headquarters of the company is in Oakland.

SAN DIEGO, CAL.—Sealed proposals will be received by the Board of Supervisors at the Court House, San Diego, addressed to J. T. Butler, county clerk, until Oct. 10, for constructing nurses' dormitories at the County Hospital in said county, including wiring and electric-light fixtures and steam heating. Plans and specifications are on file at the office of the Board of Supervisors.

SANTA CRUZ, CAL.—The Coast Counties Gas & El. Co., of Santa Cruz, has applied to the State Railroad Commission for permission to issue $200,000 in capital stock, the proceeds to be used for additions and improvements to its plant.

COEUR D'ALENE, IDAHO.—The City Council has authorized the city attorney to prepare the necessary petition to be presented to the State Utilities Commission for establishing municipal electric light and water plants. The City Council favors the purchase of the existing plants, provided they can be purchased at a reasonable price.

HAMILTON, NEV.—Preparations, it is reported, are being made by the Hamilton Pwr. Mining & Transportation Co. for the erection of a power plant on Illipah Creek, about 6½ miles from Hamilton, to furnish energy in Hamilton and to the White Pine mining district. The cost of the plant is estimated at about $30,000.

## Canada

GODERICH, ONT.—The municipality has purchased 60 Jandus Luxolabra three-lamp and one-lamp standards, which will be erected around Court House Park.

KINGSTON, ONT.—The City Council will again ask the Hydro-Electric Power Commission to submit estimates of cost of furnishing energy to operate the municipal electric system.

LONDON, ONT.—The City Council has passed a by-law approving the equipping of the London & Port Stanley Railway for electrical operation to be submitted to the ratepayers for approval.

## Miscellaneous

[illegible] PHILIPPINE ISLANDS.—The [illegible] El. Co. expects to purchase within the next six months one 250-hp or 300-hp internal combustion boiler. The company has recently completed the installation of a 250-kw, three-phase, 60-cycle, 2300-volt alternator directly connected to a 12-in. by 24-in. by 36-in. cross-compound Hamilton Corliss engine. R. I. [illegible] manager.

# New Incorporations

LOS ANGELES, CAL.—The Beardsley El. Co. has been granted a charter with a capital stock of $100,000. The incorporators are: L. Gold water, M. Elsasser, M. Cohn, W. L. Moreland, C. H. Sorg, J. T. Shannon and V. S. Beardsley.

LEBANON JUNCTION, KY.—The Lebanon Junction Lt. & Pwr. Co. has been incorporated with a capital stock of $4,500 by C. McL. Stinger, R. M. Hocker and G. W. Bache.

WALHALLA, S. C.—The Linler Pwr. Co. has been granted a charter [illegible] to build a dam and power plant at [illegible]

MEMPHIS, TENN.—The Southern El. Co. has been incorporated with a capital stock of $5,000 by John B. Vesey, G. S. Spruggs, C. E. Wells, W. W. Yates and P. H. Phelan, Jr.

MINERAL WELLS, TEX.—The Mineral Wells El. Co. has been incorporated with a capital stock of $65,000 by Percy Jones, W. E. Kaufman and D. T. Bemar.

# Directory of Electrical Associations, Societies, Etc.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, H. O. anson, Mobile Gas Co., Mobile, Ala.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Permanent cretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTRIC RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary-easurer, Matthew R. Boylan, Public Service Railway Co., Newark, N. J. nnual convention, Atlantic City, N. J., Oct. 13-17.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, H. C. Donecker, West 39th St., New York. Annual convention, Atlantic City, N. J., ct. 13-17.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION. Secretary, . C. Donecker, 29 West 39th St., New York. Annual convention, At-ntic City, N. J., Oct. 13-17.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, ehigh University, South Bethlehem, Pa.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. J. Wil-rd Travell, 27 East 11th St., New York.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary, Eugene . Stern, 101 Park Ave., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. utchinson, 33 West 39th St., New York. Board of directors meets onthly. Sections and branches in the principal electrical centers roughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State niversity, Columbus, Ohio. Annual meeting, Atlanta, Ga., December.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, lgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secre-ry, Edwin A. Scott, 29 West 39th St., New York.

AMERICAN WATER WORKS ASSOCIATION. Secretary, J. M. Diven, 47 ate St., Troy, N. Y. Annual meeting, May, 1914.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, W. Tharp, Little Rock, Ark. Annual meeting, May, 1914.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Geo. C. lberton, Pacific Gas & Electric Co., San Francisco, Cal.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, . T. Snyder, McKeesport, Pa.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, s. A. Andreucetti, Chicago & Northwestern Railway, Chicago. Annual eeting, Chicago, Oct. 20-24.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. . Drew, 112 West Adams St., Chicago. Annual meeting, New Orleans, ay 19-22, 1914.

CALIFORNIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, W. S. anbridge, 1408 Merchants' National Bank Building, Los Angeles, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, H. G. Martin, Toronto ectric Light Co., Ltd., Toronto, Can.

COLORADO ELECTRIC CLUB. Secretary, C. F. Oehlmann. Meets every hursday at Albany Hotel, Denver, Col. Annual meeting, Denver, Oct. 6.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secre-ry, Thomas F. Kennedy, 900 15th St., Denver, Col. Annual meeting, enver, Oct. 6.

ELECTRIC CLUB OF CHICAGO. Secretary, Fred M. Rosseland, Monadnock ock, Chicago. Meets every Thursday noon at Hotel Sherman.

ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER BOSTON. Secretary, S. Hale, 39 Boylston St., Boston.

ELECTRICAL CONTRACTORS' ASSOCIATION OF MASSACHUSETTS. Secretary, . D. Temple, 30 Foster St., Worcester, Mass.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secre-ry, Geo. W. Russell, Jr., 25 West 42d St., New York.

ELECTRICAL CONTRACTORS' ASSOCIATION OF THE CITY OF CHICAGO. Sec-tary, M. N. Blumenthal, 179 West Washington Street. Meets at oon on the second and fourth Wednesday of each month at 424 South abash Ave.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secre-ry, Ernest S. Cowie, 1613 Grand Ave., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert eterman, 626 Lloyd St., Milwaukee, Wis.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederick P. ose, 1343 Marquette Building, Chicago. Annual meeting, Chicago, ovember.

ELECTRICAL CREDIT ASSOCIATION OF PHILADELPHIA. Secretary, John W. rum, 1324 Land Title Building, Philadelphia, Pa..

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 ichigan Ave., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Frank-n Overbagh, 411 South Clinton St., Chicago, Ill. Next meeting, Hot prings, Va., Nov. 18-20.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. avely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Meeting, San Francisco, second Thursday of each month.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, Harvey Robinson, 124 West 42d Street, New York. Annual convention, Chicago, Oct. 27 and 28.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA, NEW ENGLAND SECTION. Secretary, L. L. Edgar, 39 Boylston St., Boston.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

FARADAY ELECTRICAL ASSOCIATION. Secretary, W. J. Collins, 1129 Masonic Temple, Chicago. Meets at noon on the first and third Wednesday of each month at Planters' Hotel.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla. Annual meeting, May, 1914.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, J. D. Israel, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia, Chicago and Pittsburgh.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, A. Newburger, 1153 Myrtle Ave., Brooklyn, N. Y.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary and treasurer, J. V. Zartman, 49 Lombard Building, Indianapolis, Ind.

INSTITUTE OF OPERATING ENGINEERS. Secretary, L. Houmiller, 29 West 39th St., New York.

INSTITUTE OF RADIO ENGINEERS. Secretary, E. J. Simon, 81 New St., New York. Annual meeting, New York, January, 1914.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNAL-COMBUSTION ENGINEERS' ASSOCIATION. President, Charles Kratsch, 416 West Indiana St., Chicago. Meeting second Friday of each month at Lewis Institute.

INTERNATIONAL ELECTRICAL CONGRESS. Secretary, Dr. E. B. Rosa, Bureau of Standards, Washington, D. C. San Francisco, Sept. 13-18, 1915.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England. Meeting at San Francisco, Sept. 6-11, 1915.

IOWA ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Secretary, H. B. Maynard, Waterloo, Ia.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia. Annual meeting, Cedar Rapids, April 23, 1914.

JOVIAN ORDER. Jupiter (president), F. E. Watts, 239 West 39th St., New York; Mercury (secretary), E. C. Bennett, St. Louis, Mo. Annual meeting, Hotel Astor, New York, Oct. 14-16.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary-treasurer, Ivor Thomas, 237 South Main St., Wichita, Kan. Annual convention, Hutchinson, Oct. 9 and 10.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, W. H. Bower Spangenberg, 625 Poydras St., New Orleans, La. Meets second Thursday of each month.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Waterville, Maine.

MINNESOTA ELECTRIC ASSOCIATION. Secretary-treasurer, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn. Annual meeting, Minneapolis, March, 1914.

MISSISSIPPI ELECTRIC ASSOCIATION (affiliated with the National Electric Light Association). Secretary-treasurer, Frank J. Duffy, Natchez, Miss.

MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATER WORKS ASSOCIATION. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis. Annual meeting, May, 1914.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, Wm. L. Smith, Concord, Mass.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York. Annual meeting, Philadelphia, May, 1914.

NATIONAL ELECTRIC LIGHT ASSOCIATION, COMMERCIAL SECTION. Secretary, J. F. Becker, 1170 Broadway, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION, EASTERN NEW YORK SECTION. Secretary, C. S. Van Dyck, Schenectady, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION, HYDROELECTRIC SECTION. Secretary, S. A. Sewall, 29 West 39th St., New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MICHIGAN SECTION. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEBRASKA SECTION. Secretary-treasurer, S. J. Bell, David City, Neb.

[illegible] retary, Mr. [illegible]

[illegible] tary, S. W. [illegible]

[illegible] retary-treasurer, A. A. Wilbur, Columbus, Ga.

[illegible] S. [illegible] M. [illegible]

National Electrical Credit Association. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago. Annual meeting, June, 1914.

National Fire Protection Association. Secretary of electrical committee, Ralph Sweetland, 141 Milk Street, Boston, Mass. Open meeting, New York, March, 1914.

National Independent Telephone Association. Secretary-treasurer, Richard Valentine, Janesville, Wis.

New England Electrical Credit Association. Secretary, Alton F. Tupper, 60 State St., Boston, Mass. Directors meet first Wednesday of each month.

New England Street Railway Club. Secretary, H. A. Faulkner, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

New Orleans Electrical Contractors' Association. Secretary, S. J. Stewart, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

New York Electric Railway Association. Secretary, Charles C Dietz, 598 Broadway, Albany, N. Y.

New York Electrical Credit Association (affiliated with the National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Annual meeting, Dec. 9.

New York Electrical Society. Secretary, G. H. Guy, 33 West 39th St., New York. Annual meeting, New York, June, 1914.

Northwestern Cedarmen's Association. Secretary, N. E. Boucher, 743 Lumber Exchange, Minneapolis, Minn. Annual meeting, Jan. 6, 1914.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio.

Ohio Society of Mechanical, Electrical and Steam Engineers Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio. Annual meeting, Columbus, Ohio, Nov. 20-22.

Oregon Electrical Contractors' Association. Secretary, F. C. Green, 291 East Morrison St., Portland, Ore. Annual meeting, April, 1914.

Pennsylvania Electric Association (State Section N. E. L. A.). Secretary-treasurer, S. C. Pohe, Bloomsburg, Pa.

Railway Signal Association. Secretary, C. E. Rosenberg, Bethlehem, Pa. Annual convention, Nashville, Tenn., Oct. 14-17.

Society for Electrical Development, Inc. Acting secretary-treasurer, Stephen L. Coles, 29 West 39th St., New York.

Society for the Promotion of Engineering Education. Secretary, Prof. H. H. Norris, Ithaca, N. Y. Annual meeting, Princeton, N. J., June, 1914.

Southwestern Electrical and Gas Association. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

Vermont Electrical Association. Secretary-treasurer, A. B. Marsden, Manchester, Vt.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 76 West Monroe St., Chicago, Ill. Annual meeting, Cincinnati, Jan. 27-29.

Western Society of Engineers, Electrical Section. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

Wisconsin Electrical Association. Secretary, George Allison, Stephenson Building, Milwaukee, Wis. Annual meeting, Jan. 15 and 16, 1914.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED SEPT. 23, 1913

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,073,589. TELEPHONE-EXCHANGE SYSTEM; S. H. Browne, Pittsburgh, Pa. App. filed Aug. 29, 1904. Calls are automatically distributed [illegible] calls as she can well handle.

1,073,596. ELECTRIC CABLE; H. C. Egerton, Ridgewood, N. J. App. filed Feb. 9, 1911. Loading coils inserted in cable in accordance with Pupin system.

1,073,598. SYSTEM OF ELECTRIC-CURRENT DISTRIBUTION; C. Le G. Fortescue, Pittsburgh, Pa. App. filed Nov. 16, 1911. Transformers, etc., in multiple-circuit relation receive distribution of current according to their several capacities.

1,073,601. ELECTRIC BATTERY; W. S. Gould, New York, N. Y. App. filed March 27, 1912. Sealed storage-battery cell for submarines in which the plates may be easily removed in small units.

1,073,619. ELECTRIC FUSE; T. E. Murray, Jr., New York, N. Y. App. filed April 22, 1912. Fuse strip in U-form with a body of refractory insulating material disposed between the arms of said strip.

1,073,632. ELECTRICAL MEASURING INSTRUMENT; L. T. Robinson and O. Holz, Schenectady, N. Y. App. filed Sept. 30, 1909. For determining relation between the impressed voltage and the current in an alternating-current circuit to indicate thereby the power-factor.

1,073,643. BRUSH HOLDER FOR DYNAMOS; H. S. Steinhart, Stuttgart, Germany. App. filed Aug. 13, 1912. Combined brush holder and conductor clamp.

1,073,662. MEANS FOR CONTROLLING SYNCHRONOUS MACHINES; J. Burke, Erie, Pa. App. filed Sept. 20, 1907. For starting, bringing up to synchronous speed and maintaining machine in [illegible].

1,073,667. TELEPHONE TRANSMITTER; H. C. Egerton, Passaic, N. J. App. filed Oct. 5, 1912. Movable electrode mounted direct on transmitter diaphragm.

1,073,670. STRAP OR CONNECTION FOR SECONDARY OR STORAGE BATTERIES; [illegible]

1,073,675. MEANS FOR REGULATING RECEPTOR CLOCKS; G. A [illegible] by Hertzian waves.

1,073,677. PRIMARY BATTERY CELL; J. H. Gugler and G. W. Colley, Milwaukee, Wis. App. filed July 22, 1910. Uses solution of chlorate [illegible].

1,073,680. SEMAPHORE SIGNAL; L. A. Hawkins, Schenectady, N. Y. App. filed April 6, 1910. Electric motor geared to semaphore arm is driven backward to act as braking generator when arm falls.

1,073,684. ELECTRIC FURNACE; J. Hess, Vienna, Austria-Hungary. App. filed Nov. 20, 1911. Gas delivery and charge supply are united in one chamber immediately around the electrode or electrodes [illegible]

[illegible] Mass. App. filed June 5, 1907. Repeating instrument [illegible] microphone type; prevents packing of granules between [illegible]

[illegible] IVER HOLDER FOR TELEPHONES; H. C. Rader, [illegible] App. filed Oct. 19, 1912. Upstanding connected to [illegible]

[illegible] W. [illegible]

E. C. Molina, East Orange, N. J. App. filed Oct. 12, 1907. Automatic finding switches for picking out idle cord circuits.

1,073,753. GALVANIC BATTERY; J. Haigh, Muskogee, Okla. App. filed Aug. 9, 1912. Has metal cylindrical electrode and cylindrical carbon arranged concentrically.

1,073,788. TELEPHONE OUTFIT FOR THE DEAF; K. M. Turner, Jamaica, N. Y. App. filed May 25, 1912. Outfit contained in a handbag.

1,073,792. PNEUMATO-ELECTRIC PIANO-PLAYER; G. Buechner and H. Semrau, Schenectady, N. Y. App. filed Aug. 16, 1912. Diaphragm-controlled circuit contacts.

1,073,823. DEVICE FOR SYNTHESIZING GASES; W. Siebert, Rheinfelden, Germany. App. filed April 9, 1909. Electric flame discharge furnace in which the gases are introduced tangentially.

1,073,863. MEANS FOR SELECTIVE SIGNALING; I. F. Manny, Milwaukee, Wis. App. filed Oct. 27, 1911. Signal may be given to one or more of a number of substations without signaling other stations on the same circuit.

1,073,868. ELECTROLYTIC APPARATUS; M. Perreur-Lloyd, Boulogne-sur-Seine, France. App. filed March 28, 1911. Anodes of circular rotary disks and cathode plates suspended between the anodes.

1,073,870. DEVICE FOR SYNTHESIZING GASES; W. Siebert, Rheinfelden, Germany. App. filed April 9, 1909. Flame discharges of double cone form are produced between two rod-shaped electrodes.

1,073,886. TELEGRAPHY; W. M. Bruce, Jr., Springfield, Ohio. App. filed Aug. 24, 1912. For long-distance telegraphy, uses alternating current and provides means for absorbing the alternations without interfering with the make-and-break impulses.

1,073,926. ELECTRICALLY HEATED GARMENT; A. Pollak, Paris, France. App. filed March 12, 1912. Flexible conductors of low resistance and small cross-section arranged in parallel groups in garment, such as glove.

1,073,935. ELECTRIC SWITCH; F. Schneider, Cleveland, Ohio. App. filed Feb. 13, 1911. For portable electric tools.

1,073,955. ATTACHMENT-PLUG FITTING; F. V. Burton, Bridgeport, Conn. App. filed Dec. 3, 1912. Attachment plug has latching elements to be engaged in different positions by co-operating latch elements on an independent outlet member.

1,074,003. ALARM ATTACHMENT FOR DOORS AND WINDOWS; T. L. McGovern and F. W. Allen, San Francisco, Cal. App. filed March 14, 1912. Burglar alarm rings continuously on opening and closing of door.

1,074,068. ELECTROMAGNETIC ORE SEPARATOR; G. Rietkötter, Hagen, Germany. App. filed Oct. 30, 1912. Stationary magnet system with inclosing revolving drum.

1,074,071. MAKE-AND-BREAK MECHANISM; H. A. Tepel, Jeffersonville, Ind. App. filed June 30, 1911. Fluid conductor switch for trolley wires.

1,074,088. ELECTRODE-SUPPORTING ROD FOR ELECTROLYTIC TANKS; F. Jensen, Perth Amboy, N. J. App. filed April 9, 1913. Rod of twisted angular stock to provide plurality of spiral contact [illegible]

13,618 (reissue). ARC LAMP; T. L. Carbone, Charlottenburg, Germany. App. filed Feb. 19, 1913 (original patent 975,935, Nov. 15, 1910) globe for flaming arcs of inverted conical shape to prevent condensation of gases on the walls of the chamber.

[illegible] T. L. Carbone, Charlottenburg, Germany. App. filed May 15, 1913 (original patent 975,935, Nov. 15 [illegible] process to prevent condensation of vapors on the globe of a flaming-arc lamp.

# Electrical World

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ol. 62 NEW YORK, SATURDAY, OCTOBER 11, 1913 No. 15

**he Government nd Telegraph Lines**

Speculation as to what the Washington administration may or may not want to do to promote government ownerhip of telegraph and telephone lines is not warranted by ıything that has been determined up to this time. The overnment has had its attention fully occupied by the riff and currency bills and, even if it wanted to give conderation to an extension of federal control over other ctivities, it has not had the time to do so. There is no resent ground for the report that the administration wants undertake the ownership and operation of these utilities. here is not a public sentiment in favor of such a course. here are strong and definite public reasons why advocates ithin the administration of such a radical step should not allowed to determine the policy of the government in the atter. The cost of the telephone and telegraph properties mbined would involve an enormous and unnecessary inease in the national debt. The cost of the lines engaged interstate business only would require a much smaller vestment but it would mean a mixture of government d private ownership that would be fatal to the high ality of service demanded by the public. The acquisition the telegraph lines without the telephone lines, or of the lephone lines alone, would put the government in comtition with the properties not acquired. It would mean t either the unacquired properties and the government uld have to agree on rates or that one competitor would el the stress of competition. Such a contingency as govrnment competition with privately owned telegraph or lephone lines is remote; but it is well to point out that me of the rumors now being circulated undertake to comit the government to a policy that is not far from the zure of private property without due process of law and vhout proper compensation. Those who have proper pperty rights should be protected in them against a plicy of confiscation or dangerous approach to that discditable course. The government should be free from a suspicion of operations of this character.

**Cap Energy Everywhere**

An inspiring picture to those engaged in electrical energy supply service and who also have the general welfare of humanity at heart has frequently been drawn by Mr. Samuel Insull, who is now, and has been for some time, engaged in the practical application of the theories which he advocates concerning the advantage of centralizing electrical energy production in a few large and economical generating plants. It is the central-station man's ideal to furnish all of the energy used in a community. Toward this end the central-station industry has been working for years. This ideal is gradually coming nearer realization. With cheap electric energy available at any point in a large territory for all purposes, including electric railways, many present social and economical problems of crowding and congestion of population and traffic will be solved. By making it easy to establish factories in the country where crowding of population is not necessary, the costly congestion of passenger and freight traffic now common in our large cities will be no longer an economic necessity. It certainly seems that cheap electrical energy supply plus good transportation offers most of the facilities for convenient transaction of business now found in large centers. As has often been pointed out, the existence of water-power is by no means always essential to the production of cheap electric energy in these days of large steam generating stations, in many of which the cost of fuel per kilowatt-hour has been reduced to a point where it is only a small fraction of the total delivered cost.

**Uniformity in Rate Making**

To a person ignorant of the operation of electrical supply systems but familiar with the uniform charges made for gas at so much per 1000 cu. ft., whether used for domestic lighting or cooking, the distinction made by central stations in the charges for electrical energy for lighting and for motor service is a subject of considerable mystery. However, little difficulty is experienced in explaining to a person of average intelligence that gas can be produced at a convenient uniform rate and stored at small cost for consumption whenever needed, while electricity can be stored only at enormous expense and, for reasons of economy, must be produced at each moment at the exact rate of the instantaneous demand. The public would be justified in insisting upon uniformity in the charge per kilowatt-hour for electrical energy used for all purposes provided such charge were made high enough to cover the cost of an adequate electrical energy storage system. Without such a system or the added charge equivalent to the cost of installing and operating it, the rate for energy for each class of customer can best be placed at a value to cover properly the average cost of production during the hours of demand by that class. Uniformity in rates has another and more significant meaning in connection with the subject of rate schedules—a subject to which the National Electric Light Association has given much attention. For the past two years the rate research committee, one of the most active of those belonging to the N. E. L. A. organization, has urged upon the membership the desirability, if not the necessity, of adopting an absolutely uniform method of presenting their rates. No attempt has been made or should be made to render the

rates in one locality equal to those in another where equipment cost, labor, fuel supply and distributing problems are different or to cause any one company to charge the same rate per kilowatt-hour for energy, independent of the customer's time of demand, load-factor or diversity-factor. That the suggestion of this committee should be widely adopted is being appreciated more and more by progressive central-station managers and public service commissioners. It would be well for the public-utility companies, which more than any others will benefit by the adoption of a uniform method of rate-making, to hasten the coming of the day of uniformity in the presentation of their schedules rather than be placed in the position of seeming to oppose a healthy change in the attitude of the companies toward the public for which the time is now ripe.

## Incandescent Head-Lamps

We print this week three articles on head-lamps and their properties, by Messrs. Charles R. Sugg, A. R. Dennington and L. C. Porter respectively. The subject, considered broadly, is of great importance from various points of view. If we consider for a moment the point of view of purpose, a head-lamp on any vehicle is installed to enable an obstacle to be detected beyond the stopping distance. The greater the speed of a given self-propelled vehicle, the greater, as the square, becomes the distance which must be traversed before it can be brought to a full stop. Hence the importance of long-distance visualization in relation to high speeds. Such visualization requires a certain amount of light to be thrown upon the obstacle. At long ranges this calls for intense luminous beams, such as arc lamps can throw when provided with suitable reflectors. Nevertheless, if the intensity exceeds a certain value, the range of effective visualization may cease to be increased and may even be diminished, for the reason that the light reflected from dust or water particles in the beam, to say nothing of casual reflections from poles and houses on land or from wave surfaces at sea, may greatly reduce the optical sensitiveness of the eye on account of the glare.

As is pointed out in the articles here considered, an ideally perfect projector would have constant luminous flux density in a uniform parallel beam at all practical distances, a condition that is neither actually realizable nor practically desirable. In practice any head-lamp may be considered as producing a slowly diverging beam. Strictly speaking, the virtual source of this diverging beam lies on the axis of the head-lamp and, at distant points along that axis, is equivalent to a straight luminous filament, like a Nernst filament, supported along the axis and passing through the center of the arc or incandescent source. The brightness of this equivalent luminous filament, or axial cylinder, reaches a maximum near to and ordinarily slightly behind the center of the actual source. Under these conditions the luminous intensity in any direction near to the axis falls off nearly inversely as the square of the distance from the head-lamp, when the distance is so great that the length of the equivalent luminous filament becomes relatively insignificant; so that the head-lamp, at considerable distances, approximates in photometric behavior to a point source. Nevertheless, as a matter of principle, and as a obvious precaution against misconception, the observe candle-power should be expressed as apparent candle-pow at the actual distance measured from the focus in the lam

## The Phase-Converter Locomotive

The use of an induction motor as a phase converter i not novel so far as laboratory experiments are concerne for it has long been considered a very convenient devic for shifting an emf into any phase position relative to th primary emfs. With a polyphase primary current and stationary but adjustable secondary winding, emf of an time-phase position can be taken from the secondary b giving the latter a suitable mechanical position. The rota ing field cuts the secondary winding and generates emfs i it. Exactly the same result can be secured, and for th same reason, in a tertiary winding on the primary cor usually stationary, by producing a revolving field by th combined magnetizing action of the single-phase primar magnetizing current and the currents produced in th secondary by its motion through the primary flux.

The difficulty with a simple phase converter is that suc a round-about magnetizing process does not, except at n load, produce in the two or more phases of the load ci cuit equal voltages and a time-phase displacement co responding to the space-phase displacement of the stat windings. In fact, the unbalancing is so bad as to rend the device useless for commercial purposes, where it mu be well loaded to render it efficient, although it might l used to balance the voltages and shift their time-phase pos tions automatically.

The phase converter has come into prominence recent because it bids fair to make the polyphase motor appl cable to railway service whenever its constant-speed cha acteristics are desirable or at least unobjectionable; that i in slow-speed heavy service. Overcoming the inhere difficulties of commutation in the series type of alternatin current motor is expensive and the motor is heavy. Th induction type is inherently cheap in spite of the fact th the only equipments of the kind so far constructed in th country were not so. As soon as polyphase railway moto are adopted on a scale great enough to permit the motors be manufactured in large quantities they will surely built at a reasonable price. They are compact, simple a rugged in construction. They permit the use of regener tive control with consequent saving in energy and in brak shoes and a decrease in the danger of operation. Even the phase converter weighs enough to offset the decreas weight of motors, there still remain the other favorat features, always provided that constant-speed character tics are desirable.

It may be safely assumed that any system of electi traction advocated by experienced engineers can and w be made to operate with entire satisfaction from the tec nical standpoint. The final decision in favor of one sy tem or another will be given largely on a basis of co The elements of ultimate cost are not all contained in t locomotive, but involve the transmission and distributi system, with provision for reliability, protection and nc

interference with other circuits and the power house. Account must also be taken of maintenance and obsolescence, including in the latter the possibility of new inventions and applications which may necessitate the scrapping of equipment long before it is worn out. Examples are fresh in our memory of expensive equipment discarded soon after installation because it was too heavy or too inefficient. Each new commercial experiment in electric traction is made in the expectation that the new apparatus is to meet the service requirements of capacity and reliability at a minimum of cost.

## Inductive Interference

The comprehensive investigation of inductive interferences between transmission lines and parallel telephone and telegraph circuits carried on during the last eight months by the Railroad Commission of California, as reported in another page of this issue, marks a new and interesting departure in the work of public service commissions. The problem attacked is an old and troublesome one, dating back to the earliest days of electric-railway development. Upon the advent of the 500-volt direct-current traction system, in the late eighties, the single-wire ground-return telephone lines of those days were found to be very sensitive to induction from the variable-frequency pulsations in the trolley current caused by commutating action in the motors. Telephone users, indeed, became familiar with the variable-pitch note of the successive commutator bars passing under the brushes, rising in pitch and diminishing in volume as a car started from rest and accelerated to full speed. The telephone companies found themselves under the physical and legal necessity of resorting to the use of transposed metallic circuits, a step in evolution which was no less necessary from the standpoints of both overcoming cross-talk between long parallel grounded circuits and establishing commercial long-distance telephony.

Although the chief difficulties were thus temporarily relieved, the open-coil series arc generator, with its complex pulsating-current wave, soon became standard for street lighting, making use of the open-loop series distribution system. Inductive interferences from this source, where the exposures were severe, were troublesome in the extreme, and for a time the only remedy appeared to be complete separation of telephone and lighting systems. Before further remedial measures were generally understood, the alternating-current constant-potential system of distribution made its appearance and inductive interferences grew still more troublesome. The supersession of the direct-current series arc system by the alternating-current series system certainly did not relieve the situation, but probably magnified the troubles, if anything. Contemporaneously with these developments the art of transmitting energy over long distances at high pressures was moving forward at a tremendous pace, and interferences from such systems, although limited at first in the number of instances, added to the difficulties of maintaining commercial telephony.

Meantime much study was devoted to the situation, and the telephone companies found it possible, about a decade ago, to lessen the interferences by the application of new principles in transposition, although the remedy by no means fitted all cases. The severity of disturbance was also much lessened by changes in the practice of power and lighting companies in grouping phase wires closer together and adopting the closed-loop system of series distribution with lamps in alternate sides of the circuit to balance the potential to earth. Transpositions were also adopted to a limited extent in distribution and transmission systems. But the most serious cause of disturbance, by far has been the alternating-current single-phase traction system, of which the electrification of the western terminus of the New York, New Haven & Hartford Railroad forms the most conspicuous example. After much work on the problem, quite satisfactory relief was devised for telephone lines in cable by the use of neutralizing transformers, but open-wire lines, on account of their variable insulation, still present a vexatious problem. The telegraph companies, with their single-wire earth-return circuits and their sensitive multiplex systems of transmission, have also suffered severely. Unfortunately, the great amount of private research work carried on in attempts to meet these various situations is, for commercial or legal reasons, locked up in private files and not available to the engineering profession. It is therefore a matter of congratulation that the California Railroad Commission, with the assistance of a well-organized advisory committee, is investigating this problem.

## Practicability of Electrification

The steam railroads may not be ready to electrify their lines, but the courts have now decided that since electrification may be carried out a certain penalty attaches to failure to employ this means of operation in cities where smoke may be a cause of damage. For more than a generation the courts of Pennsylvania have held that property owners could not recover from a railroad for injury from locomotive smoke. This rule was originally laid down in the case of Philadelphia property owners who sued the Pennsylvania Railroad for alleged damage to property near the Broad Street station. The reasoning of the courts was to the effect that as the lawful operation of a railroad as a public conveyance could not be carried on without a certain amount of smoke, the road could not be penalized for this as an offense against the property rights of others. This rule has now been upset by a decision of the Pennsylvania Supreme Court in a suit against the Reading Railroad alleging damage from smoke along the line of the Reading's new elevation through the city. The court in this case declares that the old rule no longer holds good, for the reason that the perfection of electrical transportation systems provides a means by which the smoke nuisance may be avoided. As a means of accelerating the work of electrifying steam lines no more potent force can be imagined than the threat in this decision that the penalty for steam operation in cities may be an enormous number of damage suits. How the steam roads are to get the money for immediate and wholesale electrification is something with which the court did not concern itself, but it is positive as to the practicability of electrical operation.

# The News of the Week

**Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.**

## Withdrawal of Suit Against the A. I. E. E.

In our issue dated June 14, 1913, a record was made of the denial by Justice Page, of the Supreme Court of the State of New York, of a temporary injunction to restrain the American Institute of Electrical Engineers from making transfers in membership classification in accordance with a special section of the constitution described on page 864 of our issue for April 26, 1913. Mention was made of the fact that the plaintiffs were not debarred from continuing the suit for a permanent injuction. We are now able to state that the plaintiffs have concluded not to carry the matter further and that accordingly the suit has been discontinued.

Although the special section was in force for only a few months and expired in May, 1913, a week or so after the suit was filed, the plaintiffs sought to prevent the Institute and its directors from recognizing as members of the higher grades those who had been transferred thereto under the special section. The directors claimed that for facilitating the changes in grading the special provision for a limited time was necessary, proper and legal. As a result of the suit it can now be said that the board of directors has been fully sustained in its interpretation of the special section of the constitution.

## Convention of American Electric Railway Association

The annual convention of the American Electric Railway Association and its affiliated organizations will be held at Young's Pier, Atlantic City, N. J., Oct. 13 to 17 inclusive. The parent body will hold three sessions, at which executive matters of the railway industry will be discussed. Besides the usual committee reports there will be a number of addresses on valuation, the tendency of public utility laws and regulations, relief of city congestion, railway securities from an investment viewpoint, publicity work and welfare work. Some of the most important reports to be presented before the American Association will deal with public relations and joint use of poles. The accountants will hold sessions every day during the convention, as will also the Engineering Association. The claim agents will meet on three days, and the Transportation and Traffic Association will also hold three sessions. Among the papers of special importance to be read at the engineering meetings will be one on power distribution and another on power generation. As usual, the Manufacturers' Association will make a comprehensive exhibit on the pier.

## Commonwealth Edison Company Co-operates with Associated Contractors

The Commonwealth Edison Company of Chicago has recently made an arrangement with the Electrical Contractors' Association of the city of Chicago and the Faraday Electrical Association whereby the members of those associations will receive in advance the money on approved contracts for wiring existing buildings or apartment houses to be supplied with central-station energy. In turn, the central-station company will reimburse itself by making arrangements with its customers by which the payment of the bills for electrical work will be spread over a term of two years. Contracts for wiring new buildings or for installing additional equipment in buildings which are already receiving electrical energy will be included.

As the Commonwealth Edison Company has a large construction department of its own, this agreement with the contractors may be looked upon as a result of the co-operative tendency which has been brought about by the Society for Electrical Development. It is asserted by Mr. W. J. Collins, secretary of the Faraday association, that this agreement will be beneficial in smoothing out the annual fluctuations which have existed in the electrical contracting business.

## Eleventh Annual Jovian Congress

The eleventh annual Jovian Congress will be held at the Hotel Astor, New York City, Oct. 14-16 inclusive. The congress will be opened on Tuesday morning by an address of welcome by Mayor Kline of New York City, the session being held in the north ballroom of the hotel. Mr. W. E. Robertson, of Buffalo, past Jupiter No. 6, will respond to the Mayor's welcome, and after the appointment of a number of committees the congress will adjourn until the next morning.

The registration of Jovians will begin at 9 o'clock on Tuesday in a room adjoining the north ballroom of the hotel. A badge will be furnished to those who register and this will entitle the bearer to admission to the meetings or entertainment features. A printed list of the registrations will be issued on Wednesday and Thursday mornings.

The business session of the congress will be held on Wednesday morning at 10 o'clock, and matters pertaining to the welfare of the order will be taken up at that time. These will deal in part with changes in the ritual, by-laws and constitution necessitated by the growth of the organization. Immediately following the session a Jovian lunch will be served at Michaud's restaurant, at Forty-second Street and Broadway. On Wednesday afternoon there will be competitive degree team work at the New Grand Central Palace, Forty-sixth Street and Lexington Avenue. Prizes will be given to the team doing the best work as well as to the Jovian who best interprets the part he has taken.

The annual rejuvenation will take place on Wednesday night in the New Grand Central Palace, and it is expected that some 200 men will be initiated. The rejuvenation will be followed by a smoker and supper during which there will be a vaudeville entertainment. The supper, smoker and entertainment will be given by the New York Edison Company, and will be held on the third floor of the Palace.

On Thursday morning a co-operative session will be held at which the following men have been invited to speak: Messrs. Henry L. Doherty, president of the Society for Electrical Development; Charles L. Eidlitz, past-president of the National Electrical Contractors' Association; Lee Galloway, of the New York University School of Commerce, and James H. Collins, commercial writer. The election of officers of the organization will follow immediately after the Thursday morning meeting. On Thursday night the annual banquet will be held in the grand ballroom of the

Hotel Astor. The tickets for the banquet may be purchased at the registration bureau, the cost per plate being $5.

Special entertainment features will be provided on Wednesday and Thursday for visiting ladies. On Wednesday afternoon the ladies will be given tickets for a matinee, and on Wednesday evening there will be a recital at the Hotel Astor given by Edison's newest disk phonograph. On Thursday afternoon an automobile ride will be provided, and on Thursday evening the ladies will be admitted to the balcony of the grand ballroom, where refreshments will be served. Preparations have been made by the New York Jovians to entertain their guests, and committees on entertainment are busily planning so that all visiting Jovians may be assured of an enjoyable time.

## The Bases of Reports of Government Ownership of Telegraph and Telephone Lines

Inquiries made at Washington by a representative of the *Electrical World* indicate that the report that the Washington administration is to embark on a policy of government ownership of telephone and telegraph lines is based primarily on an investigation now being made by Congressman David John Lewis, of Maryland, rather than on the present attitude of the administration itself. This investigation is being conducted wholly on the initiative of Congressman Lewis and has reached a point where his conclusions and recommended course of action are nearly ready for announcement.

Up to this time the complex subject of government ownership of telephone or telegraph lines has not been considered by the present administration so that predictions as to future possible action are not justified. So far as it could do so, the administration has been bending its energies toward the passage of the tariff bill, with the support of its party in Congress. Now that this part of its program has been carried out, it will undoubtedly turn a similar close attention to the pending currency bill. When some disposition is made of this measure, other matters will, of course, be taken up, but so far what they will be has not been decided.

If a policy of government ownership of telephone and telegraph lines is urged, it is believed that the exponent of such a doctrine among the President's advisers would be Postmaster-General Burleson. He has a plan in mind to recommend the extension of government activities in this direction, but it is nebulous. Such a plan would probably be submitted first to the President, and in circles in close touch with the administration it is stated that the matter has not been considered in this way. The fact that such a project has not received consideration except perhaps within the Post Office Department is not regarded as conveying any assurance as to the position of the administration either in favor of or against a policy of this nature. It simply has not been considered.

The extension of government service to the telephone and telegraph lines has been recommended by two predecessors of Postmaster-General Burleson. Both Mr. Wanamaker and Mr. Hitchcock, the immediate predecessor of the present incumbent of the office, favored it. The annual report of the Postmaster-General will be prepared and submitted before the close of this year, but it is impossible to ascertain whether or not the indefinite ideas now in mind will take such shape that they will be presented as formal recommendations in this document.

Some color has been given to the reports that the Postmaster-General is interested in the matter by the announcement that the Alaska military cable and telegraph system will be transferred from the War Department to the Post Office Department. This system comprises a total of 2500 miles of submarine cable, 1200 miles of land service and ten wireless stations. Major Charles McKay Salzman, of the Army Signal Corps, has been transferred to the Post Office Department temporarily in connection with the proposed change in control of this property. The War Department wants to be relieved of its duty with respect to the Alaska lines, pointing out that they are not needed now for purely military purposes. Whether any particular significance with respect to the larger subject of government control of other lines can be attached to this matter cannot be learned in Washington.

The administration and members of Congress who are especially interested in the parcels post system are unquestionably pleased over the large volume of business which this departure has brought to the Post Office Department. When this service was started it was strongly competitive with the business of express companies and subsequent development has made it still more so. The effect of the parcels post system was to make the government a competitor of the express companies to an extent that is disastrous to the revenues of those companies.

The investigation of telephone and telegraph matters which is being conducted by Congressman Lewis has been under way since March of the present year. It is based primarily on available statistical and report data regarding companies engaged in these services, supplemented to some extent by personal research. It is not confined to companies in this country, but has been extended to the systems of other countries; it embraces rates, service, capitalization and other factors of importance. Congressman Lewis has been much interested in the extension of the parcels post system and it was his study of this matter that led him into the analysis of the telephone and telegraph situation. It is not possible to learn just what use will be made of the data accumulated by Congressman Lewis, but they will be embodied in an exhaustive report.

## Jovian Records Broken in St. Louis

St. Louis Jovians are having something to say about the remarkable rejuvenation in that city on Oct. 1. It was the greatest in the history of the Jovian order, 259 candidates being initiated. In addition, the local statesman, Mr. F. D. Beardslee, has the distinction of bringing into the organization more new members in one year than any other statesman. The ceremonies were held in the Odeon Building, and Mr. Beardslee was assisted by a number of prominent Jovians, including Messrs. Ell C. Bennett, national Mercury, St. Louis, and George C. Richards, of Chicago, statesman.

Among the candidates who were initiated were Messrs. James E. Allison, formerly of the St. Louis Public Utility Commission; E. R. Kinsey, president of the Board of Public Improvements of St. Louis; C. L. Holman, president of the Laclede Gas Light Company; W. H. Whitton, secretary and treasurer of the Laclede Gas Light Company, and Frank Adam, of the Frank Adam Electric Company. Mayor Kiel of St. Louis had signed an application, but was unable to be present. The degree team, which did its work with the greatest smoothness, was made up as follows: Jupiter, Mr. George E. Cullinan; Hercules, Mr. H. Spoehrer; Vulcan, Mr. John P. Casey; Mercury, Mr. O. E. Hines; Pluto, Mr. Burt Crouch; Avrenim, Mr. A. C. Cornell; Mars, Mr. Lee Rosebrough; Neptune, Mr. P. B. Gilroy; Apollo, Mr. T. T. Richards. In addition there were a large number of "imps" and escorts. Over 500 Jovians and candidates assembled in the Odeon Building at 6:30 p. m., when a buffet luncheon was served. Mr. Thomas H. Bibber, of New York, gave an entertaining monologue, and Mr. Sam A. Hobson, of Chicago, past Jupiter, delivered an address on the history of the Jovian Order. Taken altogether, the rejuvenation and joviation were about the biggest things ever "pulled off" in Jovianism.

## Future of Associations

Mr. C. H. [illegible], secretary of the [illegible] and Electric Association, read a paper at the annual meeting of the association in New York on Oct. 2 in which he recommended various changes in the [illegible] this country.

There is a more or less prevalent opinion among lighting men, Mr. Chapin said, that association work is demanding too much time and is costing too much money. Statements of this kind do not question the value of associations but rather indicate the feeling that there is much useless duplication of effort and waste of time and money.

Associations can very properly be divided into two classes, (a) those composed of individuals and (b) those composed of corporations. The individual joins an association for the purpose of learning, through conference with others engaged in the same or similar line of endeavor, of improvements and advances in the industry, and in order to increase the value of his services either to his employer or to his clients, or he may also have the altruistic purpose of giving to his profession the benefit of his personal experience and thought. Gas and electric corporations are interested in this class of associations because they appreciate that the technical discussions tend toward greater efficiency and because the knowledge obtained by the individual employees redounds to the benefit of the employer.

A corporation joins an association of the second class realizing that there are many matters that can be handled most economically and effectively through co-operation with others, that uniformity of methods and practices is desirable so far as possible, that there is always something useful which may be learned from intercourse with others and that no public service corporation can or will be judged solely on its own merits or demerits, but that such judgment is influenced to a very considerable extent by the merits or demerits of others and that therefore frequent conference is necessary and advisable.

Mr. Chapin added that since the organization of most of the existing associations conditions in the industries in which we are interested have undergone great changes. The effects of these changes have been threefold: First, the two industries, the supplying of gas and the supplying of electricity to the public, which formerly were highly competitive, have been brought into such harmonious relations that they are now commonly referred to merely as two branches of one business; second, the adoption of the policy of regulation by state commissions has emphasized the importance of the state organization as a means for handling questions which, although local to a single state, are general throughout that state; third, the holding companies, with properties in a number of states, make necessary some sort of a clearing house or central organization.

Eliminating all considerations of existing associations and assuming a fresh start together with an entirely clear field, would not the above conditions be met by having a local gas and electric association in each state as the working unit and by then having a National Gas and Electric Association, composed of these state associations and supported by them? This National Gas and Electric Association would be the association of the second class corresponding to the American Engineering Association suggested by Dr. William McClellan in his paper before the American Institute of Electrical Engineers last June.

Mr. Chapin stated that the benefits of the scheme would be as follows: First, each operating company would belong to but one organization; second, the large amount of duplication in work which occurs under the present arrangement would be eliminated; third, the matters of public policy in any state would be in the hands of persons actually operating in that state; fourth, the companies would not be compelled to send their representatives long distances to conventions at large expense; fifth, the meetings would be smaller than is the case with the national conventions and therefore allow for freer discussion and greater informality than obtain in these gatherings.

## Wilson-Simmons-Underwood Tariff Bill

The new tariff bill was signed on Oct. 3 by President Wilson and became law. As a whole, a decided reduction in rates has been made, particularly on foodstuffs, fabrics and items of large consumption and general use. In the tabulation following appear the comparative rates under the old and the new law on some of the items of interest to the electrical industry.

COMPARATIVE TARIFF RATES

| Items | Old | New |
|---|---|---|
| Acid: | | |
| [illegible] | [illegible] per lb. | Free |
| [illegible] | [illegible] | Free |
| [illegible] | [illegible] | Free |
| [illegible] | [illegible] | Free |
| Magnesia, calcined | 7c. per lb. | 3½c. per lb. |
| [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | 15% |
| [illegible] | [illegible] | [illegible] |
| [illegible] | 5c per lb. & 20% | 4c. per lb. |
| per lb. or under | 5c. per lb. & 20% | 25% |
| Valued above 15 cents per lb. | 10c. per lb. & 20% | 30% |
| Cut or mica splittings, built-up mica: | | |
| [illegible] | [illegible] per lb. & 20% | 30% |
| Ground | 20% | 15% |
| China and porcelain wares, not decorated | 55% | 50% |
| Carbon: | | |
| Electrodes for electric furnaces and batteries, brushes | 30% | 25% |
| [illegible] | [illegible] | 10% |
| For electric lighting, made entirely from petroleum coke | 35c. per 100 ft. | 15c per 100 ft. |
| For electric lighting, made chiefly from lampblack or retort carbon | 65c. per 100 ft. | 40c per 100 ft. |
| For flaming-arc lamps | 35c. per 100 ft. | 30% |
| Pots for electric batteries | 20% | 15% |
| Glass: | | |
| Incandescent electric light bulbs or lamps with or without filaments | 60% | 30% |
| Steel Alloys: | | |
| Titanium, tantalum and tungsten metal valued at $200 per ton or less | 25% | 15% |
| Valued at over $200 per ton | 20% | 15% |
| Iron or Steel Sheets: | | |
| Valued at 3 cents per lb. or under | 5-10c. per lb. | 12% |
| Valued at over 3 cents per lb. | 30% | 12% |
| Or other metal ball or roller bearings | 45% | 35% |
| Railway fish-plates or splice bars | 3-10c. per lb. | 10% |
| Sheets or strips coated or galvanized —additional | 2-10c. per lb. | 10% |
| Sheets or plates with layers of copper, [illegible] or other metal imposed thereon | 40% | 15% |
| Wires: | | |
| Telegraph, telephone and other wires and cables of metal and rubber | 40% | 20% |
| [illegible] coated with metal — additional | 2-10c. per lb. | 20% |
| Not otherwise provided for | 45% | 20% |
| Aluminum: | | |
| Scrap alloys | 7c. per lb. | 2c. per lb. |
| [illegible] | [illegible] | 3½c. per lb. |
| Plates, sheets, bars, rods | 11c. per lb. | 3½c. per lb. |
| German silver | 25% | 15% |
| Copper: | | |
| In rolled plates, sheets, rods, strips, pipes and bottoms | 2½c. per lb. | 5% |
| Sheathing or yellow metal | 2c. per lb. | 5% |
| Nickel alloy pigs, bars, ingots, rods or plates | 6c. per lb. | 10% |
| Sheets or strips | 35% | 20% |
| Quicksilver | 7c. per lb. | 10% |
| Steam engines and machine tools | 30% | 15% |
| Railroad ties, telephone, trolley, electric-light and telegraph poles of cedar or other wood | 10% | 10% |
| Indurated fiber ware not provided for | 35% | 25% |
| Manufactures of amber, asbestos or wax not provided for | 25% | 10% |
| [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | 20% |
| [illegible] | Free | Free |
| Manufactures of India rubber or gutta [illegible] | [illegible] | 10% |
| Crude | Free | Free |
| Manufactures of hard rubber not provided for | 35% | 25% |
| Crude bauxite | $1 per ton | Free |
| Beeswax | Free | Free |
| Coal: | | |
| Anthracite | Free | Free |
| Bituminous and shale | 45c. per ton | Free |
| Culm and slack | 15c. per ton | Free |
| [illegible] | [illegible] | Free |
| [illegible] l lava | Free | Free |
| [illegible] and oxide | Free | Free |
| [illegible] ratus | Free | Free |
| [illegible] nventions | Free | Free |
| Philosophical and scientific apparatus for experimental purposes only | Free | Free |

## Society for Electrical Development Activities

The Society for Electrical Development will issue shortly a list of its members as of Oct. 1, 1913. The list will be published in pocket-size booklet form and will be mailed to members of the society, who now number over 600. Only partial returns have been received by the society from the Jovian campaign for membership. None of the forty-five Jovian leagues has reported to Jovian headquarters, as they are expecting to make their final returns at the close of the campaign on Oct. 31. The membership campaign committee, of which Mr. W. E. Robertson, of Buffalo, N. Y., is chairman, has decided to call the last week in October "pioneer member week," and every effort is being made by this committee as well as the Jovians to secure the largest possible number of members during that time.

## Proposed Training School for Electric-Vehicle Operators

At the weekly luncheon of the Chicago Section of the Electric Vehicle Association of America on Sept. 30 there was a general discussion of the proposal of Mr. George Harvey Jones, former chairman of the section, that there be established a training school for operators and handlers of electric vehicles. It is felt that a good working knowledge of the construction and operation of electric passenger cars and trucks by drivers, chauffeurs, garage owners and attendants would be of great benefit, not only to owners of vehicles but to manufacturers as well, for many times a car obtains a bad name when the trouble is entirely due to neglect of the battery or some other operating cause. The American Express Company now operates a private school of this sort on a small scale in Chicago, and the Chicago Central Station Institute operates a school for the commercial training of electrical men. It is felt that possibly by taking advantage of these existing agencies to some extent a distinct electric-vehicle training school can be built up in Chicago that will be of very great practical advantage. Chairman Niesz appointed as the educational committee to have charge of this project Messrs. George H. Jones, Commonwealth Edison Company; Ernest Lunn, Walker Vehicle Company; William C. Little, Borland-Grannis Company; C. B. Frayer, Edison Storage Battery Company; G. M. Atkin, Electric Storage Battery Company; D. C. Arlington, Philadelphia Storage Battery Company, and Harry Salvat, Fashion Garage.

## Electric-Rate Discussion in Chicago

Meetings of the Chicago City Council committee on gas, oil and electric light, which is considering the proposed reduction of rates of the Commonwealth Edison Company, were resumed on Oct. 2. Mr. Edward W. Bemis, public-utility expert, had been asked to confer with Mr. Ray Palmer, the city electrician, in relation to preparing a report supplementary to Mr. Palmer's report on the Commonwealth Edison Company of last May. In a letter to Mr. Palmer which was read, Mr. Bemis discussed briefly the subjects of going value and depreciation. In relation to going value Mr. Bemis advised that a number of items allowed in the Palmer report be rejected. These related to the proportion of the purchase price paid by the Chicago Edison Company and the Commonwealth Electric Company for the good-will and business of acquired properties, which amounted to about $3,000,000. Mr. Bemis also held that free wiring should not be capitalized for rate-making purposes. In relation to depreciation he approved the annual allowance for depreciation made in the Palmer report—about $2,000,000—but he objected to an item of about $3,600,000 listed in the Byllesby appraisal of 1908 as accrued depreciation.

Commenting on Mr. Bemis' letter, Mr. Palmer said that in making valuations on the original-cost basis going value is a proper charge. The acquirement of properties with their "intangible values" is a legitimate charge with the end in view of reducing rates. The speaker pointed out that the Sanitary District of Chicago, a municipal corporation, has made an allowance for going value in its negotiations with the city of Chicago in the matter of fixing rates for electrical energy used for street lighting. In these negotiations the Sanitary District asked, and was allowed, 21 per cent of its net total physical valuation for going value. The city electrician also contended that it was fair to allow the Byllesby accrued depreciation. He urged the committee to adopt his report and said that a saving to customers of about $636,000 a year could be effected thereby. The committee would do well, he thought, to arrive at some conclusion with the company, if possible, before the State Public Utilities Commission of Illinois comes into existence on Jan. 1 next. He pointed out that if the company refused to accept the City Council's proposal the subject would no doubt go before the state commission, when constituted, anyway.

## Colorado Electric Light, Power and Railway Association at Glenwood Springs

The eleventh annual convention of the Colorado Electric Light, Power and Railway Association was held at the Hotel Colorado in Glenwood Springs, Col., Sept. 25 to 27 inclusive. As planned originally the convention and an electric show to be given under the auspices of the Colorado Electric Club were to be held jointly in Denver during the week commencing Oct. 6. Owing to industrial conditions it was decided at a preliminary executive meeting to hold the convention earlier, and because of the recent Knights Templar Conclave in Denver the electric show has been postponed indefinitely.

Delegates from Denver and vicinity were conveyed to Glenwood Springs in four special cars attached to a regular Denver & Rio Grande train leaving Denver on the evening preceding the convention. Other members were picked up at stations en route. The morning of Sept. 25 was spent in visiting the sulphur baths and in excursions to places in the vicinity of Eagle Canon. The convention began on Thursday afternoon with a few remarks from President W. N. Clark, of Canon City. Following him, Mr. W. H. Bullock, of Denver, read a paper entitled "Industrial Motor Appliances." Mr. Artemus E. Ward, of Boulder, described a "cash register system" and went into details on methods of accounting. An interesting demonstration of the "lung-motor" given by Mr. E. S. Tyler, of Chicago, terminated the first session.

Friday morning's session was very short, only two papers being read. Mr. B. C. J. Wheatlake, of Denver, read the first paper, which was entitled "Lightning Arresters." Although the paper had been read before another association, considerable discussion followed. Mr. Charles Neely, of Cripple Creek, read a short paper on "Joint Pole Usage," but his remarks were limited chiefly to lightning arresters. Following the morning session the members enjoyed a swim in the natural hot-sulphur spring.

Mr. R. E. Campbell, of Cleveland, Ohio, delivered the first paper of the afternoon session. His topic was on "The Relation of the Incandescent Lamp to Lighting Service." Other papers were read as follows: "The Central Station in the Small Town," by Mr. H. L. Titus, of Sterling; "The Use of Single-Phase Motors from the Central Station Standpoint," by Mr. W. A. Layman, of St. Louis, Mo. (read by Mr. O. H. Davidson, of Denver), and "The Central Station Off Peak—Its Remedy," by Dr. Melcher Eckstromer, of Denver.

On Friday evening a banquet was held at the Antlers, at which about sixty-five were present. Mr. R. E. Hallett of Colorado Springs, acted as toastmaster.

The first part of Saturday morning's session was devoted to answering questions which had been contributed to the Question Box. Mr. H. S. Russell, of Denver, had charge of this discussion. About fifty-six questions were discussed relating to power plant operation, lines and transformers, wiring and lamps, meters, commercial problems, management and miscellaneous subjects. Mr. D. L. Webb, of Denver, and Mr. R. L. Holland spoke on "Public Utility Bills" and "Tax Commissions" respectively.

Reports of committees followed. The committee considering the question of affiliation with the National Electric Light Association reported that such a step was inadvisable at this time. The committee, of which Mr. W. C. Sterne, of Denver, is chairman, was continued with instructions to investigate the subject further.

A committee was also appointed, with Mr. W. G. Matthews, of Denver, as chairman, to report on the Dostal drop-out for foreign wire crossings in comparison with other methods.

Mr. John J. Cooper, of Denver, chairman, submitted the recommendations of the nominating committee, which were accepted. The following officers were elected:

Mr. W. C. Sterne, vice-president and general manager of the Summit County Power Company, Denver, president;



PRESIDENT ELECT W. C. STERNE

Mr. W. F. Raber, general manager of the Arkansas Valley Railway, Light & Power Company, Pueblo, vice-president; Mr. T. F. Kennedy, superintendent of sales of the Denver Gas & Electric Light Company, secretary-treasurer. The executive committee comprises Messrs. W. J. Barker, general superintendent of the Denver Gas & Electric Light Company; H. U. Wallace, general manager of the Northern Colorado Power Company, Boulder; L. P. Hammond, general manager of the Colorado Power Company, Denver; W. F. Raber and W. C. Sterne.

Mr. W. C. Sterne, the newly elected president of the Colorado Electric Light, Power and Railway Association, was born in Peru, Ind., in 1869. Following his graduation from Harvard in 1891, Mr. Sterne went abroad in the capacity of newspaper and magazine correspondent. He returned to this country and settled on a ranch in Littleton, Col. For the last ten years Mr. Sterne has been connected with the electrical business either as financier or as an executive head. Until 1909 he was located in Littleton, but since then he has lived in Denver. While in Littleton Mr. Sterne financed the building of the Arapahoe Electric Light & Power Company. Mr. Sterne is president and general manager of this company and is vice-president and general manager of the Summit County Power Company, which is a Doherty property. In addition to these positions he holds the following offices: president and general manager of the Arvada Electric Company, supplying a portion of Jefferson County, president and general manager of the Fort Lupton Light & Power Company, vice-president and general manager of the McCook (Neb.) Electric Company, and president and general manager of the Municipal Properties Investment Company, which is the holding company of all the Colorado companies mentioned with the exception of the Summit County company. During the years 1905-06 Mr. Sterne was president and general manager of the Laramie (Wyo.) Light & Power Company.

## Convention of Atlantic Gas & Electric Company

The first annual convention of officers, managers and employees of the Atlantic Gas & Electric Company, which owns and operates a number of public utilities in the East was held at the Waldorf-Astoria, New York City, Oct. 2. The morning session was given over to the operating and commercial men, while in the afternoon broad policies of utility management were discussed by bankers, attorneys and accountants connected with the associated companies.

Mr. A. D. Lord, president of the Atlantic Gas & Electric Company, opened the convention with a brief address, after which short papers were presented by Messrs. C. M. Pihl, Eastern Pennsylvania Power Company, Easton, Pa., on "Co-operation Toward Better Relations with and Increased Efficiency of Employees"; R. W. Kiple, vice-president of the Gas and Electric Demonstrator, the Atlantic company's publicity subsidiary, "Merchandising Gas and Electric Appliances"; S. H. Dailey, vice-president and general manager Binghamton (N. Y.) Light, Heat & Power Company, "Power Extensions"; W. B. Ross, Binghamton, N. Y., "Industrial Power"; C. W. Lee, New York, "Points of Contact with the Public"; H. W. Brunell, Gas and Electric Demonstrator, "Power-Factor and Load-Factor"; T. M. R. Meikleham, Meikleham & Dinsmore, New York, "Loyalty"; F. S. Nicholson, Sayre (Pa.) Electric Company, "Problems in Developing the Small Scattered Territory"; E. J. Hutter, mechanical engineer Atlantic Gas & Electric Company, "The Engineering Department"; G. B. Cornell, chief engineer Atlantic Gas & Electric Company, "Water-Powers"; Louis Saxon, electrical engineer Atlantic Gas & Electric Company, "Electrical Systems of Generation and Distribution"; W. H. Yeomans, manager steam-heating department Eastern Pennsylvania Power Company, "Steam Heating." An address by Mr. Frank M. Tait, Dayton, Ohio, was expected, but in Mr. Tait's absence Mr. Daniel M. Lord, formerly head of the Lord & Thomas advertising agency, gave a brief, enthusiastic talk on advertising. A buffet luncheon was served to the members and guests in one of the convention rooms.

At the afternoon meeting papers and talks were given by Messrs. Edgerton Parsons, Mather & Company, insurance brokers, New York, on "Public Utility Insurance"; J. J. Livingston, Detroit Trust Company, "Interdependency of Operators and Financial Managers"; T. C. Perkins, T. C. Perkins, Inc., Hartford, Conn., "Organization Features of the Atlantic Gas & Electric Company"; F. V. Shaw, treasurer of the Atlantic Gas & Electric Company. "Accountant in Public Service Corporations"; O. H. Oxford, auditor Atlantic Gas & Electric Company, "Auditing Gas and Electric Acounts"; N. W. Fox, attorney, Easton, Pa., "Courteous Treatment of the Public"; F. C. Culver, counsel Atlantic Gas & Electric Company; Theodore Beran, General Electric Company, "Address to the Young Men"; W. T. Meikleham, "My Connections with the Atlantic Gas & Electric Company"; C. A. Paul, Meikleham & Dinsmore, "The Philadelphia Investor"; F. W. Low, engineer of construc-

tion Atlantic Gas & Electric Company, "Plant Conditions," and J. S. Eaton, broker, "The Need of Correct Public Policy." At the close of the meeting Mr. G. S. Rose, of the General Electric Company, explained the principles of operation of the new nitrogen-filled "high-efficiency" incandescent lamp and exhibited a 1000-watt unit.

In the evening a banquet was given in the Myrtle Room of the Waldorf-Astoria for the directors, officers, managers, engineers and guests of the association.

## High-Voltage Direct-Current Locomotives for Canadian Northern Railway

As the eastern end of the Canadian Northern Railway, the new transcontinental line now being built, Montreal will have the distinction of being the first city in which the railway terminal was electrified when initially opened for service. There will be 10 miles of double track, though the Mount Royal Tunnel between the passenger and freight terminals in the city of Montreal and the Cartierville yards, where the trains will change from steam to electric locomotives.

An order has been placed with the General Electric Company for seven locomotives, eight multiple-unit motor-car equipments and complete substation apparatus. Direct-current energy will be furnished to the locomotives and cars at 2400 volts. The motors will be commutating-pole machines insulated for 2400 volts, but will be operated two in permanent series with 1200 volts across each motor. Each locomotive will weigh 80 tons and will be equipped with two four-wheel trucks articulated together with four motors geared to the drivers through twin gears.

Energy for operating the locomotives and motor cars will be purchased in three-phase, 60-cycle, 11,000 volt-form. It will be transformed to 2400-volt direct-current energy by means of motor-generator sets, each of which will consist of a 2100-kva, 11,000-volt synchronous motor driving two 750-kw, 1200-volt commutating-pole generators connected in series. At first there will be two sets, but later a third will be added, bringing the rating up to 4500 kw.

Mr. W. C. Lancaster, electrical and mechanical engineer on the Montreal tunnel and terminal construction for MacKenzie, Mann & Company, Ltd., is in charge of both the design and installation of the electrical equipment.

## Meeting of the Empire State Association

The Empire State Gas & Electric Association had an interesting and varied program at its ninth annual convention, held in the Engineering Societies Building, New York, Oct. 2. The association makes it a practice to hold its annual meetings in New York City and most of its other sessions at various points throughout the State. A new feature which contributed greatly to the success of this meeting was the participation of Mr. Martin S. Decker, chairman of the New York Public Service Commission, Second District, and Mr. Milo R. Maltbie, member of the First District commission, who spoke on public service questions.

After the opening formalities, the annual address of the president was read by Mr. C. G. M. Thomas, who reviewed carefully the work of the year in all directions.

Among the matters which received the attention of the executive committee during the year was an article in an important New York City daily paper stating that food, fuel and lighting all cost more than at any other time within the last thirty years. The article originated in the Bureau of Labor Statistics at Washington. The executive committee instructed the secretary of the association to protest against the statement that lighting cost more. The Bureau of Labor Statistics replied that "lighting" referred to candles and matches and courteously agreed to change the heading of future articles.

During the coming session of the Legislature undoubtedly further attempts will be made to establish districts within which political bodies of some kind may generate electric energy employing the so-called surplus water-power owned by the State. This matter must have careful and continuous attention by the association, and members cannot serve their interests better than by supporting the work of the committee in charge of this subject through suggestions to the executive committee.

Mr. Thomas added that compulsory liability and state insurance is a live issue. No industry does more for the care of its injured employees than the lighting industry. The cordial relations now existing between the companies and their employees arouse jealousy in the labor agitator who would supplant voluntary care with compulsory liability, though the latter provides less compensation to the injured and, by taking the process of settlement away from the members and giving it to a politically appointed commission, would end personal relations between the company and its men.

Mr. Thomas further suggested the need for earnest constructive work in outlining employment for the so-called surplus waters of the State in other channels than the generation of electric energy and its sale to the public by the State. It had been suggested that the storage of water for the prevention of floods and its use for irrigation would be much more profitable for the entire State than destructive competition with an important industry. The appointment of a committee on safety was recommended by Mr. Thomas.

Mr. Stuart Wilder, Westchester Lighting Company, presented his report as treasurer. Mr. C. H. B. Chapin, secretary, made his report.

### Meter Committee

Mr. C. G. Durfee, Rochester Railway & Light Company, chairman of the committee on electric meters, read the report of this committee, the other members of which are Messrs. S. G. Rhodes and L. Heaton.

The committee has been in touch with the meter committees of the Association of Edison Illuminating Companies and the National Electric Light Association and has confined its activities to keeping informed as to the development of the meter art, especially with reference to the development by various manufacturers of lower-priced watt-hour meters and maximum-demand meters.

The committee said in regard to the order on meters issued by the Public Service Commission, Second District, on July 3, 1913:

"It would appear to the committee as if the order merely contemplated the retirement of certain old and undesirable types of meters which may still be in use in certain parts of the State. The first part of the order, for instance, specifies the removal of commutator types of meters from alternating-current circuits. The committee feels that no member-company would object to this policy of retiring this type of meter from such use.

"The second part of the order, however, while probably drawn with the intention of retiring other old types, namely, the ampere-hour meters, has been so worded as entirely to prohibit the present or future use of any types of ampere-hour meters for either alternating-current or direct-current service. The order, therefore, plainly blocks or discourages the development of a type of meter which is very widely used and approved abroad and which is considered a most favorable line of development by the American manufacturers. We do not feel that it was the intention of the commission thus to discourage future development."

At the suggestion of the committee, it was decided that

the matter should be brought to the attention of the commission.

Mr. James T. Hutchings, chairman of the committee on electric vehicles, made a verbal report, recommending that steps be taken to provide for the charging of electric pleasure vehicles at certain points where facilities are not furnished now so as to promote trips between New York and Buffalo. He said that route maps should be prepared showing several routes between New York and Buffalo and side trips. He believed that much interest could be aroused in these trips.

Mr. Arthur Williams made a verbal report for the conservation committee, outlining the work done during last year.

Mr. A. D. Dudley, Syracuse, called attention to the advertising campaign proposed by the National Commercial Gas Association. This was described at length by Mr. T. R. Elcock, United Gas Improvement Company. The association indorsed the plan and referred it to the executive committee for action.

Mr. J. M. Wakeman presented the plans of the Society for Electrical Development. He said that it was not intended to interfere with the plan for gas development. Many members of the society are interested in both forms of service. The society now has a list of more than 600 members fairly well distributed between the different branches of the industry. The plan of the society was approved by the association.

Invitations were received from the Consolidated Gas Company and the New York Edison Company to visit the showrooms of those companies.

The association then adjourned for lunch, which was served at the Engineers' Club. At the conclusion of the lunch President Thomas expressed the appreciation of the members of the presence of Chairman Decker of the Second District commission and Commissioner Maltbie of the First District commission.

### Talks by Public Service Commissioners

Mr. Decker spoke on "Public Service by Private Corporations." He said that while the companies generally have no active competition in their communities, the potential competition under the existing form of government is a restraining influence that is bound to have effect. He said that the public service commissioners are interested in the welfare of the companies furnishing public utility service as well as in the welfare of those who buy that service.

The public service corporations, Mr. Decker said, should popularize their service. There is no reason why electricity should not be used to operate the sewing machine and other articles in the home. The most common use of public utility service at the most reasonable price would conserve the revenues of the companies. There should be saturation by service of the greatest possible public demand.

Mr. Maltbie, speaking on "The Advantages of Public Utilities," told his hearers that they are supplying what have come to be practically necessities of life. He referred to the interruption of subway and other transportation service last week as a result of the heavy rainstorm and said that it had given everyone a realization of what would happen to the whole scheme of public welfare if a similar interruption occurred to other forms of public service. If the telephone should be discontinued, the electric and gas lights should go out and there should be no transportation service for a few days, a condition of chaos would result.

The fact that corporations have such close relations with the public means, Mr. Maltbie said, that this advantage is offset by the responsibilities they assume. In the last seven years in New York State the feeling of suspicion on the part of the general public that the corporations have something to conceal has been decreased by the willingness of the corporations to show the facts. Mr. Maltbie told his audience that the principal thing to be gained is the confidence of the public. There should be a feeling on the part of the public that it can rely on the statements of the corporations and a feeling on the part of the corporations that they will get fair treatment from the public.

### Accident Prevention

At the afternoon session, Mr. James B. Douglas, United Gas Improvement Company, gave an illustrated talk on accident prevention.

Mr. Victor T. Noonan, secretary of the general safety committee of the Rochester Railway & Light Company, said that this company has, in addition to its general safety committee, twenty-eight sub-committees composed of engineers, foremen and employees. The best results in the reduction of accidents have been obtained from educational methods. Every endeavor is made to get the co-operation of the men. The problem of getting close to the men is solved if their interest is aroused and they learn that the heads of departments are concerned in their welfare.

Mr. W. P. Strickland, general inspector of the New York & Queens Electric Light & Power Company, also spoke on this subject.

Accident prevention was discussed by Messrs. R. M. Searle and J. T. Hutchings, of Rochester; Mr. James O. Carr, of Schenectady, and Mr. F. B. H. Paine, of New York. Mr. Searle suggested that one man be hired to do nothing but take out and bend down nails on boards. Mr. Paine said that the companies should inspect their men as well as their materials and should assume the responsibility for correcting the men.

### Fire Prevention

Mr. Bruce E. Loomis, Marsh & McLennan, New York, read a paper on "Fire Prevention." He said that slowly but surely the fire insurance companies have come to the conclusion that gas and electric properties are not such serious hazards as was generally thought a few years ago. Rather discouraging experiences for a number of years led to a special study of these classes and careful inspection of the circumstances in each fire.

A digest of the causes of 100 fires in power houses was shown, which emphasized the mistake of building these properties of anything but non-combustible materials. Lightning in transformer houses appears to be more of a hazard than in other buildings.

The use of non-combustible boiler-house construction and the replacing of wood floor with concrete were suggested by Mr. Loomis as preventive measures.

Mr. Loomis said he was firmly convinced that by careful inspection and the carrying out of improvements, often very simple, any rate could be secured that a company is willing to pay irrespective of the construction of the properties. The insurance companies make hard and fast rules, yet in many instances something "just as good" can be substituted and sometimes the rate can be cut in two.

Mr. C. H. B. Chapin, secretary of the association, read a paper on the "Future of Association Work," an abstract of which is published elsewhere in this issue.

President Thomas said that Mr. Chapin's paper was presented with the approval of the executive committee and that the ideas which it contained should receive careful consideration.

Mr. F. C. Bates, General Electric Company, displayed two lamps, one an old-style 500-cp lamp and the other a 1000-cp nitrogen-filled lamp.

The election of officers resulted as follows: President, Mr. James T. Hutchings, Rochester; first vice-president, Mr. J. C. De Long, Syracuse; second vice-president, Mr. E. H. Palmer, Auburn; treasurer, Mr. Stuart Wilder, Mount Vernon; secretary, Mr. C. H. B. Chapin, New York; executive committee, Mr. C. G. M. Thomas, Long Island City; Mr. C. A. Graves, Walton, and Mr. H. M. Beugler, Poughkeepsie.

## Alexanderson Single-Phase Locomotives

The adoption by the Norfolk & Western Railway Company of the split-phase type of locomotive for the Bluefield (W. Va.) section of its main line, as described on page 268 of our issue dated Aug. 9 and on page 367 of the issue for Aug. 23, directs attention anew to the subject of phase converters. The split-phase locomotive equipment comprises a number of polyphase induction motors which are inherently of the constant-speed type, a phase converter, and any system of control of the motors which would be used in a polyphase system. The only features added are the phase converter and its controller, a very simple piece of apparatus.

On page 221 of our issue of July 22, 1911, there was given an outline of a method for operating polyphase motors from single-phase circuits described by Mr. E. F. W. Alexanderson in a paper before the American Institute of Electrical Engineers. In this paper the author discussed the theory of the phase converter and reported the results of experiments which indicated the correctness of his theory. Even with the 25-kw equipment employed in the tests the efficiency of conversion was nearly 90 per cent, although the power-factor was low. The experiments, however, were so satisfactory that preparations were made immediately for carrying them out on a larger scale and in heavy electric traction work.

### Principles of the Phase Converter

Any polyphase motor can be operated as a single-phase motor by connecting one phase to the line and giving the

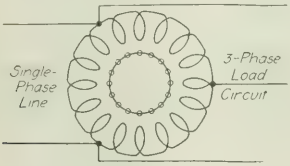



FIG. 1—SHUNT-CONNECTED PHASE CONVERTER

motor a start. The latter will then run at a speed somewhat less than its polyphase speed, and at no load its speed will be practically synchronous. From all of the primary windings, including these not connected to the line, polyphase current can be taken off. (See Fig. 1.) In this case the alternating flux produced by the line current is cut by the conductors of the rotating secondary, which may be either squirrel-cage or phase-wound. The resulting secondary current in turn produces a magnetizing force out of phase both in time and in space with the flux which produced it, and having such a direction that, when combined with the first flux, a rotating field is produced. This rotating field cuts the primary windings not connected to the line and generates emf in them. Thus in a simple manner is produced a converter for changing single into polyphase current.

When no current is drawn in the three-phase circuit the phase voltages are equal and balanced in phase position. When the three-phase circuit is loaded the simple converter described is not commercially satisfactory, as the phase voltages are badly unbalanced.

As developed by Mr. Alexanderson for the General Electric Company, the line phase of the converter is connected in series with one phase of the motor and the second phase of the converter is in series with the other phase of the motor. This arrangement reduces the phase displacement between emfs. By means of an autotransformer, or (as shown in Fig. 2) extra turns on the secondary of the main transformer, a part of the line emf is introduced into the second phase to correct for phase displacement and reduction of the induced emf. An exciting winding is placed on the rotor of the converter in addition to the squirrel cage and is furnished with synchronous exciting current from a small exciter. This permits the elimination of the exciting current from the main windings and greatly improves the power-factor.

Referring to Fig. 2, it will be noted that the trolley voltage is reduced by means of a transformer. This will in

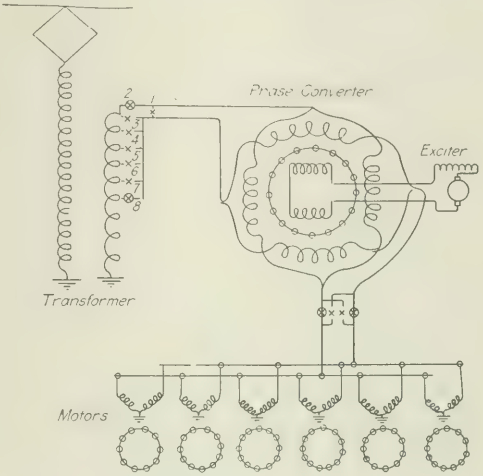



FIG. 2—SERIES-CONNECTED PHASE CONVERTER

general be necessary, as it will not be economical to insulate motors for the line potentials which will usually be employed—that is, 10,000 volts or more. The secondary of the transformer is provided with numerous taps for the purpose of varying the applied voltage, and thus the motor speed, and for supplying the compensating voltage in the second phase. The motors are connected permanently in parellel with a reversing switch in the leads connecting them with the converter.

The operation of the converter will be clearer after a study of Fig. 3, which is a vector diagram of voltages and currents in the circuits shown diagrammatically in Fig 4.

### Emf Relations

In Fig. 3 the horizontal line $OO'$ represents the line volts, $V_l$. This voltage is consumed in the converter

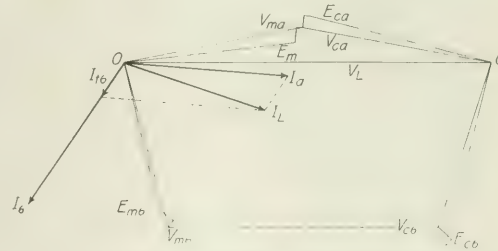



FIG. 3—VECTOR DIAGRAM BASED ON CIRCUITS OF FIG. 4

counter-emf $E_{ca}$ (Fig. 3), in the motor emf $E_m$, and in the impedance drops in converter and motor.

By induction an emf $E_{cb}$ is generated in the second phase of the converter in time quadrature with $E_{ca}$ because the windings are in space quadrature. A part of the line voltage, $V_{tb}$, is introduced into phase $b$ and the vector sum of it and $E_{cb}$ is delivered to phase $b$ of the

motor. This is denominated $V_{mb}$. By the addition of $V_{tb}$ it is brought into practical quadrature and equality with $I_{ma}$ as desired. Finally a part of $V_{ab}$ is used in overcoming the motor impedance, leaving as the motor counter-emf $E_{mb}$.

### Current Relations

By the connection of the phase-*a* windings of the con-

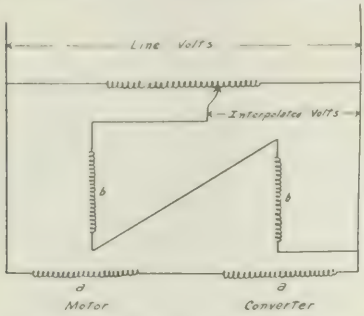



FIG. 4—TWO-PHASE CONVERTER CIRCUITS

verter and motor in series, the former becomes a series transformer the secondary of which produces a current practically equal to, and in time quadrature with, the primary current. This kind of a series transformer differs from the stationary type only in this quadrature relation of the currents. The quadrature relation, as already suggested, is due to the production of the secondary current by the motion of the secondary conductors through the primary flux. The flux is approximately in time quadrature with the primary current, and the secondary current is in time phase with the flux, being produced by motion through it.

Referring then to Fig. 3, it will be noted that a current $Ia$ is drawn through phase *a*, its value and phase position depending upon the load and the impedance of the circuit. There is also drawn through the auto-transformer



FIG. 5—[illegible] AND MOTORS

a current, $I_{tb}$, due to the connection of part of its turns in phase *b*. Its relation to $I_b$, the current in phase *b*, is determined by the proportion of turns included in phase *b*. The line current is the vector sum of $Ia$ and $I_{tb}$.

The current in phase *b*, being the secondary current in a series transformer, is proportional to the primary current, and with the same number of turns in each winding the two should be equal. Moreover, as explained, they should be in time quadrature in this case and would be so but for the presence of impedance and magnetizing current.

The effect of impedance can be eliminated by the auto-transformer voltage. The synchronous excitation eliminates the latter, the theory being as follows: In an ordinary stationary transformer the primary and secondary currents cannot be exactly equal and opposite or there would be no magnetization of the core. The phase displacement is therefore just enough less than 180 deg. to produce a resultant sufficient to set up the required flux. In a two-phase converter the same argument applies to the quadrature relation. With equal currents in quadrature there would be no magnetizing current. The phase displacement then automatically adjusts itself to some value less than 90 deg. to produce the required magnetizing component. In the case of the stationary transformer, if an extra winding carrying time quadrature magnetizing current were introduced the phase displacement could be given the ideal value of 180 deg., or if the extra current were increased above the necessary value the phase displacement would be more than 180 deg. Obviously, the flux could not be

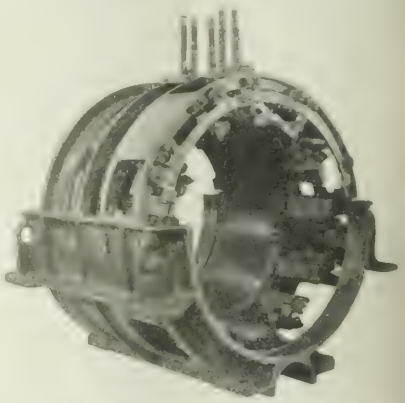


FIG. 6—REPULSION SERIES LOCOMOTIVE MOTOR

increased or the counter emf would be greater than the applied emf. The primary and secondary currents must, then, automatically produce a demagnetizing component to keep the flux at its proper value. In the phase converter an extra winding on the secondary produces any desired phase displacement between $I_a$ and $I_b$, which would be in time quadrature with exact neutralization of magnetizing component. In Fig. 3, $I_{et}$ represents the extra component in quadrature with the theoretical position of $I_b$; that is, exact neutralization of magnetizing component.

A study of Fig. 3 shows that the result of all of the three corrective devices is to produce a good phase balance and a high power-factor.

### Split-Phase Locomotive

As stated before, the General Electric Company some two years ago constructed a locomotive to test the phase converter on a larger scale. An experimental locomotive was equipped with a 200-hp motor arranged as a phase converter. This had a squirrel-cage rotor and was tested with and without an exciting winding.

One axle of this locomotive was equipped with a motor of about 250-hp rating, having a temporary steel cylindrical rotor containing no winding. While this was a make shift, the skin effect in the steel at starting, when the secondary current has line frequency, undoubtedly was of great assistance in producing good starting torque.

With this crude locomotive a number of satisfactory tests were made under very severe conditions. It was accelerated while the trolley contact was frequently interrupted, without any evil effect. As the phase converter runs light, it loses little speed when the supply current is interrupted even for a half minute or so. Its rotor momentum is considerable, and there is no resistance except friction and windage, the excitation failing with the power supply. A still more severe test was the application of full trolley voltage with the locomotive at standstill, the converter running at greatly reduced speed and with the controller at full-speed position. Under these extraordinary circumstances the converter accelerated rapidly and the motor developed sufficient torque to slip the wheels. As a climax the trolley was lowered for a minute with the locomotive at full speed forward, the controller was set for reverse and the trolley returned to position. The motor promptly developed full torque in a reverse direction, slipping the wheels as before.

These tests were so satisfactory that the company proceeded to develop a 1600-hp converter and designed a locomotive now under construction having six motors of 300-hp each intended to produce a 45,000-lb. tractive effort at 15 miles per hour, and one of 30,000 lb. at 22 miles per hour.

On the basis of experimental data now in hand the company's engineers have been able to compute the characteristics of the new equipment as given in Fig. 5. The efficiency and power-factor are both high and remain so over a wide range of output.

### The Repulsion-Series Locomotive

A promising development in single-phase traction equipment was described in an article on page 144 of our issue dated Jan. 18, 1908, based on a paper presented by Mr. Alexanderson before the American Institute of Electrical Engineers. The motor was of the so-called series-repulsion type, with which Mr. Alexanderson's name has been associated for the past five years. As stated in our issue just referred to, the motor is a commutator machine which starts from rest as a repulsion motor and operates under speed as a combined compensated-series and repulsion motor.

The repulsion-series motor has recently been applied to heavy locomotive service by the General Electric Company, which has built the locomotive illustrated above in Fig. 7. The locomotive is of the articulated type, with two driving axles and a four-wheel pony truck to each section. The locomotive is equipped with four 400-hp repulsion-series motors mounted on the truck frame over the jack-shafts, to which they are geared at both ends. Cranks on the jack-shafts are connected to the driving wheels by means of connecting rods, each motor having its own pair of drivers, as shown.

## Progress of Work of California Committee on Inductive Interference

The committee representing the electric-wire interests of California, authorized by the State Railroad Commission to investigate inductive interference between power and communication lines and to make recommendations for commission rulings to prevent undue interference, has had a force of five to eight experimenters and computers in the field since the first of the year. This staff, which is engaged in collecting and computing data, is equipped with a large amount of apparatus, including an oscillograph having three vibrators, noise standards, an impedance bridge, complete equipment for harmonic analyses, and instruments of various kinds. The total value of this apparatus approximates $9,000.

Harmonic analyses are made by two methods. The first employs the oscillograph, the recorded waves of which are greatly improved by a distortion circuit, containing inductance and capacity, which distorts the harmonics approximately according to the square. The second method employs a resonant shunt, utilizing a circuit which contains inductance and capacity so chosen that in combination with the capacity of the telephone line the whole circuit can be made to resonate for any particular frequency or harmonic whose magnitude it is desired to measure. The tiny currents so obtained, which are too small for direct measurement, are passed through a telephone receiver, and the amount of noise produced therein is equated with the noise developed by a current of sinusoidal wave shape derived from a Vreeland oscillator. The noise standard referred to measures volume of sound by equating the noise set up by the complex induced wave with the noise produced by a pure 240-cycle sine wave.

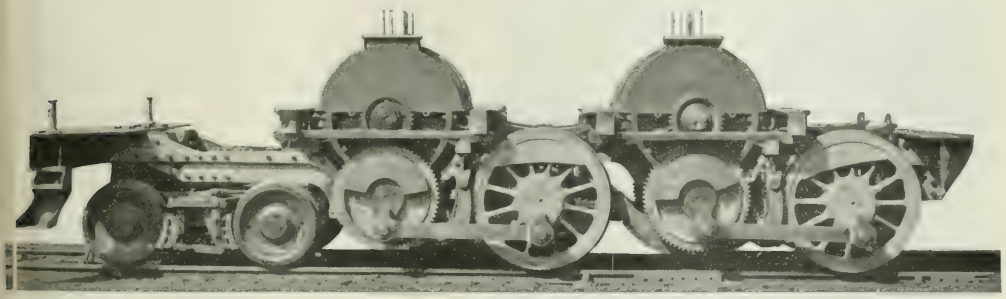


FIG. 7—DRIVING AND PONY TRUCKS OF ARTICULATED REPULSION-SERIES LOCOMOTIVE

The parallels on which this investigation work has been completed are four in number, all involving the main trunk line of the Bell system between San Francisco and Los Angeles. This lead comprises ten copper physical circuits, part being loaded and some being made into phantoms. The high-tension exposures, all of 60-cycle frequency, are: (1) a 57,000-volt line, 20 miles long; (2) a second section of the same line, 8 miles long; (3) a 22,000-volt line, 16 miles long, and (4) a 33,000-volt line, 40 miles long.

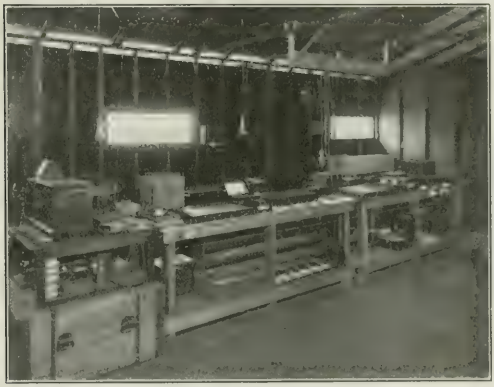
In all cases the telephone line is on one side of a public highway and the power lines are on the other side, with an average separation of 60 ft. The power lines of the two separate companies also overlap for 10 miles, and since they are operated from sources not in synchronism and neither one can be shut down to enable the influence of the other to be independently measured, the difficulties of analyzing inductive effects have been greatly increased. Again, since both telephone and transmission lines are parts of main trunks, the difficulty of isolating sections of these lines has added to the difficulties of testing.

The Sierra transmission system is operated with a solidly grounded neutral, enabling the investigators to make a thorough comparison of the inductive effects of, first, a neutral ground beyond one end of the exposure, and, second, a neutral ground beyond each end of the exposure, the latter condition giving a return path through ground for unbalanced currents in the line conductors. On the other hand, the Coast Counties system is operated without a grounded neutral, affording a certain number of comparative data between grounded systems and ungrounded systems.

Thorough investigations have also been made of residual and balanced currents and voltages in the power systems, of the shielding effects of other wires on the telephone lead, of the existing transposition systems in both the power and telephone lines, and of the relative locations of the power and telephone transpositions.

Analysis of the inductive effects has proved laborious on account of the large number of different forms of induction in action simultaneously. These may be listed as: (1) electrostatic and electromagnetic, (2) effects of balanced and of residual currents or voltages, and (3) longitudinal and transverse induction.

Longitudinal induction is that which sets up an emf between a wire and ground or a current through a wire with a ground return; transverse induction is that which sets up



INTERIOR VIEW OF LABORATORY, SHOWING TESTING APPARATUS

an emf between two wires or a current in a circuit made up of two wires without a ground connection. Obviously, transverse induction is of chief interest in telephonic interference. Each form of induction, both transverse and longitudinal, is due in part to electrostatic and in part to electromagnetic influence. Any one of the four effects of transverse electrostatic, transverse electromagnetic, longitudinal electrostatic and longitudinal electromagnetic is also due in part to balanced currents or voltages and in part to residual currents or voltages. In order, therefore, to make a complete study of transposition each of the eight effects must be considered independently. The transposition problem is further involved by the necessary transposition of the telephone wires between themselves to avoid cross-talk, which in itself becomes elaborate on a heavy load.

For the exposures so far investigated it has been impossible to get enough transverse induction to obtain oscillograph records for harmonic analysis. The study has therefore been limited to results from the noise standard and the resonant-shunt apparatus. Use of the latter involves successive measurements of harmonics, and between times it has been found that the load and wave-shape of the power system vary. The investigation has thus resolved itself into a determination of the residual and currents on the power system, which are minu pared with the main voltages and currents. And in turn required elaborate study of the errors in by current and potential transformers in the cas higher harmonics.

The joint committee has a membership of fift gineers, part of whom represent the power inter the communication interests and part the con Funds have been contributed by both the power a munication interests.

So far as can be determined by the committee, investigation has ever been undertaken on a sc parable with this work either in magnitude or thoro The study has developed into an investigation greater scope and complication than was original pated. Although eight months have already been active work, the investigation has not yet cover ficient number of exposures of different characte allow of any general conclusions. The complic the problem now appear to make extremely dif drafting of any general remedial measures wh not be onerous to the interests involved, and yet ject to so many exceptions and alternatives as to m ineffective, but the committee expects that with time and financial assistance this work can be serve as a basis of rulings which will be not only the communication interests but also to the powe in the way of standardization of construction and methods and the reduction of interruptions to Members of the committee also feel that, more than the above, the work will enable the California Commission to hand down rulings which will in duce harmful agitation, legislation and litigation.

## Public Service Commission News

### Massachusetts Commission

The Board of Gas and Electric Light Commissi Massachusetts has authorized the Suburban Gas & Company, of Revere, to issue $210,000 additional meet the cost of improvements. The company d issue $239,000 stock, but the board states that, in the uncertainty as to the precise amount of future tures for extensions, consideration of so much of tion as relates to new stock for future use may be without prejudice until the expenditure has been the reasonable necessity for the issue can be sh clearly. The commission points out that under conditions in a prosperous company where such ture, as it becomes necessary, can be financed read wise, the approval in advance of additional stock a purpose is of doubtful expediency.

The board has approved an issue by the Worcest Elec tric Light Company of 1000 shares of stock at meet improvement costs. In support of its pe company submitted a statement of probable ex for plant additions amounting to about $180,0 board states that it may be assumed that these ex are desirable and needed properly to meet a publi and satisfy the public convenience, but that an issu stock on this account does not appear as nec present. Available earnings in excess of oper penses, interest and dividends have been ample all expenditure for new plant made in the first h present year. The board points out that the ob pose of the restrictive statutory provisions as to ance of stock is to limit its amount to the actual the corporation. The company is advised to application for stock to cover anticipated outlays latter have been incurred.

### Wisconsin Commission

At the request of the People's Land & Manufacturing Company, of Oconto, the Wisconsin Railroad Commission has taken a hand in the controversy between the petitioner and the Oconto Electric Company and has ordered a uniform schedule of rates to be put into effect by both companies. After the failure of the two companies to consolidate in 1911 a campaign of competition and rate cutting set in which has reached the point where the petitioner says it can no longer meet the rates established by the Oconto Electric Company without putting its business in jeopardy. The commission's investigation showed that competition has so reduced the resources of both utilities that the conditions in which they are now found can no longer be justified by proper public policy. The rates prescribed by the commission at this time are designed to put an end to competition and are not such as will yield a reasonable return upon the investments. The following rates for electric lighting were prescribed for both companies:

A service charge of $1.10 gross or $1 net per month per active kw of connected load.

An energy charge of 6 cents net per kw-hr. for the first thirty hours' use per month of the connected load, 4 cents net for the next sixty hours' use per month, and 2 cents net for all energy used in excess of ninety hours per month.

In Class A, consisting of residences, the active connected load is to be taken as 60 per cent of the first 500 watts and 33⅓ per cent of the excess; in Class B, consisting of all installations not included in Classes A and C, the active connected load is to be taken as 70 per cent of the first 2.5 kw and 55 per cent of the remainder; in Class C, consisting of public buildings, hotels, churches, theaters, etc., 55 per cent is to be taken as active.

The minimum bill, which was abandoned during the competition, is to be $1 per month.

The power rates are to consist of a service charge of $1 gross or 75 cents net per active horse-power per month, an energy charge 2 cents net for current used equal to or less than 25 kw-hr. per month per active horse-power connected, and a charge of 1.5 cents net for all excess. The active load is to be taken as 90 per cent of the first 10 hp, 75 per cent of the next 20 hp, 60 per cent of the next 30 hp and 50 per cent of all over 60 hp.

After an investigation on its own motion, the commission has ordered the Janesville Electric Company to improve its service immediately. The commission called attention to the fact that similar orders made in the past have not been complied with and that a failure to do so in the present instance will be followed by an immediate prosecution by the Attorney-General under the provisions of the public utility law. The order provides that the utility must make a detailed report, both to the commission and to the consumer who initiated the present investigation, of all interruptions of service, with the cause and duration of the same, until the commission is assured that the proper improvements in equipment and distribution systems have been made.

### Vermont Commission

The New England Telephone & Telegraph Company and more than 100 subsidiaries have been summoned before the Vermont Public Service Commission at Montpelier to show cause why an order of the board establishing maximum rates of $18 to $33 for business telephones and $12 to $24 per annum for residence telephones, with a 10 per cent reduction in toll rates, should not go into effect Dec. 1. A large array of counsel and experts have been called into the case, and the full board is considering it.

### Indiana Commission

The Public Service Commission of Indiana has approved the lease of the Indianapolis Gas Company by the Citizens' Gas Company. In approving the lease the commission stipulated a number of terms, among them one providing that rates and dividends shall be on a scale plan. This plan will be much in use hereafter in Indiana, it is probable, in mergers of practically all public utility companies.

The plan provides for the graduated decrease or increase in the rate of return on the investment as the rate to the consumer increases or decreases. In the present instance the plan is that when gas is sold by the consolidated company at 55 cents per 1000 cu. ft., which is to be the price after Jan. 1, 1914, the return to the owners of stock in the leased company shall be 6 per cent. When gas sells at 50 cents the return shall be 6½ per cent. When gas sells at 45 cents the return is to be 6¾ per cent, remaining there no matter how far the price of gas descends thereafter. The commission has not specifically applied the descending rate of return in this case.

The Public Service Commission of Indiana has decided a case in which the Hawks Electric Company, of Goshen, sought to enjoin the city of Goshen by means of a commission order from expending money to rehabilitate its municipal plant. Two points in the decision established precedents for the commission on matters which had been in controversy since the commission's formation last spring. These points were to the effect that such a commission as the Indiana body had no injunctive power of any sort and that the commission has no power to order a city or other utility owner to stop work on a rejuvenation of its plant, even when that work amounts practically to the building of a new plant, on the ground that the new plant will mean wasteful competition.

The city of Goshen has operated an electric lighting plant for many years and at the time of filing the complaint in this case operated its plant in connection with a municipal water plant.

The Hawks Electric Company asked the commission for an order in the nature of an injunction prohibiting the city from installing machinery and appliances to be used in operating its electric lighting plant.

In the commission's decision it points out that remedy on the same questions might have been had in the courts. Since the case has been presented to the commission the matter has been carried to the courts and is still pending there. The city went ahead with its improvements, which meant practically the construction of a new plant. It proposed to produce energy for industrial purposes. The Hawks company was operating under a franchise given by the city in 1902. The company surrendered its franchise and took an indeterminate permit from the commission, believing that under the utility act it would be immune then from all competition in case the city should seek to rehabilitate its plant. The commission's order points out that the company would have been immune from any new competition, but that the commission had no power to prevent the city from rejuvenating its old plant.

Mr. James L. Clark, commissioner, in his opinion on the case, approved by the other commissioners, said: "As we construe the statute it has no application here when the city is seeking to repair its plant, even though the repairing amounts practically to a reconstruction. If the city were preparing to string new wires only or to set new poles or install a new dynamo, its right to do so would never be questioned. Because it seeks to do all these things at once, no doubt in the interest of economy and better service, this fact does not make the statute applicable. The city is now operating its plant, and under the evidence can continue to do so for some time at least without any repairs of consequence.

"In this case competition already exists. There will be no new competition except in quality of service. It could not be supposed that the Legislature intended to confer judicial powers on this commission to give relief where ample relief had long existed in the courts of the State."

# Current News Notes

Decrease in Patents Issued in 1913.—According to the annual report of the Commissioner of Patents, issued public Oct. 2, applications for patents in the last year totaled 67,986, the largest on record except for 1912 when there were 69,236. During the year 38,754 patents were granted, and 5166 trade-marks, 664 labels and 254 prints were also registered.

* * *

A Veteran Incandescent Lamp.—Mr. S. H. McDowell, of Welland, Ont., reports that a 16-cp incandescent lamp still in use at his home has been in almost continuous service since 1901. The lamp was first operated in Barrie, Ont., and later at Toronto, and has since been in practically nightly use. Mr. McDowell believes this lamp holds a world's record.

* * *

Pennsylvania Railroad Safety Exhibit.—For the instruction of its employees the Pennsylvania Railroad held an elaborate exhibit of safety appliances and methods at its New York terminal Sept. 26. Besides the display of approved mechanical and electrical apparatus, practical demonstration was given of the work of resuscitating a workman who accidentally suffers a shock from the third-rail.

* * *

The Electric Belt Again.—A laconic answer was given recently by Dr. W. A. Evans, formerly commissioner of health for Chicago, who conducts the "How to Keep Well" department of the Chicago *Daily Tribune*. An inquirer wanted to know whether the use of an electric belt would raise the blood pressure in the case of rheumatism or paralysis. The response was as follows: "No; neither will it lower it. The only effect will be on the pocketbook."

* * *

Widening and Deepening of the Welland Canal.—The Canadian government has voted an initial appropriation of $2,000,000 for deepening and widening the Welland Canal, connecting Lake Erie and Lake Ontario, so that it will be not less than 25 ft. deep and not less than 200 ft. wide. The Niagara peninsula of the Province of Ontario has experienced a decided industrial awakening since the water-power of Niagara Falls and DeCew's Falls has been made available by electrical transmission. The shipping facilities of the canal, therefore, have become of greatly increased importance. It is said that the total cost of the improvement will run to $50,000,000.

* * *

Voting Device for Congress.—An electrical voting system is under consideration by the rules committee of the House of Representatives at Washington. Under this plan members of the House would record their votes by pressing buttons on their desks. The votes would be indicated on a board in front of the Speaker's desk. The object of the device is to save time. From forty to fifty minutes is consumed in calling the roll of 435 members under the present arrangement. With the improvement it is calculated that only a few minutes would be needed. With the improved device each member would control four switches labeled, respectively, "aye," "no," "present" and "paired."

* * *

Radio-Telegraphy Publications.—Persons interested in radio-telegraph stations may secure from the Department of Commerce, Washington, or from the radio inspectors in Boston, New York, Baltimore, Savannah, New Orleans, San Francisco, Seattle, Cleveland or Chicago copies of code and abbreviation charts published by the government. These are on cardboard, 8½ in. by 14 in., and show the international Morse code and convention signals and the list of abbreviations to be used in radio-communication. The department also publishes a pamphlet containing a translation of the International Radio-telegraphic Convention, London, 1912, with its final protocol and service regulations. These publications should be in the hands of all experimenters in radio-telegraphy.

* * *

## SOCIETY MEETINGS

Colorado Electric Club.—Mr. E. E. Norton, of the Standard Underground Cable Company, Pittsburgh, Pa., addressed the Colorado Electric Club at Denver, Oct. 2, on the subject of the manufacture of electric cables.

* * *

Electrical Credit Association of Chicago.—The annual meeting of the Electrical Credit Association of Chicago will be held at the Hotel LaSalle in that city on Nov. 14, beginning at 2 p. m. In the evening, at 7 o'clock, there will be a dinner to which ladies will be invited.

* * *

Transportation Arrangements for Electric Vehicle Convention.—Mr. F. N. Carle has been appointed master of transportation for the coming convention of the Electric Vehicle Association of America to be held in Chicago on Oct. 27-28. Mr. Carle is arranging for a special train to leave New York on the afternoon or evening of Saturday, Oct. 25.

* * *

Meeting of Pittsburgh Section of A. I. E. E.—The meeting of the Pittsburgh Section of the American Institute of Electrical Engineers on Oct. 14 will be addressed by Mr. H. O. Swoboda, consulting engineer of Pittsburgh, who will present a paper on "The Design, Construction and Operation of Electric Heating Apparatus." The paper will be illustrated by lantern slides, and a number of prominent engineers have been invited to take part in the discussion.

* * *

Institute of Radio Engineers.—The second Institute meeting of the current season was held at Columbia University, New York, Wednesday evening, Oct. 1, after a well-attended informal dinner. A paper entitled "Some Recent Radio Sets of the Marconi Company," illustrated by lantern slides, was read by Mr. Roy A. Weagant. Mr. Weagant has been engaged in the design of the apparatus he described, and his comments were therefore of especial interest. The next meeting will be held on Nov. 5.

* * *

Montreal Electrical Society.—The following is the tentative program for the winter session for the Montreal Electrical Society: "The Conduit Situation in Montreal," by Mr. G. M. Gest; "Induction Motors," by Mr. B. T. McCormick, of the Canadian Allis-Chalmers; "Fire Alarm Systems," by Mr. L. E. Hamilton, of the Northern Electric & Manufacturing Company; "The Marconi System," by Mr. A. E. Reoch, of the Marconi Wireless Telegraph Company of Canada; "Transformers," by Mr. G. P. Cole of the Canadian Allis-Chalmers.

* * *

Philadelphia Section, I. E. S.—The Philadelphia Section of the Illuminating Engineering Society will hold a joint meeting with the Photographic Society of Philadelphia on Oct. 17 at 8 p. m. at the Engineers' Club. Prof. George H. Hoadley, the newly elected chairman, will preside at the meeting. Mr. W. J. Serrill will give a report of the recent Pittsburgh convention of the I. E. S., and Prof. A. W. Goodspeed will present a paper entitled "A Simple Unit Method for Measuring the Intrinsic Actinicity of Flame and Surfaces and for the Practice of Photography."

# Hydroelectric Energy for Worcester Railway System—II

**Arrangement of switching equipment and railway substations—Use of large 60-cycle rotary converters—Operating methods which are employed in the system**

In the preceding article there was described the supply of 120,000-volt hydroelectric energy from the lines of the Connecticut River Transmission Company to the system of the Worcester (Mass.) Consolidated Railway Company. An account of the railway company's steam-plant generating facilities was also presented. The following paragraphs describe the distribution, conversion and utilization of this energy in the operation of the electric railway.

The railway company's switching station at Millbury is a brick and concrete structure, 90 ft. long by 19 ft. wide, and one story in height. It houses the 25-cycle and 60-cycle, 13,200-volt feeder buses and motor-driven remotely controlled switches governing the outgoing lines to the Madison Street, Texas and associated substations. The operating switchboard is located in the turbine room of the power plant. The central portion is occupied by the bus, oil-switch and disconnecting-switch compartments, the series and shunt transformers being placed below the floor level in concrete compartments and runways. These are easily reached by raising slate slabs 2 in. thick. Incoming lines are brought to the building in conduit, crossing the canal outside the power station. The outgoing feeders pass under the floor and out to the roof through disconnecting switches and roof bushings. Besides the two circuits from the Millbury plant to the Madison Street substation, the company is now installing a double three-phase line of No. 1 copper on a single set of poles between Millbury and the Texas substation. By means of this circuit 25-cycle energy will shortly be supplied to Texas, Leicester and Charlton City and to the Webster substation. The line is designed for 33,000 volts, but for the present 13,200 volts will be employed. The Sturbridge substation is at present supplied from Charlton City. Double-current generators are now in service at the latter point, but this substation will also be supplied from the Millbury lines later.

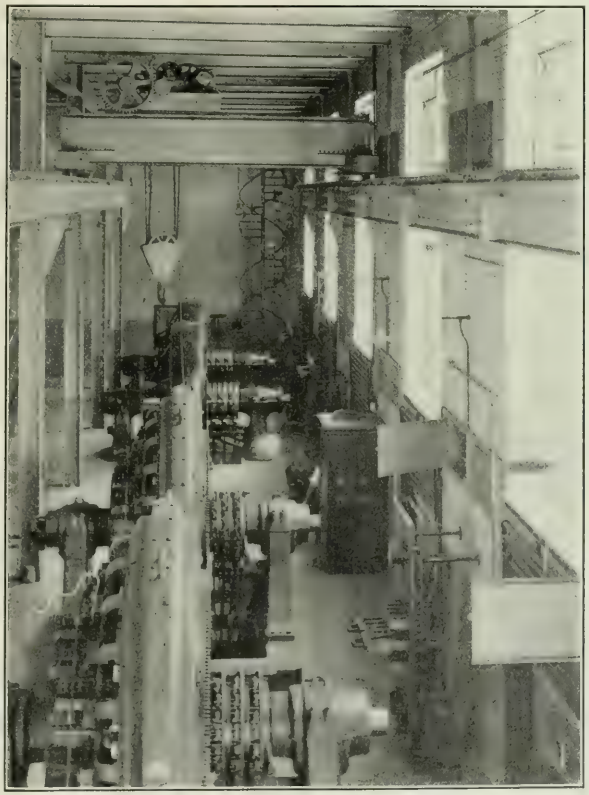


FIG. 1—MADISON STREET SUBSTATION, WORCESTER, MASS.

The Madison Street substation in Worcester was originally large enough to house its present equipment, which is noteworthy through the use of 2000-kw, 60-cycle rotary converters built by the Westinghouse Electric & Manufacturing Company. These machines were among the first of their size placed in electric-railway service to be designed for 60-cycle operation. Each occupies a space 10 ft. 11 in. long by 9 ft. 3 in. wide, the extreme length of the machine along the shaft and including the end-play device being 11 ft. 7.5 in. Each has eighteen poles and operates at 400 r.p.m., having six-phase connections on the alternating-current side. On the direct-current side the machines each deliver 3333 amp at 600 volts, normal rating. They are provided with series, shunt and interpole field windings, and their guaranteed efficiencies are as follows:

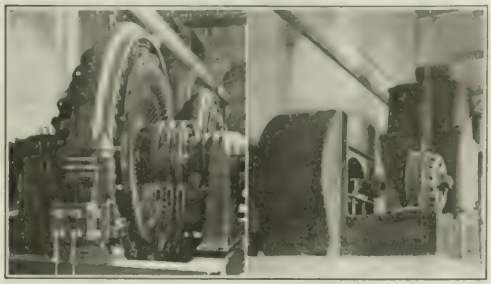
| Per Cent Load | Per Cent Efficiency |
|---|---|
| 50 | 85.5 |
| 75 | 91.3 |
| 100 | 94.6 |
| 150 | 95.2 |

The machines are arranged for automatic compounding by the usual combination of series excitation and inductance coils placed in the transformer secondary leads. Each rotary is provided with a brush-lifting device controlled by a hand lever, and this is used in starting the machine as an induction motor, the starting switches being operated by remote control from panels on the ground floor of the substation. Two pilot brushes are left in circuit in starting each machine. The brushes are of an imported carbon and copper composition type, each having four shunts and a locking device. Three voltage steps are used in starting, the full pressure being 430 volts. Each brush to be lifted is fitted with a rack in which a spring-hinged hook engages

when the lifting lever is shifted toward the rated position. The lifting arrangement is entirely independent of the brushes during normal running. Each brush is merely raised and lowered within its own holder so that the commutation is not altered.

### Incoming Lines and Transformers

The incoming lines from Millbury terminate in a light-



FIGS. 2 AND 3 2000-KW WESTINGHOUSE CONVERTERS AND TRANSFORMERS FOR THESE ROTARIES, MADISON STREET

ning-arrester house adjacent to the substation, from which underground cables are run to the second story of the latter. With 15-in. spacing between conductors, one line is carried on insulators supported on 1½-in. pipe framing, 12.5 ft. above the floor, to Westinghouse type E 15,000-volt automatic oil switches. The leads from the switches thence pass through wall bushings of porcelain to the transformers supplying the two 60-cycle rotaries. Corresponding switches control the transformers for the 25-cycle rotaries, which are supplied from the other incoming line. The current transformers are placed in the incoming lines just inside the cable pot-heads, and an automatic oil switch is included in each line, disconnecting switches being installed between the main-line oil switches and those controlling the sets of transformers for each rotary. Individual current transformers are provided in each transformer primary circuit. The oil switches controlling each bank of transformers for the 60-cycle service are housed in concrete compartments 31 in. long and 12 in. wide per phase, the over-all width being 50 in. The trip coils are installed at the rear of the compartments, and the ends of the lat-



FIG. 4 [illegible]

ter are protected by vertical concrete slabs measuring 56 in. high and 6 in. wide. These also serve as foundations for the pipe framing on which the local disconnecting switches and current transformers are supported. The oil switch and bus room is 120 ft. long and varies in width from 14 ft. to 2 ft. on account of the shape of the building.

The transformer installation consists of three 700-kva, 13,200/430-volt Westinghouse air-blast type units for each 2000-kw rotary and two sets of three 550-kw air-blast General Electric units for the smaller rotaries. They are all located on top of a brick air duct in the second story of the building immediately above the operating room. The smaller banks are ventilated by a Buffalo blower direct-driven by a 7.5-hp General Electric induction motor, and the larger sets by a No. 70 Sirocco blower direct-driven by an 11-hp Westinghouse induction motor. The secondaries are connected in Y, and the series reactances in each of the larger transformer circuits are installed in the air duct below the transformers, facilitating the ventilation of the reactances and economizing in space. The air outlets for the reactance coils are located in the transformer bases, and a hood is also provided by which the air is deflected from the reactances to the room without passing into the transformer interior ducts. The transformer room is 126 ft. long by 14 ft. wide, and the air duct is 6 ft. by 9 ft. in

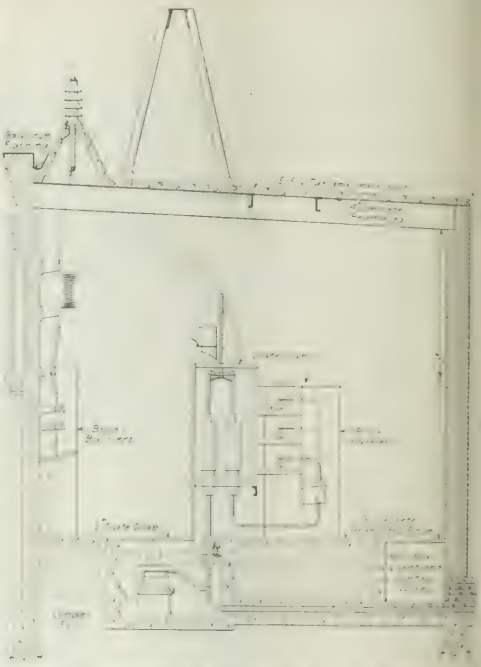


FIG. 5 SECTION OF MILLBURY SWITCH HOUSE

outside dimensions, with a division wall between the two fan systems.

### Arrangement of Switchboard at Substation

The present switchboard at Madison Street contains twenty-four 16-in. feeder panels, one 20-in. totalizing panel, four 20-in. rotary panels, and four spares, with a 4-ft. space at the rear to facilitate inspection and repairs. Each new rotary panel contains a 4000-amp Thomson watt-hour meter, main switch, field rheostat handle, circuit-breaker and ammeter. The alternating-current panels for the new rotaries each contain a set of starting switches, a 200-amp ammeter, overload shunt-trip relay and pilot lamps showing the position of the 13,200-volt oil switches on the second floor. These panels are located against the wall at the side of each 2000-kw rotary. Field-reversing switches and equalizer and positive and negative switches are all mounted on the rotary frames. The totalizing panel on the main switchboard contains a 15,000-amp ammeter, a

50-volt voltmeter and a curve-drawing ammeter and voltmeter of the same type. There are eleven 500,000-circ. mil. 600-volt tie lines between Madison Street and the Front Street stations which facilitate the equalization and emergency handling of loads in the city of Worcester. Low-tension alternating-current cables between transformers and rotary starting panels are run in ducts built into the substation wall, with pull boxes opening onto each floor.

The Leominster, West Boylston, West Berlin and Northboro substations are each supplied with energy from the Clinton substation of the transmission company through a three-phase No. 1 copper line carried on wooden poles and owned by the Consolidated company. Disconnecting switches are installed at convenient points in these lines for sectionalizing purposes. The poles are of chestnut, 35 ft. in length, set on the average 100 ft. apart, and the line is supported on Locke No. 315 insulators carried on a 10-ft. cross-arm. The substations are designed along standard lines, the 300-kw rotary being the usual unit of equipment. The West Boylston installation, shown in the accompanying photographs, is representative and consists of two 300-kw Westinghouse rotaries, six 110-kw General Electric 13,200/

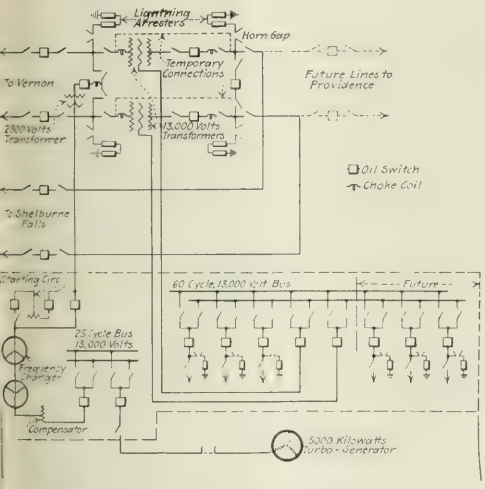
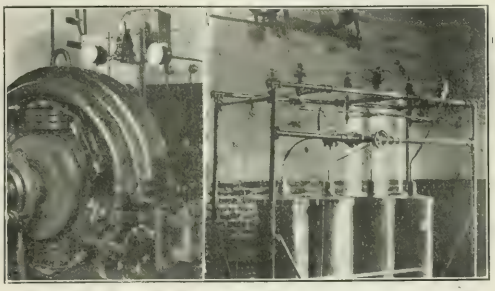



FIG. 6—DIAGRAM OF CONNECTIONS, MILLBURY SUBSTATION

370-volt oil-cooled transformers, two 45-kw reactance coils and a four-panel switchboard 5½ ft. long, housed in a concrete and brick building which is 40 ft. by 30 ft. in inside dimensions.

The incoming line is brought through choke coils and selector switches with multigraph lightning arrester connections, the transformers being arranged in a single row with the rotaries in front. The usual direct-current feeder equipment is installed on the switchboard panels. Automatic oil switches are installed in the transformer primary leads and practically the entire equipment is in sight on the working floor of the building. The telephone facilities include both public and private lines. At Fitchburg a 300-kw rotary converter with three 110-kva oil-cooled transformers and auxiliary equipment is housed in a 19-ft. by 21-ft. brick extension of the Connecticut River Transmission Company's main 9000-kw substation in the outskirts of the city. A switchboard with two 16-in. panels, one for the alternating-current and the other for the direct-current side of the rotary, is in service, a single 500,000-circ. mil feeder being all that is needed for the Consolidated service in this district. The compactness of the arrangement is noteworthy.

At Northboro a typical substation built in connection with an established steam-generating plant now held for auxiliary service is in operation. Here there are two 300-kw rotaries, with transformers and auxiliary apparatus installed in a section of the engine room 19 ft. by 55 ft. in dimensions. In this substation the arrangement of incoming line and choke coils is unusually straightforward. The wires are



FIGS. 7 AND 8—300-KW ROTARIES, FITCHBURG SUBSTATION, AND LIGHTNING ARRESTERS, WEST BERLIN SUBSTATION

carried on insulators supported on pipe framing after being brought into the building through roof bushings housed in 30-in. by 36-in. inclined openings. The choke coils are mounted on horizontal axes on insulating supports carried on the framing as shown, and the utilization of space otherwise of no value is of interest. The negative and equalizer buses are installed under the floor of the substation, and the switchboard controls the direct-current supply to feeders caring for the power demands of cars operating in the Marlboro, Northboro, Westboro and Shrewsbury district. The alternating-current sides of the rotaries are controlled from separate panels near the machines.

The company's double-circuit 33,000-volt line construction employs a standard pole about 35.5 ft. high above the rail. The high-tension wires are spaced in 36-in. equilateral triangles and are carried on pin-type insulators on 7-ft. and 12-ft. cross-arms with metal braces. The feeders are carried on 5-ft. arms spaced 24 in. apart; the trolley brackets are 9 ft. 6 in. long on tangents, and a telephone cross-arm 3 ft. long is provided immediately above the latter. At crossings double cross-arms are installed and the insulators

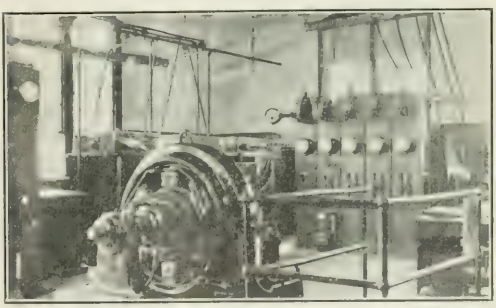


FIG. 9—200-KW ROTARY AND SWITCHBOARD, NORTHBORO

are spanned by Thomas No. 7111 line-wire protectors.

At Millbury Junction, Mass., the 66,000-volt lines of the Connecticut River company cross the tracks of both the Consolidated company and the Boston & Albany Railroad. The arrangement of suspension insulators in the second-named crossing deserves mention. Each phase wire is attached to three insulators at the ends of the cross-arms of

75-ft. steel towers anchored on each side of the span, the latter being about 170 ft. in length. The conductors are hung 10 ft. apart in a vertical plane and about 16 ft. apart horizontally. Suspension insulators of the five-disk size are used to carry the strain of the No. 00 line wires employed in this crossing. The 25-ft. span across the Con-

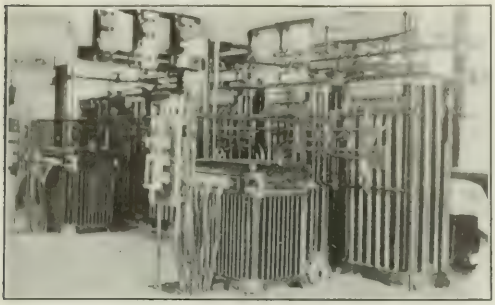


FIG. 10—TRANSFORMERS, REACTORS AND 13,200-VOLT BUSES, WEST BOYLSTON SUBSTATION

solidated track is effected by the use of a pair of A-frames about 50 ft. high, carrying pin-type insulators.

### Plant Operating Practice

The Fremont Street station, containing the original engine-driven generators of the Worcester lines, now has seven engine-driven units installed. All are of the cross-compound condensing type, with twelve water-tube boilers. This station has a coal-storage yard of 20,000 tons capacity and is located alongside the main line of the Boston & Albany Railroad in the southern part of Worcester. An extensive coal-handling system is in service at this point, but no further description need be given here of the company's steam plants, for these are gradually being retired in favor of hydroelectric service, with the exception of the turbine station at Millbury. It is the company's practice to operate an 850-kw engine-driven generator at Fremont Street to handle the requirements of all-night operation on the system. Hourly cars are operated on the principal streets of Worcester throughout the night, and the trolley is maintained alive elsewhere. All substations are shut down about midnight and started about 5:30 a. m. At the




FIG. 11—FORM OF DAILY GENERATING STATION AND SUB-STATION LOG SHEET

Charlton City plant one of the existing double-current generators will be utilized as a rotary converter in the fall, but the night service will continue to be handled from Worcester as above outlined.

Daily generating station and substation logs are kept, the latter exhibiting with considerable detail the meter readings at the starting and stopping of all rotaries, maximum volts and amperes, minimum voltage, hours of machine operation, reports of switches opened, with authorization, records of power off the direct-current bus, opening of circuit-breakers, and charging and condition of lightning arresters. In general, substations containing one or two rotaries are operated by two men on twelve-hour daily shifts.

The steam-plant organization is somewhat unsettled in view of the expansion of the Millbury station and the use of purchased power, but as a rule the organization of such plants follows the usual lines of a chief engineer and three watch engineers, with subordinates depending in number and duties upon the character of the load. The Madison Street substation will require one chief operator, two assistant operators and probably three additional assistants when the installation of the 2000-kw rotaries is fully completed. The size of the system permits more or less interchanging of operators. The work of the department of power stations is in immediate charge of a superintendent,

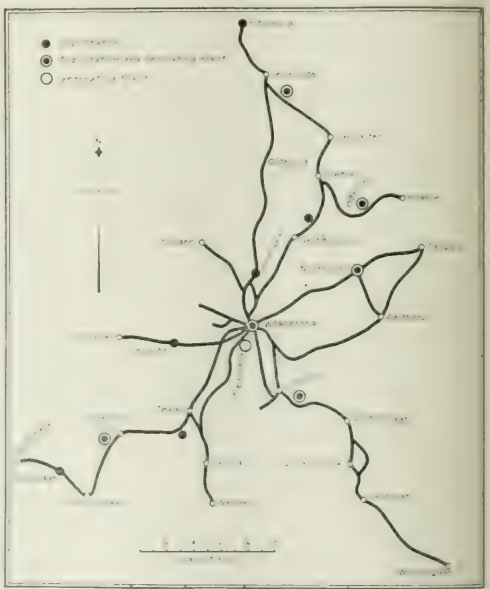


FIG. 12—MAP OF MAIN LINES, WORCESTER CONSOLIDATED STREET RAILWAY COMPANY

whose headquarters are at the Market Street carhouse in Worcester. All chief operators and chief engineers report to this point. Mr. W. M. Finlayson is superintendent of power stations, and Mr. Henry C. Page is general manager of the Worcester Consolidated system.

The engineering department of the Worcester-Springfield systems, with headquarters at Springfield, Mass., handled the greater part of the Consolidated company's engineering in connection with the foregoing improvements, which represent an expenditure of nearly $500,000 within the past two years. The engineering of the Connecticut River Transmission Company's system in connection with the improvements at Millbury and its latest steel-tower line construction, as well as the developments on the Deerfield River, was handled by the Power Construction Company, of Shelburne Falls, Mass., Mr. George W. Bunnell being president of the organization. This company also handled the engineering for the 60-cycle rotaries north of Worcester and in the Madison Street substation, subject to the approval of the Worcester company's engineers.

# Theory, Design and Operation of Head-Lamps

**Articles covering the basic principles of the illumination relations of, the design of light sources for, and the service performance of head-lamps. By Charles R. Sugg, A. R. Dennington and L. C. Porter**

## Basic Principles of Head-Lamp Illumination

By Charles R. Sugg

It is convenient and customary in discussing matters of the kind under consideration to assume ideal conditions upon which to base a theory, and in this paper point sources of light and reflectors and lens of 100 per cent efficiency will be assumed.

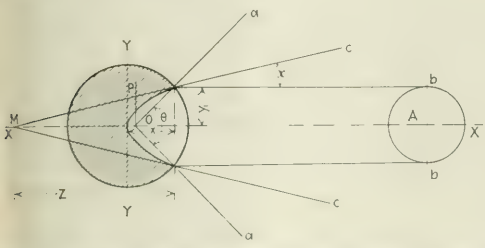



FIG. 1—PARABOLIC REFLECTOR WITH LIGHT SOURCE AT FOCUS

In order to direct all the rays of light projected from a reflector it is necessary that the reflector be so designed that every ray of light impinging on its surface will be redirected in a line parallel with the axis of the reflector. This is done by what is known as a parabolic reflector. In the case of reflected light the source of light must be placed at the focal point or focus.

Assuming the light source to be placed at $O$ in the focus of the reflector (Fig. 1), there will be a cone of light as shown by $\theta$ which will not be under the influence of the reflector and will be subject to the law of inverse squares, as is well known, but the remaining light flux, indicated by the cross-sectioned part of the sphere, will fall within the reflector and be projected along the lines $bb$ parallel to the axis $X$. This flux is no longer governed by the law of inverse squares but in a clear non-absorbing medium will be projected to infinity without increase or decrease of intensity. As the direct rays included in the angle are subject to the law of inverse squares and very rapidly become ineffective, it is convenient and not inaccurate to neglect them for the present and consider only the parallel rays.

Assuming the light flux representing the direct rays to be one-fifth of the total flux of the source, then the reflected flux will be four-fifths of the total flux. As $4\pi$ is the total flux from a unit light source, the reflected flux will be four-fifths of $4\pi$ or $16\pi \div 5$, which will be concentrated within the circle whose diameter is equal to the diameter of the reflector. The area under the assumptions will have constant intensity at all distances from the source. The question "What is the candle-power of reflected light?" is often asked. From the foregoing it is readily seen that as the projected beam does not diminish in intensity the term is a misnomer, but one can state what would be the candle-power of unreflected light placed at the same point and producing the same intensity on an equal area at a specified distance, and as the unreflected light would vary in accordance with the law of inverse squares, the value of the effective candle-power would vary in the same ratio.

If the reflector be so designed as to give a small angle of divergence, $\alpha$, the law of inverse squares becomes effective again, but instead of making measurements from the center of the source the measurements must be taken from the point $M$, where the outer rays at the edge of the reflector, if projected backward, cross the $X$ axis of the reflector. This point is the "virtual" center or focus of the light beam. The light flux at the front edge of the reflector can be ascertained, and having the distance $Z$ (Fig. 1), one can determine the candle-power required at $M$ to produce the same light flux. This value of candle-power will be constant for all distances, but it must not be forgotten that all calculations must be based on measurements taken from point $M$ as the origin and not the center of the light source $O$.

Consider now the projection of light by use of a lens $L$ (Fig. 2), still using a point source located in its focus $O$ and designed to project parallel rays. The same reasoning applies to this as to the parabolic reflector, except that only the amount of light included in the beam is that included in the cone represented by the angle $\theta$ (Fig. 2). In order to include more of the light in the beam, one may provide a suitable reflector, as shown at $R$ (Fig. 2). The only type of reflector suitable for this is a spherical reflector located behind the light source at such a distance that its center or focus will coincide with the light source. This reflector will reflect each ray of light back through the light source, thus doubling the intensity of the ray, provided that none of it is absorbed. The discussion relative to the reflected parallel beam and slightly divergent beam outlined under the above paragraph relative to reflectors holds good for the lens both without and with the reflector.

Assume now some concrete cases and apply the above discussion to them, still assuming ideal conditions. Referring again to Fig. 1, take $Y_1 = 9$ in. and $X_1 = 13$ in.; then $P = 1.5$ in. The area of the beam will be 1.75 sq. ft. The total light reflected in lumens is 11.31 times the mean spherical candle-power of the light source, which

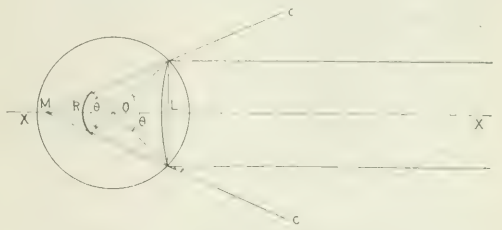



FIG. 2—PARALLEL LIGHT RAYS DELIVERED FROM POINT SOURCE THROUGH A LENS

for an arc lamp may be taken as 650 mean spherical candle-power. The total light flux is 7351.5 lumens, which, divided by 1.75, will give an average of 4200 lumens per square foot over the cross-section of the beam. Assuming a distance of 1 ft. from the source, the candle-power of a lamp at the same point would be 4200 cp, and at 100 ft.,

according to the law of inverse squares would be 1,000 times this amount, or 42,000,000 cp.

In the case of a divergent ray, if a 2-deg. cone, the illuminated field at a distance of 800 ft. will be approximately 28 ft. in diameter, and, using the same arc lamp as specified above, the divergent ray projected backward will cross the $X$ axis at $M$, approximately 44 ft. from the front of the reflector. The average illumination at the front of the reflector will be approximately the same as for the parallel ray, that is, 4200 lumens per square foot. To produce this illumination by an unreflected light source at $M$ would require a lamp of approximately 8,132,000 cp. The illumination at any other point in front of the reflector may be determined by the inverse-square law by using this value and referring to point $M$ as an origin. One can then refer to the lamp as equivalent to an 8,132,000-cp source.

With an 18-in. lens designed to subtend the same spherical segment as the reflector just described, there will be only 1.26 lumens to be projected and the average intensity of the ray will be 468 lumens per square foot, which, if taken at 100 ft. from the source, would be equivalent to an unreflected lamp of 4,680,000 cp. With a divergent ray of 1 deg., as before, the beam would be equivalent to that from a source of approximately 906,000 cp located at $M$. By using the reflector $R$ (Fig. 2) the values would be doubled.

The above deductions have been made under the assumption of ideal conditions. In practice these conditions are not realized. A reflector becomes tarnished and absorbs a very large portion of the light; the source is seldom placed in the focus and is not a point, but an area; particles in the atmosphere absorb, reflect and refract the light, thereby diminishing its intensity, the amount of which will have to be determined by experiment. With the lens and reflector a small deposit forms on the inner surfaces and absorbs a portion of the light; it is the writer's opinion that the loss from this source is small in comparison with the loss from a tarnished reflector and from the spread of the light source.

No attempt has been made in this discussion to give values of the coefficients of reflection, refraction or absorption of light for any of the substances or media which are involved in practice, all of which vary under different conditions and must be determined by direct experiment.

## Considerations in the Design of Head-Lamp Light Sources

By A. R. Dennington

The rapidly increasing use of incandescent electric headlamps on automobiles, street cars and locomotives makes of interest in engineering circles a review of the conditions which the lamps must successfully meet.

The older forms of illuminants, oil and gas flames and electric arcs, used in head-lamp work have met more or less successfully the rather exacting conditions and have very largely determined the type of fixtures and reflectors in use at the present time. The incandescent electric lamp, thought it has the advantage of giving no fumes or soot to discolor the reflecting surface and requiring none of the reflector cut away in order to secure ventilation, was not until recently a rival of the electric arc or gas flame for head-lamps. The reason for the incandescent lamp lagging behind was that it has been impracticable to construct a lamp of sufficiently high candle-power having the filament arranged within a space small enough to permit [illegible] with a reflector. The advent of the ductile tungsten-filament lamp has made possible constructions with the incandescent material wound in close spirals and supported so as to occupy a very small space, usually within a sphere of 0.25-in. to 0.5-in. diameter. By concentrating the light source within a small space the effect produced by a reflector or lens is very much better than if the light source larger and irregular.

If all the filament could be placed at the focal point of perfect parabolic reflector, the light would be projected i parallel rays and the only diminution in intensity with i creasing distance would be that due to absorption and di persion by the dust particles in the atmosphere. Und these conditions the surface illuminated by the beam wou be a circle having a diameter equal to the diameter of th reflector. A beam of light having perfectly parallel ray even if it were obtainable, would be of value only in speci cases and would not be suitable for the illumination of th space ahead of a moving carriage or locomotive. As it impossible to obtain a true point source of light, the ra emanating from the portions of the incandescent filame outside of the focal point of the reflector will diverge indicated in Fig. 1 by lines *a* or will converge towa a point and then diverge as shown by lines *b*. The d verging rays emanate from portions of the filament in fro of the focal point and the converging diverging ra emanate from behind the focal point. The rays from th portion of the light source directly at the focal point w be projected in parallel lines *c*. The amount of divergen in any given case depends upon the ratio of the maximu distance of the incandescent material from the focal poi to the focal length of the reflector. As the focal length the reflector is small, varying from about 0.875 in. to 2.5 i

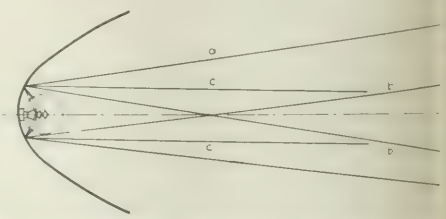



FIG. 1—DIVERGING AND CONVERGING RAYS FROM FILAM

it is important to have the over-all dimensions of the fi ment of a lamp for use in such reflectors as small as po sible.

Lamps for automobile head-lamp service are placed sockets at the rear of the reflector and burn in a horizon position, while in locomotive service the lamp is, in ma instances, held in a vertical position and can be installed a reflector designed for an electric-arc lamp or an oil lan A reflector which is cut away to allow the use of an electr arc or oil lamp is less efficient than one designed for incandescent lamp and having the opening for the la socket at the apex of the parabola. In every case pr vision should be made for adjustment of the socket so th the filament can be centered accurately at the focal poi In making up lamps it is impossible to get the filament exactly the same position in every bulb because of t fact that the glass cannot be worked in exactly the sa manner each time.

The curve of distribution of light from a lamp with co centrated filament (Fig. 2) shows that the intensity fairly uniform except opposite the tip of the bulb, where t intensity falls to a very low value. This result is attrib able to the fact that the tip reflects or absorbs practica all the light rays falling on it from the filament and t incandescent area is so small that no direct rays can p into the dark space *a*. However, the tip is of no spec disadvantage when the lamp is used in a reflector, as non-parallel reflected rays illuminate the space which do not receive any direct radiation from the filament.

A number of points must be taken into consideration

mounting the filaments for head-lamp service, as the filament must be able to withstand shocks, be within a limited area and have minimum cooling due to terminals and supporting wires or anchors. In the case of automobile headlamps, where the emf across the lamp terminals is only about 6 volts or 7 volts and the candle-power usually less than 25, the filament is so short and light that it can be counted without any supports excepting the leading-in wires to which the filament is fused, as indicated in Fig. 3. As the weight of the filament is very small, the bending stress at a point *a* near the lead wires is slight and the wire is stiff enough to withstand it without being set into vibration. Moreover, the springs and pneumatic tires of the automobile prevent sharp shocks from being transmitted to the lamp, and therefore the filament remains intact even after it has become brittle by being heated to high temperatures for long periods. There is little danger of the filament becoming broken while the lamp is lighted because the temperature is high enough to make the tungsten wire soft. If the specific consumption of the lamp is too low—that is, if the ratio of the total watts to the mean horizontal candle-power is much less than unity—the filament may be so soft as to sag out of shape with its own weight and the useful life of the lamp is materially reduced.

The service conditions under which lamps for locomotive service operate are much more severe than for automobile service, not only because of the greater severity of the shocks which must be successfully withstood, but also because only a single lamp is in use and because of the necessity for a thoroughly reliable source of light. The electric generators used on steam locomotives have been designed for operating arc lamps and therefore develop pressures of from 25 volts to 35 volts. It is essential that incandescent lamps, at least during the transition period from arcs to incandescents, should be designed to operate at the voltages suitable for the arcs. Though a lower electrical pressure might be desirable from the standpoint of ruggedness of construction of an incandescent lamp, there are disadvantages which may overbalance any gain due to a short, thick filament. With a low-voltage lamp it is necessary to supply a large current in order to get sufficiently high candle-power for head-lamp service, and consequently the difficulties encountered in securing a satisfactory seal between the leading-in wires and the glass are very much increased. The expansion of the wires *a* and *b* (Fig. 4) at the top and bottom of the press or flat portion

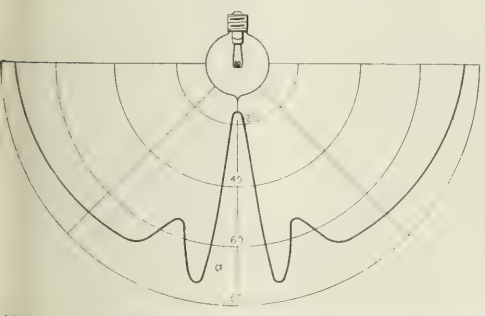
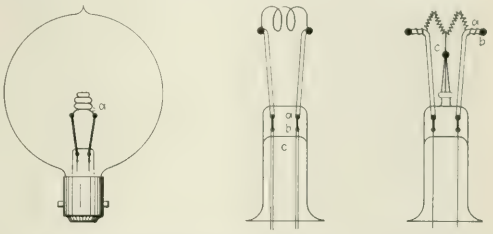



FIG. 2—VERTICAL DISTRIBUTION OF LIGHT OF CONCENTRATED FILAMENT LAMP

of the stem where the wires are sealed into the glass causes a wedge-like action which tends to split the glass. Moreover, in order to embed the large wires properly it is necessary to use heavy tubing for the stem, and this heavy tubing is more difficult to work than light-weight or medium-weight tubing. Special care must be used to prevent stresses being set up in the glass, as these stresses may cause a crack in the completed lamp. The heavy wires supporting the filament bring a stress on the glass whenever the lamp is subjected to a shock in a direction perpendicular to the stem. Shocks of this nature occur frequently in railway service when couplings are made and when heavy freight trains are being started. Instances have occurred where the failure of the lamp was due to the breaking of




FIGS. 3, 4 AND 5—TYPES OF UNSUPPORTED AND SUPPORTED FILAMENTS

the glass at a point just below the lower weld *b* in the stem. The cause of such breakage is generally a combination of the stresses due to manipulation during manufacture and those attributable to a sudden shock or change of temperature.

The filament must be connected to the leading-in wires in such a way as to give good electrical contact and also mechanical strength. Short, thick filaments may be satisfactorily connected to the terminals by fusing the wire into a bead around the end of the filament. However, if the filament is long it is certain to vibrate more or less and thus cause bending at a point near the leading-in wire. The continual bending results in the fatigue of the material and ultimately in breakage. The strengthening of this part of the filament or the distributing of the bending stress is therefore necessary. A method which has been tried, but with indifferent success, is to wrap the filament around itself for a short distance from the supporting wire. This method did not prove satisfactory, even though it did strengthen the wire, as the bending was merely transferred to a point at the end of the wrapping. Much better results can be obtained by wrapping the filament *a* (Fig. 5) two or three turns around the leading-in wire and fusing it at the end *b*. A spiral spring effect is thus introduced which distributes the bending and reduces the fatigue of the material. Vibration or bending of the filament must be eliminated as far as possible, and therefore the intermediate supports or anchors *c* must be rigid. The desired rigidity may be secured by using a tripod of small wires or a single heavy wire, to which is fused or clamped a small molybdenum or tungsten wire which may be brought into contact with the filament. The wire actually coming in contact with the filament should be as small as consistent with the demands for rigidity in order that the cooling effect may be reduced to a minimum, and the number of supports should be as small as possible. The fewer the supports the more nearly uniform the temperature of the filament from end to end and the greater the life of the lamp for any given specific consumption. If portions of the filament are cooled by anchors, the intermediate parts must be heated to a proportionately higher temperature in order to reduce the watts per candle to the desired value.

The actual mean horizontal candle-power of incandescent head-lamps for locomotive service varies from about 50 to 100 or more. Tests have shown that a 50-cp lamp properly focused in a parabolic reflector will enable an engine driver to distinguish an obstruction, such as that represented by two men in dark clothing, at a distance of from 600 ft. to 1000 ft., depending upon the speed of the train and the clearness of the atmosphere. As the speed of the train is

increased the distance at which an obstruction can be distinguished is decreased. The measured distance in a number of tests has been approximately 200 ft. less at a speed of 30 miles per hour than at standstill, other conditions remaining unchanged. The candle-power of lamps must evidently be greater for high-speed than for low-speed service, not only because the danger distance ahead of the train is greater in the first case but also because of the fact that the driver will not be able to distinguish objects as readily as when the speed is low.

The space available for the bulb of a head-lamp is limited by the reflector, and it is therefore necessary to use bulbs as small as possible in order to get the filament at the focal point. If filaments for high candle-power are placed in small bulbs, there is liable to be early blackening and consequently the useful life of the lamp is reduced. However, recent experiments have shown that the tendency to blacken can be largely overcome by using an inert gas, such as nitrogen, at nearly atmospheric pressure instead of vacuum in the bulb. Lamps of this type can be made of sufficiently high candle-power to meet all the requirements of head-lamp projection and seem destined to supplant other sources of light for this purpose.

## Performance of Incandescent Head-Lamps

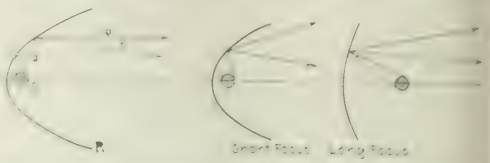
By L. C. Porter

Increasing public interest shown in the question of locomotive operation has brought about legislation on the head-lamp question in several states. In others the matter is pending. Naturally, this condition has resulted in considerable development and study, both on the part of the railroads themselves and also on that of the head-lamp manufacturers. A short account of technical questions involved in the production of a head-lamp, and some of the recent developments, may be of value in bringing about intelligent and effective legislation on the subject.

The principal light sources now available for head-lamps are oil flames, acetylene-gas flames, incandescent electric lamps and electric-arc lamps. The light emitted by any one of these, to be effective for head-lamp service, must be concentrated into a beam. There are two principal methods of accomplishing this—one by the use of a lens, the other by the use of a parabolic reflector. In either case to obtain good results the light source must be fairly well concentrated at the focal point of the lens or reflector.

Assume, for example, that each "ray" of light emanating from a light source is of 50-cp intensity. If one of these "rays" be re-directed so as to coincide with another, the result will be 100 cp. As there are a vast number of 50-cp rays emanating from a 50-cp light source, by re-directing a sufficient number of them a beam of many times the intensity of the original light source would be obtained. The more nearly these rays approach coincidence, the more powerful will be the beam. Consider, for example, a spherical light source $S$ of Fig. 2, having its center at the focus of a parabolic reflector. A ray of light $a$ emanating from the center of $S$ will be reflected parallel to the axis of the reflector; a ray $b$ emanating at the surface of the sphere will be similarly bent upon reflection, thus diverging. The further away from the focus the light originates, the greater will be the scattering; hence the less powerful the beam.

The focal length of the parabolic reflector influences the spread of the beam. Assuming the same diameter of light source, it is evident that the angle between the two extreme rays which determine the spread of the beam (the angle of incidence being equal to that of reflection) will be greater in a short focus reflector than in a long one (Fig. 3). The curves of Fig. 4 show the relation between diameter of light source in sixteenths of an inch, focal length of reflector in inches, and spread of resultant beam in degrees.




FIGS. 2 AND 3—PARABOLIC REFLECTORS OF DIFFERENT FOCAL LENGTHS

As it is practically impossible to concentrate a powerful oil or gas flame into a small volume, these light sources are eliminated where a strong head-lamp is required. The electric arc is a very powerful light source of small volume. Backed by the proper reflector, it will produce an extremely powerful, dazzling beam. Many roads, especially the double-track ones equipped with block signals, consider such a beam detrimental to the safe operation of trains, owing to the temporary blinding of the engineer of an approaching locomotive, reflection from glass signal lenses, fog, etc.

Between the flame head-lamps (which are really only markers) and the other extreme comes the incandescent. The present high-efficiency drawn-wire tungsten can be formed into a lamp filament of high candle-power occupying a very small space. With such a light source backed by a good parabolic reflector excellent beams can be obtained—beams of sufficient intensity to enable an engineer to distinguish a man a thousand or more feet ahead of the locomotive, and having spread enough to cover a double-track roadbed, without throwing a powerful light onto the glass signals along the sides or over the roadbed. The accompanying table gives the feet of track covered by beams having various angular spreads at different distances ahead of the locomotive. Fig. 5 is the distribution curve at 500 ft. taken across the beam thrown by a 6-volt, 50-cp concentrated filament tungsten lamp, backed by a 20-in. metal parabolic reflector of 2.75-in. focal length.

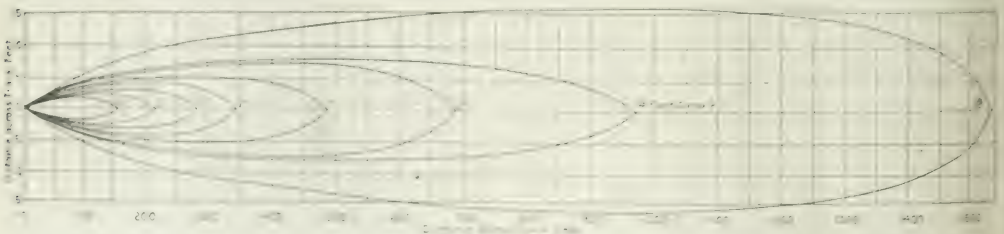


FIG. 1—ISOLUX CURVES OF INCANDESCENT HEAD-LAMP ILLUMINATION

Fig. 1 shows the isolux curves of the beam shown in Fig. 5; that is, it shows the curves joining points of equal vertical illumination in a horizontal plane, passed through the

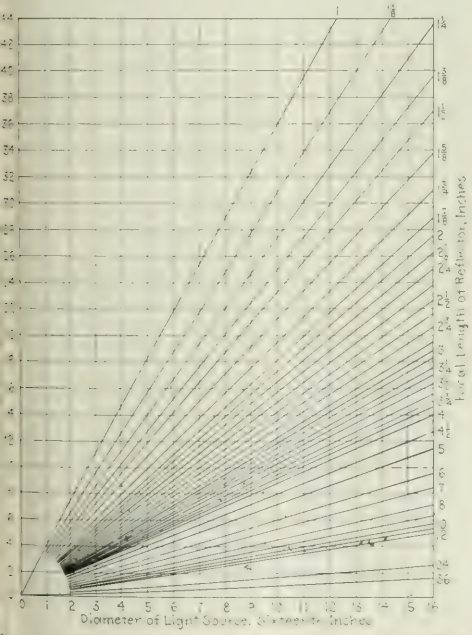
ead-lamp.* In order to apply these easily to a railroad, ie curves have been plotted as if laid off along a track, the ngth scale being ten times that of width. For example, very point on the 0.1-ft.-candle curve will be illuminated

ILLUMINATED AREA ALONG TRACK

| egrees pread of eam | Width of Track Covered, in Feet, at Different Distances from Headlamp | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 100 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900 | 1000 |
| 1 | 1.75 | 3.50 | 5.25 | 7.00 | 8.75 | 10.50 | 12.25 | 14.00 | 15.75 | 17.50 |
| 2 | 3.50 | 7.00 | 10.50 | 14.00 | 17.50 | 21.00 | 24.50 | 28.00 | 31.50 | 35.00 |
| 3 | 5.25 | 10.50 | 15.75 | 21.00 | 26.25 | 31.50 | 36.75 | 42.00 | 47.25 | 52.50 |
| 4 | 7.00 | 14.00 | 21.00 | 28.00 | 35.00 | 42.00 | 49.00 | 56.00 | 63.00 | 70.00 |
| 5 | 8.75 | 17.50 | 26.25 | 35.00 | 43.75 | 52.50 | 61.25 | 70.00 | 78.75 | 87.50 |
| 6 | 10.50 | 21.00 | 31.50 | 42.00 | 52.50 | 63.00 | 73.50 | 84.00 | 94.50 | 105.00 |
| 7 | 12.25 | 24.50 | 36.75 | 49.00 | 61.25 | 73.50 | 85.75 | 98.00 | 110.25 | 122.50 |
| 8 | 14.00 | 28.00 | 42.00 | 56.00 | 70.00 | 84.00 | 98.00 | 112.00 | 126.00 | 140.00 |
| 9 | 15.75 | 31.50 | 47.25 | 63.00 | 78.75 | 94.50 | 110.25 | 126.00 | 141.75 | 157.50 |
| 10 | 17.50 | 35.00 | 52.50 | 70.00 | 87.50 | 105.00 | 122.50 | 140.00 | 157.50 | 175.00 |

an intensity of 0.1 ft.-candle; every one on the 0.25 rve to 0.25 ft.-candle, etc. Therefore, every point in e area between these two curves will receive an illumi- ation of not less than 0.1 nor more than 0.25 ft.-candle. milarly with the other curves.

Tests by various railroads seem to indicate that it is ecessary to throw an intensity of from 0.05 to 0.10 -candle on a man in dark clothes to render him visible at om 800 ft. to 1000 ft. on a railroad track. It is seen that e 0.10 ft.-candle curve extends 1540 ft. ahead of and di- ctly in front of the head-lamp—1000 ft. if 17 ft. to one de of the center of the beam, etc. Tests have also shown




. 4—CURVES SHOWING SPREAD OF BEAM FROM PARABOLIC EFLECTORS OF VARIOUS FOCAL LENGTHS EQUIPPED WITH ARIOUS-SIZED LIGHT SOURCES

t a man in white clothes can be discerned about one and 5-tenths times as far down the track as one in gray, while t latter can be seen one and three-tenths times as far as anan in black.

These curves are calculated from the candle-power distribution curve, n the assumption that the intensity of a head-lamp beam varies inversely as the square of the distance from the lamp to the point of measurement.

The braking distance of an express train running 60 miles per hour is in the neighborhood of from 1200 ft. to 1500 ft., depending upon various road conditions. Thus the incandescent head-lamp would show up obstructions in sufficient time to allow the engineer to reduce speed to such a point that the safety of the passengers would be assured.

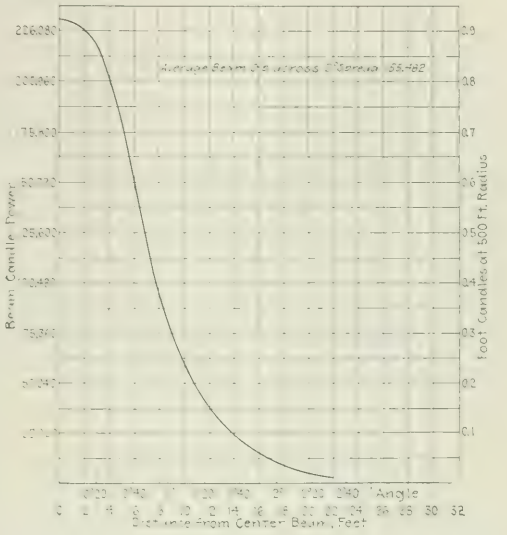



FIG. 5—CANDLE-POWER DISTRIBUTION

With the present location of the head-lamp on top of the boiler and the center of the beam trained on the track 1500 ft. ahead, the intensities on the track itself, close to the locomotive, would be somewhat lower than those shown in the isolux curves of Fig. 1. It would be an advantage if the head-lamps of locomotives could be mounted closer to the track. This would give better track illumination and less glare in the eyes of an approaching engine driver, and would make the classification lamps carried on the boiler more clearly visible.

There are under construction small 6-volt turbine generators of sufficient output to take care of head-lamps, cab-lamps and classification lamps, thus giving the locomotive a complete and independent lighting equipment. Recent improvements in the efficiencies of tungsten lamps seem to indicate that this lighting may also be accomplished by a relatively small storage battery.

## Fort Wayne Ordinance Favors Electric Signs

In Fort Wayne, Ind., where the "city beautiful" movement has gained a strong foothold and is still being pushed by its adherents, an electric-sign ordinance has been passed which is aimed directly at unsightly advertising methods. The ordinance stipulates that nothing but electric signs shall be erected along the main thoroughfares. Such electrically illuminated signs must not be transparent, and they must have a minimum illumination of 2 cp per square foot of area. The latter clauses are added in order that the outline sign may be useful in reflecting light to the street where it is needed. The candle-power per unit area is specified so that a merchant may not erect a large canvas with a small lamp in the corner and call it an electric sign. Several attractive signs have recently been added to the circuits of the Fort Wayne & Northern Indiana Traction company.

# Central Station Management

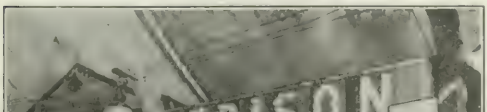
**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Reduced Mortality Among Ozonized Chicks

Mr. F. Allen, a poultry man of Waltham, Mass., has been carrying on experiments, with the assistance of the Edison Electric Illuminating Company of Boston, in administering ozone to hatching and brooding chicks and has obtained some interesting and successful results. Ordinarily twenty-four to forty hours elapse from the time the first chick peeps forth from its shell until the last has appeared, but owing to the vigor imparted by the ozone a recent hatching came out in ten hours, and Mr. Allen, whose plant hatches 2000 chickens weekly, declares that this brood was uncommonly strong and robust. Experiments are now being extended to purifying the hen-poisoned ground of the brooders, in an attempt to save a portion of the 50 per cent mortality which occurs after the young chickens are hatched.

## Neighborhood Merchandising

All large cities are usually made up of a number of neighborhoods, each with its social and business life. Recently there was held at Brownsville, the clothing manufacturing center of Brooklyn, N. Y., populated almost exclusively by Hebrews, an industrial exhibition. Here, under a large tent, occupying an entire block, were assembled a number of booths illustrating the industrial progress of Brownsville, and right alongside the display of the various classes of garment makers was the brilliant exhibit of the Edison Electric Illuminating Company of Brooklyn, which utilizes such affairs to get into personal touch with present and prospective customers and makes




EDISON BOOTH AT INDUSTRIAL EXHIBITION BROOKLYN N. Y.

a point of entering into the spirit of such occasions, in the same way as the local merchant does.

An attempt was made to show the public the right way to use various kinds of lamps, appliances and motors. For instance, a tailor's iron was rigged up complete with regulator stand, pilot switch and cord supporter; household appliances were demonstrated and various signs attached to an exhibit of tungsten lamps to show how much electricity is consumed by each lamp and what it costs to operate. Results showed that considerable interest has been aroused among prospective customers by the Edison exhibit. The first night six persons requested estimates for the wiring of their homes, four owners of tailoring shops applied for further demonstration of tailors' irons and several inquiries were made concerning 500-watt tungsten lamps, one being for twenty-five, to be used in a large dance hall. There were also many inquiries about changes from carbon to tungsten lamps. This method of exhibiting at local affairs, bazars and other social gatherings seems to be a cheap and practical way of awakening public interest.

The tent in which the Brownsville exhibit was held was lighted with forty 500-watt tungsten lamps, which in itself was a big advertisement for electric light. Next to the Edison exhibit, shown in the accompanying illustration, was the booth of an electrical contractor, and further on was the display of a garment makers' union, which demonstrated that the best way to run sewing machines is with electric motors.

## Electric Cooking at 1 Cent a Meal

In a Western city a rather extensive electric-cooking installation was put into service a few months ago in the local Y. M. C. A. cafeteria. Electricity is supplied from the central station. At the request of the electric-service company the manager of the association has given the following report of two months' operation:

"In the latter part of June, 1913, we installed a complete electric cooking equipment, consisting of Simplex stoves, ovens, etc., as follows: Two 17-in. ovens, two 8-in. stoves, two 10-in. stoves, two 12-in. stoves, one three-hole waffle iron, one 12-in. by 18-in. hot-cake griddle, one 1-quart coffee boiler, two toasters, one coil for 5-gal. coffee urn, and four 500-watt oven elements for hot table.

"The electric hot table was an experiment with us, but it is entirely satisfactory and very efficient. The hot table is divided into four compartments. Two are for meats and are 27 in. square with copper roll tops. Each of these has a false bottom 27 in. square and 3 in. deep in which is installed a flat 500-watt oven element. The air space is but little more than 1 cu. ft., and the electricity heats it perfectly. The remainder of the hot table is for vegetables and soups, each compartment being 27 in. square and about 7 in. deep. The containers are earthen crocks 12 in. in diameter and 7 in. deep, with a flange 2 in. from the top, allowing 5 in. of the lower part of the container to be in the oven.

"The meat ovens make very satisfactory plate warmers when not being otherwise used. With the exception of the toasters and egg boiler, all elements are installed with three-heat switches.

"During the first month, from July 1 to Aug. 1, we consumed 2120 kw-hr., from which should be deducted 50 kw-hr. used in preparing a banquet and also 96 kw-hr for heating water for dish-washing when the hot-water plant in the building was out of commission, leaving 1904 kw-hr. at 3 cents per kw-hr., a total of $57.12. This was the total

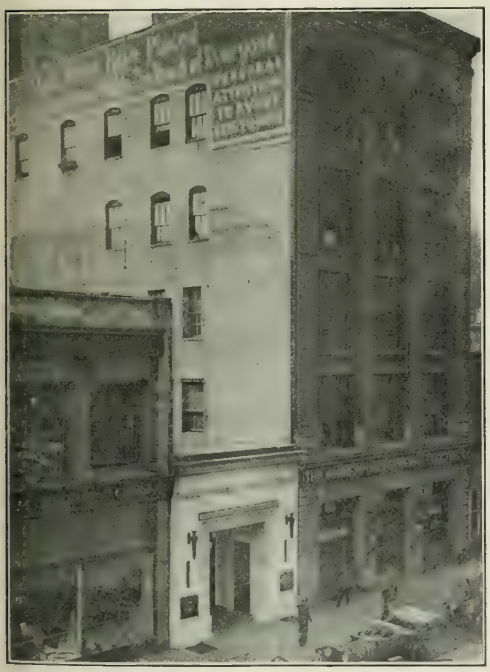
cost for preparing the food and keeping the hot table and a 5-gal. coffee urn hot for six hours each day. During the month of July we served 5220 meals, making an average cost of electricity for cooking slightly more than 1 cent per meal, or $1.13 per 100 meals.

"In August the energy consumed was 1964 kw-hr. at 3 cents, a total of $58.92. The number of meals served was 6271, or an average of only 94 cents per 100 meals. This reduction in cost per meal of nearly 17 per cent during the second month is due to the fact of our experience gained in knowing when and how to be economical. We feel that during each month we will show further slight reduction.

"While the cost of cooking by electricity may be slightly more than with wood or coal, the cleanliness and convenience of electricity, with the comfort and pleasure of a cool kitchen, more than compensate for any difference in cost."

## "Personal Attention" Blazoned on the Outer Walls

Every effort is made by the Minneapolis General Electric Company to cultivate friendly relations with its customers and with the general public. Under the management of H. M. Byllesby & Company a policy of entire frankness has been adopted in dealing with the public. One of the company's mottoes is "Personal attention to every customer," and, as shown by the accompanying picture, the announcements of low rates and of personal attention are painted prominently on the walls of the company's office building. It is the intention to illuminate these signs later. The suggestion that the blank walls of the sides of the building be used for advertising is attributed to Mr. W. H. Hodge, publicity manager for the Byllesby organization. Electric sign and outline lighting is used on the front of the building.



PROMINENT "PERSONAL ATTENTION" SIGN ON OUTER WALL OF MINNEAPOLIS GENERAL ELECTRIC COMPANY'S BUILDING

## Savings with Electric Trucks at Springfield, Mass.

Rapid expansion is under way in the commercial department of the United Electric Light Company, of Springfield, Mass., which serves one of the most representative communities in New England, from the cultural, business and manufacturing points of view. Within the past year the company has revolutionized its transportation service, and it now has a fleet of ten electric trucks in regular operation, ranging in size from 750 lb. to 5 tons capacity. The company's large stable has been transformed into an electric garage, and about a dozen horses have been displaced, besides the services of a number of stablemen.

A 5-ton machine is operated for cable pulling, and in the meter department two covered 1000-lb. Anderson electric vans have been installed. These cars are arranged for carrying meters and lamps and have a special floor covering of thick velour which provides an easy riding surface for the instruments. On the sides are boxes permitting quick selection of the sizes required for different installations. In a recent fifteen-month period one of these cars was run 9000 miles at a total cost of operation of 10 cents per mile, allowing for depreciation, current, license number and one set of tires. The cost of electricity for a day's run about town is about 3.7 cents per mile, figuring energy charge at 6 cents per kw-hr. In all its transportation work the company has saved about 30 per cent over former horse-traction costs. The meter wagons run at a speed of about 16 miles per hour.

## Co-operating to Avert a Water Famine in Oklahoma City

During the latter part of August and the early part of September Oklahoma City experienced a serious lack of water. When the Canadian River, which is practically the only source of supply for the city, began to fail, owing to the continued drought, the usual quantity of 9,000,000 gal. a day pumped into the city mains was reduced to 2,000,000 gal. and the pressure was maintained in the residence districts for only one hour a day, at which time the citizens were obliged to procure all the water they needed for domestic purposes. This reduced service continued for about ten days, but the river showed no signs of rising. It then became imperative for the city officials to take some quick action to get water from some other source.

Apparently the most feasible plan was to draw upon the lake in Northeast Park, which, it was estimated, held enough water to supply the city for a period of from twenty to thirty days. The Oklahoma Gas & Electric Company, one of the Byllesby properties, has always been a public-spirited corporation. It noted with concern the serious effects of the drought, and a conference was held between the Mayor, the city commissioners and Manager W. R. Molinard of the company. Mr. Molinard offered to negotiate on behalf of the city with the Oklahoma Natural Gas Company for the loan of about 4 miles of 8-in. pipe, and he also offered to build an electric transmission line about 4 miles long to Northeast Lake to provide the energy for pumping. The central-station company also tendered the loan of the necessary material, provided the city would pay for the labor of construction and for the reclamation of such material as could not be afterward used by the company at its full value.

Mr. M. W. Walsh, superintendent of the gas department of the company, went to Tulsa, and the natural-gas company kindly offered to lend the necessary piping and fittings. Six carloads of piping were accordingly shipped from Tulsa to Oklahoma City, and by Sept. 8 two carloads had been unloaded and placed along the proposed line. Meanwhile work had been begun upon the electric trans-

mission. It was intended to use the poles of the street railway company as far as possible. But on Sept. 7 rain began falling in substantial amount, and by the morning of Sept. 9 it was determined to suspend operations until the result of the rains could be seen. The rains continued and encouraging reports were received from the upper waters of the North Canadian River, so that the city commissioners felt that it would, in all probability, be unnecessary to continue construction on the emergency line. By Sept. 18 nearly 3 in. of rain had fallen and the situation seemed to be relieved.

The promptness and public spirit with which the Oklahoma Gas & Electric Company and the other public-utility companies arranged to come to the assistance of the city were favorably commented upon by the press and the public.

## The Story of Denver's 874 Electric Vehicles

Denver, Col., now has 822 electric pleasure cars and fifty-two electric trucks, evidence of the remarkable development which has followed the aggressive campaign of the Denver Gas & Electric Light Company. The latter's vehicle-charging ouput alone now totals 180,000 kw-hr. monthly, practically all of which is off-peak business with its demand coming between 10 p. m. and 8 a. m.

In order to introduce and popularize the electric vehicle, the Denver company several years ago created a special department of electric-vehicle and storage-battery engineering, with an expert engineer in charge. The first duty assigned to the engineer was to develop a higher class of service in existing garages, both public and private. He also set about establishing an educational scheme among the men of the company's commercial department by devoting a portion of each day to soliciting electric-vehicle "prospects" with the salesmen having charge of the various territories.

During this work personal calls were made on the owners of private garages, and instruction was given to those who desired it concerning methods of charging batteries and inspection of vehicles. Meanwhile particular attention was devoted to a campaign of solicitation directed at the officers and heads of firms and mercantile houses, with a view to interesting them in the adoption of electric vehicles for transporting and delivering goods. Different makes and types of vehicles were explained and data furnished as to cost, operating expenses, body designs, etc., of cars especially suited for the customers' purpose. In other words, the prospective user had placed entirely at his disposal the vehicle department's facilities for investigating motor delivery by means of electric-driven conveyances.

In addition to these direct selling efforts, the publicity department of the Denver Gas & Electric Light Company also issues an attractive monthly magazine, *The Electric Vehicle*. This sixteen-page bulletin is inclosed in colored covers and its contents are made up of interesting and authoritative reading matter concerning electric vehicles, both local and general. At intervals spaces in the newspapers are devoted to electric-truck advertising, and billboard displays are also used to good advantage in furthering the work of publicity.

Sixteen public garages, with a capacity for stabling 910 vehicles, are now in operation in Denver. For garaging, charging, washing and delivering electric pleasure cars the garage rates range from $25 to $35 per month. For trucks the rates vary from $30 to 90 per month, depending upon size. Among the local users of fleets of electric trucks are the Daniels & Fisher Stores Company and the American Express Company. These and other large customers seem pleased and satisfied with the service furnished by their electric trucks and have sent in orders for additional machines. The average rate received for vehicle charging in Denver is 3 cents per kw-hr.

## Rates for Electric-Vehicle Charging

Presented herewith is a tabulation of the schedule of rates made by central stations in various cities for the charging of customers' electric-vehicle batteries. In some cases the concession made by the electric company requires that the customer avoid coming on the lines with his charging load during the peak period. Other central stations make no such restrictions, offering the special rate without

CENTRAL-STATION RATES FOR VEHICLE CHARGING

| City | Rate per Kw-hr., Cent |
|---|---|
| [illegible], N. Y. | 5 |
| [illegible] | 3 |
| Turners Falls, Mass. | 3 |
| [illegible], Ohio | 4 |
| [illegible], N. Y. | 12 |
| [illegible] | 5 |
| [illegible] | 3 |
| [illegible] | 4–5 |
| Portland, Ore. | 4–1.5 |
| [illegible], Ala. | 4 |
| [illegible], N. Y. | 3 |
| [illegible] | 3 |
| [illegible], Ala. | 1.5–2.5 |
| [illegible] | 3.5 |
| [illegible] | 2 |
| Denver, Col. | 3 |

limitations. Usually a minimum bill of $3 or $5 per month is collected to meet the readiness-to-serve cost of the heavy charging load, for in residential districts this often requires the installation of additional transformers and copper. The rates made for alternating-current and direct-current charging service are usually the same, the customer defraying the cost of the slight loss in conversion, through a mercury rectifier, motor-generator or rotary converter, in outlying districts where only alternating-current service is available.

## Sale of Electrical Supplies by Central Stations

By W. E. Robertson

Of the three general classes into which articles for sale may be divided—namely, necessities, conveniences and luxuries—electrical supplies can best be considered as belonging to the second. The methods followed in the sale of necessaries on the one hand and luxuries on the other present the extremes of economy and extravagance. We have nothing to do with either of these methods in the consideration of the sale of conveniences.

Every article of convenience is sold to take the place of some less efficient or less desirable article in use, or to meet some need not hitherto supplied. In every instance where a campaign to introduce a convenience has been successful the price of the article has been sufficiently low to make its use generally desirable, and yet sufficiently high to cover the cost of a long campaign of education and promotion, a campaign in which several times the price received for the first articles sold must be spent in creating the demand.

As practically everything that uses electricity is a convenience, and as with the introduction of all new conveniences there comes an educational campaign, the cost of which must be borne by future and not immediate profits, and as it is to the advantage of all companies selling electrical energy to encourage the widest diversity in the creation, manufacture and sale of convenient energy consuming devices, and as the essential of all campaigns in the past to manufacture and sell conveniences has been the control of the re-sale price, I believe it follows, as a matter of logic, that the success of the central-station industry is to be found in the sale of electrical supplies on a commercial basis—that is to say, at a price which covers all of the elements of cost entering into the acquisition

sale and delivery of the article plus a fair return on the capital invested.

The central stations, for the present at least and possibly for many years to come, should assist in creating a demand by advertising the use of all kinds of energy-consuming devices. They should aid the manufacturers by publishing the standard retail price of the goods advertised and thus supplement the efforts of the manufacturer in his campaign of national advertising. They should show the goods advertised in attractive display rooms and absolutely maintain the fixed prices of the manufacturer as the soundest possible permanent policy. This policy will create opportunity for dealers and contractors, and where opportunity exists men will be found to take advantage of it. The stimulation to the industry caused by having numbers of small stores in convenient locations for the display, sale and installation of electrical devices of all kinds, with the added impetus of individual ambition on the part of the owners of these stores, will many times effect the slight advantage now obtained by cut prices as an inducement to buy the device.

The writer is satisfied from a study of the field that the recent enormous increase in the sale of household devices is due to the national campaigns of advertising and publicity carried on by the manufacturers, and that the central-station advertising has had very little to do with this increase. Cut prices on the part of the central stations as an inducement to the consumer of energy to use electrical devices are as old as the central-station industry itself, and yet the development of the manufacture of these devices and the use of them by the public has been of remarkably slow growth. Suddenly a change has been brought about. Manufacturers of courage and ambition projected extensive and expensive national campaigns of education to create the demand at a fixed price for electrical devices, and the result has been the stimulation of the manufacture of all kinds of devices and an increase in business little short of marvelous. These campaigns have been of tremendous value not alone to the central stations in the sale of energy, but to all manufacturers of apparatus and supplies used to generate or convey their energy, and because of this demonstrated result it should be evident to the manufacturers, jobbers, contractors and central stations that the greatest welfare of the central-station interests in particular and the electrical industry as a whole is to be found in the sale of electrical devices and supplies at established manufacturers' prices and the constant discouragement of selling at cut prices.

While I believe that it is wrong for owners of commodities or dealers in them to boost prices artificially by agreements among themselves, yet I believe in the right of the creator of a device in the nature of a convenience to control absolutely the terms of the sale of it.

I can conceive of no possible harm being inflicted upon the people by not only permitting this, but by also punishing anyone who attempts to cut the price or interfere with the general prosperity of the creator of the article, and I can see a tremendous boon conferred on the people as a whole by permitting this absolute control of the resale price, in that it will furnish the greatest incentive to creative work, and our civilization will be rapidly or slowly developed as this idea is fostered or disregarded.

While the common law and later the statutes covering barter and sale were wise as applied to the times in which they were evolved, conditions have changed, and civilization is now more complex. An article is no longer a unit, but an essential part of the great whole made up of millions of such units. The welfare of the manufacturers and of those connected with the industry is of infinitely more importance than property rights to the individual who buys something which is not necessary to the maintenance of his health, liberty or happiness, but is merely an addition to the number of conveniences which enhance his comfort.

## Rural Lighting and Motor Service Near Noblesville, Ind.

The Noblesville Heat, Light & Power Company operating an 825-kw station at Noblesville, Ind., about 25 miles north of Indianapolis, the capital city of the Hoosier State, has been making strenuous efforts during the past year to secure rural customers for its circuits. The success which

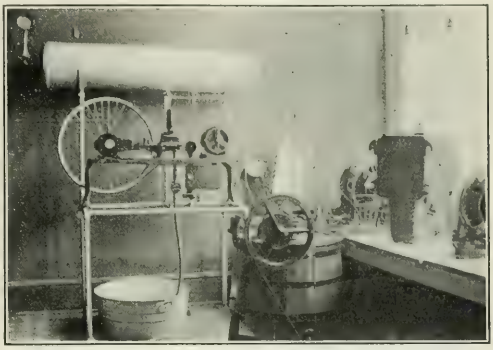


FIG. 1—WINDOW DISPLAY IN COMPANY'S OFFICE

has attended these efforts has been marked. One hundred strictly farm customers have been added to the company's list of patrons, in addition to a number of suburban homes not formerly reached and several neighboring small towns which have been supplied with electrical energy over the rural transmission lines.

The city of Noblesville had, according to the census of 1910 a population of 5073, while the surrounding towns which are supplied with energy from the local station are led by Lapel with 1045 inhabitants, Cicero and Arcadia having each 990 people, Westfield having 770 and Fishers

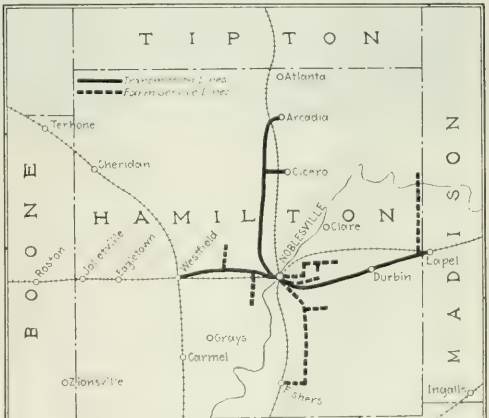



FIG. 2—MAP SHOWING TRANSMISSION LINES IN VICINITY OF NOBLESVILLE, IND.

188. In Lapel, Arcadia and Westfield electrical energy is also furnished from the Noblesville plant for street lighting. A local distributing company at Cicero buys the energy at wholesale from the Noblesville station and retails it to the inhabitants and to the city for street lighting. The transmission lines to these towns are shown on the map in Fig. 2.

All of the farm lines except that running 6 miles north from Lapel are operated at 2200 volts. The Lapel line carries 4400 volts. All service is single-phase. For the strictly farmer-service circuits the company estimates that at least four customers per mile must be obtained to make the line commercially profitable, and the following clauses quoted from the contract form set forth the terms under which these lines will be built:

"Application is hereby made to the Noblesville Heat, Light & Power Company by the undersigned for electric service for light and power on a line extending into the county and along the public highways in Hamilton and adjoining counties in Indiana, for a period of three years from date.

"The rate for service to be the same as prevails to customers in the towns, viz., 10 cents per kw-hr., subject to a discount of 5 per cent if paid on or before the fifth of the following month.

"The undersigned applicant agrees to use enough energy to make a quarterly bill of $1.50, or to pay that amount should sufficient energy not be used.

"The undersigned applicant further agrees to equip his premises to use electricity for such purposes as he may desire and pay for same, together with a transformer and wires from the main line of poles to his premises.

"The undersigned applicant further agrees to pay his proportional share of the cost of the main line in the public highway along his premises, with at least three other applicants per mile, provided the line does not exceed $200 per mile and with the understanding that the money thus paid for main line in public highway is to be refunded to said applicant in energy used at the above-mentioned rates.

"It is understood that the main line is to be owned, controlled and maintained by the Noblesville Heat, Light & Power Company, its successors or assigns.

"A written acceptance of this application by the Noblesville Heat, Light & Power Company shall make this a contract between the parties."

All lines built under this contract have been erected with standard two-pin arms on 25-ft. poles spaced at distances varying from 150 ft. to 225 ft., depending upon the kind of wire which was being strung. Where the load is light the 225-ft. spacing has been used to advantage, employing copper-clad steel wire for the conductor. Higher poles are used at road crossings and other places where the clearance demanded is more than can be given with a 25-ft. pole. Fig. 4 shows the type of construction used in these lines and also a three-wire house service which allows the farmer to operate his motors at 220 volts and have 110-volt service for the lighting. The transformer for the installation is mounted on the pole. The line shown in Fig. 3 is a combined transmission and farmer-service line and the type of construction here used is somewhat more sturdy than that seen in Fig. 4. Nearer the city, where it was possible by a contract with the telephone company to effect joint-pole construction, the combined transmission and farmer-service line is still more strongly built. Fig. 5 is a view of this joint line taken near the city limits of Noblesville.

Mr. John T. Kestner, who is contract agent of the Noblesville station and who has taken considerable personal interest in promoting the farm load, says that the central Indiana farmer is not so keen as he might be concerning the possibilities of motor service and that educational campaigns along this line are needed to stir up proper enthusiasm. However, the subject of electrically lighting the barn, when properly presented to the man who has always had to depend upon a smoking kerosene lantern for illuminating about 128,000 cu. ft. of space, which is a fair figure for an average barn, never fails to be a talking point, capable of holding attention and of creating that interest which speedily leads to the signing of a consumer's application.



FIGS. 3, 4 AND 5—TYPICAL FARM LINE AND JOINT LINE CONSTRUCTION AT NOBLESVILLE, IND.

For interesting the rural population in the application of motor service to ordinary farm labors, fitting windo displays, such as the one shown in Fig. 1, are used fro time to time in the company's office. The pumping installa tion in this picture is a home-made affair rigged up t show the ease with which a pressure-tank water syste can be automatically maintained at constant pressure b means of a 1-hp motor connected to the service wir through a pressure limit relay. The pipe and hose co nections have been arranged so that the water can be le to run into the tub and can be pumped out again into t pressure tank.

Meters on the rural lines are read quarterly by a linem who drives over all of the lines. A lineman has be selected for this work for the reason that he can not on perform the duties of a meter reader but is able to mal any needed repairs to the circuits and in many cases remedy cases of trouble which require attention. All bi are paid at the office of the company in Noblesville eit by mail or personal call. The central-station compa employs two wiring gangs and keeps one busy on outs construction while the other attends to inside wiring bo in the country and in the towns on the company's circuits.

# Illumination and Wiring

## Curved Electric Sign on a Suburban Real-Estate Office

The accompanying photograph shows an effective electric sign recently installed on top of a prominent real-estate office at Coolidge Corner, Brookline, Mass., facing an important electric-railway junction point and transfer station. In this installation the sign is arranged to attract attention on the north and east sides of the building as well as at intermediate points. It consists of two short straight sections and a curved section in the middle, giving a total length of 58 ft. over all and a width of 42 in. The electrical equipment consists of 306 5-watt, 11-volt tungsten




CURVED ELECTRIC SIGN

lamps supplied with alternating current through two transformers connected with the Boston Edison service. The lamps burn continuously from dusk until midnight, and the sign is installed about 15 ft. above the sidewalk. The letters are of the sunken type with gold-leaf trim and the sign cost about $240. On account of sharp competition in real estate in this portion of Greater Boston and the location of several offices of rival firms at this point, the sign illustrated herewith has been found to be a valuable factor in stimulating business. All outer Beacon Street and Harvard Avenue street cars pass this point on short headway service, and the adjoining streets are main highways of automobile traffic.

## Errors in Photometry

In a paper read before the recent Pittsburgh meeting of the Illuminating Engineering Society by Messrs. Evan J. Edwards and Ward Harrison, Cleveland, reports were given on four separate investigations relating to the causes for error in photometric measurements.

The first investigation covered the relative accuracies of Bunsen and Lummer-Brodhun devices. This test, involving several thousand readings, showed the sensitivity, expressed in average deviation, to be 0.4 per cent for the Lummer-Brodhun as compared with 1.4 per cent for the Bunsen.

The magnitude of error from parallelism of rays in the photometry of reflector sources was the subject of the second investigation. The results of tests on typical reflectors for general illumination purposes showed the errors in assuming the inverse square law to hold to be negligible.

For the third investigation the authors selected the adjustment error and the calibration of portable photometers. This method consisted in taking photometer readings for various distances from a working standard lamp and analyzing the results by reducing the relation to a straight-line function. The constant of the photometer was obtained from the slope and working standard intensity.

The fourth investigation related to errors in illumination measurements due to failure of the test plate to obey the cosine law. Discrepancies between the measured and calculated values of illumination were fully accounted for by this investigation. The average error of the plates investigated was found to be over 10 per cent at 45 deg. Computations show that the photometer results for an average installation are about 12 per cent low.

An interesting and valuable method of obtaining and recording candle-power distribution data was described by the author. A so-called thousand-lumen basis of drawing distribution curves was proposed, in order to avoid error and confusion in comparing reflector units. On this basis zonal lumen values are instantly convertible to percentage of the total, and the intensity values to percentage of the horizontal candle-power for the bare lamp. By using a single multiplying factor all values can be corrected to current lamp specific consumptions.

According to the method proposed, the polar candle-power curve is drawn on the basis of a lamp giving a total of 1000 lumens, which is very nearly correct for a 100-watt lamp operating at 1 watt per horizontal candle-power. Assuming the standard reduction factor of 78 per cent for the 100-watt straight-sides lamp, the total lumens at 1 watt per candle are 980, or 2 per cent less than the 1000 used. On the basis of a reduction factor of 81 per cent, which is standard for the larger round-bulb lamps, the total lumens for 1 watt per horizontal candle-power would be 1018. Therefore, the specific consumption is within 2 per cent of 1 watt per candle for both the straight-sides and round-bulb lamps on the basis of 10 lumens per watt, and the average happens to be within 0.1 per cent. It is seen that all values of lumens are instantly convertible to percentage of total. The intensity values are as easily converted into percentage of the horizontal for the bare lamp, with an error not greater than 2 per cent.

Among those taking part in the discussion were Messrs. W. R. Mott, Lakewood, Ohio; M. Luckiesh, Cleveland; S. L. E. Rose, Schenectady, N. Y.; L. J. Lewinson, New York; W. F. Little, New York; T. H. Amrine, Harrison, N. J.; Isador Ladoff, Pittsburgh; H. E. Ives, Philadelphia, and Evan J. Edwards, Cleveland.

In reply to the question of the other speakers, Mr. Edwards stated that the inverse-square law is applicable within reasonable errors even when projectors are photometered.

## Store Lighting

In a paper read at the recent Pittsburgh convention of the Illuminating Engineering Society Messrs. Clarence L. Law and A. L. Powell reported the results of a study of the lighting equipment of various stores in New York City. Data were given concerning the dimensions, wall, ceiling and floor coverings, arrangement of fittings, type of glassware, number and sizes of lamps, and a general description of the appearance of each store. The data related to toy, toggery, millinery, candy, grocery, tea, shoe, curio, book, ladies' wear and stationery stores.

A sufficient number of installations were described to indicate quite clearly that the lighting system should blend with the general scheme of decoration. The authors stated that the satisfactory illuminating equipment is not dazzling, glaring or commonplace, but is inconspicuous and forms a part of the furnishing of the room. They claimed that one is able to apply commercial diffusers and reflecting devices to almost any class of service, and that there is no necessity

for the design of special auxiliaries. The authors remarked that in designing the lighting of shops of the better class discretion should be exercised in the selection of lighting units, and the prospective customer should not be offered something which is, on the face of it, purely utilitarian.

In discussing the paper, Mr. S. G. Hibben, Pittsburgh, remarked that glass can now be obtained to match decorative interiors, being made in various tints, such as old gold, green, amber, etc., and with etched monograms.

Mr. C. A. B. Halvorson, Jr., West Lynn, Mass., claimed that the arc lamp is well suited for certain interiors, such as large restaurants.

Mr. D. McF. Moore claimed that the vapor-tube lamps are excellent where distinctive lighting is desired.

In reply to a question by Mr. M. H. Flexner, Chicago, Mr. Powell said that cluster lamps are in favor because of the flexibility in the control of the illumination and the economy in operation when full brilliancy is not needed. Side-wall lamps are used in restaurants chiefly because ladies prefer an abundance of light on their faces in such places.

## Quartz-Tube Lamps in Ornamental Lanterns for Decorative Illumination

At the Adams Street entrance of the present Continental and Commercial National Bank Building in Chicago, which will soon be the office headquarters of the Commonwealth Edison Company, four large and handsome street lanterns are attached to the side of the building by brackets, and project over the sidewalk. These lanterns are about 7 ft. high, and 3 ft. in diameter. They are of bronze, octagonal in shape, and are provided with panels of thick art glass nearly white in color. Tungsten lamps had been installed in these massive fixtures, but owing to the size and construction of the lanterns and the character of the ornamental glass the illumination was not particularly effective. Recently the incandescent lamps were supplanted by four Cooper Hewitt quartz-tube mercury-arc lamps, and the result is a striking and unique illumination. The lamps are of the same type as



FIG. 1—LANTERNS AT ADAMS STREET ENTRANCE WITH QUARTZ-TUBE LAMPS INSIDE

the six suspended by steel booms from building fronts on West Randolph Street, between North LaSalle Street and North Fifth Avenue, Chicago. They are operated on 220-volt Edison direct-current circuits, each lamp taking 726 watts. The lamps are installed about 15 ft. above the sidewalk. The color of the light is of the greenish tinge of the mercury-vapor lamp, but the effect is striking and the illumination is excellent. Fig. 1 is a daylight picture showing the fixtures, and Fig. 2 is a reproduction of an unretouched night photograph showing the effect



FIG. 2—NIGHT VIEW OF ILLUMINATION FROM QUARTZ-TUBE LANTERNS

of the illumination from the quartz-tube lamps in the fixtures on the left.

## Church Lighting

Mr. Robert B. Ely, of the Philadelphia Electric Company, presented a paper at the Pittsburgh convention of the Illuminating Engineering Society, in which the various problems relating to the lighting of churches were discussed.

Concerning lighting systems the author stated that direct lighting, having been used to the greatest extent, still predominates. This fact is largely due to the architects, as they are more familiar with this method of lighting. There is a tendency, however, in favor of indirect lighting or a concealed direct-lighting system. The semi-indirect system has not been adopted to any extent, owing to the great cost of translucent glass bowls and the greater installation costs.

Direct-lighting systems have been installed more generally, owing to lower installation and operating costs, the influence of the architect and the general public's lack of information on lighting matters. It is not at all unusual to see new buildings and churches equipped in a manner at variance with good practice simply because the architect's plans were drawn and the client had entire confidence in the architect. Generally architects will co-operate with the illuminating engineer, but this is not always the case.

There are some general rules that should be followed relative to the illumination of the church auditorium. The light sources should be within the line of vision. All lamps in any system of illumination should be hung sufficiently high, so they will not obstruct the view of those in the gallery of the church. No fixtures should be located so as to obstruct the architectural features. The intrinsic brilliancy of all light sources should be reduced, when visible from any point, by frosting or other diffusing means. Hymn boards should be illuminated by a concealed source where the general illumination is low or otherwise.

Generally in the construction of the chapel one or more side or roof windows are provided for daylight illumination of the chancel, thereby making this section of the church lighter by comparison than the main body of the

church. With artificial illumination this effect may often be obtained more readily and more effectively.

In formulating a plan or method of lighting the chancel or sanctuary the construction of the interior of the chancel will frequently demand special apparatus, reflectors and lamps, in order to obtain effective results. A chancel arch will greatly facilitate the installation of lamps and reflectors, but when there is no arch it is more difficult to place the lamps and reflectors to direct the light to the best advantage and avoid sharp shadows. Such equipment when placed at a great height should be so arranged that it can be lowered for renewal and cleaning purposes. But owing to the installation costs lighting units are more often located in a permanent manner behind the arch and renewals are made by the use of extension ladders.

The use of decorative altar illumination is increasing. Electric imitation candles are being used in many churches. The lighting of tabernacle niches as well as the outlining of altars is being done quite successfully by the use of low-voltage lamps. A sign-lighting transformer is often installed and receptacles are provided at various points on the altar, together with the permanent equipment, so that small electric bulb signs and emblems may be readily connected. The cost of such an installation is more or less offset by the low operating costs of the equipment.

On account of the tendency in recent years to increase the illumination in the body of the church it is necessary to increase the illumination in the sanctuary to make a noticeable difference in the intensity of the light in the two sections of the church.

The depth of some of the chancels is fairly great, and in order to increase the illumination on the altar or reredos it is necessary to concentrate the light from a source more or less localized.

The use of dimmers in the church is becoming more general. In some cases they are placed on the chancel and imitation candle standard circuits in Episcopal churches, and when the choir procession takes place the lamps are gradually brought to full brilliancy as the choir enters the chancel. In some of the Catholic churches dimmers are connected to the circuits of the church auditorium and sanctuary for use during special services.

The question of appropriate fixtures is an important one. The fixture designer has been studying ornaments for years, and this knowledge of ornament is of equal importance to the illuminating engineer, as he is not only called upon to plan the outlets for a lighting scheme but he often is obliged to select the fixtures. In the case of some of the more novel schemes of illumination, he is obliged to design fixtures to meet unusual conditions. This means that he must be familiar with the fundamentals and the different orders of architectural design. The illuminating engineer must study harmony of design, and particularly the effect of light and shadow on architectural ornaments.

There have been many apparent reasons given for copying ancient lamps and light sources to harmonize with certain styles of architecture. In carrying out such designs of fixture and lighting units, the units have frequently been so placed as to be distressing if not harmful to the eyes. Therefore novel and unusual methods may be inaugurated in designing the illumination for the church with due regard for ritualistic symbolism.

When the illuminating engineer attempts to effect new and unusual methods of lighting churches he should of course be familiar with the orders of architecture and ornament, so that he will be able so to design the lighting installation that some of the architectural features of the building may be brought out by light and shadow without distorting their appearance.

The candle is used in the services of the Roman Catholic Episcopal (high), Lutheran and German Lutheran churches. It has more prominence in the ceremonies of the Roman Catholic church than in the others.

In the Catholic churches the altar is the main feature to be considered for its symbolic significance, as the rubric of the church requires the use of wax candles for the various services. However, in numerous instances some of the candles that are still in use can be replaced by either gas or electric imitation candles to greater advantage, and this will result in a more effective appearance.

The lighting specialist should know when and how candles are used in religious services, their advantages and disadvantages. The mellow glow of the candle with the low intrinsic brilliancy of its flame is pleasing aside from the flicker—although there probably is an open question as to whether the flickering of the candles used for religious purposes is a distracting feature, or whether the light is more effective that way. There are certain times, particularly on holy and feast days, when the altar is illuminated to a greater extent than for ordinary services.

The author contended that from every standpoint good illumination is just as important in the church as it is in the place of amusement. Emphasis is laid upon the comparative methods employed by places of amusement and churches in the matter of making their audiences comfortable, because there is a very real analogy, which is too apt to be overlooked. There is nothing in religion which teaches that those who attend church services should be made uncomfortable, and yet lack of forethought upon the part of those responsible too often makes attendance at church services a positive source of distress for those whose eyes are not strong or are perhaps overstrained.

*Discussion*

Mr. Joseph D. Israel, Philadelphia, remarked that the purely business features of church-lighting work can best be handled by persons experienced in this line in order not to detract from the sacredness of the subject.

Mr. J. R. Cravath, Chicago, directed attention to the helical filament tubular lamps which are particularly advantageous in cove lighting. In illuminating paintings on ceiling decorations, it is essential to advance the light source so as not to be in the line of vision.

Mr. A. L. Powell, East Orange, N. J., remarked that certain simple designs of opal-glass bowls have been developed to harmonize excellently with church architecture.

Mr. S. L. E. Rose, Schenectady, N. Y., suggested the use of incandescent lamps equipped with parabolic reflection for lighting the gilded cross on the church steeple to obviate the need of a steeplejack.

Mr. R. F. Pierce, Gloucester, N. J., claimed that either the direct or the indirect lighting system will give satisfactory results in a church, provided each is properly installed and the simple brightness is kept at a low value.

# Letter to the Editors

## Associated Austrian Technical Societies

*To the Editors of the Electrical World:*

Sirs:—In connection with the proposed Association of American Engineering Societies, mentioned in your issue dated July 5, 1913, attention should be called to the General Congress of Austrian Technical Societies, which meets at five-year intervals. A committee is appointed at each meeting to conduct the business for the congress until it meets again. This committee consists of one delegate from each society, of which there are now forty-nine, and twelve members selected by the congress as a whole.

At the sixth congress, which met in December, 1911, the following twelve members were elected: Dr. von Bergen, president; Professor Lorber, vice-president; Dr. Dompieri and Messrs. Fellner, Goldemund, Günther, Höller, Kapaun, Klandy, Manthner, Mayreder and Singer.

*Trieste, Austria.* Dr. Gino Dompieri.

# Field of the Operating Engineer

**A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers**

## Canal Gang's Cable-Pulling Record

The cable gang working at the Gatun Locks, Panama Canal, under the direction of Supervisor G. A. Balling, recently established a local record for cable pulling. In one eight-hour day they drew 9828 ft. of eight-conductor, No. 10 lead-covered cable and 12,300 ft. of five-conductor, No. 10 lead-covered cable, a total of 22,128 ft. A total of 9200 ft. of cable was pulled during the first three hours. It rained the entire day, and on this account the conditions under which the work was carried on were unfavorable. The best Canal Zone record for any one month was made at Gatun Locks when 113,002 ft. of cable was pulled.

## Gasoline as an Aid in Digging Holes in Frozen Ground

In northern Minnesota, where the earth freezes to a depth of from 4 ft. to 5 ft. in winter and where consequently the cost of digging holes is high, the following expedient is used to keep down costs. When the top of the hole has been picked out to a depth of 6 in. or more a tin cup full of gasoline or coal-oil is poured into the hole and lighted. The digging is then continued, the burning oil thawing the earth, and from time to time more oil is added. It is said that with the help of about a gallon of oil per hole the cost of digging can be reduced approximately 15 per cent.

## Automobile Trailers for Line-Construction Crews

The accompanying illustration shows the automobile and trailer truck used by the line crew of the Central Illinois Lighting Company, which is now building a transmission line between Farmington and Peoria, Ill. The outfit has a capacity for hauling fifteen men at a speed of from 25 to 30 miles per hour. In this way the crew is taken out to the job in the morning and returned in the evening. When the distance from the site of the work back to Farmington is less than 12 miles the gang rides in for dinner.

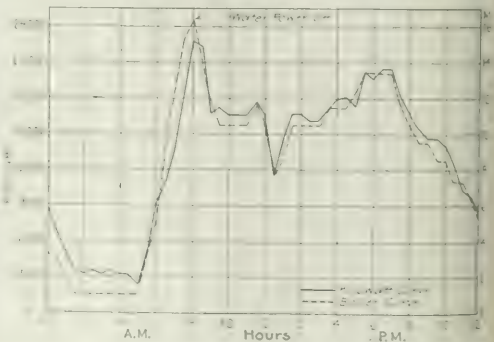
Similar use of automobile trailers is made by the properties of the Amesbury (Mass.) Electric Light Company, as recently mentioned in these columns. Each district of the system is equipped with a Ford runabout and a 1200-lb. trailer carried on roller bearings. The combination outfit is used in taking the line gang and its tools to each job in the morning, after which the superintendent uncouples the trailer, leaving it with the men as an outdoor shop. He then visits customers in trouble or needing the company's attention and returns at noon to take the men home for dinner, again attaching the trailer. The program is repeated in the afternoon. The combination equipment, loaded, will make a speed of 15 miles per hour on the road. The cost of operating one of these cars over 30,000 miles since November, 1911, has averaged 5 cents per mile, including gasoline, oil, repairs and sinking fund on the car.



AUTOMOBILE AND TRAILER CARRYING LINE GANG.

## Boiler-Room Record Comparing Steam and Energy Outputs

Shown herewith is a copy of the boiler-room record kept by The Milwaukee Electric Railway & Light Company for the purpose of comparing the steam produced with the electrical energy generated. It provides a ready means of ascertaining whether the firemen are operating the boilers at their most efficient rating and whether the steam piping is in proper condition. The steam curve is plotted in boiler-hp, and the electrical energy curve is plotted in kilowatts. As a standard from which to work the operating engineer is instructed to produce a certain number of kilowatts per rated boiler-hp or an equivalent higher number of kilowatts per boiler-hp, figured at the most efficient operating point. With definite figures from which to work and with a record like the one shown it is a simple matter for the superintendent of power plants to find out whether instructions are being followed. The boiler-hp is estimated from steam-flow meters installed in the stations. The reason for the steam curve being below the electric curve at one time and above at another is that the water-power plant operated in conjunction with the steam station at which this record was taken was in operation only part of the time. Where such auxiliary power was not used the steam curve falls above the electric curve.




COMPARATIVE STEAM-PRODUCTION AND KW-HR. LOAD CURVE

## Comparative Costs of Motive Power in Ice Manufacturing

At the recent International Congress of Refrigeration in Chicago Messrs. R. H. Tait and L. C. Nordmeyer, of St. Louis, presented a paper on "Comparative Installation and Operating Cost of a Combined Ice-Manufacturing and Cold-Storage Plant" in which they compared the costs of (1) a simple steam plant, (2) a compound condensing steam plant and (3) a Diesel-engine and electric-auxiliary plant. It is assumed that the plant would be located in the Southwest and be capable of developing the equivalent of 72 tons of ice-making capacity for twenty-four hours daily. The yearly work is equivalent to 14,880 tons of ice. The cost of fuel oil is figured at 95 cents per barrel of 42 gal. The present price of fuel oil is greater than this, but not enough to make the oil engine a poor investment. Oil is burned under the boilers of the steam plants.

The estimates of the authors show the greatest economy for the oil-engine-electric plant. The equipment consists of two 225-hp Diesel engines, each belted to a 60-ton refrigerating machine and a 40-kw generator. All auxiliaries in the plant are driven by electric motors. Depreciation on oil engines is figured at 10 per cent for oil engines and 5 per cent for other machinery.

After giving estimates in some detail for the three types of plants, the authors summarize the comparative costs of installation and operation in the accompanying table.

COMPARATIVE COSTS OF ICE-MAKING PLANTS

| | Simple Steam Plant | Compound Condensing Steam Plant | Diesel-Engine Plant |
|---|---|---|---|
| Cost buildings | $60,000.00 | $60,000.00 | $60,000.00 |
| Cost machinery | 65,000.00 | 76,400.00 | 83,923.00 |
| Total cost | $125,000.00 | $136,400.00 | $143,923.00 |
| Cost water per ton ice | ..... | ..... | $0.090 |
| Cost fuel per ton ice | $0.976 | $0.753 | 0.226 |
| Fixed charges machinery | 0.546 | 0.642 | 0.821 |
| Operating cost | 0.579 | 0.579 | 0.516 |
| Cost per ton ice (no building charge) | $2.101 | $1.974 | $1.653 |
| Building charge per ton ice | 0.504 | 0.504 | 0.504 |
| Cost per ton ice with building charge | $2.605 | $2.478 | $2.157 |

Comparisons deduced by Messrs. Tait and Nordmeyer are as follows:

*Simple Versus Compound Steam Plant.*—The compound condensing steam plant costs $11,400 more than the simple steam plant, but a saving of 12.7 cents per ton of ice is accomplished, which for 14,880 tons of ice-making capacity per year amounts to $1,889.76 per year. On this basis the compound condensing steam plant will pay for the difference in cost between it and the simple plant in approximately six years.

*Simple Steam Plant Versus Diesel-Engine Plant.*—The Diesel-engine plant will cost $18,923 more than the simple steam plant, but a saving is accomplished of 44.8 cents per ton of ice, or $6,666.24 per year. On this basis the Diesel-engine plant will pay for the difference in cost between it and the simple steam plant in less than three years.

*Compound Condensing Plant Versus Diesel Plant.*—The Diesel-engine plant costs $7,523 more than the compound condensing steam plant, but a saving of 32.1 cents per ton of ice is accomplished, which amounts to $4,776.50 per year. The Diesel-engine plant will pay for the difference in cost between it and the compound condensing steam plant in less than two years' time.

"From the comparison given above," say the authors, "it seems apparent that the oil-engine plant would be an exceedingly good investment. This should especially be apparent on account of the manner in which the deductions were made. The steam-driven plants received the benefit of the best efficiency that could be obtained—namely, a boiler efficiency in the case of the simple plant of 65 per cent, and in the case of the compound condensing steam plant, with the use of an economizer, of 71½ per cent.

"The steam consumption of the simple engine of the refrigerating machine was assumed to be 27 lb. per indicated hp-hr., while that of the electrical generators was assumed to be 30 lb. of steam per indicated hp-hr.

"In the case of the compound condensing steam plant, a steam consumption of 18 lb. per indicated hp-hr. for the steam engines of the refrigerating machine and 20 lb. per indicated hp-hr. was assumed for the generator engines, including steam for vacuum pumps and other auxiliaries.

"In the oil-engine plant the engines were credited with a low efficiency of 8 gal. per 100 boiler-hp-hr., while we have found that the fuel consumption of engines installed in the Southwest by the Busch-Sulzer Brothers-Diesel Engine Company was approximately 6½ gal. per 100 boiler-hp-hr. under normal working conditions. In addition to this, the oil-engine plant is charged with water bought from the city, as against artesian well water used in the steam plant.

"A further advantage is given to the steam installation by charging it with a depreciation and obsolescence of only 5 per cent, as against 10 per cent charged to the Diesel oil-engine installation."

## Changing Two-Phase Generators for Three-Phase Operation

Following the recent merger of the Merchants' Heat & Light Company with the People's Light & Heat Company at Indianapolis, Ind., parallel operation of the stations of

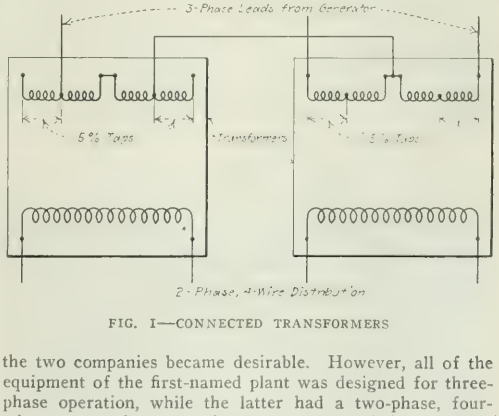



FIG. 1—CONNECTED TRANSFORMERS

the two companies became desirable. However, all of the equipment of the first-named plant was designed for three-phase operation, while the latter had a two-phase, four-wire system, the generating apparatus consisting of three two-phase alternators totaling 850 kw. In order to operate the two plants in parallel one of the larger units of the People's plant, a 300-kw alternator, was T-connected. The scheme used for making the connections is shown in the accompanying drawings. The terminal of one winding was first connected to the middle point of the other; then a tap was taken out at a point representing 86.66 per cent of the full length of the first phase coil. One lead from the four-wire machine was then discarded and the remaining three wires, being connected as shown, were used as the conductors for the three-phase energy.

The attendant transformer difficulties arising were overcome by an ingenious arrangement of connections shown in Fig. 1. The 5 per cent taps which are to be seen in the drawing were omitted from the leg of the T, which is commonly made 86.66 per cent of the full leg, making the actual

relation 90 per cent to 100 per cent. This proportion has proved to be sufficiently near the theoretical values for practical purposes, and on the trial run the machine readily came into synchronism with the remainder of the system and carried its full rated load without showing any signs of undue heating. The machine which has been

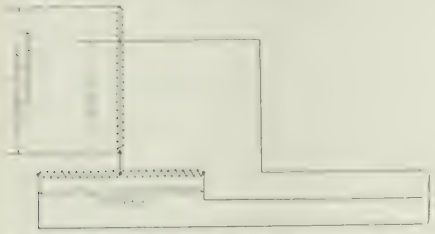


FIG. 2. DIAGRAM OF REARRANGED GENERATOR CONNECTIONS

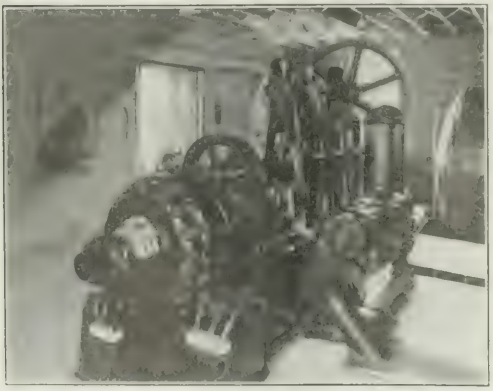
changed is rated at 300 kw, 2200 volts, 60 cycles, and operates at 240 r.p.m.

## Automatic Electric Water Works at Farmington, Mich.

The automatic electrically operated pumping plant which furnishes both the water supply and fire protection for Farmington, Mich., a typical village in a farming community, was described by Mr. A. R. Cary, of the Eastern Michigan Edison Company, before the recent convention of the Michigan Section, N. E. L. A. The equipment employed is of a type especially suitable for service to villages and small towns and was installed by the Dayton Pump & Manufacturing Company in 1912.

Water is obtained from two wells 170 ft. deep, one being 3.5 in. in diameter and the other 8 in. in diameter. From the large well the supply is pumped into a cistern or reservoir under the pump-house, while from the smaller bore the water is delivered directly into a pressure system. A pressure tank with a capacity of 13,000 gal. is used, although as normally operated the supply held in the tank is only 10,000 gal. or less.

The pumping equipment installed consists of: (1) a 5-hp,



THE FIRE WATER WORKS AT FARMINGTON, MICH.

220-volt, three-phase Wagner motor running at 1140 r.p.m., which drives through gears a Dayton deep-well pump operating from the smaller well, at 45 strokes per minute, with a 12-in. stroke; (2) a 7.5-hp, 220-volt, three-phase Wagner motor running at 1720 r.p.m., which drives through gears a Dayton deep-well pump operating from the larger well at 46 strokes per minute; (3) an air-compressor drive through gears by a 3-hp, 220-volt, three-phase Wagn motor running at 1720 r.p.m. and discharging into t pressure tank, and (4) a triplex, single-acting, geared fi pump driven by a 30-hp, 220-volt, three-phase Westin house motor with a wire-wound rotor and slip-rings, whi runs at 860 r.p.m.

The small pump delivers continuously into the pressu system. If the pressure drops below 30 lb., the fire pun is automatically put into service and pumps from the ci tern into the pressure system. If the water level in t cistern falls below a certain point, the pump working fro the larger well is "cut in" and fills the cistern. When t use of water is small and the pressure is right the small pump is also automatically put out of service.

No operator is needed in a plant of this kind. The v lage employs a man for a small sum to inspect the equi ment and keep it oiled and in repair, which he can do about one hour per day. The labor cost for operation therefore negligible. As there is no meter on the wat supplied, it is impossible to give any cost for the wat pumped. The monthly bills for electric service, at 4 cen



FIG. 2—DEEP-WELL PUMP, WATER-WORKS AT FARMINGT MICH.

per kw-hr. (less 5 per cent for prompt payment), have r as follows: $40.77, $40.33, $36.18, $31.77, $32.42, $30 $48.34, $48.37, etc.

All water is paid for by meter. There are forty-ei t consumers at present, but many more are being added. Th minimum charge of $1.50 per quarter allows the consur r to use 9000 gal. When more water than this is used, the is a charge of 15 cents per 1000 gal. for the next 10,000 g and a charge of 10 cents for all over 19,000 gal. used.

Energy supply to operate this installation is received fr n Detroit over a 4600-volt, three-phase line. This press e is then stepped down to 230 volts by a 30-kva Gene l Electric transformer located about 50 ft. from the buildi .

A generally similar pumping plant, to cost $14,000 s being installed in a small town near the center of the St ', and three others are soon to go in.

## Load-Factor of Hydroelectric Plants

The combined output of the Niagara Falls Power C - pany and the Canadian Niagara Falls Power Compan is over 868,000,000 kw-hr. a year and the load-factor i 82 per cent. This is the largest and most satisfac hydroelectric development from all viewpoints that 'e know of.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*Polyphase Series Motor.*—J. Jonas.—An article illustrated by diagrams on methods of phase compensation and methods of insuring the stability of operation of polyphase series motors. The author discusses methods based on variation of the winding ratio and shows that neither special choice of the winding ratio nor the saturation of the series transformer insures stability over the whole speed range, but that this can be attained by the use of additional resistance in the motor circuit. The combination of these three methods is advantageous.—*Elek. Zeit.*, Sept. 18, 1913.

*Standardization Rules of Dynamo-Electric Machinery.*—Revised standardization rules for rating and testing electric machines and transformers were adopted at the last meeting of the German Association of Electrical Engineers and will be in force after July 1, 1914. These regulations contain definitions, rules on the testing of dynamo-electric machinery, commutation, temperature increase, overloading, insulation, methods of determining efficiency, and voltage drop.—*Elek. Zeit.*, Sept. 4, 1913.

*Direction of Rotation of Vectors.*—Fritz Emde.—A letter taking exception to the arguments given by Breisig and Wagner in favor of rotation to the left of alternating-current vectors.—*Elek. Zeit.*, Sept. 11, 1913.

### Lamps and Lighting

*Arc-Lamp Electrode.*—A note on a recent British patent (No. 10,210, 1913) of J. Rondal. The electrode has high emissivity and is not easily oxidized when burned in an inclosed but not air-tight lamp. The carbon before or after pressing is impregnated with a mixture of sodium or potassium aluminum phosphate and graphite containing earthy admixtures. Preferably also baked calcium saccharate is added to the core.—London *Elec. Eng'ing*, Sept. 4, 1913.

*Street Lighting in Dresden.*—A. Strauss.—A translation in abstract of his article recently abstracted in the *Digest* and showing the gradual development of street lighting in the city of Dresden in Germany from carbon arc lamps to flame-arc lamps and more recently to tungsten incandescent lamps.—London *Electrician*, Sept. 5, 1913.

### Generation, Transmission and Distribution

*German-Swiss Water-Power Plant.*—E. Frey and O. Albrecht.—The first part of a fully illustrated description of the new power development at Rheinfelden. It consists of two separate projects. One is the Wyhlen water-power plant of the Rheinfelden transmission system and the other is the Angst power plant of the city of Basle. The present article relates to the Wyhlen plant. In view of the time required to build the water-power development, a steam-turbine station of 10,000 hp rating with two turbo-generators was first erected. The water-power plant, which was finally opened last year, has ten main turbine units and two turbine-driven exciters. Each main unit is rated at 2200 hp. The article is to be concluded.—*Elek. Zeit.*, Sept. 11 and 18, 1913.

*Victoria Falls Power Scheme in South Africa.*—An editorial note referring to the fact that some years ago it was proposed to transmit energy from the Victoria Falls, on the Zambesi, to the Rand. A power house with a capacity of 50,000 hp was to be constructed as a beginning, and 12.5-cycle energy was to be transmitted over a three-phase aluminum line at a pressure of 150,000 volts. The beginning was made by buying up existing steam stations, and the latter plants have developed so well that the system now has an aggregate capacity of 230,000 hp, with 32 miles of transmission line over which supply is satisfactorily maintained. An additional 90,000 hp has been contracted for. According to the 1912 report of the directors, "as yet the company does not derive anything from the Falls except its name and the exclusive right to develop the power there. When the demand is large enough to justify the heavy outlay necessary in order to utilize the falls the company will exercise that right."—London *Electrician*, Sept. 19, 1913.

### Traction

*Wireless Train Control.*—An illustrated account of a recent exhibition in England of the Prentice automatic system of wireless train control. The system includes: (a) an ordinary track-circuit arrangement whereby the presence of a train or vehicle in a section short-circuits a relay; (b) a high-frequency plant, the current from which is controlled by the track-circuit relay; (c) an insulated conductor known as the "wave wire," placed along the track to carry the high-frequency current; (d) an arrangement of antennas, known as a "harp," below the engine, whereby the energy from the "wave wire" is received on the locomotive; (e) a coherer and decohering device and relay in synchronism; (f) a "time-lag" relay for the time required for decoherence, whereby a continuous holding action is realized as long as the "wave wire" is energized; (g) a "master" relay, and (h) devices whereby the release of the "master" relay by the cessation of the high-frequency current causes the exhibition of a "danger" indication on the engine, application of the brakes and the sounding of an audible alarm. A wiring diagram of the connections is given and described in detail.—London *Electrician*, Aug. 29, 1913.

### Installations, Systems and Appliances

*Bremen.*—The electric distribution problem of the German city of Bremen is rendered difficult by the many small houses, which necessitate a great cable length, and the large number of house installations for the number of customers (at present 9000 house installations for 11,000 customers). As long as only direct current at $2 \times 115$ volts was available the network was restricted to the interior city and to some of the better residence districts. But since a second power plant was erected in 1907 supplying three-phase alternating current the network has been extended over the whole city and to outlying villages. The transmission pressure is 7000 volts, while the distribution voltage is mostly 216 volts. Details are given of the transmission system, especially the construction of the transformer stations, the telephone system and the use of a portable testing station. —*Elek. Zeit.*, Sept. 18, 1913.

### Electrophysics and Magnetism

*Electromagnetic Waves.*—K. W. Wagner.—An elementary treatment of electromagnetic waves. From Faraday's induction law and the law of the magnetic circuit it is shown how electric magnetic waves are produced and what laws they obey. From the consideration of the energy in a propagating wave the conception of the energy flux is

deduced. Finally, electromagnetic waves caused by closing switches, etc., are briefly discussed.—*Elek. Zeit.*, Sept. 11, 1913.

*Lightning Flashes.*—W. Kohlrausch.—A description of some peculiar lightning-flash observations which partly indicate a high skin effect of the lightning flash and partly seem absolutely inexplainable.—*Elek. Zeit.*, Sept. 18, 1913.

*Columnar Ionization.*—E. W. Wellisch and J. J. Woodrow.—An account of an investigation in which a method was devised to compare the ionization due to a single alpha particle when measured in a longitudinal and transverse field. The results confirm the view of Moulin and Langevin that the upward slope characteristic of the alpha-ray ionization curve when a longitudinal field is employed is due entirely to recombination of ions in the column. The suggestion of Wellisch and Bronson that the slope is due in part to ionization by collision is shown to be untenable. It is shown that Langevin's theory of recombination appears to be applicable to the ionization produced by a single alpha particle; also the theory enables an estimate of the mean cross-section of the column to be computed.—*Philos. Mag.*, September, 1913.

*Disintegration of Uranium.*—Alexander Fleck.—An account of an investigation in which the existence of a new radioactive disintegration product, uranium $X_2$, discovered by Fajans and Gohring, is confirmed. Its period of average life is one and six-tenths minutes and its period of half value is one and one-tenth minutes. The hard beta rays of uranium $X$ come from uranium $X_2$ as found by Fajans and Gohring, and the soft beta rays come from uranium $X_1$. Hence uranium $X_2$ cannot be the parent of actinium.—*Philos. Mag.*, September, 1913.

### Electrochemistry and Batteries

*Electric Furnace Electrodes.*—W. McA. Johnson and George N. Sieger.—The second article of a serial on electric furnaces, their design, characteristics and commercial applications. In the present instalment the authors give practical information concerning graphite and carbon electrodes, with features of design, installation and consumption.—*Metall. and Chem. Eng'ing*, October, 1913.

*Electric Steel Refining.*—Joh. Harden.—An account of a new electric steel refining plant in England, the induction furnace being used. Details of the design and cost of operation are given.—*Metall. and Chem. Eng'ing*, October, 1913.

### Units, Measurements and Instruments

*Dielectric Properties of Non-Conductors.*—Phillips Thomas.—A Franklin Institute paper which describes and gives the results of tests upon the electrical properties of mica, paraffined paper, celluloid and ice. The materials were tested in the form of condensers, and the tests included measurements of the capacity, power-factor, conductivity, break-down strength and capacity variation with applied voltage. The tests covered a range of from 3000 cycles to 250 cycles per second by sine-forming alternating voltage and from 83 cycles to 1 cycle per second by unidirectional charges applied for equivalent times of charge. The results of the tests were reduced to values for unit dielectric volume, and a table of such results is included. It is shown that there is a general relation between the electrical properties of the materials tested—that is, that the substances with high dielectric constant have also high dielectric losses, low breakdown strength and low insulation resistance. Temperature effects were eliminated by making all measurements on each condenser at a constant temperature. As far as possible this temperature was made the same for different materials, so that a comparison of the results is not subject to temperature correction. It is shown that within ordinary commercial limits the capacity of condensers having either of these substances as dielectrics is independent of the magnitude of the voltage applied to them. The results of the tests are given in the form of curves.—*Journal Franklin Inst.*, September, 1913.

*Measuring Magnetic Susceptibility.*—W. H. F. Murdoch.—A paper read before Section G of the British association pointing out the advantages of the magnetometer method for measuring magnetic permeability and susceptibility, especially its directness and simplicity. In the cut $S'$ is a long solenoid used to magnetize the specimen $s$, which is in the form of a wire situated in the magnetic axis of the solenoid. In series with this solenoid is a coil $C$, in the center of which is suspended a magnetized needle $n$, to

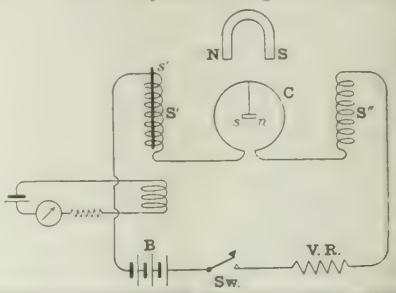



DIAGRAM OF CONNECTIONS FOR MEASURING MAGNETIC SUSCEPTIBILITY

which is attached a mirror or pointer; $NS$ is a controlling magnet to neutralize the earth's horizontal intensity acting on the needle $n$ and $S''$ is a solenoid suitably arranged to neutralize the magnetic effect of $S'$ on the needle $n$. These solenoids and coil are joined in series with one another and a battery $B$, variable resistance $VR$, switch, etc., are included in the circuit. A compensating coil to neutralize the earth's vertical intensity acting on the specimen may be wound over $S'$, and this circuit includes a battery, resistance and current indicator. The needle $n$ is adjusted so that when the earth's horizontal intensity is neutralized it comes to rest in any position about the center of the coil, and the magnetic action of any small current is sufficient to put it into the zero position, which is perpendicular to the plane of the coil $C$. If now a piece of iron is inserted in the solenoid $S'$ it acts on the needle $n$ in such a way that it is attracted or repelled out of the zero position. The solenoids may be arranged in either the "A" or "B" position of Gauss, or unipolarly. The theory of the method is given, as are the results of its application to tests of a iron wire.—London *Electrician*, Sept. 19, 1913.

*Meter.*—An official announcement of the Reichsanstalt by which a meter with a double counting device of the Berg mann Electric Company is admitted for calibration. The construction is described and illustrated.—*Elek. Zeit.*, Aug. 28, 1913.

*Experimental Alternating-Current Plant.*—R. M. Arche —An illustrated description of an experimental alternating current plant for a British technical laboratory and of the switchboard specially designed in connection with it. The author urges that students should make their own connections.—London *Electrician*, Sept. 5, 1913.

*Phase Meter.*—K. Gruhn.—An illustrated description of a new electrodynamic phase meter of a German company. It is essentially a double wattmeter with one single movable current coil (connected to a measuring transformer). Four poles arranged symmetrically in a circle hold the voltage coils of the wattmeters. There result two fluxes to which by means of an induction coil there is given a certain desired phase difference. The commercial phase meter for 5 amp and 50 cycles has a voltage drop of 1 volt and consumes in the voltage coil 60 milliamp.—*Elek. Zeit.*, Aug. [illegible].

*Photometers.*—G. A. Shook.—A second article of the serial on quantitative spectrum analysis in which the auth

describes several types of spectra photometers and discusses their advantages and disadvantages.—*Metall. and Chem. Eng'ing*, October, 1913.

*Seismograph.*—J. J. Shaw.—A note on a recent British association paper on new improvements in the seismograph. Hitherto it has been found that the free oscillation of the boom was a great disadvantage, and Continental European workers have endeavored to avoid the difficulty by employing a heavier boom. This, however, is unsatisfactory, since it reduces the sensitiveness of the instrument. The author's method consists in attaching a light aluminum disk to the end of the boom in such a manner that it can oscillate between the poles of four permanent magnets, and thus damping is effected by the induction of eddy currents in the disk. The device secures a damping effect of about 8 to 1.—London *Electrician*, Sept. 19, 1913.

*Meter.*—An official announcement of the Reichsanstalt admitting for calibration a polyphase induction meter of Landis and Gyr. The construction and operation are described, the connections are shown in diagrams, and rules to be followed for calibration are given.—*Elek. Zeit.*, Sept. 11, 1913.

### Telegraphy, Telephony and Signals

*Wireless Telegraphy.*—G. W. O. Howe.—A paper read before Section G of the British association on the nature of the electromagnetic waves employed in radio-telegraphy and the mode of their propagation. The author bases his discussion on power transmission over two wide strips of thin copper placed face to face and close together. After discussing the physical aspects of this problem he arrives at Poynting's theorem and lays the foundation for a discussion partly analytic and partly graphical of electromagnetic wave phenomena.—London *Electrician*, Sept. 19, 1913.

*Wireless Telegraphy.*—W. H. Eccles.—A paper read before Section G of the British association. Mathematical analysis has shown that wireless-telegraph signals could not be transmitted a quarter way round the globe by means of diffraction. One assumption of this analysis is that the air is a perfect homogeneous dielectric. Against this the author states that the atmosphere is always and everywhere ionized to some extent and is almost certainly more ionized at high levels than at low. Heaviside pointed out that if strong ionization sets in suddenly at some high level, this layer would act as a reflecting envelope and make possible the propagation of waves to the antipodes. The hypothesis introduced by the author is based on the assumption that the sun's rays ionize the atmosphere in such a way that the concentration of ions increases gradually as we ascend in the atmosphere. On this basis the author gives a simple method of treating mathematically the problem of refraction of electric waves around the earth.—London *Electrician*, September, 1913.

*Wireless Telegraphy.*—H. Mosler.—An account of an investigation extending over a year in which the receiving intensity of a station at a distance of 425 km (255 miles) was measured day and night. During the day the receiving intensity is not influenced by the height of the sun or, in other words, is constant during the whole year, but during the night there are characteristic maximum peaks in autumn and spring. The receiving intensity is particularly increased for short intervals in the night during the cold season, and this is thought to be due to changes in the ionization phenomena in the upper atmosphere. Effects of moonlight were not observed.—*Elek. Zeit.*, Aug. 28, 1913.

### Wires, Wiring and Conduits

*Pure Mathematics.*—H. F. Baker.—His presidential address to Section A of the British Association for the Advancement of Science. The address dealt with the proper place of pure mathematics in the scientific world.—London *Electrician*, Sept. 12, 1913.

# Book Reviews

The Inspector and the Troubleman. By Stanley A. Edwards and A. E. Dobbs. Chicago, Ill.: Telephony Publishing Company. 196 pages, 86 illus. Price, $1.

This book is intended especially for practical telephone men working in small magneto exchanges. Included in the narrative of the instruction of a young troubleman by his superiors, the older linemen and the company's inspector, is to be found a great amount of information relating to the theory of electricity as applied to telephony. Line construction and maintenance, common and uncommon cases of trouble that occur on magneto exchange systems are discussed in a conversational style, so that in addition to furnishing diversion to the reader the story carries with it many facts and the solution of practical problems that cannot fail to be of interest to the man in the field and to prove of real value to him in showing the right way out of the difficulties of one kind and another that he is constantly meeting in his work.

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Safety. Methods for Preventing Occupational and Other Accidents and Disease. By William H. Tolman, Ph.D., and Leonard B. Kendall. New York: Harper & Brothers. 422 pages, illus.

Comprehensive in scope, filled with practical information and valuable data, this volume will make a wide appeal. It is the first general exposition of the subject that has appeared in English. The statement of the authors that the annual number of accidents resulting fatally or in partial or total incapacity is 500,000, at an economic loss of $250,000,000 per annum, is rather startling, and emphasizes the need for specific information on safety measures and the great desirability of the conservation of human life. The contents of the volume are divided into four parts: general conditions, danger zones, industrial hygiene, and social welfare. The large amount of material covering many industries has been carefully edited. Safety measures adopted by various companies in the United States and abroad are discussed. The data will be found of much value to companies planning additional safety measures and welfare work, with all their far-reaching influence for good. The illustrations lend much of interest to the work, and the very complete index adds to its usefulness.

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Illinois Public Utility Commission Law and Municipal Ownership Law. By William J. Norton, M. E. Chicago: Published by the author. 200 pages. Price, $2.

Mr. Norton, who is secretary of the rate research committee of the National Electric Light Association and who was formerly first assistant secretary of the Public Service Commission for the First District of the State of New York, has done a real service to the privately owned utilities of Illinois and all students of the subject of the regulation of utilities by preparing this book. The new public utility commission law and the new municipal ownership law of Illinois are given in full from the official text as passed by the Legislature and signed by Governor Dunne last June. The book contains an index-digest which shows in a clear and comprehensive manner the powers of the commission, what the utilities must do, the proceedings before the courts, penalties, etc. In addition, the law is printed with marginal notes and with footnotes, the latter giving the source of the various provisions and occasionally making comment. The laws are printed on one side of the page only so that the other is available for notes. An alphabetical index is provided to supplement the analysis in the index-digest. A brief synopsis is also given of the provisions for the indeterminate permit in the law providing for the new Public Service Commission of Indiana.

# New Apparatus and Appliances

**An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers**

## Cement for Use at High Temperatures

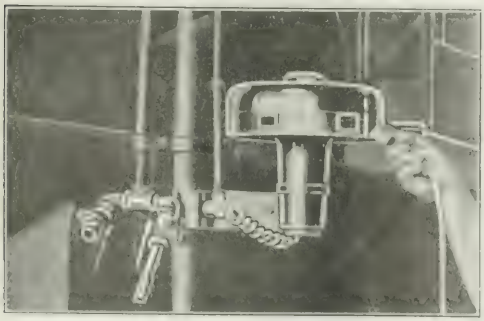
The H. W. Johns-Manville Company, New York, has recent brought out a new furnace product, known as "high-temperature cement No. 31," which it is said can be used successfully whenever working temperatures range between 1500 deg. and 3100 deg. Fahr. The new material is a dry powder mixture composed of asbestos and other ingredients of secret preparation. When being made ready for use it is mixed with water to the proper consistency (say, about 18 lb. to 20 lb. of water to 100 lb. of powder) for working like mortar or tamping around molds. Used for setting up firebrick for boilers and furnaces, lining and roofing furnaces of various kinds, molding into door jambs, lining fire doors, repairing side walls of furnaces, making stay-nut caps, etc., it has considerable mechanical strength. When air-dried, it will withstand a crushing strain of 883.5 lb. per sq. in. It vitrifies at the comparatively low temperature of 1418 deg. Fahr. and has a high melting point (3182 deg. Fahr.).

Being semi-acid in character, it can be used with chrome bricks, silica bricks or fire-clay bricks.

## Revolving-Head Receptacle

Six receptacles and fuse blocks arranged on a pivot form what is called a "revolving-head receptacle" by its manufacturer, the Central Electric Company, Chicago, Ill. A set of conductors rings make connection to the receptacles so that the head may be revolved freely in any direction. Cover and base are of cast iron and are fastened together with wing-nuts.

Ordinarily the head is supported on a heavy cast-iron base fitted to the top of a 3-in. pipe forming a central stand from which energy for a number of lamps or other

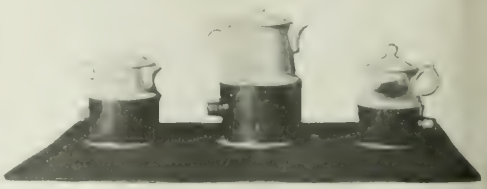


RECEPTACLES ON POST IN SHOP

devices may be taken. However, in the illustration herewith the head is shown fastened by a malleable-iron bracket to an upright post in a crowded shop. It is said that in shops where forgetful workmen are apt to leave their trouble lamps in cars or where traveling cranes are liable to become entangled in temporary wiring this revolving head is of great value, as it will allow the socket upon which the pull is being made to align itself so that the attachment plug will be drawn from its receptacle without damage.

## English Earthenware Cooking Devices

The so-called "boiling pot" and "boiling jug" are made of earthenware with the heating element in the form of a closely fitting band attached to the outside surface. In the



EARTHENWARE COOKING DEVICES

devices shown the plug which is attached to the heating band is of a type not standard in the United States, but no doubt the manufacturers will meet this requirement if a sufficient demand arises for their goods on this side of the water. The earthenware is a pleasing gray buff in color and the banded heating element is enameled in dark brown. The form of construction and the material employed leave the inside surface of the device clear and enable it easily to be kept clean. It can be used for a variety of purposes such as heating soups and other liquids and boiling eggs. With the addition of an inner vessel, the two-pint size makes an efficient milk sterilizer, cereal cooker and beef-tea brewer.

The largest device shown is a 2-pint "boiling jug" which, the makers state, will boil 2 pints of water in fourteen minutes. It is 8.5 in. high, 3.5 in. in diameter at the top and 6 in. at the bottom. These devices are made by the Sun Electrical Company, Ltd., London, England.

## Direct-Current Motor Starters

A feature to be found in the direct-current motor starters which are being manufactured by the General Electric Company, Ltd., London, England, is the self-aligning contact block. This device has been introduced so that the starter may be able to adapt itself to the irregularities inevitably occurring in practice due to continued arcing. All contacts are renewable from the front and the no-voltage release coils are also made detachable for the reason that many users in ordering starters overstate the voltage of their service and consequently find that the no-voltage release will not hold the lever in the running position. When a case of this kind occurs the coil is removed and returned for rewinding.

For making the main contacts in the larger sizes of starters there are two brushes, one of carbon and one of brass, the carbon brush taking the arc and protecting the brass contacts. The starters are made in sizes ranging from 0.25 hp to 100 hp.

## Commutator Insulation for Replacing Built-Up Mica

A new insulating material has been developed to replace mica for V-rings, bushings, taper rings, and the like. The dielectric strength of "formica," which is the name given the new product, is said to be 1000 volts per mil under all atmospheric conditions, as the material is non-hygroscopic and will not be affected by moisture. A commutator equipped with V-rings and bushings of the new material has shown its ability to withstand a potential of 20,000 volts to ground before breaking down. As to the thermal properties of the new material, it is said that it will stand 155 deg. C. continuously and 265 deg. C. momentarily, that it will not warp at any temperature, and that after baking it is infusible at any degree of heat even up to the temperature of carbonization. Mechanically, formica is tough and strong but not brittle, and it can be formed to any dimensions possible with built-up mica. Its ultimate tensile



COMMUTATOR INSULATION IN VARIOUS SHAPES

strength is stated as being 20,000 lb. per sq. in. and its ultimate strength under compression is 20,000 lb. per sq. in. in the direction of greatest weakness. Of the chemical characteristics of the insulation it may be said that it is practically unaffected by any of the common solvents, is impervious to oil, and will not absorb grease or carbon dust. This new insulating material is being marketed by the Electric Service Company, of Cincinnati, Ohio.

## Improved Two-Cycle Oil Engine

The relatively high steam consumption of turbines ranging in rating from a few horse-power up to 500 hp leaves this portion of the generating field open to successful oil engines. Among the firms foremost in the development of this type of apparatus is the Allgemeine Elektricitäts Gesellschaft, which is now placing on the market an engine that has been subjected to severe operation on the test floor of the factory since 1910. Fig. 1 is a cross-section of a two-cylinder engine of this type. Two pistons working

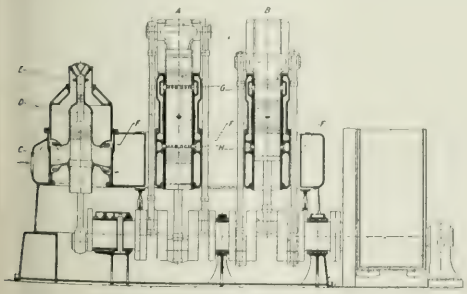


FIG. 1—CROSS-SECTION OF TWO-CYLINDER ENGINE

in the same cylinder are connected to the crankshaft so that at one dead-center position they will be at a minimum distance apart and at the other they will be at a maximum distance. The exhaust ports, shown at *G*, and the admission ports, at *H*, are so arranged that as the two pistons move from one extreme of their travel to the other both sets of ports are alternately opened and closed by the pistons themselves without the aid of valves. The injector pumps and scavenger pump are shown at *D*, *E* and *C* respectively. The letter *F* indicates the receiver and the working cylinders are shown at *A* and *B*.

The main points of advantage claimed for the engine by its makers are its superior scavenging qualities and low fuel consumption. The arrangement of the ports and their

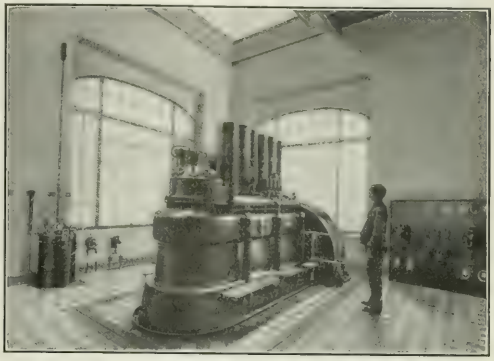
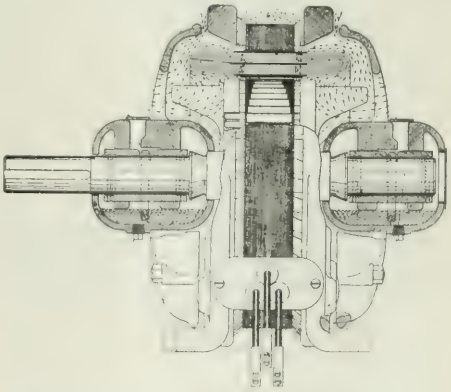


FIG. 2—TWO-CYCLE OIL ENGINE IN STATION

ample area of opening are cited as the chief features which make possible complete scavenging operations in this "two-stroke-cycle" engine. The fuel-oil consumption is said to be as low as any that has been obtained with low-speed four-stroke-cycle engines. The absence of heavy exhaust and admission valves renders the operation steady and noiseless.

## Ventilated Induction Motor

An improved type of polyphase induction motor has recently been developed and placed on the market by the U. S. Electrical Manufacturing Company, of Los Angeles, Cal. Light, compact construction is made possible by the use of a riveted frame, thus eliminating the heavy cast-iron frame



IMPROVED TYPE OF VENTILATED INDUCTION MOTOR

of former days together with the dead-air pockets which it created. Exposure of the stator core directly to the air facilitates heat radiation. Air-directive fans on the rotor also insure good air circulation and low operating temperatures. Space fingers are cast on the end flanges so that liberal ventilating ducts are formed on each side of the stator-core punchings. The welded-ring type of construction in the

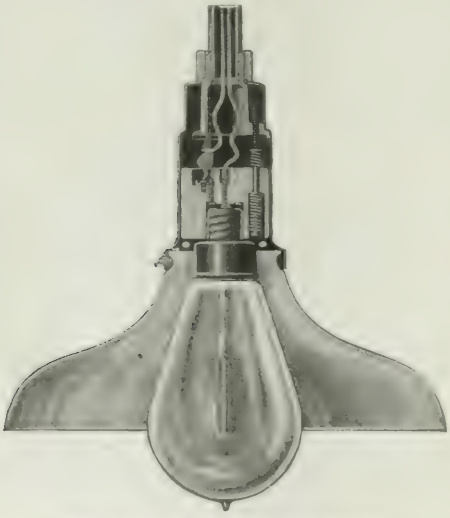
rotors makes it unnecessary to depend on solder for either mechanical strength or electrical conductivity. Elimination of paper from the rotor construction minimizes trouble due to burn-outs. The motors are made in both constant-speed and variable-speed types. The partial section of the motor illustrated herewith shows the paths of the cooling air.

## Fixture Control of Light Distribution

An ingenious device to control light distribution from single-unit fixtures has been brought out by the George Cutter Company, of South Bend, Ind., under the name of the "Idealite" fixture. The manufacturer points out that in any system of lighting it is advisable to provide means for changing the intensity of illumination to suit varying conditions. This may be done without changing reflectors or lamps, by raising and lowering the lamp in the reflector. When the lamp is placed low in the reflector the light is widely distributed but has low intensity; with the lamp high in the reflector the intensity is high but the light is distributed over a small area. The accompanying illustration gives a sectional view of the fixture, showing the means of adjustment by which the lamp may be moved up or down through a range of 1 in.

The socket in this fixture is composed of molded insulation and is suspended from a steel body by means of three adjusting screws. Upon these screws are placed six spiral springs which support the socket and lamp, protecting the latter from vibration. A brass shell incloses the mechanism and serves also as a holder for the reflector or shade.

By means of the three adjustable screws the socket may be raised or lowered to bring the lamp into proper relation to the reflector to accomplish either concentration or various degrees of diffusion of light as desired. By taking advantage of this means of adjustment it is also possible to place



SECTIONAL VIEW OF ADJUSTABLE FIXTURE

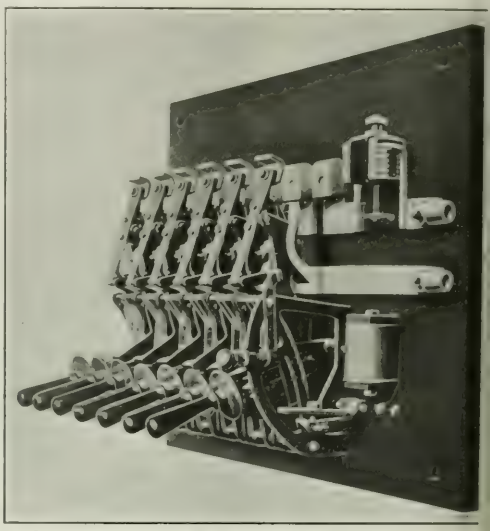
lamps of various candle-powers in proper relation to the reflector. This avoids the necessity of changing the reflector when changes are made in the size of lamps. These fixtures may be equipped with either enameled steel or glass reflectors to fit varying conditions of service.

The leading-in wires are attached to the socket by means of two substantial screws, thus avoiding the necessity of soldered connections in the fixture stand. The fixtures are furnished with canopy and with rigid stem or chain suspension, as desired. They may be equipped with ornamental glassware or with varying designs of steel-enameled light reflectors, according to requirements.

## Multiple Lever Motor Starter

The following main features are possessed by the direct-current motor starter illustrated below.

(1) By means of the true "loose-handle" starting device



FRONT VIEW OF MULTIPLE-LEVER STARTER

the brushes cannot be held in the closed position, because they open automatically when an overload or no-voltage condition occurs during starting or subsequently, quite independently of the operating handles or operator.

(2) The "loose-handle" feature renders it impossible to start up too rapidly, and hence the motor is effectively safeguarded against excessive current and consequent trouble due to sudden starting.

(3) The overload devices can be fitted to much larger sizes than hitherto and can be equipped with time-limit devices when desirable.

(4) The construction of the starter is such that levers must be closed in the correct sequence, thus insuring the resistance being reduced gradually.

(5) The levers open in the opposite order to that in which they are switched in, and hence there is no heavy arcing on individual contacts.

(6) After having opened levers are ready for starting up again without further adjustment.

(7) The overload coil in operation opens the circuit of the no-voltage coil, which method possesses a great advantage over the usual practice of short-circuiting the no-voltage coil, in that the overload attachment breaks the no-voltage coil circuit under all circumstances.

(8) Regulation over any number of steps can be obtained if desired, while all the automatic features can be retained. Thus, if it is desired to eliminate a separate rheostat or speed regulation, additional levers over and above those required for starting only can be fitted in order to obtain the necessary rheostatic effect.

The above-described starter has been developed for the market by the British Westinghouse Electric & Manufacturing Company, Ltd., Trafford Park, Manchester, England.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**New Tariff Bill Signed.**—The Simmons-Underwood tariff bill was signed by President Wilson on Oct. 3 and some portions went into effect immediately. The President expressed satisfaction with the measure and spoke concerning the importance of the currency bill now before Congress.

**Licensed Under Mullin Patents.**—The Nyelec Switchboard Company, of 39 Cortlandt Street, New York, has been licensed to work under the Mullin patents, covering a new form of vertical feeder support, made by the Norris Electric Specialty Company, of 38 Park Row, New York. The device was described in the Sept. 6 issue of the *Electrical World* and is being used by the first-named company in its work on the Haywood, Strasser & Voigt Building, at Twenty-sixth Street and Eleventh Avenue, New York.

**Home Tax on Lighting Material Irksome.**—German manufacturers of incandescent lamps claim to be seriously handicapped in their export trade, particularly to the United States and Canada, by the home tax on lighting materials imposed by the German government. It is stated that this tax has been added to the value of German exports by the customs authorities of both the countries mentioned in calculating the import duties, with the result that the German goods cannot compete in price with other goods in those markets. In fear that other countries may follow this example, two large German associations, representing electrical manufacturing interests, are preparing a petition to the Reichstag, urging the repeal of the tax.

**General Electric Company Incorporated in Brazil.**—The General Electric Company of Brazil has been incorporated to take care of the interests of the General Electric Company in that country. Guinle & Company, exporters, of 42 Broadway, New York, formerly the representatives of the General Electric Company in Brazil, have given up the electrical end of their business incidental to this change. The incorporation of a Brazilian company is in line with the General Electric policy of handling foreign business through separate companies holding foreign charters, and in addition to its English and European subsidiaries there are allied companies in Mexico, Paraguay and some others of the South and Central American republics.

**Extensions in Jamestown, N. Y.**—The Jamestown Street Railway Company is building an addition 75 ft. long and 63 ft. wide at its Boat Landing power house to house additional equipment, including eighteen transformers. It is reported that within a short time the company will install a 5000-kw Westinghouse-Parsons turbo-generator in the present power house. Two of the old high-speed Westinghouse engines and generators will be taken out to make room for the large new unit. The two turbo-generators now in service in the power house are each rated at 1500 kw. Connections will be made so that in case of necessity electrical energy from Niagara Falls, which now comes as far as Mayville, may be transmitted to Jamestown. Mr. Ira A. Douglass is the chief engineer of the Jamestown Street Railway Company.

**Status of the Incandescent Lamp Industry in Austria.**—A recent German technical paper in discussing the present position of the incandescent lamp industry in Austria stated that it is one of the few lines which have not suffered from the Balkan war. The demand for metal-filament lamps was stated to be especially active, and the restriction of the carbon lamp field was predicted, to accompany the introduction of more perfect methods for manufacturing the metallic-filament lamps. The present output of this type of lamp in Austria-Hungary is between 18,000,000 and 20,000,000 per year, or about twice the home consumption, so that a large number of them are exported. The carbon-lamp agreement which exists between German, Austro-Hungarian and Dutch firms expires next May, and it is predicted that this agreement will not be renewed, as manufacturers are of the opinion that, with the altered circumstances in the industry, free competition will prove the best policy.

**New Wireless Station Assured.**—The Marconi Wireless Telegraph Company of America has just closed a contract with the Norwegian government for the erection of a large wireless station in Norway, to connect with a similar station to be erected in Massachusetts. This latter will be a duplex installation, arranged so that messages can be sent and received simultaneously, and will be connected by wire with New York and Boston. It is stated that the Norwegian government is making arrangements at the present time for wireless communication with Sweden, Denmark and the north of Europe, and the Marconi Company is understood to have plans for a system connecting Europe and the United States with South America, to be followed by stations in Asia and Australia. The site for the Massachusetts station is understood to have been already purchased, and it is probable that the J. G. White Engineering Corporation, of New York, which is now building Marconi stations in New Jersey, California and the Sandwich Islands, will secure the contract for its erection and equipping.

**Where Chicago Is Backward.**—Chicago possesses thousands of apartment buildings, many of them handsomely appointed. But it is said to be behind every other large city in the country in the use of telephonic communication between the entrance and the various apartments. Speaking-tubes are still specified in buildings with sleeping porches, electric laundry equipment, wall safes, built-in bookcases, vacuum-cleaning outlets and other up-to-date improvements. A man who should know accounts for this state of affairs by saying that it is due to Chicago's telephone history. When the fundamental patents of the American Bell Telephone Company expired, about twenty years ago, Chicago was the center of the independent or anti-Bell telephone activity. Manufacturers of telephonic apparatus sprang up over-night almost. Many of these concerns were not equipped by knowledge or experience to make satisfactory telephones. At that time many inferior inter-communicating systems were put into Chicago apartment buildings, and the experience of architects and builders was so unsatisfactory that they are still prejudiced against the use of the telephone in place of the speaking-tube. Of course, since then the incompetent manufacturers have been weeded out, but the bad impression still remains apparently.

**Electric Welding of Car Wheels Proves Successful.**—The jarring incidental to the operation of an industrial railway car is particularly hard on the wheels, and where these are keyed to the axles both the keys and the keyways become worn and distorted very quickly and are then practically ready for the scrap heap. In some instances it has been found practicable to shrink the wheels onto the axles, but this method is not adaptable for every class of service. The Electric Welding Company, of 220 West Forty-second Street, New York, has developed a method for taking care of this difficulty which has proved successful under trying operating conditions. On the outside or bearing face of the wheel hub the axle bore is beveled and a weld made between the wheel and axle by the arc-welding process, the metal deposited filling the beveled section and being finished finally to the surface of the hub. On the inside face of the hub a weld is made between the wheel and axle, allowing the deposited metal to build up, since in this place it does not interfere with the bearing. The process above described has been applied to the cars used by the Nichols Copper Company for hauling hot ingots and metallic ores and has given

satisfaction where the keying and shrinking methods have failed. The Nichols company has all of this work done on contract, thereby avoiding the necessity of buying an expensive special outfit and of maintaining the force of skilled mechanics and engineers necessary to its successful operation.

**Allis-Chalmers Establishes Office in Indianapolis.**—The Allis-Chalmers Manufacturing Company has recently opened an office in Indianapolis, Ind., from which all of the business in that State will be managed. This is the first time that the company has had an office in Indiana, the Chicago office handling this territory before. Mr. O. C. Ross is sales engineer and manager of the office, which is located in the Traction Terminal Building.

**Unusual Telephone Installation.**—On two telephone switchboards supplied by the Western Electric Company for use at Buckingham Palace, instead of the usual numbering of the local line jacks, each jack is labeled with a small plate giving the full designation of the person or place with which it is desired to communicate. The two boards were installed because it was not desired to have the day exchange occupied at night. The reason for this is not known.

**Tree-Cutting by Electricity.**—Mr. F. C. Enright, the representative of the Chicago Association of Commerce in Buenos Aires, has received a request from the Forestry Bureau of the Department of Agriculture of the Argentine government for complete information relating to the method of cutting trees by the use of resistance wires rendered white hot by a current of electricity. The Argentine officials believe that this plan is in use in the United States. The business manager of the Chicago Association of Commerce will forward to those interested any information in relation to this particular method of tree-cutting.

**New Vacuum Cleaner Marketed.**—The Hoover Sweeper Company, of New Berlin, Ohio, with a New York office in the Marbridge Building, Broadway and Thirty-fifth Street, has recently added to its line of electric vacuum cleaners the "Baby Hoover," which operates on the same principle as its large cleaner but is about one-third the size and price of that machine. The company is pushing its foreign sales as well as those in the United States and already has a foothold in Europe and South America. It markets its goods through large department stores and hardware shops and through central stations. These mediums are used simply for distribution centers, and the company carries on its advertising and selling campaign in the same way as if they were branch offices. This system takes from the distributors the burden of pushing the sale of the cleaners and, since an effort is made to use only the highest grade stores as distributing agents, better and more economical results are probably attained than if the company tried to establish branch stores of its own for the same purpose.

**Electrical Equipment of the Adams Express Building in New York.**—Construction work is nearing completion on the new Adams Express Building, at 35 Trinity Place, New York. This structure when completed will stand thirty-two stories above street level, quite a little higher than any of the buildings immediately adjacent. Its generating equipment will consist of three 400-kw Westinghouse three-wire 125-250 volt units and one 200-kw unit of the same type, all driven by cross-compound Hamilton Corliss engines, supplied by the Hooven, Owens, Rentschler Company, of Hamilton, Ohio, and operating on 150 lb. steam pressure. The boiler equipment is to be supplied by the Babcock & Wilcox Company, of New York, and will consist of three boilers of 500-hp rating and one of 375-hp rating. The main switchboard equipment consists of a generator panel at each machine and two distributing panels, one at the east and another at the west end of the building. The lighting service for the building will call for about 4000 plug outlets, and approximately the same number of ceiling outlets and wires will be drawn in galvanized concealed conduits. In addition to the lighting load, the generating equipment will supply energy for the operation of twenty-four Otis passenger elevators as well as for the electrically driven vacuum cleaning system, hot-water-circulating pumps and centrifugal exhaust fans. The installation of a double system of busbars in this building will add reliability to the electrical service and aid in preventing the elevator load from seriously interfering with the lighting service. Messrs. Griggs & Holbrook, of 3 South William Street, are the engineers on this building, ar the electrical contracting is being done by L. K. Comstoc & Company, of 30 Church Street, New York.

**English Manufacturers Reduce Prices on Metallic-Fil ment Lamps.**—The General Electric Company, Ltd., London, announces that further technical progress in co nection with drawn-wire filaments, combined with increase output of the Hammersmith Osram Works, has enabled to effect further economies in the manufacture of tungste lamps. The company has consequently decided to give th benefit of these reductions to its customers and has made considerable reduction in the prices as quoted in its catalo This reduction in most cases amounts to about 10 per ce on the list prices. The Siemens Brothers Dynamo Work Ltd., of London, also state that they have decided to give similar reduction in price on their tantalum metallic-fil ment lamps and tungsten drawn-wire lamps. From th British Thomson-Houston Company, Ltd., of Rugby, it learned that prices will be reduced on its tungsten lamp owing to improvements in the manufacturing end of i business brought about by the introduction of the draw wire process of making the filaments. Another conce which has taken this step is the British Westinghouse Ele tric & Manufacturing Company, Ltd., of Manchester, whi has made a reduction of about 10 per cent in the prices its tungsten drawn-wire lamps. These lamps are now in u under conditions which precluded their use in the earli days, and with the present manufacturing process a strong and more durable filament is secured than could be ma formerly. Other companies announcing reductions are t Pope Electric Lamp Company, Ltd., of London; Crysel Ltd., of Bedford; Edison & Swan United Electric Lig Company, of Middlesex; the Brimsdown Lamp Works, Lt of London, and the Foster Engineering Company, Ltd London.

## September Statement of the Copper Producers' Association

While the stocks of copper on hand on Aug. 31 we the lowest ever reached in the history of the associati the September record gives a further falling off in this ite as shown by the following summary:

| | —September, pounds— | — August, |
|---|---|---|
| Stocks on hand in the United States on first | | |
| [illegible] | | |
| [illegible] | | |
| [illegible] | | |
| [illegible] | | 73,649,801 |
| Foreign deliveries | 73,085,275 | |
| [illegible] | | |

NEW YORK METAL MARKET PRICES

| | Bid | Asked | Bid |
|---|---|---|---|
| Standard, spot* | | | |
| [illegible] | | | |
| [illegible] | | | 16.75 |
| Electrolytic | 16.40 | | 16.50 |
| [illegible] | | | 16.25 |
| [illegible] | | | |
| Nickel | 40.00 | | |
| Sheet zinc, f. o. b. smelter | | | |
| Spelter, spot | 5.65 | | |
| Tin, spot | 41.40 | | |
| [illegible] | | | |

*OLD METALS

| | |
|---|---|
| Heavy copper | 15.00 |
| Brass, heavy | 9.75 |
| Brass, light | 8.50 |
| Lead, heavy | 4.65 |
| Zinc, scrap | |

*COPPER EXPORTS

[illegible] the New York Metal Exchange

# Corporate and Financial

**Stock Issue Planned by the Boston Edison Company.**—At the annual meeting, scheduled for Oct. 14, the stockholders of the Edison Electric Illuminating Company of Boston will be asked to authorize the directors to make application to the Board of Gas & Electric Light Commissioners for authority to issue $2,275,600 additional capital stock, the proceeds being intended for use on extensions and improvements to the company's property. Stockholders will have an opportunity to subscribe this issue when authorized, on a basis of one new share to every eight shares held. The company has made a very attractive power rate and is pushing that end of its business.

**South American Utility Has Prosperous Year.**—The Brazilian Traction Light & Power Company, which was formed by a consolidation of the Rio de Janiero Tramways, Light & Power, the Sao Paulo Tramways, Light & Power and the Sao Paulo Electric companies, finished the first year of its organization on Aug. 31. During that period the earnings amounted to $22,741,102 in the gross, which corresponds to a net of $12,471,102, or nearly 12½ per cent on the common stock outstanding. As this is the first year of the consolidation, comparisons with previous figures are impossible, but the earnings as recorded above were well up to the estimates made at the time of organization.

**West Penn Traction & Water Power Matters.**—During the twelve months ended Aug. 31, 1913, the West Penn Traction & Water Power Company not only earned the 6 per cent dividend on its $6,497,400 of preferred stock, but after payment of the same had left a balance of $207,422, or over 1 per cent on the outstanding issue of $20,497,400 common stock. This company, which is one of the American Water Works & Guarantee Company's subsidiaries, has been increasing its earnings steadily. It is making a large number of new power contracts and as it is favorably located with respect to the coal, iron and steel industries of Pennsylvania, a field in which electric power applications are rapidly growing, it looks forward to large future expansion along these lines.

**October Bond Interest Paid by the American Water Works & Guarantee Company.**—The receivers of the American Water Works & Guarantee Company have made arrangements to pay the interest due Oct. 1 on all of the bonds guaranteed by that company, with the exception of the interest on the notes of the United Water & Light Company and on the bonds of the St. Joseph Water Company, the California-Idaho Company and the Twin Falls-Oakley Land & Water Company. There is every probability that the first two of these four companies will be cared for in this respect within a few days, since according to reports the water companies are earning well in excess of their fixed charges, including interest on their bonded debt. The delay in the case of these companies is stated to be due to the necessity for obtaining court action preliminary to making the payments. A protective committee is being formed to look after the interests of the irrigation bond holders, and a call is expected shortly to all such parties to deposit their certificates with this protective committee.

**Further Call for Utah Securities Corporation Notes.**—Ten per cent of the Utah Securities Corporation's $27,500,000 note issue has been called for, payable 5 per cent on or before Oct. 17 and 5 per cent by Nov. 5, bringing the total amount called to date up to 70 per cent of the issue. Future call on the remainder of these notes, during the rest of the year, will depend largely on the weather conditions. If an open winter is experienced, the improvement and extension work for which the issue was made will be carried along rapidly and one or perhaps two more calls may be made. With a continuation of this work at the present rate, it is evident that more money will be required for it within the year. The corporation is now earning about $1,000,000 net per annum. There is approximately $5,000,000 going into development work, not yet completed, so that interest on this portion of the notes is properly chargeable to construction cost. Allowing for this, the company is earning enough now to cover its 6 per cent interest obligations with a slight margin over.

**Southern Utility Plans to Take Over Municipal Plant.**—The Southern Gas & Electric Company, known formerly as the Baltimore Utilities Company and having its headquarters in Baltimore, Md., has made an offer to take over the municipal gas plant at Richmond, Va., and operate it as a private plant. It is proposed to pay an annual rental of $140,000 and 1 per cent of the annual gross receipts on a thirty-year lease. Gas is to be furnished at 80 cents per 1000 cu. ft. for the first ten years and at 75 cents per 1000 cu. ft. for the last twenty years, as compared with the rate of 80 cents now charged. A bond of $500,000 was offered for the carrying out of the contract. The company agreed also to expend not less than $1,000,000 on extensions and improvements during the first three years of the lease. The contract has not yet been approved by the city. The Southern Gas & Electric Company was formed for the purpose of acquiring and developing gas and electric properties in the South, and it now controls the Suffolk Gas & Electric Company, the Bluefield Gas & Electric Company and the Sumter Gas & Eletric Company.

**Westinghouse Electric Company Makes Part Payment on Maturing Note Issue.**—Of the $1,500,000 of collateral trust notes of the Westinghouse Electric & Manufacturing Company, maturing Sept. 27, $250,000 were paid off with cash held in the company's treasury and the balance were extended for nine months. These notes were in the form of a bank loan, distributed among a number of the banks with which the company does business, and their extension was readily obtained. The extension makes these notes fall due on June 27, 1914, only about a month before $4,000,000 of collateral 6 per cent notes are due, on Aug. 1, but as the company is now earning a liberal balance over dividend requirements, it is thought that part or all of the extended note issue can be paid off at maturity. Since the close of the last fiscal year there has been a material reduction in the outstanding floating debt, and to-day the property is in better shape financially than it has been for a long time past. The business of the company has been unusually good for the past few months, and this condition is expected to last for some time, although perhaps not at the same record figures. With the spread of trunk-line electrification the company expects to do a very large business, since this is one of the branches in which it has specialized, doing work for the New Haven, the Pennsylvania and the Long Island roads in this connection. It has secured the contract for the Norfolk & Western electrification and is figuring on similar work for the St. Paul road.

**Note Issue of the Virginian Power Company.**—The Virginian Power Company, of West Virginia, is offering for subscription $1,250,000 first-lien 6 per cent notes dated August, 1913, and maturing Feb. 1, 1915. The offering is made at 98.5, and included with the purchase of each $1,000 of these notes are rights to subscribe to $1,000 first and collateral trust 5 per cent bonds at the underwriting price when these bonds are issued and a bonus of $100 of the company's common stock. An additional bonus of $10 common stock will be given if the right of subscription is subsequently exercised. The new note issue is secured by the deposit of $2,500,000 of the first and collateral trust 5 per cent bonds which are a first lien on the 27,000-hp steam station now under construction in the Kanawha-New River coal district. In addition to the construction of this steam station the company is building 160 miles of high-tension transmission lines in the same district where energy is to be furnished for operating the coal mines. Water-power sites with an aggregate capacity of 170,000 hp are controlled by the company, and the initial hydro-electric development is to be made at Bluestone, where there is 125,000 hp available. In connection with this development it is understood that the company plans to build transmission lines to Cincinnati and the adjacent towns The steam plant above mentioned was built to stave off a threatened series of isolated generating station installations for supplying energy for the large coal mines in the vicinity. On the completion of the hydroelectric plants this steam station will take its place as an auxiliary source of energy, and, in the mean time, it will be able to care for the business secured in advance of the completion of the water-power stations.

## Business Notes

**The American Insulating Machinery Company** is now located at the corner of Huntington and Emerald Streets in Philadelphia, instead of Lansdale Street as heretofore.

**The Crypto Electrical Company,** of 159 Bermondsey Street, London, England, has built a large addition to its factory at Willesden. This new factory is now being equipped and will be in operation within the next few weeks.

**Rosenbaum & Stockbridge,** patent attorneys, of 41 Park Row, New York, announce that they have associated with them Victor D. Borst, who has been engaged for several years in the practice of patent law before the Patent Office and the federal courts. The firm will be known as Rosenbaum, Stockbridge & Borst.

**The Monmouth Electric Company,** manufacturer of wireless-telegraph instruments, has located its office and plant at 92 Murray Street, New York, and completed arrangements for the manufacture of its product. C. H. Hopper, the president of this company, was formerly secretary and general manager of the firm of Hunt & McGee.

**The Blackburn Specialty Company,** Cleveland, Ohio, manufacturer of ground clamps and locks for electric automobiles, moved into its own new fireproof building, corner Thirty-fifth Street and Perkins Avenue, Cleveland, about Oct. 1. The structure measures 70 ft. by 100 ft. in plan, and the company will have at its disposal for manufacturing operations nearly 30,000 sq. ft. of floor space.

## New Industrial Companies

**The Magic Fire Alarm Company,** of Fairfield, Maine, has been incorporated with a capital stock of $10,000 to manufacture and deal in electrical and other fire alarms. Thomas Burke is president and A. S. Burke treasurer.

**The Automatic Train Control Company,** of Kansas City, Mo., has been granted a charter with a capital stock of $2,000,000 to manufacture and deal in mechanical and electrical devices for block signals and safety appliances.

**The G. & W. Electric Specialty Company,** of Chicago, Ill., has been incorporated by H. T. Haines, W. G. Colvin and R. F. Carter, all of Chicago. The company is capitalized at $250,000 and proposes to manufacture electric specialties.

**The Automatic Electric Sign Company,** of New York, N. Y., has been chartered with a capital stock of $10,000. The incorporators are Walter E. Godfrey, Emanuel Friedman and Harry O. Liberman, all of 135 Broadway, New York, N. Y.

**The Eveland Electric Riveter Company,** of Camden, N. J., has been chartered with a capital stock of $10,000 to acquire patents and assignments and to manufacture and deal in articles of metal or wood or both. The incorporators are S. S. Eveland, E. A. Reeve and John A. MacPeak.

**The Grant Vacuum & Sales Agency,** of Providence, R. I., has been incorporated with a capital stock of $10,000 to manufacture and deal in vacuum cleaners and selling electrical devices. The incorporators are Irving A. Salisbury, Arthur C. Jenney, Susan A. Grant and Horace M. Grant.

## Trade Publications

**Lighting Fixtures.**—The National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, has recently issued a number of temporary catalog pages which illustrate some new designs in luminous bowl fixtures.

**Induction Motors.**—Type CS squirrel-cage induction motors for constant-speed service are fully described and illustrated in Descriptive Leaflet No. 2321, issued by the Westinghouse Electric & Manufacturing Company.

**Used Machinery.**—Calvin H. Currier, 141 Milk Street, Boston, Mass., has issued a list of used steam and electrical apparatus for sale by him at the present time. The list includes alternating-current and direct-current motors, engines, pumps, boilers and other apparatus.

**Transformers.**—W. E. Burnand & Company, Chippinghouse Works, Lowfields, Sheffield, England, have issued a catalog devoted to transformers. It contains fifty-eight pages, numerous illustrations and some efficiency curves, including a general description of the apparatus.

**Steam Turbines.**—The Allis-Chalmers Manufacturing Company, Milwaukee, Wis., in Bulletin No. 1084, treats very fully the subject of its steam turbines and generators. Numerous illustrations and diagrams showing the construction features of this apparatus accompany the text.

**Reflectors.**—Harvey Hubbell, Inc., is sending out attractive advertising literature in poster effect, folded for mailing. One of these folders, size 19¼ in. by 12½ in., contains an illustrated talk on Hubbell reflectors. Another tells about Hubbell lamp guards and their effectiveness in guarding against breakage and theft.

**Ozonators.**—In Bulletin No. 850, the Sprague Electric Works of the General Electric Company, 527 West Thirty-fourth Street, New York, discusses its industrial ozonators. A general talk on ozone, its properties, production and application, is followed by information on ventilation and air purification and a description of the industrial ozonator with illustrations and diagrams showing its features of construction.

**Connectors.**—The Sloan Engineering Company, 240 Hall Street, Brooklyn, N. Y., has recently published a booklet entitled "Standardization as Applied to Binding Posts." The connector which is described is designed for making electrical and mechanical connections with any type of wire or wire tip. Information regarding the design, use and carrying capacity of the binding post is given, together with a few illustrations.

**Booklet on "Pioneers."**—The Wagner Electric Manufacturing Company, St. Louis, Mo., has issued a booklet of sixteen pages entitled "Pioneers; Wagner Quality." The attractive cover appropriately illustrates the trials of the pioneer, and the reading pages contain short sketches illustrated by photographs of pioneers in electrical science, as well as brief outlines of pioneer apparatus developed by the Wagner company.

**Engineering Installations.**—L. B. Stillwell, consulting engineer, 100 Broadway, New York, has brought out an attractive brochure, entitled "Twenty Years' Progress," which gives a brief account of various important engineering works designed and supervised during the past twenty years by engineers now associated with the firm. These include a number of notable installations. The booklet is well printed and illustrated.

**Electrical Appliances.**—The Hotpoint Electric Heating Company, Ontario, Cal., is sending out a broadside addressed to dealers urging them to make window displays modeled after the company's double-page advertisement in one of the prominent weeklies of general circulation. Practical suggestions are given to this end referring to the fireless cooker, and a section of the sheet is arranged for the dealer to use as a poster.

**Switches.**—The Hart & Hegeman Manufacturing Company, Hartford, Conn., is distributing Catalog "K," a neatly arranged publication of sixty-four pages which lists and pictures "H. & H." switches and accessories. The line includes a large variety of switches. Diagrams of wiring connections for rotary surface switches, rotary flush switches and push flush switches are shown, and a complete index and price list are given.

**Traveling Electric Hoist.**—The Pawling & Harnischfeger Company, of Milwaukee, has issued a recent bulletin (No. 301) describing its new type U hoist. The use of traveling electric hoists in handling material in manufacturing plants is growing rapidly. The type U hoist is designed for normal speed and ordinary operation and is made in several different types. Both direct-current and alternating-current equipment can be furnished, the motors ranging from 1.25 hp to 7.5 hp. The bulletin describes briefly design and construction, with illustrations, drawings and data tables.

# Personal Mention

**Mr. F. E. Stevens** has resigned as superintendent of the accounting department of the Edison Electric Illuminating Company of Boston.

**Mr. Philip R. Dunton** has succeeded Mr. T. C. Miller as superintendent of the municipal electric-light plant and water-works at McPherson, Kan.

**Mr. R. P. Stevens,** retiring president of the Lehigh Valley Transit Company, Allentown, Pa., was tendered a banquet at the Elks' Club, Sept. 30, by the heads of the departments.

**Mr. H. J. Willis,** who has been superintendent of the La Crosse (Kan.) municipal light and power department for the past six years, has become associated with the water and electric light department at Scott City, Kan.

**Mr. J. Duhan** has been made manager of the Montana Electric Company, a jobbing house of Butte, Mont., to succeed Mr. R. C. Kemp. Mr. Duhan came from the Westinghouse company at Salt Lake City two years ago, when he was made assistant manager.

**Mr. Attila Norman,** retiring manager of the Freeport (Ill.) Railway & Light Company, was tendered a farewell dinner at the Freeport County Club, Oct. 2, by the leading business and professional men of that city. A desk set of copper with silver applied was presented to Mr. Norman by the assembled guests.

**Mr. H. E. Grant,** sales manager in the San Francisco office of the Holophane Works, has joined the editorial staff of the *Journal of Electricity, Power and Gas* of San Francisco. Mr. Grant was formerly in the engineering and commercial departments of the British Columbia Electric Railway Company at Vancouver.

**Prof. Frank G. Wilson,** for the past three years assistant professor of electrical engineering in charge of the laboratories of that department at the University of Illinois, has been appointed head of the electrical department at the Wentworth Institute, Boston. Professor Wilson is a native of Bozeman, Mont., and was educated at the Montana State College, University of Wisconsin and University of Illinois.

**Mr. A. H. Fehr** has been chosen president of the Lehigh Valley Transit Company, of Allentown, Pa., as successor to Mr. R. P. Stevens, whose resignation was announced in these columns on Aug. 23, 1913. Mr. Fehr was formerly connected with the Easton Transit Company, which recently became part of the Lehigh Valley Transit Company's system. The Lehigh Valley Transit Company controls the Allentown Electric Light & Power Company and leases the Bethlehem Electric Light Company and the South Bethlehem Electric Light & Power Company.

**Mr. T. I. Jones,** general sales agent of the Edison Electric Illuminating Company of Brooklyn, has been engaged by the Department of Education of the city of New York to deliver a series of lectures on electrical subjects on the Friday evenings of October and November. The subjects of lectures, beginning with that of Oct. 17, are as follows: Electric Motors," "Electric Railways," "Electric Heating and Welding," "Incandescent Electric Lighting," "Arc, Vapor and Non-vacuum Lamps," "The Telephone and Telegraph" and "Wireless Telephone and Telegraph Systems." All of the lectures will be illustrated by apparatus in operation and stereopticon views and will be delivered in the assembly hall of the public library at Fourth Avenue and Fifty-first Street, Brooklyn.

**Mr. Emmett MacDonald,** the newly elected president of the Illinois State Electric Association, has been a valued member of the association for a number of years, having served as treasurer several years ago and being promoted from the position of second vice-president to the presidency. He is and has been for eleven years superintendent of the Lincoln (Ill.) Water & Light Company. He is a sensible, level-headed man of Scotch extraction and is a believer in the benefits of co-operation in association work. In addition to his connection with the Illinois association, he is a member of the National Electric Light Association, the American Waterworks Association and the Illinois State Water Survey. Mr. MacDonald, who is about forty-five years of age, is a man of few words, but his good judgment commands the respect of his associates.

# Obituary

**Charles Heideloff,** of Hyde Park, Mass., for many years prominent in the electrical business in Boston, died Sept. 19. Mr. Heideloff had just returned from Germany, whither he had gone in search of health.

**William W. Gamewell,** former treasurer of the Stanley Electric Company of Pittsfield, Mass., and a director of electric companies at Greensboro, N. C., Madison and Sheboygan, Wis., died at Sheboygan on Sept. 21.

**F. P. Catchings,** a well-known Southern electrical engineer, was drowned off Atlantic Beach, Fla., Sept. 21. Mr. Catchings was educated at Emory College and Vanderbilt University and for several years was chief electrical engineer of the Georgia Railway & Electric Company of Atlanta, Ga. At the time of his death he was superintendent and electrical engineer of the Alabama Power Company of Birmingham, Ala., having gone to that city from Atlanta about one year ago.

**R. D. Apperson,** until recently president of the Lynchburg (Va.) Traction & Light Company, died at Santa Monica, Cal., Oct. 6. Mr. Apperson was born in 1863 and in 1886 became connected with the Little Rock (Ark.) & Citizens' Street Railway, remaining with that company until 1890, when the property was sold. He then went to Staunton, Va., where he built an electric railway, of which he assumed the management, and later also built and operated at Staunton an electric light and gas plant. Mr. Apperson and his associates purchased the property of the Petersburg (Va.) Gas & Light Company and the Lynchburg Gas Company in 1899 and two years later acquired the Lynchburg Electric Railway & Light Company and the Lynchburg & Riverton Street Railway. These properties and that of the gas company were afterward consolidated as the Lynchburg Traction & Light Company. In 1903 the Apperson interests purchased the property of the Roanoke Railway & Electric Company, and when, in 1910, the American Railways acquired the property of both the Lynchburg Traction & Light Company and the Roanoke Railway & Electric Company Mr. Apperson continued as president and general manager of both and became a director of the American Railways. Mr. Apperson resigned a few months ago as president of the Lynchburg Traction & Light Company, but continued as chairman of the board of directors of the new company and of the Roanoke Railway & Electric Company.

**Robert Edwards,** who established the firm of Edwards & Company, Inc., manufacturing electricians of New York, died at his residence in Lowerre, Yonkers, N. Y., Sept. 27, 1913. Mr. Edwards was born September, 1838, in London, and came to the United States in 1847. He first resided in Fond-du-Lac, Wis., but in 1849 moved to New York City with his family. After completing his education at Manhattan College in that city Mr. Edwards entered the jewelry business and for many years was with the firm of Bishop & Rein in the old Fifth Avenue Hotel. In the early seventies he entered the electrical business and in 1872 organized Edwards & Company as a contracting concern. The business of the company has been carried on continuously from that time. During the early days of Mr. Edwards' career the company merely manufactured material for its own use, but about ten years ago the manufacturing interest became prominent, the construction end of the business was disposed of and all the energies of the concern were devoted to manufacturing. Mr. Edwards continued as the head of Edwards & Company until about five years ago, when he retired from the active management, although he still retained an interest in the business and was the president of the company at the time of his death.



ROBERT EDWARDS

# Construction

## New England

[illegible] FALLS, VT.—A new switchboard will be erected at the [illegible] plant within the next two years. [illegible] purchased). The town expects to build a new power house and install new equipment within the next three years. D. H. Bailey is superintendent.

BOSTON, MASS.—At the annual meeting of the stockholders of the Edison El. Illg. Co. of Boston to be held Oct. 14 the stockholders will be asked to authorize the directors to apply to the Board of Gas and Electric Light Commissioners for permission to issue 22,756 shares of [illegible] and improvements to the property.

BOSTON, MASS.—The Commonwealth Ice & Storage Co. of Boston, Mass., will install a cold-storage and power plant on Pier 6, Northern Avenue, to furnish light, power and refrigerating service for the fishing industry on Pier 6. The equipment will consist of four 500-hp vertical water-tube boilers (Erie City Iron Works); Taylor stokers; two 14-in. by 18-in. Lentz simple engines, 200 r.p.m.; four 21-in. and 36-in. by 36-in. cross-compound Lentz engines, 45 r.p.m., manufactured by the Erie City Iron Works, and two 185-kva, 60 cycle, three-phase, 220-volt Triumph generators. Coal-conveying machinery and switchboard equipment have not yet been purchased. About 80 meters and 30 arc lamps will be required, contracts for which have not yet been placed. All wires will be placed underground. Sterrett & Benson, 156 State Street, Boston, Mass., engineers, have charge of the work.

BROCKTON, MASS.—A special meeting of the stockholders of the Edison El. Illg. Co. of Brockton has been called for Oct. 24 to vote on the proposition to increase the capital stock of the company by 3162 shares, the proceeds to be used for improvements and additions to its plant, the chief items being an extension to the East Bridgewater station and the installation of equipment to increase the output by 5000 kw.

FALL RIVER, MASS.—The State Board of Gas and Electric Light Commissioners has granted the Fall River El. Lt. Co. permission to issue 2000 shares of additional capital stock at $150 per share to pay for floating indebtedness and for improvements and extensions.

GREENFIELD, MASS.—The Greenfield El. Lt. & Pwr. Co. has been granted permission by the State Gas and Electric Light Commissioners to issue $250,000 in capital stock, the proceeds to be used for payment of debts already incurred and for additional extensions and improvements to its property.

NORTH ATTLEBORO, MASS.—The Electric Light and Water Department has awarded the contract for the erection of a three-phase transmission line to the manufacturing plant of the J. F. Sturdy Sons Co., jewelers, to Fred S. Ley & Co., of Boston, Mass. William Plattner is manager of the electric light and water department.

## Middle Atlantic

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, until Oct. 14 for repairs, alterations and additions to the electric equipment in Public School 20, Union Avenue and Keap Street, borough of Brooklyn. Blank forms, plans and specifications may be obtained or seen at the office of the superintendent, estimating room, Park Avenue and Fifty-ninth Street, New York, and also at branch office, 131 Livingston Street, Brooklyn.

CHITTENANGO, N. Y.—The contract for lighting the streets of the village has been awarded to W. J. Phillips, owner of the Manlius electric-light plant.

COLTON, N. Y.—The Public Service Commission has granted the Northern Pwr. Co., of Potsdam, permission to erect a distribution system in Colton to furnish energy for lamps and motors.

ITHACA, N. Y.—An order has been issued by Justice Giddings permitting the receivers of the New York, Auburn & Lansing Ry Co. to issue certificates for $90,000 for improvements to the Remmeton power plant, purchased last spring. H. A. Clark, of Ithaca, is general manager.

ITHACA, N. Y.—Bids will be received by E. L. Williams, treasurer Cornell University, Ithaca, until Oct. 16 for construction, heating and ventilating and electric work for the stock-judging pavilion and agronomy building at the New York State College of Agriculture, Cornell University, Ithaca. Bids will be received for each division of the work separately and no combination of bids will be considered. Plans and specifications and blank forms of proposals may be obtained at the office of Green & Wicks, architects, 110 Franklin Street, Buffalo, N. Y., upon deposit of $25, to be refunded upon return of plans. Plans and specifications are on file at the office of Lewis F. Pilcher, state architect, Capitol, Albany, and at the office of the treasurer of Cornell University, [illegible] extensions to its distribution system. The company purchases energy [illegible]

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of schools, Park Avenue and Fifty-ninth Street, New York, until Oct. 14 for installing fire-alarm telegraph system in Public Schools 5, 8, 90, 119 and 169, borough of Manhattan; also for additions and repairs to electric equipment in Public Schools 13, 49 and 70, borough of Manhattan. A separate proposal must be submitted for each school [illegible] plans and specifications may be obtained or seen at the office of the superintendent, at estimating room, Park Avenue and Fifty-ninth Street, borough of Manhattan.

NEW YORK, N. Y.—Bids will be received by Henry S. Thompson, commissioner of water supply, gas and electricity, Department of Water Supply and Electricity, Room 1903, 13 to 21 Park Row, New York, until Oct. 15 for furnishing and installing switchboards, electrical wiring and all appurtenances, together with control cables, in underground ducts, from the South Street high-pressure pumping station to the gate vaults in the Bowery south of East Houston Street, and in Stone Street between Whitehall and Broad Streets; also from the West Street high pressure pumping station to the gate vault located in Hudson Street south of North Moore Street. Blank forms, together with copy of contract, including specifications, may be obtained upon application to the above office.

NIAGARA FALLS, N. Y.—The lighting committee of the Business Men's Association has decided to form a stock company to install and operate an electric plant. The company will be capitalized at $75,000 and will file application for a franchise to operate in this city. Peter F. Jenss, Isaac Bier and Henry A. Welch are directors.

OAKFIELD, N. Y.—The Village Board has granted the Genesee Lt. & Pwr. Co., of Batavia, a franchise to furnish electricity in Oakfield. The board has entered into a contract with the company for a period of 10 years. The company has purchased the distribution system and other equipment of the United States Gypsum Co., which for several years has furnished electrical service to the village. The Genesee company proposes to erect a transformer station in Oakfield.

SALEM, N. Y.—The Salem Lt., Ht. & Pwr. Co. expects to purchase within the next three months some graphic meters. W. H. Simpson is superintendent.

SCHENECTADY, N. Y.—The contract for electric wiring of three new schools, one to be erected at Van Vranken Avenue and Salina Street, one at Seventh Avenue and Webster Street, and the third at Guilderland Avenue and William Street, has been awarded to Finch & Hahn, of Schenectady, at $3,337 for each of the two smaller schools and $5,995 for the large school.

CORRY, PA.—The new management of the Corry City El. Lt. Co., it is reported, is preparing plans for extensions and improvements to the plant, including the construction of a new boiler room. Orders have been placed for a 60-ft. stack.

PHILADELPHIA, PA.—Plans are being prepared by Biberman Brothers for the erection of a reinforced-concrete building, 77 ft. by 12[illegible] and installation of a 300-hp power plant. The equipment of the [illegible] plant will consist of two 150-hp boilers, one 150-kw generating [illegible] one 50-kw generator and a radial brick stack. The cost of the b[illegible] is estimated at $175,000, and bids will be received Nov. 15. Bid[illegible] power plant will be received Nov. 30, by [illegible] approximately $[illegible] Sauer & Harris, 111 Chestnut Street, Philadelphia, are architects.

PITTSBURGH, PA.—The battery shop of the Fort Wayne Railroad shops, in the North Side, was recently destroyed by fire, causing a loss of about $15,000. All of the machinery in the shop was destroyed.

PITTSBURGH, PA.—Bids will be received until Oct. 14 by the Board of Inspectors of the Western Penitentiary, Pittsburgh, for electric [illegible] [illegible] on the south house on property of the Western Penitentiary, Rockview Station, Pennsylvania Railroad. Drawings and specifications [illegible] at the Western Penitentiary, Pittsburgh, at the [illegible] Rockview Station, and at the office of John T. Windham, architect, [illegible] Philadelphia. An appropriation of $[illegible] has been made for the building and equipment. John Hannum is superintendent of construction, Western Penitentiary, Pittsburgh.

[illegible], PA.—Notice has been sent with the State Department at Harrisburg of the absorption by the Mercer County Lt., Ht. & Pwr. Co. of the [illegible] Lake, Delaware, Sandy Lake and Stoneboro Pwr. Companies, all recently chartered [illegible] Mercer County. The Mercer County company will furnish energy to a large territory.

MILLBURN, N. J.—Bids will be received by the Millburn Township committee, First National Bank Building, Millburn, until Oct. 14 for furnishing and installing fire-alarm equipment; also for reconstruction of the present out-of-doors or aerial lines of fire-alarm wire used in connection with the fire-alarm system in accordance with specifications on file in the office of the township clerk. Proposals may be submitted for the entire work, or separate proposals for the equipment and wire reconstruction work will be received. Ernest L. Smithers is chairman of committee.

RAMSEY, N. J.—The Borough Council is contemplating the installation of a municipal electric-light plant in connection with the water works system.

BALTIMORE, MD.—The Consolidated Gas, El. Lt. & Pwr. Co., of Baltimore, has plans under way for an additional boiler house at the Westport power station. A 15,000-kw generator has been ordered from the General Electric Co., and orders have been placed with the Edg[illegible]

oor Iron Co. for six 1000-hp Edge Moor boilers. Plans are being repared for construction of building and contracts will soon be awarded. he coal-handling plant will be increased during the winter, either by eeding up the present plant or by installing an entirely new system. . S. Loizeaux is electrical engineer.

BALTIMORE, MD.—The contract for the construction of a 5-story nd basement furniture factory, 34 ft. by 166 ft., with an ell 34 ft. by 3 ft., reinforced-concrete construction, has been awarded to the West onstruction Co., of Baltimore. The building will be equipped for gas id wired for electric lighting and for motors for operating furniture achinery, freight elevators, steam heating, plumbing and sprinkler system. No power plant will be required as heat will be obtained from ie adjoining building and energy from the local company. Bids for eating apparatus, electric wiring, elevator and sprinkler will be asked r later.

COLLEGE PARK, MD.—Bids will be received by the building comittee of the Maryland Agricultural College, College Park, Md., at the fice of the secretary of the college, until Oct. 20 for construction, cluding plumbing, heating equipment, electric wiring and fixtures, of dormitory building. Drawings and specifications may be had at the fice of Flourney & Flourney, architects, 152 H Street, N. W., ashington, D. C. A deposit of $50 will be required for specifications overing this contract, which will be refunded upon return of plans.

BENWOOD, W. VA.—The City Council has granted the Brooke El. a 30-year franchise to furnish energy for lamps and motors in nwood.

CHARLESTON, W. VA.—The Virginia Pwr. Co., of Charleston, is lding a 26,666-hp plant on the Kanawaha River with steel-tower transsion lines to furnish energy to numerous mines in that vicinity. The t of the plant is estimated at about $1,000,000. The company conmplates completing its hydroelectric power plant at Bull Shoal on New er, including dam 1400 ft. long and 125 ft. high, to develop 100,000

It has three other power sites on New River, one at Bluestone, ere it is estimated that 125,000 kw can be developed; the second at chmond Falls, capable of developing 15,000 kw, and the third at uley Junction, where 30,000 kw can be developed. It is proposed imately to transmit energy to Cincinnati, Ohio, Huntington, W. Va., rtsmouth, Ohio, and Louisville, Ky. Wilbur Tusch is secretary and harles O. Lenz chief engineer, 149 Broadway, New York, N. Y.

ALEXANDRIA, VA.—The Southern Ry. Co. is planning to erect substation for a 4400-volt, three-phase transmission line to operate tomatic electric block signal system. B. Herman, 1300 Pennsylvania venue, Washington, D. C., is chief engineer.

ORANGE, VA.—The Southern Ry. Co. is erecting a power station Orange for emergency service, to be equipped with gasoline engine generator. The company is installing an automatic electric block nal system between Seminary and Orange, a distance of 80 miles. Herman, 1300 Pennsylvania Avenue, Washington, D. C., is chief gineer.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supes and Accounts, Navy Department, Washington, D. C., until Oct. 21 furnishing at the various navy yards and naval stations supplies as ows: Philadelphia, Pa., Schedule 5892—Furnishing and erecting two llon, three-motor electric traveling cranes; Brooklyn, N. Y., Schedule 50—10 radio receiving sets. Bids will also be received until Oct. 28 furnishing at Puget Sound navy yard: Schedule 5893—One 5-kw, volt turbo-generating set (steam pressure 140 lb.). Application for posals should designate the schedule by number. T. J. Cowie is paymaster general.

## North Central

DETROIT, MICH.—The Detroit Shipbuilding Co. has awarded a ntract for the construction of a power house at its Orleans Street plant.

FENTON, MICH.—At a special election held recently the Flint El. Co. was granted a 30-year franchise to furnish electrical service in Fenton. Among the improvements contemplated is the erection of a new power plant. A 24-hour service will also be established.

GREENVILLE, MICH.—The R. J. Tower El. Co., of Greenville, expects to purchase within the next six months one 150-hp to 200-hp turbine waterwheel and material for concrete dam and flume. S. L. Tyler is manager.

HUNTERS CREEK, MICH.—A deal has been closed whereby the Schlegel Lt. & Pwr. Co., of Lapeer, will furnish electricity for lamps and motors in Hunters Creek. Upon completion of the local system the company contemplates extending its system to Metamora.

KALAMAZOO, MICH.—The managers of the municipal electric-light plant are considering the question of establishing a day service. Harry E. Churchill is superintendent.

LAPEER, MICH.—The F. J. Schlegel Lt. & Pwr. Co., of Lapeer, expects to erect within the next six months a new power house and to purchase new boilers, generators, turbines or engines, stokers and coal and ash-handling equipment, pumps, oiling system, switchboard, instruments, switches and protective devices, transformers, lightning arresters and electrical appliances, including vacuum cleaners, washing machines, etc.

HARBERTON, OHIO.—The Board of Control has awarded the contract for erection of the distribution system for the municipal electric-light plant to Fred Gangle, of Akron, for $46,850. Contracts for equipment for power house, etc., have also been awarded.

LOWELLVILLE, OHIO.—Bids will be received by the Board of Public Affairs of Lowellville until Oct. 25 for furnishing material and labor for rebuilding and extending the present lighting system in accordance with plans and specifications on file with the Board of Public Affairs as follows: (1) all materials as specified; (2) all labor required for removing the present material and the erection of new material.

MANSFIELD, OHIO.—The Mansfield Gas Lt. Co. has decided to enter the electrical field and work on construction of a new plant will begin in November. Two 750-hp natural-gas engines have been ordered for the proposed plant.

NEW CONCORD, OHIO.—The New Concord Wtr. & El. Co. has applied to the Ohio Public Utilities Commission for permission to issue $17,000 in bonds for improvements to its plant.

TROY, OHIO.—The town of Troy is considering the question of rebuilding the municipal electric-light plant next year. As yet nothing definite has been decided. L. A. Pool is superintendent.

LEXINGTON, KY.—The City Council is considering the question of issuing $200,000 in bonds for the purpose of establishing a municipal electric-light plant. The proposition will be submitted to the voters at the November election.

LOUISVILLE, KY.—The General Construction Co., it is reported, will install a $7,500 lighting plant in a large apartment house which it now has under construction.

WHITESBURG, KY.—The installation of an electric-light plant in Whitesburg is under consideration. Ira Fields, Jr., of Harlan, is reported to be interested in the project.

WINCHESTER, KY.—The pavement committee of the City Council is ready to award contracts for ornamental iron standards to be used in connection with the installation of a street-lighting system.

BEDFORD, IND.—The Southern Indiana Pwr. Co., of Bedford, expects to erect within the next six months two substations (750 kva each, 22,000 volts and 4000 volts) to feed stone mills and quarries in Bloomington (Ind.) limestone field. Energy is to be transmitted on a steel tower line (recently completed) from the Williams plant of the company, at 22,000 volts, a distance of 35 miles. The company also expects to purchase within the next six months material for 35 miles of 4000-volt distribution lines, consisting of wooden poles supporting No. 1 wire, in the Bloomington stone belt. D. J. Angus is manager.

NEWBURG, IND.—The local electric-light plant was recently purchased by Jennison and Schumaker. The new owners took possession Oct. 1 and contemplate making considerable improvement to the system during the coming year, including the purchase of a 30-kw to 33-kw, 250-volt generator.

ORLAND, IND.—R. E. Sanderson, owner of the local electric-light plant, expects to erect within the next eight months a cement block building for power house and to purchase a 75-hp boiler, a 60-hp or 70-hp steam engine, transformers, hoods and posts for incandescent street lamps and heating apparatus, etc.

TERRE HAUTE, IND.—The Terre Haute, Indianapolis & Eastern Trac. Co., of Terre Haute, expects to erect two additional high-tension transmission lines for connecting coal mines of the Deering Coal Co. and the Vandalia Coal Co., material for which has already been purchased. T. F. Grover is general manager.

COLLINSVILLE, ILL.—Plans for the installation of an ornamental street-lighting system have been presented to the City Council by the Collinsville El. Lt. Co. It is proposed to erect standards carrying five-lamp clusters. The cost of the installation is to be paid by the business men.

ELGIN, ILL.—The City Council has decided to call an election, to be held Oct. 16, to submit the proposition to issue $160,000 in bonds for the installation of a municipal electric-light plant in Elgin.

JACKSONVILLE, ILL.—Investigations are being made with a view of installing a heating plant in connection with the power plant of the Jacksonville Ry. & Lt. Co., owned and operated by the Illinois Trac. Co. The cost of the plant and mains is estimated at about $100,000. W. B. Miser is general superintendent.

MARINE, ILL.—Plans are being prepared for the construction of an electric-light plant for the Marine El. Lt. & Pwr. Co. Fred Scheurer is reported to be interested in the project.

MORRISONVILLLE, ILL.—The Southern Illinois Lt. & Pwr. Co., it is reported, contemplates improvements to its local electric plant, involving an expenditure of about $20,000.

JANESVILLE, WIS.—The Wisconsin Railway Commission has instructed the Janesville El. Co. to make improvements to its service and install new equipment.

LADYSMITH, WIS.—The Ladysmith Ltg. Co., it is reported, contemplates the installation of a new generator and other improvements to its plant.

MENOMONIE, WIS.—The City Council is considering two propositions for street-lighting, one for using electricity and the other for gas. If electric lamps are decided upon, ornamental street lamps will be erected on Main Street, at a cost of about $4,900. The present plans provide for 49 lamp standards.

MINERAL [illegible]. WIS.—The Mineral Point [illegible]

MOSINEE, WIS.—The Mosinee El. Lt. & Pwr. Co. expects to purchase one transformer and some wire.

POYNETTE, WIS.—Plans and specifications have been prepared for the installation of electric-light plant and construction of a power dam. It is understood that bids will soon be called for construction work.

BROOTEN, MINN.—Bids will be received by John Bohmer, president Union El. Co., until Oct. 16, for the construction of an electric-lighting system in the village of Brooten. Plans and specifications are on file in the office of John Bohmer, president, of the Union El. Co., Brooten, and in the office of Earle D. Jackson, consulting engineer, Capital [illegible], St. Paul.

MADELIA, MINN.—A franchise has been granted to Thomas J. McGovern, of Mankato, to install and operate an electric-light plant in Madelia. Work will begin at once on the erection of a transmission line from Lake Crystal. Energy will be supplied from the dam at Rapidan. Ornamental street lamps will be erected on Main and St. Paul Streets, and incandescent lamps will be installed on all other streets.

MOORHEAD, MINN.—Application has been made to the Council by M. H. Davis for a franchise to construct and operate an electric-light plant in Moorhead.

MOUNTAIN LAKE, MINN.—The contract for lighting the city has been awarded to the Mountain Lake Milling Co. The cost of the installation of the system is estimated at about $10,000. J. J. Hiebert is manager.

NEW MUNICH, MINN.—Bonds to the amount of $5,000 have been voted for the installation of a municipal electric-light plant.

WARROAD, MINN.—The contract for the construction of the municipal electric-light plant has been awarded to the Northwestern Electrical Supply Co., of St. Paul, for $29,925. The contract includes building, electrical equipment, wiring, water mains around block 4 and Lake Street to State. The plant will be equipped with two 60-hp gas-producer engines and a 75-kw alternating-current generator.

WOODLAKE, MINN.—All bids received Sept. 25 for furnishing material and erecting a 13,200-volt transmission line from Granite Falls to Woodlake and a distribution system in Woodlake have been rejected. New bids will be considered by the village. Harry F. Payne is village recorder.

CORRECTIONVILLE, IA.—The power and milling plants of the Union Lt. & Pwr. Co., of Correctionville, were recently destroyed by fire, causing a loss of about $20,000. A new light plant, it is understood, will be erected at once.

CUMBERLAND, IA.—P. A. Johnson, proprietor of the Anita electric-light plant, has applied for a franchise in Cumberland. If granted a franchise, it is understood that a new plant will be erected in Anita and the transmission line extended to Wiota.

HAMPTON, IA.—The contract for street-lighting has been awarded to the Hampton El. Lt. Co. About 70 electroliers will be purchased, of which about 50 will be used in the business section and 20 in the residential districts.

McGREGOR, IA.—Arrangements, it is reported, have been completed for the installation of an electric-light plant in Monona, energy for operating the system to be supplied from the plant of G. S. Donaldson, of McGregor, 14 miles distant. A. Wellman, of Monona, to whom was recently granted a franchise to install a system here, will erect a substation at the city limits and purchase energy from the McGregor plant. Mr. Donaldson will erect the transmission line to the substation. The proposed transmission line will pass through the villages of Girard and Froelich.

MILFORD, IA.—G. F. Sheldon, of Sheldon, has applied for a franchise to install an electric-light plant in Milford.

MOORHEAD, IA.—Application has been made to the town of Moorhead by M. H. Davis for a franchise to erect a power plant.

PACIFIC JUNCTION, IA.—At an election held recently the proposition to grant the Red Oak El. Co. a franchise in Pacific Junction was carried. The company is now erecting its transmission lines west from Red Oak and will connect with the lines at Plattsmouth, Neb., the two companies consolidating. The transmission line will pass through Emerson, Hastings, Malvern, Glenwood and Pacific Junction. The company has been granted a franchise in Hastings and an election will soon be held in Emerson and Malvern.

SWANVILLE, IA.—The installation of an electric-light plant to furnish energy for lighting the city is contemplated by Albert Mielke.

WHAT CHEER, IA.—The What Cheer El. Lt. Co. expects to complete the erection of its 13,000-volt transmission line connecting with the Sigourney Transmission Co. at Delta within the next month. Material for the line has been purchased.

JEFFERSON CITY, MO.—The City Council has engaged R. L. Baldwin, consulting engineer, of Kansas City, to prepare preliminary plans for a municipal electric-light plant.

ST. LOUIS, MO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 30 for an electric elevator, including hoistway, etc., in the United States post office at St. Louis, Mo., in accordance with drawings and specifications copies of which may be obtained at above office. O. Wenderoth is supervising architect.

FESSENDEN, N. D.—Plans, it is reported, are being considered for enlarging the local electric-light plant.

ROLLA, N. D.—A franchise has been granted to John Munro for the installation of an electric-lighting system in Rolla.

MITCHELL, S. D.—Bids will be received by N. H. Jensen, city auditor, until Oct. 20 for material and labor for the construction and installation of a municipal telephone system in the city of Mitchell. Bids are to be submitted on the labor and material as a whole; also separate bids for each. Plans and specifications are on file at the office of the city auditor, copies of which may be obtained upon deposit of $5, which will be refunded upon return of same.

EXETER, NEB.—The Exeter El. Lt. & Pwr. Co. expects to erect within the next two months one 125-hp tubular boiler, one 80-hp Corliss engine and a 60-kw, 125-volt direct-current generator.

POLK, NEB.—Bids will be received by the village clerk for the construction of a complete electric-light plant and additions to the water works system, including a 40-hp oil engine, 20-kw generator, 80-amp storage battery, switchboard and distribution system, 700 ft. 6-in. and 4-in. mains, 18 hydrants, valves, pressure tank and air compressor. Grant & Fulton, of Lincoln, Neb., are engineers.

ARMA, KAN.—Bonds to the amount of $26,000 have been voted for the first instalment on the municipal electric-light plant and water-works system. Bids for construction will be called in about six weeks. Albert C. Moore, of Joplin, Mo., is engineer.

CONCORDIA, KAN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 12 for construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Concordia, Kan. Drawings and specifications may be obtained at the above office or from the custodian of site at Concordia, Kan. O. Wenderoth is supervising architect.

GLASCO, KAN.—The manager of the municipal electric-light plant expects to purchase within the next 60 days inside wiring material. C. H. Simpson is superintendent.

GYPSUM, KAN.—The Gypsum Lt. & Pwr. Co. expects to purchase within the next six months a 25-hp or 30-hp oil engine, underground conduit and cable for street-lighting system, ornamental street lamp posts, washing machines, etc.

HIGHLAND, KAN.—The Home Tel. & El. Co., of Highland, expects to erect within the next two months 2200 ft. of No. 2 copper wire and to purchase self-starters for two 15-hp direct-current 220-volt motors, rubber-covered wire (from $250 to $350 stock), porcelain knobs, tubes, conduits, fittings and other wiring supplies; also within the next six months one 50-hp oil engine directly connected to a 37½-kw or 40-kw, 110-220-volt, direct-current generator. Work has begun on the construction of the Highland municipal water system, to be completed by Jan. 1, 1[illegible]. Energy for operating the pumping plant will be furnished by two 15-hp 220-volt direct-current motors, energy to be purchased from the Home Tel. & El. Co. With this increase in load the company hopes to establish a day service within the next few months. J. H. Bender is manager.

ONAGA, KAN.—The Onaga Lt., Ht. & Pwr. Co. expects to erect within the next four months a 4½-ton ice plant to be operated in connection with its electric plant. All contracts for the work have been awarded. Ernest L. Frezieres is manager.

PEABODY, KAN.—The electric-light and ice plants in Peabody were recently destroyed by fire. It is understood that the plants will be rebuilt.

SABETHA, KAN.—The city of Sabetha has recently purchased a new 187-kva, three-phase, 60-cycle, 2300-volt Westinghouse turbine, several hundred new poles and a large amount of weatherproof wire for rebuilding the overhead distribution system. The city also proposes to install a new ornamental street-lighting system in the near future. W. Hunter is city engineer.

STOCKTON, KAN.—The city of Stockton expects to purchase within the next three months one 30-hp and one 15-hp pump directly connected to electric motors. O. M. Goodrich is chief engineer and electrician. F. A. Chipman is city clerk.

WHITING, KAN.—Bids will be received until Oct. 16 at Whiting for the erection of a transmission line and electric-light plant as follows: Section (A) For furnishing poles; (B) for furnishing pole material and wire; (C) for installation of plant; (D) for material and labor for transformer station. Plans and specifications are on file in the office of Henrici, Kent & Lowry Engineering Co., 715 Reserve Bank Building, Kansas City, Mo., or will be forwarded upon a deposit of $3. Frank Todd is city clerk.

## Southern States

JACKSONVILLE, N. C.—The contract for the installation of an electric-light plant in Jacksonville has been awarded to the Newbern Elec. Sup. Co., of Newbern. The plant will furnish energy for street-lighting and also to private consumers. Luther Taylor, of Jacksonville, is owner.

RUTHERFORDTON, N. C.—The town of Rutherfordton is contemplating the installation of either an electrically driven deep-well pu[illegible]

or an electrically driven air compressor and air lift apparatus in connection with the municipal electric-light and water plant. L. C. Gidney is superintendent.

WILMINGTON, N. C.—The Tidewater Pwr. Co., of Wilmington, expects to purchase within the next six months a complete conveying equipment for handling sawdust and heating duct to its boilers. Raymond Hunt is superintendent of electrical department.

LAKE CITY, S. C.—The City Council has engaged the J. B. McCrary Co., of Atlanta, Ga., as consulting engineers to take charge of the construction of the proposed municipal electric-light plant and water-works system. The work will involve an expenditure of approximately $12,000.

GORDON, GA.—The contract for the proposed municipal electric-light plant has been awarded to the Modern Equipment Co., of Savannah, Ga. The plant will be driven by a Foos oil engine.

HOMERVILLE, GA.—The Barnhill-Ferndon Co. has been granted a 30-year franchise to construct and operate an electric-light plant and water-works system in Homerville.

KISSIMEE, FLA.—The City Council, it is reported, is considering the installation of an additional generator in the municipal electric-light plant, to cost about $7,000.

LARGO, FLA.—Preparations are being made by J. N. McClurg, manager of the Clearwater ice factory, to construct and operate an electric-light system in Largo. Energy for operating the system will be supplied from the power house in Clearwater. A three-phase transmission line, 3 miles long, will be erected.

MIAMI, FLA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 1 for an electric passenger elevator in the United States post office, court house and custom house in Miami, in accordance with drawings and specifications copies of which may be obtained at the above office. O. Wenderoth is supervising architect.

KENTON, TENN.—Bonds to the amount of $30,000 have been voted for the installation of an electric-light plant.

COLUMBUS, MISS.—All bids received Oct. 1 for installing an electric-light plant at the Mississippi Industrial Institute and College were rejected. As yet no time has been set for receiving further bids. D. T. Gaston is secretary and treasurer.

YAZOO CITY, MISS.—The Public Service Commission expects to purchase within the next three months one motor-generator set and a six-panel switchboard with instruments from the General Electric Co. James S. Butler is manager.

ARGENTA, ARK.—The City Council has granted the Merchants' Ltg. Co., of Little Rock, a franchise to furnish electricity in Argenta for a period of 30 years. The municipal electric-light plant will be closed down and energy for the local system will be supplied by the Merchants' company.

BOKHOMA, OKLA.—The installation of an electric-light plant, it is reported, is under consideration by the Wilson Lumber Co. W. M. Waterman is general manager of the company.

MEDFORD, OKLA.—Bids will be received by J. G. McKelvey, town Clerk, until Oct. 15 for construction of a power house for water and light plant. I. H. Ruth is president of board of trustees.

SUPPLY, OKLA.—At an election held Sept. 29 the proposition to issue bonds for the installation of a municipal electric-light plant was carried. S. C. Devoe is chairman of board.

DALLAS, TEX.—The Municipal commission has awarded the contract for electric wiring the new city hall to the W. M. Clower El. Co. for $7,960.

DALLAS, TEX.—Bids will be received by the county auditor at Dallas, Tex., until Nov. 3 for the installation of heating and washed-air ventilating systems, also plumbing and elevators to be installed in the nine-story and basement criminal courts and jail building for Dallas County. Separate bids are to be submitted for plumbing and elevators; bids for power plant and boilers will be asked for later. Plans and specifications may be obtained at the office of H. A. Overbeck, architect, 901 Juanita Building, Dallas. A deposit of $50 will be required for plans, to be refunded upon return of same.

MERKEL, TEX.—The Merkel El. Co. expects to purchase within the next six months 250 25-ft. poles with 6-in. tops and within the next month it will purchase 20 posts for street-lighting. W. E. Britain is manager.

TEXAS CITY, TEX.—The proposition to issue $250,000 for the construction of an electric light and power plant and the purchase of the lighting and sewer systems of the Texas City Corpn. will be submitted to the voters in the near future.

VENUS, TEX.—The Venus Lt. & Wtr. Co. expects to purchase within the next six months a carload of poles. A. D. Frost is owner and manager.

VERNON, TEX.—The Texas Pub. Ser. Co. (Vernon division) expects to erect within the next three months a new power house and transmission line and to purchase a new engine and generator; auxiliary equipment not yet decided upon, poles, wires, etc. The Texas Pub. Ser. Co. recently took over the Vernon Lt. & Pwr. Co. A. E. Gilman is business manager.

## Pacific States

EATONVILLE, WASH.—The only bid for the construction of the proposed municipal electric-light plant was submitted by Buxbaum & Cooley Co., of Seattle, at $14,000. The bid was rejected and the proposition awaits change in specifications or source of supply. Charles C. Beggs is town clerk.

KELSO, WASH.—A transmission line will be erected between Kelso and Castle Rock by the Washington-Oregon Corpn., of Chehalis. This line, when completed, will be the means of connecting a continuous line from Woodland to Tenino, also connecting the power plants at Chehalis and Kalama.

PUYALLUP, WASH.—The City Council is considering the proposition to purchase energy for lamps and motors from both the Tacoma municipal electric-light plant and the Stone & Webster Corpn. The cost of erecting a transmission line from the Tacoma plant to Puyallup is estimated at about $15,000.

SEATTLE, WASH.—The Seattle El. Co. is contemplating the construction of a coke oven at its plant at 2000 Northlake Avenue, to cost about $50,000.

SPOKANE, WASH.—The City Council has voted an appropriation of $5,000 to secure definite engineering data in regard to the construction of a municipal electric-light plant. C. M. Fassett, commissioner of public utilities, is a member of the committee appointed to make investigations.

TACOMA, WASH.—The contract for installing a power plant in the Lincoln Park High School has been awarded to the Washington Machinery Depot, of Tacoma, for $20,911. Alfred Lister is secretary of the school board.

ASHLAND, ORE.—The California-Oregon Pwr. Co., it is reported, will extend its transmission lines through the village of Suncrest and into adjacent territory. Energy will be supplied to the farmers along the line and to the Suncrest Orchard Packing Co. The work will involve the expenditure of several thousand dollars.

BAKER, ORE.—The Eagle River El. Pwr. Co., of Baker, expects to purchase within the next two months one 500-kw, 60-cycle, 2300-volt turbo-generator, complete with condenser, to be installed in auxiliary plant at Baker. J. K. Romig is vice-president and manager.

PORTLAND, ORE.—The City Council has decided to employ a hydro-electric engineer for the purpose of investigating various municipal lighting and power projects which Commissioner Daly of the Public Utilities Department has under consideration.

PORTLAND, ORE.—The Portland Ry., Lt. & Pwr. Co. expects to erect within the next 30 days a 500-kw motor generator set in its hydro-electric station at Bull Run to furnish energy to operate the Mount Hood division. O. B. Coldwell is general superintendent of light and power department.

THE DALLES, ORE.—The power plant of the Oregon Pwr. Co. was recently damaged by fire, causing a loss of about $1,500. It is reported that additions are planned when repairs are made.

BANNING, CAL.—The water-power of the Whitewater River will be utilized to generate energy by the Consol. Pwr. Co., of which H. Edwin Moore, of Los Angeles, is manager. The company has completed the diversion of the river from the desert, bringing the water in conduits 6 miles to a point near Banning, where several sections of land will be irrigated. Announcement is made by the officials for the company that two and possibly three power houses will be installed at points a few miles north of Banning in the early spring. Arrangements have been made for financing the project, aggregating $500,000, and preparations have been made for the work.

OROVILLE, CAL.—Work, it is reported, will soon begin on the construction of two additions to the Big Bend power plant of the Great Western Pwr. Co. on the North Fork of the Feather River at Las Plumas, 18 miles from Oroville, to cost about $1,000,000. The additional units to be installed will increase the output of the plant from 40,000 kw to 60,000 kw.

PALO ALTO, CAL.—The city of Palo Alto expects to purchase within the next six months a switchboard panel and equipment; also within the next 12 months material for distribution system (from $2,000 to $3,000 worth), and to expend about $3,000 for electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, etc. Contract has been awarded for a 300-hp generating unit, consisting of Diesel engine and generator. J. F. Byxbee, Jr., is city engineer.

RED BLUFF, CAL.—The Secretary of the Interior has authorized the Reclamation Service to execute a contract with the Iron Canyon Project Association of California whereby the federal government is to make surveys and preliminary investigations to determine the feasibility of the Iron Canyon irrigation project, preparing plans and estimates of cost, etc. The proposition involves the construction of reservoirs on Sacramento River or its tributaries for the purpose of irrigating lands, mainly situated below the city of Red Bluff along Sacramento River; improvement to the navigability of the Sacramento River in the vicinity of the project, the prevention of floods in the Sacramento Valley, the development of hydroelectric power, etc., all being incident to the main plan of irrigating land in the Iron Canyon project. The expense is not to exceed $20,000, one-half of which will be borne by the association, the other half by the federal government.

SUSANVILLE, CAL.—The Lassen El. Co., of Susanville, expects to [illegible] 2200-volt generator, complete with exciter, switchboard, synchronizing apparatus and Tirrill voltage regulator for 150-kw generator, all to be used as an auxiliary installation to the present plant. The company would consider good guaranteed second-hand machinery. L. R. Cady is general manager.

KELLOGG, IDAHO.—The Bunker Hill & Sullivan Mining Co., of Kellogg, is reported to be contemplating the installation of a new street-lighting system in Kellogg and Wardner to replace the lamps now in use. It is proposed to install tungsten lamps, at a cost of about $4,000.

FLORENCE, ARIZ.—At an election held recently the proposition to grant the Florence Improvement Co. a franchise to install an electric-light system in Florence was carried. R. G. Arthur, of Douglas, is general manager.

HARDIN, MONT.—Plans are being prepared by E. [illegible] Hardin, engineer, for a large hydroelectric power plant to be erected on the Big Horn River.

## New Incorporations

[illegible] ILL.—The Consumers' [illegible] has been incorporated with a capital stock of $10,000 by H. M. Stone, E. M. Hohlitt and H. H. Tenney.

UNION, MISS.—The Union Lt. Co. has been incorporated with a capital stock of $10,000 by J. M. Cole, P. L. Ratcliffe and others.

NEW LONDON, MO.—The North Missouri Lt. & Pwr. Co. has been chartered with a capital stock of $60,000. The company proposes to purchase energy from the Keokuk power plant to be delivered at the substation at Ilasco, 8 miles east of New London. The company will distribute electricity for lamps and motors in New London, Center, Perry and Frankfort, and also to the farmers along the transmission line. The directors are: M. C. Briggs and P. M. Megown, of New London; M. J. Jones and J. D. Pitt, of Frankfort; E. W. Keithley and J. Van Elzea, of Center; Samuel C. Gill and William Tibbles, of Perry.

PHARR, TEX.—The Pharr El. Lt. & Pwr. Co. has been chartered with a capital stock of $5,000. The incorporators are: S. R. Cawthrop, Marvin Evans, of Pharr, and A. K. McColl, of Kansas City, Mo.

TORONTO, ONT., CAN.—The Upper St. Lawrence Pwr. Co. has been incorporated with a capital stock of $3,000,000.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED SEPT. 30, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,074,125. METHOD OF OPERATING INDUCTION MOTORS; B. G. Lamme, Pittsburgh, Pa. App. filed July 6, 1908. Primary winding has a plurality of sections for each phase, sections being connected in different relations.

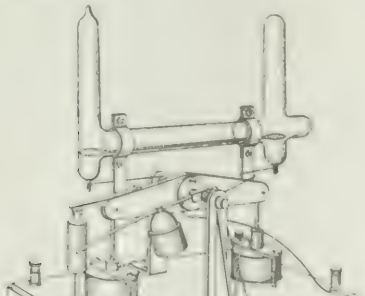
1,074,137. PRESSURE-ALARM GAGE; F. Schubert, Sellersville, Pa. App. filed Feb. 26, 1912. Bourdon tube type, with contacts; adjustment is inclosed and locked to prevent its being tampered with.

1,074,146. THERAPEUTIC ELECTRODE; R. H. Wappler, New York, N. Y. App. filed Dec. 5, 1912. Pressure on the electrode controls strength of current entering the body.

1,074,152. ALTERNATING-CURRENT MOTOR; H. L. Zabriskie, Westfield, N. J. App. filed Feb. 1, 1913. Small motor which may be run on alternating current from 133 to about 25 cycles, or on direct current of same voltage without any change in connections.

1,074,170. TELEGRAPHIC SYSTEM; J. Gell, London, England. App. filed Dec. 21, 1910. Exchanges, trunk-line connections between exchanges and local subscribers' connections at each exchange.

1,074,171. RECEIVER FOR AUTOMATIC TELEGRAPHIC SYSTEMS; J. Gell, London, England. App. filed Jan. 30, 1911. Morse or Wheatstone type of receiver in which the magnet and armature structure may be adjusted as a unit to give neutral, marking or spacing bias.



1,074,253.—Vapor-Electric Apparatus.

1,074,215. ELECTROTHERMOSTATIC REGULATORS; J. G. Schurmann, Kent, Wash. App. filed May 20, 1912. Primarily for automatically controlling supply of energy to an electric heating pad.

1,074,216. ELECTRICALLY HEATED PAD AND THE LIKE; J. G. Schurmann, Kent, Wash. App. filed May 20, 1912. The sections of the heating element are flexibly connected to permit the pad being folded.

1,074,218. FUSE DEVICE; A. E. Simmons, Sacramento, Cal. App. filed Feb. 10, 1913. Signal given when fuse is blown; fuse wire is renewable.

1,074,241. COMBINATION ELECTRIC SWITCH; Y. Burgess, Chicago, [illegible] be placed in a certain definite relation to close the circuit, for automatic ignition circuits and the like.

[illegible] Schenectady, N. Y. App. filed April 27, 1904. Covers movable container for the liquid electrode and automatic means (shown as electromagnets) for moving the container to make and break the conductive connection between the electrodes.

1,074,262. ELECTRIC OSCILLOGRAPH; J. T. Irwin, South Kensington, London, Eng. App. filed Sept. 19, 1908. Measures the difference in pull produced by electrostatic pressure on two stretched diaphragms.

1,074,286. MICROTELEPHONE; W. B. Oliver, Collingswood, N. J. App. filed July 27, 1909. For aiding defective hearing; has the capacity for controllably selecting and amplifying certain sound vibrations, while minimizing others.

1,074,298. TELEPHONE REPEATER SYSTEM; H. E. Shreeve, Millburn, N. J. App. filed Feb. 24, 1912. Repeating apparatus is associated with the two ends of a link circuit in such manner that when the link circuit is connected with the main circuits it constitutes a connection between the two main circuits.

1,074,303. ELECTRICAL ILLUMINATION; E. Weintraub, Schenectady, N. Y. App. filed Feb. 9, 1907. Mercury-vapor arc is passed through a refractory tube of small bore in an exhausted space.

[illegible] GLOWER FOR ELECTRICAL INCANDESCENT LAMPS; O. M. Throwless, Newark, N. J. App. filed Jan. 20, 1911. Filament composed of tungsten and oxide of aluminum covered with refractory metal.

1,074,338. DYNAMO-ELECTRIC MACHINE; [illegible] E. F. Ahlm, Cleveland, [illegible] App. filed Feb. 14, 1910. Special method of supporting [illegible] pole pieces.

1,074,383. ELECTRICAL METAL-WORKING APPARATUS, [illegible] Reitzel, Charlestown, R. I. App. filed May [illegible], 1909. Provides for welding a seam by a step-by-step process.

1,074,392. ELECTRIC MOTOR REGULATION AND CONTROL; [illegible] [illegible] W. Willey, [illegible], Ohio. App. filed Jan. 25, 1912. For securing good commutation and avoiding sparking on interpole motors.

1,074,396. RIVETER; F. J. West and H. W. Darby, Winnipeg, Manitoba, Canada. App. filed July 8, 1912. Electric hammer for riveting purposes.

[illegible] APPARATUS FOR FUSING ELECTROLYTES, [illegible] [illegible], Niagara Falls, N. Y. App. filed March 1, 1909. [illegible] [illegible] [illegible] [illegible]

1,074,428. MEANS FOR OPERATING COCKS, VALVES AND THE LIKE FROM A DISTANCE; J. M. F. H. Gil, Paris, France. App. filed May 31, 1911. Valve-operating motor with starter located at a distance.

[illegible] CONTROLLING CONTACT, [illegible] Schenectady, N. Y. App. filed Oct. 29, 1910. Shunt contact for circuit-breakers; arcing takes place on carbon surfaces.

1,074,434. FUSE; J. W. Hooley, New York, N. Y. App. filed May 7, 1913. Renewable fuse inclosed in transparent case.

1,074,454. LIGHTNING ARRESTER; F. W. Peck, Jr., Schenectady, N. Y. App. filed Feb. 10, 1909. A closed electric circuit [illegible] secondary is placed in inductive relation to the discharge [illegible]

[illegible] CONNECTOR, H. W. Pease, [illegible] [illegible], 1912. Plug connection, particularly for [illegible]

1,074,462. OZONIZER; F. H. Richards, Hartford, Conn. App. filed Dec. 10, 1912. Special mounting for the concentric tubes of the device.

1,074,512. CONTROLLER REGULATOR; R. Marx, Philadelphia, Pa. App. filed March 15, 1912. Requires the controller handle to be brought to a full stop and moved slightly back before it can be advanced to the next "point."

1,074,533. PUZZLE OR TOY; E. J. Schowalter, Racine, Wis. App. filed Nov. 20, 1912. Parts of a figure are moved about by means of a magnet.

1,074,544. THERMOSTATIC CIRCUIT CLOSER; C. V. Fite, Charlotte, N. C. App. filed Jan. 10, 1913. Thermostatic element moves a [illegible] to the [illegible]

1,074,549. ELECTROLYTIC APPARATUS; H. Heinkel and W. Weber, [illegible] App. filed June 16, 1913. Apparatus for continuously producing hydrogen peroxide.

# Electrical World

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**Strength and Work of the Jovians**

With a membership of 12,000 individuals, the Jovian Order, the eleventh annual convention of which was held in New York during the present week, has become one of the largest and most widely representative organizations of men connected with the electrical industry in the country. During the first seven years of its existence the enrollment totaled 220, the average increase being only thirty-two per year; during the past eight years the annual increase has ranged from about 360 to nearly ten times that number. So any question concerning the need for such a society as that of the Jovian Order the enormous membership enrollment is an effective and satisfactory answer. Without some real reason for existence the Order could never have attained a membership of 12,000. Its growth is to be credited to the spirit of fraternity and co-operation which is the foundation stone of the organization. Little difficulty is encountered in selecting several lines of activity which the Jovian Order, with its strength in numbers and diversity in membership, is well qualified to undertake. The best of these were covered in the report of Secretary Bennett, which was received with much favor and adopted by the membership. The Order has acted wisely in laying plans for serious work in the future, and even more wisely in retaining all those fraternal, co-operative features to which its present strength are to be attributed.

**Anniversary of the Incandescent Lamp**

Oct. 21 will mark the thirty-fourth anniversary of the incandescent lamp, for it was in 1879 that Edison made his famous horseshoe filament of carbonized thread and afterwards paper that created such intense excitement in the United States and in Europe. The problem of a practical still incandescent lamp was then completely solved, and it is a striking tribute to the genius of Edison to note that despite all the years that have since elapsed his lamp still stands without a single salient feature eliminated or added. Carbonized-paper filaments soon gave way to filaments made from bamboo and subsequently to the present squirted cellulon filament; but, nevertheless, developments in the carbon incandescent lamp field were rather slow viewed in the light of those that have taken place recently. Better lamps than the carbon-filament have come and gone within the past five years, the tungsten lamp representing the survival of the fittest, and here again it is worthy to note that Edison himself first worked on metal-filament lamps using platinum, iridium, titanium and other metals only to discard them in favor of carbon. The wonderful developments in the incandescent-lamp field, especially in the high-candle-power tungsten lamps with nitrogen-filled bulbs, have come within the present year, the very latest work in this field being chronicled elsewhere in this issue. How greatly the industry is indebted to Edison for the incandescent lamp it were vain to guess. Certainly the human race owes him a debt which it can never pay.

**Rapid Computation of Suspensions**

In a recent series of articles published in *La Lumière Électrique*, M. André Blondel reviews some interesting graphic charts for determining the proper tension in erecting conducting spans, which he published in 1902. He now introduces some improvements in detail, which facilitate their use, and increase their precision. The improved charts appear to offer distinct advantages over their earlier prototypes. This field of overhead line construction naturally pertains to what is ordinarily called civil engineering. But in erecting the high-tension lines of most recent development, the electrical engineers have carried their experiments, computations and graphics more thoroughly into this domain of statics, field-work, and construction, than had previously been either customary or demanded. In order to ensure the maintenance of his conducting lines, under all conditions of weather, a safety factor has to be provided for any reasonable concurrence of sleet and wind. In our own columns have been recorded a variety of such investigations within the past few years.

**The Triumph of Wireless**

In the latest sad disaster of the sea, radio-communication once again displayed a wonderful and humane rôle. At 8 o'clock on that fateful Thursday morning on the North Atlantic, fire was discovered raging in the hold of the Uranium Line steamship *Volturno* with 650 souls aboard. Despite the utter isolation of mid-ocean about 500 passengers and crew were taken off the burning vessel, of which number every individual life must be credited to the faultless operation of the wireless and to the courage and devotion of the operators who sent and detected the signals. And not only did wireless spread the alarm, but even after the life-saving fleet had assembled in impotent cordon about the *Volturno*—the rescue ships almost as helpless in the wild seas as the victim herself—it was once more radio-communication between the plunging vessels which exchanged advice, unified effort, and facilitated work with the life-boats. And again, days before any of the rescue ships had sighted land, the newspapers of the world had spread before their readers detailed aerogram reports of the mid-ocean disaster. What a triumph, indeed, for the feeble laboratory spark phenomenon of Hertz!

## Tungsten Lamps of High Efficiency

The papers by Messrs. I. Langmuir and J. A. Orange on high-efficiency tungsten lamps before the American Institute of Electrical Engineers last week are of great importance and interest. They indicate the practical value which may attach to careful physical research when conducted with a utilitarian aim. It is a well-recognized fact in the science of radiation that a solid body such as an incandescent lamp filament must radiate a long invisible spectrum of dark heat before it reaches the temperature of visible red heat, and that at dull red heat the power which it radiates in the visible spectrum as light is very small compared with the power which it radiates in the invisible spectrum as heat. In other words, its luminous-radiant efficiency at dull red heat is very low. As the temperature is raised, the body becomes brighter and radiates more power in all parts of the spectrum, but relatively more in the luminous than in the non-luminous parts, and hence a larger percentage of the total power radiated is luminous, or is useful light. The higher the temperature of the body the more the total power, and the greater the percentage within the visible spectrum; moreover, the color of the light given out tends to be less red and more blue, a condition that makes for a close resemblance to sunlight. This condition of increasing luminous-radiant efficiency with rise in temperature goes on until the body fuses or disintegrates.

Drysdale's researches have indicated that 1 watt in white light, that is, entirely within the visible spectrum, gives about ten mean spherical international candle.. Since the ordinary good carbon-filament lamp gives only about 0.25 mean spherical candle per watt, its luminous efficiency is less than 3 per cent, while the ordinary good tungsten-filament lamp with, say, ⅝ mean spherical candle per watt, has a luminous efficiency of roughly 8 per cent. The principle reason for the great advance of the tungsten over the carbon filament lies in the higher temperature of its operation. Neither filament is operated close to its fusing temperature. When an attempt is made to operate a tungsten-filament lamp at a terminal voltage greatly exceeding the normal, one may be able to secure perhaps twice the normal luminous efficiency, but the life of the lamp will be very short. Even at the normal voltage and luminous efficiency, the lamp bulb blackens in time and distinctly lowers the luminous output.

The papers under discussion show that what curtails the useful life of an incandescent lamp is evaporation of the filament. The rate of evaporation rises much faster than the temperature, so that the operating temperature has to be kept down to a point very distinctly lower than the fusing temperature in order to keep the filament from evaporating too rapidly. It was found, however, that when an inert gas, and especially nitrogen, was introduced into the lamp chamber, at about normal atmospheric pressure, the evaporation of the glowing tungsten filament was greatly reduced, so that the operating temperature could be raised markedly nearer to the fusing limit, with a great gain in luminous efficiency. It is pointed out that a new heat loss occurs in the nitrogen-filled lamp, namely, convection through the gas. With very thin filaments the loss of power by convection may more than offset the gain due to raising the temperature, but if the filament is fairly thick, or of relatively large diameter, the surface area is less in proportion to the power in the filament. Consequently, in such lamps, the gain due to the rise of temperature is much more than the extra loss due to convection. Moreover, by suitably shaping the filament and the lamp bulb, the evaporated tungsten is not deposited over the areas of glass wall where the bulk of the light is emitted but is convected away to the top, so that the principal walls do not blacken. The result of the investigation appears to be a thick-filament tungsten lamp, adapted to relatively low voltage and large current, producing about two mean spherical candles per watt at the terminals. For series street-lamp circuits, and also for powerful light sources at 110 volts, the apparent advantage of these new lamps is very marked, both as to efficiency and color.

## Electric Lighting in Horticulture

An interesting report has reached us from abroad concerning a new set of experiments recently tried in the forcing of plant growth by electric light. The subject is an old one and the general result has always been of the same character, showing that additional hours of light unquestionably tend to push along the growth of plants. Sunlight, of course, is the great and potent stimulant of growth, but artificial light, in so far as it may be substituted for sunlight, is naturally to be expected to show similar results. The present experiments are a little unusual in that they were tried indoors in two exactly similar houses, one lighted naturally and the other having in addition to its natural lighting facilities an ordinary mercury arc lamp which was placed in use about an hour before sunset and kept in service for approximately four and a half hours. The exposure and temperature of the two houses were alike, so that the results appear to have been strictly comparable. They were rather striking. In the first place it is reported that seeds of ordinary vegetables germinated considerably earlier in the electrically lighted house than in the other. This is one of those extraordinary results which have sometimes turned up before in similar sorts of experimentation, but for which no rational explanation can be offered. It is highly probable at least that the seeds were buried and it is highly improbable that any light ray reached them. Certainly the mercury arc gives no radiation except a certain amount of heat radiation which could penetrate earth even to a very small distance. It is possible that in this case the heat radiation of the lamp, which is considerable since its net efficiency is much lower than its radiation in the visible spectrum would suggest, undoubtedly might produce at least a small effect on the buried seed. Certainly one cannot fairly ascribe this particular effect to the light received, of which the character is perfectly well known.

In the case of the growing plants the various flowering specimens could be directly affected by the light and are reported as actually showing considerable increase in growth and much freer flowering than the similar plants in the unlighted house. A similar result reported for a strawberry bed which showed an increase of crop of some

25 per cent is equally understandable and are quite in line with some previous experiments. It would be extremely interesting to know what rays of the mercury arc were effective in producing the effect noted. One would naturally suppose that the light of the visible spectrum representing that range of radiation in which living things have been developed should be charged with whatever of benefit may be reached, for the radiation from a mercury arc in a glass tube is far from being strong in the ultra violet, giving rather less than sunlight having the same intensity of illumination. Whatever may be the actual stimulating rays in such a case, the main point is that from one sort of radiation or another apparently a very considerable beneficial effect was derived from four and a half hours extra lighting of the growing plants. Perhaps one may hardly expect the process to be an economical one in ordinary agricultural operations, but it certainly might be well worth trying in floral culture where, on account of the ordinary effect of the seasons, a little additional forcing may lead to a materially better price for the product. The experiments ought to be carefully repeated at some of our agricultural experiment stations so as to get, if possible, some quantitative results sufficient to settle the economics of the matter. Experiments of this kind are somewhat difficult to carry out and interpret, yet the results before us are sufficiently promising to justify some additional research.

## Carbon Electrodes for Arc Lamps

In view of the recent improvements in coarse-filament tungsten lamps well adapted for street lighting, there can be no doubt that arc lamp designers will be stimulated to make advances in order to maintain a position of relative superiority in economy of light production, such as has belonged to them in the past. It would not be surprising if the new tungsten lamps proved, in this respect, to be the arc-lamp's best friend after all, because we have similarly witnessed the incandescent lamp and the gas lamp rush each other upward, in rivalry for domestic lighting.

Even allowing the claims of champions for the new tungsten lamp that its white luminous efficiency reaches 20 per cent, there is still a vast difference between that value and the efficiency of a good dynamo-electric machine, so that there is a good prospect ahead for brighter and more efficient illuminants. Who knows but that some new discovery may, in time, make the tungsten lamp look like a tallow dip! Light sources which depend on radiant gases, instead of on radiant solids, are free from the law of dark-spectrum radiation. A gas is capable of radiating selectively in a single band, or group of bands, instead of in a long freight-train procession that runs far beyond the visual limit of observation. A gas of 100 per cent luminous-radiant efficiency does not, therefore, seem to be a physical self-contradiction, however difficult or beset with limitations it may be to realize.

The article by Mr. A. T. Baldwin, which we print on page 793, describes very fully the composition, methods of manufacture, physical nature and operating characteristics of carbon electrodes, as used in the modern arc lamp. Many of these particulars are not easy of discovery by the man who is unconnected with arc-lamp manufacture. It will be observed that the figures claimed for the luminous efficiency of some of the inclosed flaming arcs, referred to the true-arc power, are very high.

## The Direction of Advance in Diagrams

Discussion has recently been directed, in the columns of the *Elektrotechnische Zeitschrift*, to the question whether the decision unanimously adopted at the Turin meeting of the International Electrotechnical Commission in 1911 as to the conventional direction of phase advance in alternating-current vector diagrams is the best that could have been made. Articles have been presented on the subject by Messrs. Görges, Breisig and Wagner, Emde, and Richter. These articles are not in agreement, some of the writers taking the view that the I. E. C. convention is right and others the view that it is wrong.

On considering the arguments on the two sides of this much-debated question, it is evident that there are not only several different points of view but also several different conceptions attached to a vector diagram in the minds of different writers, such as purely mathematical relations between vectors on the one hand and structural relations in the windings of rotating machinery on the other. It is practically impossible to have a conventional direction of phase advance which will satisfy at once all these different needs and conceptions. One direction of rotation will satisfy some, and the other direction of rotation will satisfy the others. One is reminded of Socrates' answer to the young man's inquiry as to whether marriage was desirable or no; namely, to do just as he preferred, because whichever way he acted in the matter he would be likely to regret it.

The Turin rule has made positive or counterclockwise rotation the direction of phase advance, which is logical. It has not pleased everyone, but it has pleased the majority, and it was unanimously adopted by the I. E. C. It has largely been adopted, to the great relief of the bewildered student of alternating-current technology. It effects an exact anology between the established phase representation in the mathematics of vibrations in the mechanics of rigid vibrating bodies and in the electrics of alternating-current circuits. It preserves the same direction of measuring an angle in the circle and in the hyperbola as applied to alternating-current circuits with distributed constants. When, therefore, vector diagrams are presented without remark, the Turin convention should be, and practically is, taken for granted. But if, for any reason, a writer finds himself hampered by the Turin convention, then he cannot be constrained from working the other way round. But in any such case he should clearly, and beyond all peradventure, disclose his heterodoxy. Moreover, as the *Elektrotechnische Zeitschrift* discussion has shown, the mere addition of a curved arrow on the diagram is not sufficient to make the intent of the writer clear. He should explain explicitly. The question was raised casually at the recent I. E. C. meeting in Berlin and was there closed substantially in the manner here indicated.

# The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

## Rate Expert Argues Against Going Value

Mr. Edward W. Bemis, public utility expert, appeared before the Chicago City Council committee on gas, oils and electric light on Oct. 10, by invitation, to discuss some features of the report of Mr. Ray Palmer, city electrician, on the Commonwealth Edison Company in the rate-investigation case. Mr. Bemis confined his remarks almost entirely to going value. He advised the committee not to fix rates for a period longer than three years, as the electric-service industry is progressing rapidly in the matter of effecting economies. Mr. Bemis does not believe in allowing going value in rate cases. Of the five older rate-regulating commissions in the country—Massachusetts, Interstate Commerce, the two in New York State and Wisconsin—he said, only the Wisconsin commission has allowed going value. Of the more recent commissions, New Jersey and some of the other states have also allowed it. The state courts differ on the question, but the trend of decisions in the United States courts seems to be against allowing the capitalization of going value. Mr. Bemis said that the action of the committee would have more than local influence and he urged the aldermen not to endorse the dangerous principle of capitalizing going value for rate-making purposes.

## Convention of Railway Electrical Engineers

The sixth annual convention of the Association of Railway Electrical Engineers will be held at the LaSalle Hotel, Chicago, Oct. 21 to 24. It is expected that this will be the largest meeting ever held by the organization, and that all the principal railroads of the United States and Canada will have representatives present. Following is an advance program indicating the order of business:

Tuesday. Morning—Business session, and report of committee on standard reports for operation. Afternoon—Reports of committees on terminal facilities for handling car-lighting equipment, on head-end equipment and on electric head-lamps.

Wednesday. Morning—Reports of committees on methods of charging storage batteries, on standards, on dynamo suspension, on car-lighting reports, and on lamp specifications. Paper, "Incandescent Lamps," by Mr. Preston S. Millar. Afternoon—Reports of committees on wire and cable specifications, on wiring installation, and on outside construction and yard lighting.

Thursday. Morning—Reports of committees on illumination and on shop practice. Afternoon—Demonstration of new appliances by supply manufacturers. Papers, "The Gas-Electric Truck," by Mr. Joseph, and "The Electric Truck for Handling Freight," by Mr. T. V. Buckwalter.

Friday. Morning—Report of committee on data and information, and question box. Election of officers.

In connection with the convention a comprehensive exhibit of railway electrical apparatus will be displayed on the top floor of the hotel, which has been reserved for this purpose. Mr. D. J. Cartwright of the Lehigh Valley Railroad, is president of the Association of Railway Electrical Engineers, and Mr. Jos. A. Andreucetti, general foreman, [illegible] Chicago [illegible] treasury.

## Convention of Texas Power Company Managers

A convention of the plant managers of the properties operated by the Texas Power & Light Company, whose headquarters are at Dallas, was scheduled to be held at Waco, Tex., Oct. 9 and 10. Following is the program, as announced by Mr. F. R. Slater, general superintendent of the company: Thursday morning—Address of welcome by the Mayor of Waco, followed with addresses by Messrs. W. B. Head, assistant general manager of the company; J. F. Strickland, president, and George S. Haley, vice-president. Thursday afternoon—Paper, "The 190 Miles of 60,000-Volt Transmission Lines of the Texas Power & Light Company," by Mr. W. G. Schmauder, superintendent of power. Friday morning—Paper, "Commercializing the Electric Light and Motor-Service Business," Mr. Hartwell Jalonick, commercial manager. Friday afternoon—General discussion and answers to the Question Box.

## Society for Electrical Development "Pioneer Member Week"

It has been decided to make an extraordinarily vigorous campaign for membership in the Society for Electrical Development during the week beginning on Monday, Oct. 27. The officers and directors of the society, its more than 600 members, forty-five Jovian Leagues and 12,000 members of the Jovian Order will concentrate their efforts to enlarge the society's membership to the best of their ability during the six days mentioned. The society is growing rapidly but is still some thousands of dollars short of the $200,000 required before its active work can begin. It is believed that the personal efforts of all those actively interested in the commercial development of the electrical field concentrated in this short period of time, will go far toward bringing about the desired results.

## Kansas Contractors Discuss Business Methods

The Kansas Electrical Contractors' Association met at Hutchinson, Kan., Oct. 9 to discuss the relations of manufacturers, contractors, jobbers and dealers. The association was organized in Topeka last May as a section of the National Electrical Contractors' Association, and at that time the following officers were elected: President, Mr E. L. Staley, Wichita; vice-president, Mr. I. C. Bushong, Ottawa; secretary, Mr. J. A. Mercer, Topeka, and treasurer, Mr. J. R. Woodhouse, Atchison.

At the Hutchinson meeting Mr. W. R. Meeks, of Eldorado, Kan., was appointed as a committee of one to confer with the national secretary to devise methods for the prevention of improper selling practices.

The grievances expressed at this meeting were similar to those which have been aired in other sections of the country; namely, direct sales by manufacturers to retail buyers and central-station competition. The Kansas association is attempting to divide the electrical industry into four branches or classes, manufacturers, jobbers, contractors and central stations, its aim being to make the jobber the middleman between the manufacturer and the retailer central station and contractor.

About thirteen contractors now belong to the Kansas ssociation, but this membership, it is asserted, represents bout half the contractor's purchasing power in Kansas. The next meeting will be held in May.

## A. I. E. E. Affairs

At the regular monthly meeting of the board of directors f the American Institute of Electrical Engineers, held in New York on Oct. 10, President C. O. Mailloux was author-zed to change the organization of the electric power com-nittee by substituting for the sub-committee on prime novers, a committee on power generation, and to make the ommittee on prime movers an independent committee.

President Mailloux announced the following additional ommittee appointments: Power generation, Mr. H. W. uck, chairman; technical lectures, Prof. W. I. Slichter, hairman; engineering co-operation, Dr. William McClel-n, chairman.

Upon the petition of the Panama members of the Insti-ute, and the recommendation of the sections committee, uthority was granted to organize an Institute section in ie Canal Zone, to be known as the Panama Section.

In response to an invitation from the National Conserva-on Congress, the president was authorized to appoint five elegates to represent the Institute at the Fifth National onservation Congress, to be held in Washington, Nov. 3 to 20, 1913.

Upon the recommendation of the executive committee f the International Electrical Congress, President Mail-ux was authorized to reorganize the executive committee ith a chairman and vice-chairman, with the several mem-ers of the committee serving also as chairmen of the ecessary sub-committees.

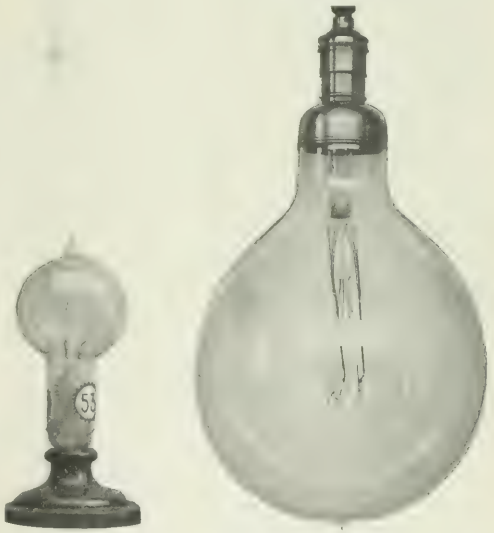
The executive committee of the committee on organiza-on of the International Electrical Congress, San Fran-isco, 1915, reported that it had unanimously decided to vite Dr. Charles P. Steinmetz to accept the position of onorary president of the congress and Dr. E. B. Rosa accept the position of honorary secretary of the con-ess. This action was unanimously approved and con-med by the board of directors.

## Convention Program of the Electric Vehicle Association

The program for the annual meeting of the Electric ehicle Association of America, to be held in Chicago, Oct. 4 and 28, has been announced as follows: President rthur Williams' address at the morning session of Oct. 4 will be followed by the reports of the secretary and the reasurer and the various committees. Mr. John F. Gil-rist, chairman of the committee on rates and charging stions, will report the work of his committee. At the fternoon session reports on "What the Sections Are oing" will be presented by Mr. Homer E. Niesz for the hicago Section; Mr. J. A. Hunnewell for the New Eng-nd Section; Mr. Harvey Robinson for the New York lectric Vehicle Association, and Mr. Day Baker for the lectric Motor Car Club of Boston. "Traffic Problems and he Automobile" will be discussed by Dr. E. E. Pratt, nager of the industrial bureau of the Merchants' Asso-ction of New York; "The Merchant, the Central Station nd the Electric Truck" will be the subject of Mr. F. Nel-s Carle's paper; and "Co-operation Between the Electric Vhicle Manufacturer and the Central Station" will be presented by Mr. E. L. Callahan. The nominating com-mittee will make its report at Tuesday's session, after which the following papers will be presented: "Charging of Storage Batteries in Unattended Garages," by Mr. Maxwell Berry; "Electric Vehicle Salesmanship," by Messrs. George H. Kelly and E. J. Bartlett; and "The Electric Vehicle in Department Store Service," by Messrs. C. A. Duerr and David F. Tobias, and "Recent Developments in the Lead Battery for Electric Vehicles," by Mr. Bruce Ford. The election of officers will terminate the morning session. In the afternoon Mr. F. E. Whitney will discuss "Electric Commercial Vehicle Tires" and Mr. Frank W. Smith will make a report of the publicity and advertising committee. The session will be concluded with a talk on "How to Make the Business Healthy" by Mr. Ralph Temple.

## Anniversary of Incandescent Lamp

The thirty-fourth anniversary of the birth of the Edison incandescent lamp occurs on Tuesday, Oct. 21, for it is recorded that on Oct. 21, 1879, Edison, after many patient trials, carbonized a piece of cotton sewing thread bent into a loop of horseshoe form and had it sealed in a glass globe from which the air was afterwards exhausted. This lamp when put on the circuit lighted up brightly to incandescence and maintained its integrity for over forty hours. This was considered to be the first practical incandescent lamp. Shortly afterwards Edison's famous "paper horseshoe" lamp appeared, which was considered by many to have been the first thoroughly commercial lamp, and of which some 700 or 800 were installed in the Edison laboratory and workshops, dwelling houses and through the streets of Menlo Park, N. J. The filament of this lamp was cut



FIGS. 1 AND 2—PAPER HORSESHOE FILAMENT LAMP OF 1879 (ONE-THIRD SIZE) AND 5000-CP TUNGSTEN-FILAMENT, NITROGEN-FILLED LAMP (ONE-SIXTH SIZE)

out of a piece of bristol board, which in carbonizing shrunk about one-third in size. Before arriving at this form, which gave place to the well-known carbonized bamboo filament lamp which in later years was superseded by the squirted filament type of lamp still used to-day, Edison had in common with various other inventors experimented with incandescent platinum as an illuminating agent. Lamp filaments were also made of thread rolled in tar, from graphite and of many kinds of vegetable fibre. From the first Edison aimed to make each of his lamps an independent

unit, consisting of a high resistance filament sealed in a glass receptacle with platinum leading-in wires.

Little is known of the characteristics of the first incandescent lamp. Edison's carbon filament lamp had a resistance of 140 ohms hot and more than twice that when cold. With such a high-resistance filament he was enabled to connect his lamps across the electrical conductors like rungs in a ladder, and did not require large conductors as each unit only took a small amount of current. These conditions were essential to the commercial success of the incandescent lighting system. Fig. 1 herewith shows one of the first paper horse-shoe filament lamps contained in the Hammer historical collection set up in the Engineering Societies Building, in New York. The engraving shows the lamp one-third its actual size. Fig. 2 shows the latest development in incandescent lamps, a 5000-cp tungsten filament in a nitrogen filled bulb. The latter lamp is shown one-sixth its actual size and does not necessarily represent the final commercial form of this type of lamp, having been made especially for the Electrical Show now being held in New York. The past and the present types of lamp are shown side by side, the tungsten lamp for the time being representing the survival of the fittest. With its specific consumption of one-half watt per candle there would appear to be little excuse for the existence of the other types of lamps. However, there are still possibilities for the carbon-filament lamp.

## High-Tension Transmission Line Not Dangerous

A number of property owners of Chesterfield County, Va., failed in their effort before the State Corporation Commission on Sept. 24 to prevent the use of the right-of-way of the Seaboard Air Line Railway between Richmond and Petersburg for a high-tension transmission line. The line was erected by the Virginia Railway & Power Company, of Richmond, for transmitting energy generated at the falls of the Appomattox River to Richmond manufacturing plants, and it was so arranged that in the event of the breakdown of the Petersburg power house energy from Richmond could be instantly supplied there for lighting and other purposes. An extended written opinion was handed down by Judge Prentis, chairman of the Corporation Commission, in which it was brought out that by an agreement dated Aug. 22, 1912, the Seaboard Air Line Railway Company had leased to the Virginia Railway & Power Company the right to operate a high-tension transmission line with iron towers to carry energy with a potential as high as 110,000 volts from Kingsland Creek to Richmond. The petitioners claimed that they have occasion to use the railway for passenger and freight traffic and that they also own farming and park lands through which the transmission lines pass. They maintain that the transmission of high-tension energy is dangerous to life and property and is liable to interfere seriously with telephone and telegraph lines used for dispatching trains, and that generally such use of the right-of-way of the railway company was not contemplated in the company's charter or in the condemnation proceedings under which the line was acquired.

In answer, the defendant companies maintained that the contracts were a proper exercise of the rights of the two corporations, and they denied that the construction of the line constituted any danger or menace to the petitioners or to the traveling public. The Virginia Railway & Power Company asserted that the transmission line, which is of the suspension-insulator type, is the safest known to electrical science and affords complete protection and safeguard from accident and injury. Having disposed of the legal objections from both sides, Judge Prentis discussed the facts as to the dangers alleged as brought out in the evidence, saying that while the apprehensions of the petitioners in the present state of knowledge or lack of knowledge with reference to electricity were probably natural, he believed that they were unfounded in fact. From consideration of all the testimony he stated that the only appreciable danger to human life would be encountered in case one climbed to the top of one of the towers and touched one of the transmission lines, in this way completing the circuit and causing a current of electricity to pass through his body and into the ground. The touching of the towers by men or animals is not dangerous under normal conditions, and even under abnormal conditions the electricity would go through the tower by the most direct pathway which offered the least resistance to the ground, that is, through the grounded towers, and not through the body of the person touching the tower. As many lines carrying high voltages are in operation along railroad rights-of-way and even along street of cities, the commission concluded that the petitioners had failed to establish the allegation that the line is a menace and a danger to the public.

The petitioners made an effort to prevent the construction of the line before the Chesterfield County Court, but after hearing in the case, this was abandoned and the fight taken to the State Corporation Commission. A part of the line has been in operation for about two years, and the contested part has been in operation since the latter part of June, 1913. The electrical experts for the defendants were Messrs. P. W. Sothman, of New York; F. D. Samson superintendent of distribution for the Southern Power Company; T. A. Worcester, of the General Electric Company, and J. G. Stribling, superintendent of distribution of the Virginia Railway & Power Company.

## N. E. L. A. Executive Committee Meeting

At the meeting of the executive committee of the National Electric Light Association held in New York, Oct. 3 the total membership was reported as 12,557. Vice-President H. H. Scott, chairman of the committee on organization of the industry, offered three prizes of $25, $15 and $10 respectively for the best contributions giving ten reasons why membership in company sections is desirable. The contributions must be submitted on or before Dec. 1, 1913 and the prizes are open to all members of company sections.

Owing to numerous requests from outside sources for the Meterman's Handbook it was decided to make the handbook available for schools, colleges and other educational institutions at the price charged to members. The Eastern New York Section recommended that a suitable hero medal be awarded to the person who resuscitates a comrade by means of the prone-pressure or other method of artificial respiration. The plan was approved and referred to the resuscitation commission.

President J. B. McCall reported that the overhead line construction report printed for the New York convention in 1911 was out of print and inasmuch as the present committee is working on a revision of the fourth section of the report dealing with crossings it had been decided not to reprint the original. He suggested, however, that attention should be called to the fact that changes are being made in order that any public service commissions contemplating its adoption would defer the matter until the revised edition is ready. To avoid any misunderstanding the resolution passed at the meeting of Dec. 7, 1911, in which the executive committee commended the report of the overhead line construction committee to the favorable consideration of member companies, was read. In that resolution it was pointed out that local conditions or special considerations may in particular cases make the adoption of the recommendations of the report in whole or in part impracticable or inadvisable, so that non-compliance therewith in such cases would not necessarily be bad practice.

Mr. W. H. Blood, Jr., presented a plan whereby the Independence Inspection Bureau of Philadelphia would furnish regular bulletin service and lectures on fire and accident prevention to class A members. It was voted that the issuance of the fire bulleting be approved and carried into effect as soon as Messrs. W. H. Blood, Jr., and T. C. Martin could get subscriptions of $2500 toward the expense, it being recommended to the companies that they contribute enough to have a copy of the bulletin sent each month to their plants.

Preliminary arrangements are being made in Philadelphia for the 1914 convention of the association, and President McCall outlined the plan for celebrating the thirtieth anniversary of the first electrical exposition in this country, which was held in Philadelphia in 1884. In speaking of the 1915 convention President McCall said that Vice-President J. A. Britton, of San Francisco, whose plans to attend the meeting had gone awry, had advised him of the necessity of making reservations both for hotel accommodations and convention halls at once. The executive officers were empowered to make the necessary arrangements for space and it was decided to advise Mr. Britton that the attendance from east of the Rockies would probably be about 1500. At the luncheon which followed the meeting, Mr. G. W. Elliott, master of transportation, discussed several points connected with the transportation arrangements for the Philadelphia convention and particularly for the San Francisco meeting.

## Graduation from Electrical Courses in the United States

In accordance with plans carried out during the past seven years we give herewith certain statistics relating to the students in and graduates from schools in the United States conducting systematic courses in electrical engineering. Statistics for the earlier years appeared in our issues dated July 27, 1907, Dec. 26, 1908, Feb. 10, 1910, Dec. 22, 1910, Nov. 11, 1911, and Nov. 23, 1912. It will be noted that in some cases the data herein given for 1912 differ from the data recorded in our issue of Nov. 23, 1912, for that year. The difference is attributable in

TABLE I—STATISTICS OF POST-GRADUATE AND UNDER-GRADUATE STUDENTS IN 1912 AND 1913

| Year | Class | Freshmen | Sophomore | Juniors | Seniors | Post-graduates | Total Students | Graduates | Total Graduates to June, 1913 |
|---|---|---|---|---|---|---|---|---|---|
| 1912 | First .... | 1113 | 866 | 728 | 604 | 122 | 3433 | 611 | 9,321 |
| | Second.... | 1538 | 1034 | 775 | 688 | 47 | 4079 | 530 | 7,556 |
| | Third.... | 522 | 378 | 267 | 221 | 21 | 1409 | 301 | 2,803 |
| | Grand totals.... | 3173 | 2278 | 1770 | 1510 | 190 | 8921 | 1442 | 18,680 |
| 1913 | First .... | 1069 | 833 | 767 | 591 | 113 | 3373 | 533 | 9,854 |
| | Second.... | 1598 | 1103 | 808 | 674 | 101 | 4289 | 598 | 7,154 |
| | Third..... | 475 | 366 | 366 | 276 | 3 | 1486 | 235 | 3,038 |
| | Grand totals. .. | 3142 | 2302 | 1941 | 1541 | 217 | 9143 | 1366 | 20,046 |

part to the slight increase in the number of schools in the present list, thereby including data for 1912 not previously reported, and more largely to revision in the statistics relating to graduates, the actual rather than the projected number being used in the present 1912 group.

As will be seen from Table II, reports have been received from 115 schools, more than one-half of which have been placed in the middle class. In Class I have been included twenty-five schools of the highest standing, the degrees from which confer more or less prestige on the graduate. Class III includes nineteen schools in which the instruction is quite elementary, but which have regularly organized courses of instruction in electrical engineering.

It is noteworthy that so far as total numbers of students and graduates are concerned there has been practically no change during the past seven years. There was a slight increase in the number of students in 1913 over 1912, and a slight decrease in graduates during this period, but the figures for both 1912 and 1913 do not differ greatly

TABLE II—ELECTRICAL ENGINEERING STUDENTS AND GRADUATES

| | Number of Schools | Students 1912–13 | Graduates 1913 | Total Graduates to June, 1913 |
|---|---|---|---|---|
| Class I . . | 25 | 3373 | 533 | 9,854 |
| Class II..... | 71 | 4284 | 598 | 7,154 |
| Class III..... | 19 | 1486 | 235 | 3,038 |
| Totals . . . | 115 | 9143 | 1366 | 20,046 |

from those of 1907 or the intervening years. The past three years have witnessed a steady increase in the number of students taking post-graduate courses, the figures being 166 for 1911, 190 for 1912 and 217 for 1913.

Almost exactly 20,000 students have graduated from electrical engineering courses in the United States, practically one-half this number having received their degrees since 1906. It is safe to assume that at least 40,000 have entered the freshman classes and received instruction for from one to four years. Students who do not continue

TABLE III—COMPARISON OF STATISTICS FOR SEVEN YEARS

| Year | 1907 | 1908 | 1909 | 1910 | 1911 | 1912 | 1913 |
|---|---|---|---|---|---|---|---|
| Number of students..... | 8929 | 9651 | 8670 | 9041 | 9515 | 8921 | 9143 |
| Number of graduates.... | 1358 | 1501 | 1473 | 1545 | 1614 | 1442 | 1366 |

their courses until graduation profit by their training and many become active factors in the industrial progress of the country. It is fair to estimate that on the basis of years of training given by the electrical engineering schools the equivalent of trained men is 30,000 rather than 20,000. Not all of these men continue in engineering work. In fact, a large number of them enter other lines, but few indeed are those who do not find their technical training useful in their life work.

## Permit Issued for California Power Development

A water power permit has just been granted by the secretary of agriculture to the Truckee River General Electric Company, a California corporation, under which that company will develop power on the Eldorado national forest, to serve various California towns and cities. The company expects to construct seven reservoirs, five for water storage and two for equalizing the flow. Two of the storage reservoirs are on upper Rubicon River. By the use of a tunnel, approximately a mile and a half long, the flow of the upper Rubicon River and the waters stored in the two reservoirs will be brought into the Gerle Creek drainage, where the waters will be further stored. From this storage the water will be conveyed by ditches and natural streambeds to Pilot Creek, upon which the two power plants mentioned in the permit are to be located. The water will finally be discharged into the Rubicon River. At each of the two plants there will be a head of approximately 1300 ft. The company expects to make an initial installation which will develop about 16,000 hp., which will probably be doubled as the market for the product increases. The headquarters of the Truckee River General Electric Company are at Reno, Nev.

## Floods Threaten Power House at Houston, Tex.

At Houston, Tex., during the last twenty-five days of September 18 in. of rain fell, of which downpour nearly 12 in. fell during the last seven days. The result was a severe flood which inundated the low sections of the city and for a time threatened to destroy the Houston Electric Company's fuel house, 50,000-gal. water tank, and even the plant itself. A torrent from a broken sewer attacked the earth bank on which the station stands and was rapidly eating it away when Mr. David Daly, manager of the company, set a force of thirty men at work covering the earth bank with tarpaulins weighted with rails, digging ditches and building cofferdams of sand-bags. Two of the company's three generators were put out of commission, and for several days local street-car service was impaired.

## New York Electrical Show

The Electrical Exposition and Motor Show of 1913 opened its doors to the public at the Grand Central Palace, New York, on Wednesday night of this week. Over 100 separate exhibits, some very large and some very small, are spread over three floors of the immense building, which has been suitably transformed for the occasion by Mr. M. A. Singer, the well-known decorator. Lexington Avenue, on which the Palace fronts, is illuminated at night from Forty-second Street to Forty-seventh Street by twin flaming-arc lamps, so that even in the great city of New York those in the vicinity of the Grand Central Station and of the Palace,



FIG. 1—SECTION OF NEW YORK ELECTRICAL SHOW

four blocks away, will be attracted by the greater illumination obtaining during the show in that section of the city. Lined as the Grand Central Palace is with monumental columns which are decorative in themselves, it is impossible to obtain a general view of the entire exhibition and it is only by wending one's way in and out among the booths that any comprehension of its size and scope is obtained. The booths are uniform and artistic in arrangement, the color tone being French gray, so that with the great quantity of light used, the dominating impression obtained is that of immaculate cleanliness minus the usual coldness which is associated with cleanliness.

The government is well represented by exhibits of more than passing and of immense popular interest, the Agriculture, Commerce and Labor, Navy, Army and Treasury departments all contributing, as well as the State of New York and the Bureau of Municipal Research. In the domain of therapeutics much use is of importance in model hospital work is portrayed. In addition to a model hospital shown by the New York Edison Company's electro-therapeutic bureau there are twelve exhibits made by manufacturers of medical apparatus. The commercial and industrial exhibits are numerous and varied, almost every manufacture of importance being represented, and it is difficult to think of an electrical device intended for the home which is not shown. Demonstrations and working exhibits are scattered throughout the entire show, which embraces everything from an electric iron and toaster to an army wireless pack wagon and a model mint. Nor are spectacular show features lacking, for on the third floor is an electric farm and dairy where cows are milked, butter churned, chicks hatched, etc., by electricity. Of course all of the central stations in the vicinity have exhibits of special interest to the householder for whose benefit the show is chiefly given, and below are given brief descriptions of the booths maintained by the lighting companies.

### NEW YORK EDISON COMPANY'S EXHIBIT

The exhibit of the New York Edison Company is scattered throughout the building. The motor service department is showing an electric farm on which electrically operated incubators hatch chicks and ducks. Motor-driven devices for milking cows are also shown in operation. In the model print shop of the company a daily newspaper chronicalling the events of interest about the show is published three times daily. The bureau of electrotherapeutics has arranged a hospital in which are displayed nearly all of the electrically operated devices now in use. In another portion of the building the cooking and heating department operates a restaurant where everything is cooked by electricity. A model laundry equipped with washing and wringing machines and other devices for making housework easy is a feature shown elsewhere. The educational bureau of the company exhibits the work of its scholars, showing the progress made under the company's instructors. The illuminating engineering department has devised a scheme whereby any patron so desiring can be shown the relative light-giving qualities of lamps. At the booth of the advertising bureau many of the Cooper drawings of the New York company's "at your service" man are on exhibition.

### EXHIBIT OF THE BROOKLYN EDISON COMPANY

The booth of the Edison Electric Illuminating Company of Brooklyn is divided into three portions. In the central portion is shown the $49 house-wiring plan which the company is offering its patrons. A parlor, dining room, kitchen and hall are wired complete with fixtures and lamps as called for under this contract. One of the other portions of the booth at the right contains a demonstration arranged to show what 10 cents' worth of electricity will do in Brooklyn when used with any of the modern lighting, heating or cooking devices. Each device in this exhibit is suitably tagged with a card giving the specific work which the device will do when supplied with 10 cents' worth of electrical energy. For instance, the toaster carries a placard stating that 120 slices of bread can be toasted for 10 cents; a 500-watt lamp can be burned for two hours; 20 cigars may be lighted electrically each day in the year; tea for six can be made each day in the week, etc. At the other end of the model house the motor-service department has an exhibit of small motors, each of which is labeled with a display card in the same manner as the household devices. This portion of the booth is intended to show a manufacturer just how much work can be accomplished in several particular lines with motor-driven for 10 cents.

### UNITED ELECTRIC LIGHT & POWER COMPANY'S BOOTH

At the booth of the United Electric Light & Power Company visitors are received in a small reception room a

conducted to the central portion of the booth, which is equipped with small tables and chairs made to resemble as nearly as possible a model electric grill room. In this room a brilliantly lighted electric fountain forms a pretty center setting for the scene and its attractiveness is doubled by means of surrounding mirrors. The food served to the guests at the electric grill is all prepared in an adjacent



FIG. 2—BOOTH OF UNITED ELECTRIC LIGHT & POWER COMPANY

electrical kitchen, where modern electrical household devices are displayed in operation. In the office of the company, which is situated near the reception room of the booth, the company's $69 house-wiring plan and its special offer on 500-watt tungsten lamps are placarded.

NEW YORK AND QUEENS ELECTRIC LIGHT & POWER COMPANY'S BOOTH

Queens, the factory district of New York, is making a strong effort to induce manufacturers to buy sites and locate their plants in that borough. In the booth of the New York and Queens Electric Light & Power Company are shown many suitable factory sites and also views of



FIG. 3—BROOKLYN EDISON BOOTH

many successful plants which are now in operation on the company's circuits. All of the latest developments, including the railroad which is now about to connect Queens with Manhattan are pictured. In addition, domestic appliances are tastefully displayed about the booth. Stereomotorgraphs, illuminated color pictures, signs, charts, etc., show also the suburban sections of Queens.

BOOTH OF THE YONKERS ELECTRIC LIGHT & POWER COMPANY

The Yonkers Electric Light & Power Company, supplying electrical energy to patrons in an area of more than 22.5 sq. miles just outside Greater New York, is exhibiting in its booth statistics showing the growth of the company during the past few years together with pictures of many attractive homes using electric service in that suburb. As Yonkers is neither a manufacturing nor a residential district exclusively, an attempt has been made at the company's booth to interest all of the patrons.

The exhibition will close Oct. 25.

## Eleventh Annual Jovian Congress

The eleventh annual Jovian congress opened at the Hotel Astor on Oct. 14 with an address of welcome by Mr. Frank E. Watts, reigning Jupiter of the Jovian order. Mayor Kline, of New York City, who was to have delivered the address of welcome, was unable to attend owing to the urgency of municipal matters. In his address, Mr. Watts spoke of the rapid growth of the order, which is now one of the largest electrical associations in the country. He also expressed the hope that the congress would represent more than a convention of Jovians for pleasure, and added that, in his opinion, there is much real work to be done which falls within the scope of the order. Closer attention by the various statesmen to the work of the local societies was suggested as one of the ways to solve local problems and maintain enthusiasm in the order.

Owing to the absence of Mr. E. W. Robertson, of Buffalo, past Jupiter No. 6, the response to the address of welcome was given to Mr. H. F. MacGregor, past Jupiter No. 2, of Houston, Tex. Mr. MacGregor spoke of the early days of Jovianism, and reviewed the growth of the order from its inception in Texas. Committees were then appointed as follows: Resolutions, Messrs. Frank D. Beardslee, St. Louis, chairman; E. H. Waddlington, Chicago; Charles Martin, Dallas, Tex. Nominations, Messrs. George W. Elliott, New York, chairman; Henry Harris, Pittsburgh; W. E. Robertson, Buffalo; J. R. Crouse, Cleveland; A. E. Loeb, Columbus, Ohio. Secretary's report, Messrs. Sam A. Hobson, Chicago, chairman; T. H. Bibber, New York; Fred. Johnson, St. Louis. Jewelry, Messrs. Robert L. Jaynes, Pittsburgh, chairman; W. D. Shaler, Pittsburgh, and Mac Sterrett, Dallas, Tex. The committee on degree team work included all of the past Jupiters present at the convention.

PAST JUPITERS' ASSOCIATION

At the business meeting on Wednesday morning Mr. J. Robert Crouse, of Cleveland, presented the report of the association of past Jupiters. He stated that the past Jupiters' fund amounted to $4000, all of which had been donated voluntarily by the members of the Jovian order. He also outlined a plan which is to be followed in using the interest accruing from this money. For the first ten years neither principal nor interest is to be expended for any purpose, and during the second 10 years 10 per cent. of the interest will be used for such purposes as the past Jupiters acting for the Jovian order elect. During the third ten years 20 per cent. of the earnings will be used, and this method of procedure will be followed until three-quarters of the earnings of the investments are being used, at which time no further increase in the amount of interest expended will be made. Of the present funds 50 per cent. is invested in gilt-edged securities, 25 per cent. in stocks, 15 per cent. in ventures of a more speculative nature, and 10 per cent. is held as a cash reserve. All of the investments are made in stocks and bonds of the largest manufacturing and central station companies in the electrical industry.

JOVIAN ACTIVITIES

The report of Mercury Ell C. Bennett, St. Louis, was divided into two parts, the first of which covered the work of the present administration. In this report Mr. Bennett spoke of the increased Jovian activity following the extensive tour of Reigning Jupiter Watts across the continent and remarked that the money spent by the order in traveling expenses had produced results. Trips made by Mercury Bennett himself were also followed by increased activity in the cities which were visited. The *Jovian Year Book* will be available about Jan. 1. There are at present 52 Jovian luncheon leagues in the United States and Canada, many of which are splendidly organized and effective. A very gratifying result of this year's work is evidenced in the activity on the Pacific Coast, in Canada, and in the renewed interest in Texas. Following a suggestion made at the last annual meeting, Mercury Bennett has been in communication with persons in England with a view to establishing Jovian chapters in that country. This investigation has not yet reached a point where it would justify the expenditure of money for an envoy to that country. However, the investigation is being continued and will be reported on later.

In accordance with the resolution passed by the eleventh congress the Jovian order has undertaken to secure subscriptions for the Society for Electrical Development. As an appreciation of their interest the society has offered a prize of $500 to the Jovian league securing the largest number of subscriptions, and in addition to this a prize of $250 to the Jovian securing the largest number of subscriptions, $150 to the individual next highest, and $100 to the third. Up to the present forty-five statesmen have indicated their intention to engage in the campaign.

MEMBERSHIP AND FINANCES

During the tenth administration 3535 new members, or 2218 more than in any previous year, were initiated. The eleventh administration now reports a still more remarkable increase, as it has at present initiated 3442 members and has still to hear the results of six rejuvenations. Mercury Bennett states that the last potential issued during this year will be approximately 12,100; that is, the present membership of the society is approximating 12,000. Owing to the fact that a number of rejuvenations had not been reported, the financial statement, although incomplete, showed that an approximate balance of $8000 would be turned over to the next administration after all deductions, including more than $900 for the Past Jupiters' fund, had been made.

SUGGESTION REPORT

From the ideas sent in to the central office of the Jovian Order at St. Louis, Mr. Ell C. Bennett compiled the second part of Mercury's report, which he called the "Suggestion Report." In this were ideas and suggestions intended to be helpful in improving Jovian efficiency. Recognizing that the importance of the Jovian Order rests upon its success in establishing many and capable local organizations, much stress was laid upon the necessity for expansion in this direction.

Some Jovians believe that the order should be purely social in nature, and, according to Mr. Bennett, this opinion is entitled to respect.

ORGANIZATION OF A COMMERCIAL DIVISION

The Jovian Order could never exist successfully without this social function, and this feature of the order must be guarded jealously and fostered. The commercial possibilities, he contended, must not be allowed to develop to a point where they dominate it, nor must the attempt ever be made to mix one with the other. However, if the Jovian Order is to grow and prosper, and command the time of men of affairs, it must find some other reason for its existence and a practical method of applying that reason for the good of the electrical industry.

Earnest study of the condition outlined, coupled with useful thoughts from a number of Jovians, has suggested a separate, authorized branch, which will make use of local organizations, for the double purpose of giving those organizations a greatly needed incentive, and of accomplishing results which will mean commercial advancement for every man in the electrical industry.

After adding this helpful suggestion Mr. Bennett offered his services to the Jovian Order as manager of the commercial division. This work he expects to carry along with the work which he is doing for the social section, giving up his other business connections. All he asked of the Jovian Order was that he be given the necessary authority and the office force to carry on the detail work. He recommended that no change be made in the present organization of the central offices and that none of the present employees be used for commercial division work. Mr. Bennett is at present formulating a plan whereby the commercial division can be made self-supporting.

GOOD-FELLOWSHIP COMMITTEE AND STUDENT MEMBERSHIP

Several instances were cited where the central office of the Jovian Order has rendered assistance to needy and worthy brother Jovians. It was suggested that the Jovian Order create a committee of good-fellowship, and that the reigning Mercury and secretary of the Past Jupiters' association act as members of this committee, which is to be supplied with the maximum of $500 a year to cover cost of investigating appeals for aid and to supply funds for the necessary help.

Statesman-at-large, Mr. P. Loyd Lewis, suggested admitting to Jovianism, on a decreased or postponed initiation fee, students of recognized institutions of learning who are studying electrical engineering and who intend to engage in the electrical or some allied industry after graduation.

COMMERCIAL DIVISION APPROVED

At Thursday morning's session the committee on the secretary's address reported favorably on the suggestions contained therein and recommended that the plans outlined by Mr. Bennett be placed in operation as speedily as possible.

Following the report of the committee addresses were made by men prominent in the electrical and other fields. Mr. Henry L. Doherty, president of the Society for Electrical Development, spoke on the co-operative work which the Jovian Order is doing in connection with the Society. The title of the address by Mr. Charles L. Eidlitz, of New York, was "The Truth, the Whole Truth and Nothing but the Truth." Dr. Lee Galloway, of the New York University School of Commerce, spoke on "Disorganized Distribution." A talk by Mr. James H. Collins, whose articles in the *Saturday Evening Post* have attracted much attention, concluded the morning's addresses.

ELECTION OF OFFICERS

Acting upon the recommendations of the nominating committeee consisting of Mr. George W. Elliott, chairman, and Messrs. W. E. Robertson, J. Robert Crouse, Henry Harris and A. L. Loeb, the following men were elected to the offices indicated:

Jupiter, Mr. W. N. Matthews, St. Louis; Neptune, Mr M. F. Knapp, Pittsburgh; Pluto, Mr. T. H. Bibber, New York; Vulcan, Mr. A. H. Halloran, San Francisco; Avrenim, Mr. Louis V. Nogueira, Dallas, Tex.; Hercules Mr. George C. Rough, Toronto, Canada; Mars, Mr. E. A. Wilcox, Boise, Idaho; Apollo, Mr. George C. Richards, Chicago; Mercury, Mr. Ell C. Bennett, St. Louis, and Trenton,, Mr. M. H. Jones, Baltimore. Jupiter is the president of the order, while Mercury is the secretary in charge of the central office.

Mr. W. N. Matthews, the Jupiter-elect of the Jovian

Order was born in St. Louis, Mo., July 9, 1869. He was educated in the public schools of the city and at Smith Academy. Early in life he started to work as an office boy in a wholesale drug house and while there his uncle, the late Admiral E. O. Matthews, invited him to accompany him on a cruise in Chinese waters on the *U. S. S. Brooklyn*, which was then the flagship of the Asiatic squadron. After living on the seas for a year young Matthews returned to St. Louis in September, 1887, and took up his work again in the drug business. There he remained until 1890, when he left to enter the electrical supply business as vice-president of the St. Louis Electrical Supply Company. In 1898 he sold out his supply business to start as a manufacturers' agent, representing at that time the H. T. Paiste Company and several other manufacturing companies. Out of that grew his present business as a manufacturer of electrical specialties. In 1900 Mr. Matthews took his brothers, Leonard, Jr., and Claude L., into partnership with him, his brother Leonard having since withdrawn from the firm. Mr. Matthews was one of the original members of the Electrical Supply Dealers' Association organized in 1906 and is at present vice-president of the St. Louis League of Electrical Interests. He was Apollo at the ninth Jovian Congress and was instrumental in



JUPITER-ELECT W. N. MATTHEWS

obtaining the services of the present Mercury, Mr. Ell C. Bennett, for the Jovian Order.

ENTERTAINMENTS

On account of its fraternal nature, the Jovian Order possesses means of entertainment not afforded by other electrical and engineering associations. On Wednesday afternoon the various degree teams held a competition in the work of "Rejuvenation," or initiation, of candidates. The team honors were awarded to the New York team, while the individual honor was bestowed upon Mr. Thomas Gibber for his impersonation of Pluto. The annual rejuvenation of the Order was held on Wednesday evening when 183 candidates were accepted as members. Following this exercise was a combined smoker, supper and vaudeville entertainment provided by the New York Edison Company in the Grand Central Palace, where the New York Electrical Show was being held at the same time. The concluding feature of the congress was the annual banquet at the Hotel Astor, during which the get-together fraternal spirit of the organization reached its climax.

The entertainments provided for the ladies consisted of a matinee on Wednesday afternoon and a recital in the evening by Mr. Edison's disk phonograph. On Thursday there was an automobile ride followed by tea at the Astor.

## Convention of the American Electric Railway Association

The annual conventions of the American Electric Railway Association and its allied and affiliated Engineering, Accountants', Claims, Transportation & Traffic and Manufacturers' Associations were held at Atlantic City, N. J., Oct. 13 to 17. The attendance was, as usual, large, a total of 2839 members and guests being registered by the end of Oct. 15.

The sessions of all of the associations, which were well attended, were held on Young's Million-Dollar Pier. The meetings of some of the associations began on Monday and the concluding sessions were not held until Friday of this week. The programs were varied and, while they related generally to all matters of electric railway operation, they dealt to some extent with the larger questions of corporate policy which concern all of the public utility companies of every class in the country. Some of the matters which are of general interest to the electrical industry are mentioned briefly in the following notes:

Gen. George H. Harries, president of the American Association, referred in his address to the invitation extended to the committee on public relations by the public policy committee of the National Electric Light Association to meet at a dinner in New York on Feb. 19. Frank interchange of opinions combined with harmony of desire so that the outcome was an agreement to co-operate in the good work of public education. Pending the consideration of certain essential details, final action on the appointment of the joint committee proposed to conduct the co-operative work has not been taken, but the organization will be completed at once and, there is every reason to believe, be highly efficient.

The report of the commitee on public relations was presented before the American Association by the chairman, Mr. Thomas N. McCarter, Public Service Corporation of New Jersey. Reference was made to the conference held in New York in February with the public policy committee of the National Electric Light Association. The discussion was said to have been of great importance as developing the ideas of men prominent in both the electric railway and the electric light industry as to ways and means for bringing about what all are striving for, a better condition of affairs as between the companies and the public. The National Electric Light Association has already appointed its members of the proposed joint committee representing the two associations to devise means of effective publicity with respect to questions of public relations. The names of representatives of the American Electric Railway Association to serve on this committee will be announced shortly.

Mr. Clarke M. Rosecrantz, general counsel, Milwaukee Electric Railway & Light Company, discussed other elements of value than franchise values. Taking up first values that were neither physical nor franchise in nature, Mr. Rosecrantz said that as a result of the litigation construing the questions involved, common and equitable views as to what constitutes the value of the intangible property of public utilities were gradually being reached. Good-will as such will not be considered. Going value is made up of various elements—cost of promotion and deferred dividends when the question is one of reasonableness of rates, to which will be added a further sum for intangible values based upon the capitalization of the net earnings available for dividends. For municipal acquisition the same elements will be considered and the same rules followed as if the sale were between private parties. The valuation for taxation purposes approaches the exchange value. Mr. Rosecrantz said that in all valuations of physical value it may as well be recognized as an axiom that only the depreciation value will be considered, that is, the then value of the physical property. All efforts to have the basis fixed upon the cost of reproduction new have been unavailing and

the courts are ruling that the cost of reproduction new less depreciation is the test of determining physical value. It would then seem of the highest importance that definitions for determining accrued depreciation be agreed upon speedily and with fairness.

Mr. William M. Wherry, Jr., of Wherry & Mygatt, New York, discussed franchise values before the American Association. A franchise unused, he said, is of no value. A man who develops and uses it is performing services, and the value which accrues from such use and development is the measure of those services. The consideration for the development of the franchise is this value and it cannot be taken away without depriving those who have created it of the reward for their services.

Mr. Richard McCulloch, United Railways Company of St. Louis, discussed the present tendency of public service regulation before the American Association. He said that the conditions of operation without regulation and operation under regulation are quite different. The change has been sudden and it will require time for the utilities to adapt themselves to the new conditions as well as time for the commissions to become familiar with the immense amount of detail which they must handle before they can intelligently pass on the problems presented. Public service commissions may have been instrumental in putting an end to certain bad financial practices, but their growing disposition to interfere in the details of the business and their policy of cutting the rate of return to a barely non-confiscatory basis is not encouraging to investors. A far-seeing regulation would be one which would encourage the investment of private capital.

Mr. Frank Hedley, Interborough Rapid Transit Company of New York, read a paper on the "Present Tendency of Public Utility Laws and Regulations" before the American Association. He said that the existence of a public service commissioner with ample power to regulate is of great assistance in defeating demagogic bills introduced in the Legislature for political effect and violently opposed to corporation rights. By the adoption of a uniform system of accounts the field of railroad securities is made a safe and inviting one with resultant benefit to both the company and the public. When the personnel of commissions embraces men of practical experience, fairness of mind and education suited to the tasks confronting them (a discharge of duty without consideration for political expediency) Mr. Hedley thinks there will be that degree of co-operation and hand-in-hand work which is desirable for all.

A report of the committee on welfare of employees was presented before the American Association by Mr. J. J. Burleigh, Public Service Corporation of New Jersey. In the report it was said that if men are to be kept for long periods in a given service their employment must be made attractive and inducements must be offered beyond the prevailing day's wage. Moreover, if a man gives the best years of his life to an industry he has some right to expect that industry to provide for his sustenance when his days as a producer have passed. The Public Service Corporation of New Jersey, which assumes the entire cost of what it regards as four types of insurance, namely, health, accident, old age and life, finds that last year it expended for these purposes $104,818.

In a paper on "Statistical Units Used in Analysis of Electric Railway Accounts," presented before the Accountants' and the Transportation & Traffic Associations jointly, Mr. James A. Emery, with Ford, Bacon & Davis, New York, said it seemed the height of absurdity in the electric service business to draw careful distinctions between the elements of demand and output in making rates and then to pay absolutely no attention to this distinction in the records of cost of service. To determine or check the important figures upon which the charges to customers are based, it is necessary to go through a painful process of analyzing expense and construction accounts. There is no reason why central-station expense accounts, he argued, should not be kept in such a way that a company may know every month the cost of maintaining a kilowatt of equipment in readiness to serve of the additional cost of generating and distributing 1 kw-hr., and of the cost per customer of those operating expenses which vary directly as the number of customers.

The subject of the income tax law was discussed at the meeting of the Accountants' Association. Mr. C. L. S. Tingley, American Railways Company, said that while he did not want to be reported as speaking authoritatively, he was advised that where a mortgage provided that the income should be paid without reduction for any present or future tax the company would be required to pay the tax.

The Engineering Association will publish an Engineering Manual containing the existing standards and recommended practices of the association. The association has compiled the recommendations governing standards of previous conventions and has them in such shape that it is expected that the 1913 additions can be inserted without serious delay and the complete manual made ready for distribution not later than Jan. 1, 1914.

In the discussion of the report of the committee on energy distribution before the Engineering Association, Mr H. G. Stott, New York, suggested the addition of a paragraph to the following effect: "In awarding contracts based on these specifications, due regard should be given to the reputation of the manufacturer as an element to be considered."

## Philadelphia A. I. E. E. Meeting

A regular meeting of the American Institute of Electrical Engineers was held at Philadelphia on Oct. 13, the headquarters and meeting hall being in the Drexel Institute. President C. O. Mailloux, who honored the gathering by his presence, insisted on leaving the conduct of the meeting in the hands of Mr. A. R. Cheyney, chairman of the Philadelphia Section of the A. I. E. E.

### ELECTRIC DRIVE IN MACHINE SHOPS

The importance of the motor drive for the machine shop was well emphasized in a paper presented by Mr. Charles Fair, Schenectady, N. Y. The author stated that, on account of recent improvements in motors, accessories and methods of application, and the increase in the number and variety of motor-driven tools in service, the relationship of motors and control to machine tools is much better understood by the machine builder and the user than heretofore and, consequently, comparatively little trouble is experienced with either motors or control for the ordinary type of machine tool. Misapplications of both motor and control occur occasionally due largely to insufficient or unreliable information regarding the characteristics of the machine but the number of these misapplications is relatively small. The tendency to both over and under motor machines is constantly growing less, owing to the large number of tests made, and to the accurate information available. There is still, however, a tendency on the part of some machine builders to over-motor their machines either with the mistaken idea of the strength of their machine or with the idea that possibly prospective customers will be impressed with the enormous power that their "heavy type" machines take. Conversely, other manufacturers want to show how little power it takes to operate their "very efficient" machines and consequently get into trouble. These extremes are gradually disappearing and a more normal condition is taking its place. In comparatively short time the greatly over-motored and under-motored machine will be a thing of the past, at least so far as the general type of machine is concerned. A number of manufacturers have already recognized three ratings of motor drive on certain of their machines, namely, heavy, medium and light. Much of the existing

trouble in motor applications to special machines or to machines rigged for special operations could easily be avoided if only preliminary tests were made with a temporary motor before making the permanent installation. A not uncommon source of trouble, and one that could easily be avoided, is that of attempting to increase considerably the productiveness of a tool by speeding up the machine, increasing the cuts and attaching automatic feeding devices, etc.; all of which increases production, but, in doing so, the motor is often overlooked and, if the tool were originally under-motored and the power is not increased, trouble is apt to result. Increased production often calls for an increase in power although there are cases where this is not true.

To increase production and to decrease cost are two important questions continually before the manufacturer to-day. In the majority of cases labor is the greatest cost of production, thus where machine tools are a considerable factor in the production, the importance of obtaining maximum output from the tool is evident.

Mr. Fair remarked that the improvements in control appliances have kept pace with the motor development. Much more exacting requirements of both motor and control are now demanded. Motors driving machines reversing ten times per minute, twenty-four hours per day, are now not uncommon. Duty cycles that were impossible to meet only a short time ago are now not only practicable but common.

Much of the success of a motor-driven machine depends on its control. Magnetic control, which is coming into more general use than formerly, somewhat complicates the control situation. While the possibilities of magnetic control are infinitely greater than the older types of control, likewise the chances for misapplication are greater. However, as the characteristics of the different types of control become better known these complications will disappear.

*Discussion*

Mr. Harold Goodwin, Philadelphia, expressed the opinion that in making a selection between individual motor-drive in machine shops and group drive the determining feature is often the cost. Although from many points of view individual drive is preferable to group drive, yet the extra cost involved in driving each machine individually over that required for group drive is prohibitive.

Prof. A. J. Rowland, Philadelphia, called attention to the importance of considering the depreciation of equipment when discussing the relative merits of group drive and individual drive.

Mr. R. L. Lloyd, Philadelphia, stated that one must take into consideration the importance of economy of operation with individual drive in comparison with the interest on the initial expenditure for the individual drive equipment.

Mr. C. O. Mailloux, New York, said that the belt had practically disappeared from industrial establishments in Europe, motor drive having been substituted for line-shaft drive in European practice. This fact can be accepted as conclusive evidence against any argument as to the excessive cost of electrical motor drive, because in Europe every increase in expense for equipment is investigated thoroughly before the equipment is purchased. In textile mills motor drive is now used exclusively not only on account of the economies in operation but by reason of the increased production and uniformity of output.

In closing the discussion, Mr. Fair remarked that under ideal conditions it would be best to use both individual drive and group drive, and perhaps both alternating-current and direct-current motors. In some cases the major number of machines will be driven in groups, and in other cases individual drive will predominate. In each case the cost for the motor equipment would be more than covered by the increase in production.

INDUSTRIAL SUBSTATIONS

Many of the important features of design and installation of industrial substations were discussed in a paper by Mr. H. P. Liversidge, Philadelphia. Descriptions were given of twelve plants of this nature selected as being representative of good modern practice.

In analyzing the design details special attention was paid by the author to space economy, cost, operating requirements, fire hazard and safety to attendants. The author stated that space economy must be given careful consideration, especially when the equipment is to be installed in an already existing factory building, where the consumer has allotted all the space available, and this space permits no latitude in the arrangement of equipment.

A striking example of economy effected was afforded by a synchronous converter substation of four 300-kw units. The space provided for the equipment was one corner of an existing engine room which already contained several engine-driven generators, a heavy duty air compressor, and other miscellaneous power plant auxiliaries. The floor area allotted to the substation equipment measures approximately 30 ft. by 30 ft. The height of the engine room permitted the construction of a short gallery upon which was placed all high-tension switching and protective apparatus. This arrangement, while it might not have been selected had a new substation building been erected, nevertheless made possible the installation of all apparatus without necessitating any changes in the building construction.

The author said that the conditions under which the various equipments of substations operate are often radically different, due to the requirements of the consumer, and that careful consideration should be given this point.

One of the important features relating directly to the operating requirements is the duration of continuous service, which may vary from a few hours per day to a practically continuous supply. As due provision must be made for inspection and repairs, it is quite evident that, in the case of continuous operation, attention must be given to the proper sectionalization of the apparatus and duplication of equipment. In this case of a certain plant described by the author each individual circuit controlling the incoming feeders and transformer banks is provided with disconnecting switches. This plant operates almost continuously, and such an arrangement permits of a ready examination of the operating equipment during light loads, without necessitating the interruption of the consumer's service. This type of construction also permits a comparatively simple installation, and obviates the necessity of a duplicate set of busbars and oil-break switch equipment.

In contradistinction to this arrangement a second plant supplying energy for very intermittent service is arranged without any means for sectionalization. Provision is made merely for disconnecting the single incoming high-voltage feeder from the substation equipment.

Concerning fire hazard and safety to attendants attention was called to the tendency toward particular care in construction details as they relate directly to this subject. Where substation apparatus is to be installed in existing industrial plants, a considerable amount of reconstruction is sometimes advisable. In many cases, the floors and ceilings of the industrial buildings are of wood. These should be made fireproof. The usual building alterations consist of the changing to concrete flooring and metal-lined or asbestos-covered ceilings.

In oil-cooled transformer installations, special arrangements are necessary for properly draining the contained oil from the transformer cases. This is accomplished either by pipes connected directly to the transformers or by concrete drains built in the transformer foundations and connected to a common outlet.

An interesting example of this latter type of construction was noted in one installation in which the transformer banks were placed on a concrete base so constructed as to

provide a very effectual drainage system for the entire equipment. The high voltage switchboard equipment was enclosed to secure the maximum of safety to attendants. Asbestos lumber doors and partitions form the more important part of this detail in construction. Besides serving as a protection from accidental contact with high-voltage circuits, these partitions in many cases are excellent barriers for protection from fire.

Concerning cost the author stated that not infrequently the central station engineer is limited to a certain minimum expenditure imposed by the prospective consumer, and which in most cases affects the electrical equipment under consideration. It is evident that this limitation may affect materially the character of the installation; and particularly will this be evidenced in the switchboard and controlling equipment. The changes in this part of the construction are most apparent in the details of control equipment, namely, the type of switchboard, whether marble, slate or open iron frame; the number and type of instruments on the individual circuits, and the character of bus-bar construction. These details in many cases are closely related to, and influenced by, the factors already noted. Nevertheless, there are many points in the design that will be directly influenced by the important question of construction cost.

*Discussion*

Mr. W. C. L. Eglin, Philadelphia, claimed that the author had placed too much importance upon minimizing the space occupied by substation equipment. In many cases the cost of space is small compared with the reliability of service. In the substations described sufficiently free space was provided around the revolving machinery, but the stationary apparatus was crowded together to a degree not warranted by the advantages obtained thereby. Although certain advantages are secured by enclosing switches and other electrical devices it seems best to make enclosure in such a way as to render a considerable portion of the equipment visible for rapid inspection in case trouble develops. Mr. Eglin remarked that instead of employing extreme measures to prevent water from entering substations it would often prove advantageous to select waterproof apparatus which cannot be injured by complete submersion.

Mr. P. M. Lincoln, Pittsburgh, expressed the opinion that under present conditions a correct design of an industrial substation is as important as the design of the main generating station in many communities.

Mr. G. W. Brooks, Philadelphia, remarked that in three-phase installations it does not seem desirable to provide complete duplicate sets of transformers because the desired results can be obtained by installing as reserve one single-phase transformer rather than three transformers connected as a three-phase group.

In closing the discussion Mr. Liversidge called attention to the fact that the space allotted to industrial substations is most frequently determined by the owner of the industrial establishment who sets aside for this purpose the minimum amount of space in which the apparatus can be placed. In reply to questions by Messrs. Charles Penrose and Harold Goodwin, Philadelphia, Mr. Liversidge stated that the amount of equipment which should be installed for insuring continuity of service, such as double bus-bars or sectionalized bus-bars, is determined by the character of service to be rendered. If the equipment is to be operated continuously and no time is allowed for periodical inspection duplicate apparatus must be available, but if the service is such that the equipment can frequently be inspected and is idle at regular intervals such added expense is often not justified. He claimed that with modern apparatus properly installed and operated central-station service could be guaranteed to be absolutely reliable so far as continuity is concerned.

VARIATION OF ENERGY COST WITH PLANT SIZE

In a paper presented by Mr. Paul M. Lincoln, Pittsburgh, Pa., three reasons were assigned for substituting central-station for isolated-plant service. These reasons are:

1. Because the first cost per kilowatt of large units entering into the construction of a large plant is lower than that of the small units entering into the construction of a small plant, thereby reducing the first cost of the apparatus necessary for the given service and, therefore, reducing the annual fixed charges thereon.

2. Because a large plant inherently can be operated more economically than a small one, and because, further, the large plant can afford to introduce economies which would be out of the question in a small one.

3. Because of the existence of diversity-factor, whereby 1 kw of equipment rating in a central station will serve a combined load that would take considerably more than 1 kw if each part of that combined load were to be served separately.

Mr. Lincoln stated that there are two arguments that may, with reason, be urged against the central station method of supply. The first is that the central station requires the addition of a transmitting and distributing system before its customers can be supplied and the cost, upkeep and losses in this transmitting and distributing system must be added to the central station to make it comparable with individual customers' plants. This argument is entirely legitimate, as far as it goes, but it does not go far enough. The cost and losses of the transmitting and distributing system do not amount to enough to begin to offset the advantages on the part of the central station. It is, of course, possible to imagine a condition where the cost and losses of transmission and distribution make the central station supply more expensive than that from an isolated plant, but this means that the proper radius of the station has been exceeded. The advantages (in the matter of cost) of the central stations are so great that the utmost additions on account of transmission and distribution, and still maintain good regulation, are not sufficient to permit isolated plants to compete.

The second argument in favor of the isolated plant is that during the season that heating is required the steam may be used twice, as live steam for energy generation and as exhaust for heating. This is also a legitimate argument so far as it goes and its complete discussion requires much space. In general, however, it can be shown that the advantages which accrue to the centralization of a large amount of power at one point will far outweigh the advantage of the isolated plant even when it is coupled with the heating proposition, as it so often is.

When the isolated plant is used for heating, one must bear in mind that there is a large part of the year, certainly more than one-half of it, when no heating whatever is required and during this period the plant must accept the losses which are inherent with the combination of energy generating and steam-heating plant using the same steam. Another thing which must not be forgotten is the daily diversity between the heat and electricity loads in the isolated plant. Take for example, the case of an office building. The building will, of course, cool off to a certain extent during the night and it is required that it be brought to a certain acceptable temperature by the time the office force arrives in the morning. This will require a considerable amount of steam during the early morning hours at which period absolutely no use is made of energy for lighting in the building and practically none for motor service. The heavy demand for energy in this same office building will occur just before the force is getting ready to leave for the night and at this particular period of the day the requirements for heat are at a minimum because the heat inertia of the building is sufficient to keep up the temperature at this time, and it is useless to put in more

heat at the time when the force is getting ready to leave. Therefore, while it is perfectly true that the same steam can be used economically for lighting and heating, it is impossible so to arrange a combination plant of this kind that the diversity in time requirements for the different kinds of service render it possible to make complete use of this advantage. This is a case where diversity works against and not for economy.

As a result of the foregoing analysis, Mr. Lincoln expressed the opinion that there are only two reasons why central stations do not supply all of the electric service within legitimate reach of their distributing systems. These are, first, because the rate offered by the central station does not bear a suitable relation to the cost of the service to be supplied, and, second, because the prospective customer has some motive other than the cost of the supply for not taking his service from the central station.

*Discussion*

Mr. H. A. Hornor, Philadelphia, claimed that in making estimates concerning the cost of service rendered by isolated plants, central-station managers obtain figures that are too high, while the isolated-plant engineers give figures that are too low. He expressed the opinion that when the facts are properly presented to isolated-plant owners by central-station managers the number of isolated plants in central-station territories will rapidly become smaller.

Mr. W. C. L. Eglin, Philadelphia, remarked that the economy of isolated-plant equipment rapidly becomes less when used, yet it is difficult to convince isolated-plant owners of this fact. Although little difficulty is experienced in convincing a factory owner that it is not to his advantage to install an isolated plant initially, yet it is very hard to convince the owner of a plant now in service that it is to his advantage to scrap his plant equipment and purchase energy from a central station.

Mr. C. O. Mailloux, New York, called attention to several cases where isolated-plant service was found to be much more economical than central-station service. One of these was a large sugar-refining establishment, in which 10,000 hp was needed for evaporation processes. In this case the steam was produced at a pressure of 150 lb. and utilized at 10 lb. after having passed through steam engines used to drive electric generators. In this way the electrical energy became an extremely inexpensive by-product. A large portion of this energy is being used for electric cooking, from fifty to 100 people being served in this manner. Mr. Mailloux predicted that the development of high-efficiency tungsten lamps will have the effect of decreasing the number of isolated plants, because when such lamps are used the cost of central-station service is relatively small compared with the cost of operating an isolated plant.

Dr. M. G. Lloyd, Chicago, stated that in comparing isolated plant with central-station service, it is not proper to ignore the high cost of the system for distributing energy from the central station. In many cases the cost of the distributing circuits and equipment is equally as great as that of the generating plant. Although the peaks of the lighting load and of the steam-heating load do not occur simultaneously, yet it is improper to state that the steam may be cut off from office buildings late in the afternoon. The fact of the matter is that office buildings must be kept well heated each night until, say, 10 o'clock, because a few of the tenants remain in their offices until this hour or later.

Prof. J. P. Jackson, Harrisburg, remarked that isolated-plant owners are usually unwilling to acknowledge that obsolescence has any effect on the relative economy of operating their equipments and purchasing central-station energy. On this account central-station managers often experience difficulty in convincing isolated-plant owners of the economies involved in substituting central-station service for isolated-plant service.

## Kansas Convention at Hutchinson

The sixteenth annual convention of the Kansas Gas, Water, Electric Light and Street Railway Association was held at Hutchinson, Kan., Oct. 9 to 11, with an attendance of over 100 members and guests. Mayor Frontron welcomed the convention to Hutchinson, and Mr. B. F. Eyer, of Manhattan, responded on behalf of the association. In his official address President L. O. Ripley, of Wichita, discussed matters of association organization, and the subject of affiliation with the N. E. L. A. The executive committee has advised against this step, owing to the fact that the Kansas association includes other than electric utilities. It has recommended, also, that the name be changed to that of the Kansas Public Service Association.

ILLUMINATION TOPICS

Mr. F. A. Pielsticker, of Eldorado, opened the technical program with an interesting paper describing an ornamental street-lighting system recently installed in his city at moderate cost. An abstract of this paper will be given later in these columns. Mr. C. L. Bullock, Wichita, followed with a paper on natural-gas transmission.

Mr. G. R. Walker, St. Louis, Mo. characterized the development of the new nitrogen-filled lamp as an important step in the progress of illumination. He also explained how burning ordinary lamps below rating reduces central-station revenue. Several methods of avoiding such losses were suggested, among them being that of dividing a city into voltage zones. All service wires in one zone would then supply a definite voltage, for which the lamps used in that zone would be especially designed. The nitrogen-filled lamp was also described further by Mr. F. T. Benson, Chicago, who enumerated its advantages.

Following Mr. Benson's talk the session adjourned and the members boarded trolley cars for a sight-seeing trip. In the evening a smoker was held in the club rooms, at which Mr. P. Lloyd Lewis, of Kansas City, Mo., explained the purposes of the Jovian Order.

Mr. F. B. Uhrig, Kansas City, Mo., read a paper on "The Treatment of Poles," which he illustrated with stereoptican views. He spoke of the increasing demand for poles, the limited supply available, and the resulting necessity for preserving those now being set. The suitability of Michigan and Western cedars for different conditions was brought out, and the theory and methods of preserving timber against decay were discussed. Results obtained from tests on treated and untreated poles, as well as on poles whose butts have been reinforced with a collar of concrete, were also described. Mr. Uhrig closed his remarks by enumerating some of the advantages of concrete poles.

IRRIGATION WITH MOTOR-DRIVEN PUMPS

Artificial irrigation in western Kansas is practical and will be effective in increasing the production of grain in the state, declared Mr. H. B. Walker, state irrigation engineer, at Friday morning's session. The annual precipitation in western Kansas is about 20 in., which is insufficient. An enormous underflow of water, however, exists beneath the state at depths varying from 60 ft. to 300 ft. There are two and three separate basins in some localities, and the supply does not seem to be affected when drawn upon by individual pumping plants. For suitable irrigation at least 10 gal. of water per minute per acre should be available. Mr. Walker therefore advises drilling batteries of wells, each 10 in. to 15 in. in diameter and 30 ft. from center to center, connecting a common suction from one pump onto such a group. For lifts of over 30 ft. it is necessary to sink a well casing and install pumps at the bottom. With electrically driven centrifugal pumps water can be delivered to irrigation ditches at from 3 cents to 9 cents per acre per foot of lift. Single-stage pumps are preferable for lifts of 50 ft. or less, while multi-stage pumps are desirable for the higher lifts.

Most of the dissatisfaction experienced with artificial irrigation can be traced to ignorance on the part of the operator of pumping engines. When driving centrifugal pumps such engines must be operated at a definite speed. Mr. Walker believes that electrically driven pumps using central-station energy furnish the best solution for the irrigation problem.

During the discussion Mr. Ripley described a large electric pumping plant being installed on a farm near Wichita. The electric-service company there paid for the 35-hp motor and the pumps, and the farmer will run the plant to give a practical demonstration of the usefulness of such an installation. Data obtained from this equipment will be used in fixing rates for future service to other farm customers.

Mr. H. H. Wakefield, of Chicago, delivered an interesting paper on "Fire Insurance," quoting figures to show that the United States pays more for its fire losses than all other countries put together. Too often fires which cannot be traced to other causes are attributed to faulty wiring. Mr. Wakefield closed his remarks by describing the layout of a central station ideal from the viewpoint of fire prevention.

"The Manufacture and Installation of Concrete Poles" was the title of a paper by Mr. C. L. Brown, of Abilene. The author, who is a central-station man, has devoted considerable effort to developing and improving a hollow reinforced-concrete pole to take the place of cedar poles for overhead transmission work. An abstract of his paper will appear later in these columns.

### DISTRICT HEATING AND UTILITY OPERATION

"Central-Station Heating in the Smaller Cities" was the subject discussed by Mr. H. C. Kimbrough, of Chicago. Specific examples were given showing the efficiency of district heating when the mains are properly insulated, and typical engineering problems were discussed to indicate the amount which can be legitimately expended to improve a system. The heating plant of the Excelsior Springs (Mo.) Water, Gas & Electric Company was described, and forms of contracts for heating were reproduced.

Mr. A. M. Patten, of Topeka, followed with a description of the district-heating system in his own city, where several hotels, a number of business buildings and the Santa Fé Railroad shops are served with steam heat. The fact that the company is equipped to furnish both steam heat and electricity is of value in keeping out isolated plants.

"Some General Features which All Public Utilities Have in Common" was the subject on which Mr. Patten was scheduled to make an address. His paper was short but to the point, bringing out some interesting features. Better understanding between utilities and public he cited as a most important requirement for successful operation. If only the utility which occasioned public enmity were affected, the results might not be so disastrous, but the sentiment once developed is generally directed at all corporations, guilty or innocent. Employees should be taught the company's policies and should be informed that it is, after all, the public which pays their salaries. Utilities should keep in touch with the people through the newspapers. It is better that news should originate from the right source in the first place; and cordial newspaper relations are advised even if the information divulged is unsatisfactory in character. Good service is, of course, essential in all cases.

In the discussion which followed this paper Messrs. L. O. Ripley, W. E. Sweezy, Junction City, Kan.; H. R. Summerhayes, of Schenectady, N. Y.; Louis Bendit, Kansas City, Mo., and C. L. Brown, Abilene, Kan., took part. Much of this discussion grew out of reports that consulting engineers have advised cities to operate their own plants and furnish service at lower rates than is possible if expenses are to be paid. The engineers' opinions were formed in many of these cases without having investigated all the conditions, it was contended, but such reports are nevertheless harmful in producing dissatisfaction with existing conditions.

The executive committee was advised to correct such fallacious views, and it was also suggested that operating data covering private and municipal plants would be valuable for comparison in checking. The opinion generally expressed was that the state commission should have jurisdiction over municipal as well as privately owned plants, and that at the next meeting of the Legislature steps should be taken to amend the utility law in this direction. In closing the discussion President Ripley declared that the commission should protect the investor as well as the public, and should not allow confiscation of property or misrepresentation of facts.

### ELECTRICAL INSTALLATIONS

Mr. H. R. Summerhayes, of Schenectady, N. Y., next abstracted his general résumé on recent developments and tendencies in electrical apparatus, mentioning briefly such topics as the use of temperature-measuring coils in generators and transformers, design of large generators and transformers with high internal reactance, competition of Diesel engines with small turbines, development of nitrogen-filled tungsten lamps, etc.

Mr. C. A. Fees, engineer with the Kansas City Gas & Electric Company, Wichita, read a paper entitled "Determining Operating Costs of Power Installations," which gave a synopsis of methods of ascertaining costs of operation when energy is generated or purchased. An engineering study of the layout of a plant in advance will simplify such classification of expenses. Considerable insight into operating problems may be secured by interviewing employees. Through conversations with engineers of isolated plants subjects are often also brought up which show the advantages of central-station energy. The speaker described methods of selecting types of motor drive (whether individual or group) for use in factories. Methods of estimating the power required, and the load factor obtained under different arrangements were also discussed.

Messrs. W. E. Sweezy, Junction City, and W. A. Scothorn, Wichita, took part in the discussion on energy consumption required for milling grains under different weather conditions. Mr. Scothorn said that in a 80-barrel to 120-barrel establishment 3.5 kw-hr. to 7 kw-hr. is required per barrel of grain milled. Mr. Fee gave from 6 kw-hr. to 7 kw-hr. per barrel as the range in consumption.

### EDUCATION AND UTILITY VALUATION

Dean P. F. Walker of the engineering school of Kansas University, Lawrence, described the latter's correspondence course arranged for the education of central-station employees. The course will be inexpensive and will be similar to that inaugurated by the University of Wisconsin. Work of a practical nature is being mapped out for boiler and engine-room employees. Dean Walker solicits suggestions from central-station managers and superintendents. President Ripley and others joined in heartily in recommendations of the work, and promised their co-operation.

Prof. George Shaad, of Kansas University, Lawrence, read an interesting paper on "Intangible Values and Their Relation to the Valuation of Public Utilities." Subjects of valuation, determination of rates, franchises, and good-will were discussed. The speaker favored putting state commissions in control of municipally owned utilities. Rates should be fixed according to cost of production, and should represent a reasonable return on physical value plus intangible value. In states where commissions prevent unnecessary competition, franchises and good-will have no capital value, the speaker asserted. "Going value" can be estimated by logical methods and Professor Shaad believes

should be capitalized along with early losses in operation.

A discussion followed regarding capitalization of discounts on bond issues, in which Messrs. Sweezy, Ripley and H. W. Magruder, Liberal, took part. A diversity of opinion was brought out, the contention being whether the discount should be charged to capital account, operating expenses, or profit and loss.

INTERNAL-COMBUSTION ENGINES

A paper was read at the evening session by Mr. F. L. Weakly, Kansas City, Mo., on the "Internal-Combustion Engine." The speaker said that oil engines give a more uniform turning moment than gas engines, and are hence better suited to driving generators. Although the price of gasoline is continually rising, Mr. Weakly believes that crude oil will be subject to the same changes in price as coal. Crude-oil engines of moderate size should operate at a cost of 1.25 mills per brake hp-hour at full load, and maintenance should not exceed 60 cents per 1000 hp-hours. A table was shown comparing the cost of power from crude oils, fuel oil, and distillates.

Mr. Louis Bendit, Kansas City, Mo., followed with a brief talk on the same subject. Oil engines, he suggested, can be installed by central stations in isolated districts to educate the people of the locality to the advantages of



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electric service. Then after a load has been built up, transmission lines can be erected to connect the central station with the new community, the oil-engine set being meanwhile installed to develop another locality.

FINANCING OF PUBLIC UTILITIES

In the absence of Mr. H. P. Wright, Kansas City, Mo., his paper on "Financing of Public Utilities" was read by President Ripley. Obligations and fixed charges should be so arranged that they may be settled from surplus earnings, declared the author. The conditions contained in franchises should be satisfactory to begin with, for they can seldom be changed after acceptance. Bond issues should not exceed 50 per cent of the value of the property, Mr. Wright believes. Stock should be controlled by the common stockholders, and the preferred stock issue should represent only half the common stock. Modern equipment should be installed, and stockholders should be informed periodically of the physical condition of the plant and the local political situation.

Mr. Charles D. Bell, of Wichita, Kan., delivered the last paper on the program, which was entitled "Some Features in the Organization and Development of an Interurban Railroad." He said that interurban freight traffic can be considerably increased when there is an interchange of cars with steam roads. Most of the freight of an interurban line can be carried during the night after regular passenger traffic has ceased, utilizing off-peak hours of plant operation. Other subjects touched upon were those of handling and estimating traffic, construction features, equipment, attitude of the public, and treatment of employees.

NEW OFFICERS AND NEXT MEETING PLACE

On Friday evening, Mr. M. T. Flynn, Kansas City, Kan., chairman of the nominating committee, submitted recommendations for new officers. These were accepted by vote of the association and the election announced as follows: President, Mr. A. L. Newman, Arkansas City; first vice-president, Mr. H. W. Magruder, Liberal; secretary-treasurer, Mr. Ivor Thomas, Wichita; chairman of the executive committee, Mr. L. O. Ripley, Wichita.

Mr. Newman, the president-elect of the Kansas association, is the secretary-treasurer and manager of the Arkansas City (Kan.) Gas & Electric Light Company, with which he has been connected since 1905.

The 1914 meeting of the association will be held at Arkansas City, Kan., some time in October.

During the Hutchinson convention Messrs. J. F. Springfield and W. A. Scothorn entertained the delegates with trolley car and railroad trips to points of interest about the city.

## Public Service Commission News

MASSACHUSETTS COMMISSION

The Public Service Commission has issued a finding approving by a vote of 4 to 1 the petition of the New York, New Haven & Hartford Railroad for authority to issue 6 per cent convertible debenture bonds at part to the amount of $67,552,000, to meet the cost of improvements and retire floating indebtedness. The decision involves an interpretation by the board of the financial sections of the 1913 public service commission act, and follows protracted and heated hearings. The board finds that the company's floating debt and prospective equipment funding are necessary and proper; that the commission has authority to permit the issue of bonds convertible into stock at par, although such action has never before been taken in Massachusetts; that the 6 per cent rate of interest is proper and necessary in the present market conditions; that the capital stock of the company is sufficient to warrant the issue under the act of 1913, and that if the company were required to issue short-time notes to meet its financial needs, the cost would be excessive and the remedy but temporary. The proposed 2½ per cent underwriting commission for the Morgan banking house is condemned as not in accord with ethical standards or sound public policy, in view of the directoral relations existing. Commissioner George W. Anderson filed a dissenting report. It is understood that some of the funds raised on the issue will be applied to electrification work on the New Haven system.

OHIO COMMISSION

The Public Utilities Commission, realizing that the bond market is not in such condition as to enable a company to sell its securities advantageously, has granted the Valley Light & Power Company of Maumee authority to borrow money on its issue of $49,000 first-mortgage bonds. A condition is made to the effect that the amount borrowed must not be less than 80 per cent of the face value of the bonds.

The Ohio Fuel & Supply Company has been given authority to absorb the Cambridge Light & Fuel Company by purchasing the remainder of the stock from individual stockholders at $45,000. The stock's par value is $25,000.

# Current News Notes

Passenger Cars, Not Pleasure Cars.—At the suggestion of Mr. George Harvey Jones, former chairman, the Chicago Section of the Electric Vehicle Association is endeavoring, so far as its influence extends, to use the term electric "passenger" cars rather than electric "pleasure" cars.

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Electric-Service Plant at Nome Destroyed.—A great storm, beating in from Bering Sea, laid waste a large portion of Nome, Alaska, on Oct. 5 and 6. It is said that one-half of the little city has been destroyed, the damage being estimated at $1,000,000. Among other losses, the electric-light plant is reported as wrecked. This is probably the generating station of the Seward Peninsula Power Company.

* * *

Ice Plants Almost as Numerous as Central Stations.—Mr. Van der Vaart in reviewing the growth of the refrigerating industry before the International Congress of Refrigeration at Chicago recently said that there are about 3500 ice-manufacturing plants in the United States, equipped with machinery capable of producing between 18,000,000 tons and 20,000,000 tons of ice annually. The capital invested in the ice-making industry alone he estimated to be not less than $150,000,000.

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Electricity on a Georgia Farm.—A Georgia farmer whose pasture is skirted by the high-tension line of a transmission company recently had a couple of fine cattle struck by lightning during a severe thunderstorm. Without delay he brought suit against the power company. When the latter's surprised attorneys questioned the plaintiff concerning grounds for his attack, he gravely explained that he had lived there "twenty years" and yet never until the erection of the electric wires had lightning ever struck those cows. Therefore he concluded to hold the electric company responsible.

* * *

Wireless Aids Banana Trade.—The proposed imposition of a tax on the importation of bananas has served to draw attention to the remarkable organization of the business of transporting bananas. The fruit is packed while green and rushed thousands of miles in a few days before it ripens. So carefully is this business of transportation organized that millions of bananas are brought from the tropics and sold so cheaply as to be within reach of all. As a precaution against loss due to the ripening of the fruit because of a delay in transportation, every fruit vessel is equipped with a wireless plant. If a fruit vessel be delayed, a wireless call is quickly sent out for help and assistance is rushed to the disabled vessel, so that the shipment is expedited in every way.

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Labor Law in New York.—Attorney-General Carmody of New York State has rendered an opinion on the new labor law which became effective on Oct. 1, providing for one day of rest for employees of factories and mercantile establishments. The opinion was rendered in answer to a letter from Mr. William C. Rogers, Acting Commissioner of Labor, who said that he was in doubt as to whether the law should be applied to engineers and firemen in waterworks pumping stations and to engineers, firemen and other employees in private and municipal gas and electric light manufactories. The opinion of the Attorney-General is that engineers, firemen and other employees and private gas and electric manufactories come within the meaning of the act except as they are particularly excluded therein. He believes that an electric light corporation comes within the definition of a factory and that municipal gas and electric light plants are included within the law.

Trenching Through Stone with Wires and Abrasive.—To accommodate electric-power cables which will cross the River Seine on the 300-year-old Pont Neuf, Paris, a trench 4 ft. wide and 7.5 ft. deep is being cut through the solid masonry and flint-rock concrete of the bridge structure with the aid of helicordial wires and abrasive powder. The section trenched in this way, 550 ft. in length, was found to be too hard to be attacked by tools, while explosives were excluded for fear of weakening the venerable arches. Four parallel wire cuts were made in each of the three sections, each roughly 200 ft. in length. An 18-hp motor operated the continuous-belt cutting wires, which were held taut by weights, while abrasive powder was fed into the kerfs.

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## SOCIETY MEETINGS

Dallas Electrical Display.—Oct. 31 will be known as "Jovian and Electrical Men's Day" at the Dallas (Tex.) State Fair. Arrangements have been made for an electrical street parade at night when the residences and along the route will be kept in darkness to heighten the effect of the electrical illumination provided by the floats.

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New England Wireless Society.—Interest in wireless telegraphy has been stimulated in New England by the recent alliance of the wireless societies of Tufts College Harvard University and the Massachusetts Institute of Technology with the original body, the New England Wireless Society. Mr. Harold B. Richmond, 12 George Street Medford, Mass., is secretary of the allied societies.

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Welfare Efficiency Convention.—The Pennsylvania Industrial Welfare and Efficiency Convention will be held at Harrisburg, Oct. 28, 29 and 30, under the auspices of the Engineers' Society of Pennsylvania. The conference has been called by Prof. John Price Jackson, formerly dean of the School of Engineering of Pennsylvania State College, the recently appointed commissioner of labor and industry of the State of Pennsylvania. Representatives of industrial establishments, engineers, contractors and other employers of labor and heads of the various state departments coming in contact with engineering and industrial affairs will take part in the convention. An exhibition will be held in connection with the convention from Oct. 2 to Oct. 31 in the building of the Harrisburg Railway Company. A program of papers covering a wide range of subjects has been arranged. The meetings are to be held at the State Capitol. Mr. George S. Comstock, president of the Engineers' Society of Pennsylvania, will preside at the convention.

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New York I. E. S.—At a meeting of the New York Section of the Illuminating Engineering Society held on Oct. 9, Mr. Norman Macbeth reported his observations on the recent Pittsburgh convention of the society, giving a brief outline of the main convention features and abstracts of the papers and discussions. Mr. A. L. Powell presented the paper, of which he and Mr. Clarence L. Law were the authors, entitled "Distinctive Store Lighting." This paper was illustrated with lantern slides and auto-chrome color plates. It was discussed by Messrs. G. A. Stickney, V. R. Lansingh and J. B. Taylor with special reference to the use of colored lantern slides. The next meeting of the section will be held jointly with the New York Section of the National Electric Light Association, in the Edison Auditorium, Twenty-seventh Street, on Nov. 17. The neon-tube lamp will be demonstrated and discussed. Street lighting abroad will be discussed at the December meeting, which will be held in co-operation with the Municipal Arts Society

# The "1912 Extension" to Fisk Street Station

**Very large turbo-generators, including one 25,000-kw. unit imported from England—Some details of the latest example of power-house design in Chicago**

UNUSUAL interest attaches to the "1912 Extension," as it is called of the Fisk Street generating station of the Commonwealth Edison Company of Chicago. Work on this extension has been delayed for various causes, and is still under way, although it was on March 23, 1912, that the *Electrical World* contained the announcement that the company had placed an order with Messrs. C. A. Parsons & Company, Ltd., Newcastle-on-Tyne, England, for a 25,000-kw horizontal turbo-generator to be erected in an extension to the widely known Fisk Street generating station. Later a 20,000-kw horizontal turbo-generator was ordered from the General Electric Company of this country for the same addition to the generating station. The parts of the English unit have been delivered in Chicago, being imported in bond to the point of destination.

The Fisk Street extension possesses a great degree of interest, partly from the large side of the units employed (although a 30,000-kw horizontal General Electric unit has been ordered more recently for the Northwest station of the Commonwealth Edison Company), partly from the fact that it marks a departure from the vertical steam-turbine units previously installed by this company, partly from the ingenious and compact arrangement of the steam-raising equipment, and partly from the international character of the undertaking. The English unit was designed and built under the personal supervision of Sir Charles A. Parsons, perhaps the leading authority on steam-turbine engineering; the English consulting engineers for the work are Messrs. Merz & McLellan, of Newcastle-on-Tyne and London, while the American consulting engineers of the Commonwealth Edison Company, Messrs. Sargent & Lundy, of Chicago, have the immediate responsibility for the execution of the work, having, in conjunction with the electrical engineers of the company, designed all of the company's generating stations.

## GENERAL FEATURES

Extending from the south end of the existing station, which has a service rating of 120,000 kw, the addition under construction extends for a distance of 200 ft. to the South Branch of the Chicago River. The width of the extension is about 265 ft., while the older portion of the building is 240 ft. wide. The entire station, when completed, will be about 675 ft. long and will be a harmonious and imposing architectural unit. The switch-house is being extended also to correspond to the generating-station requirements.

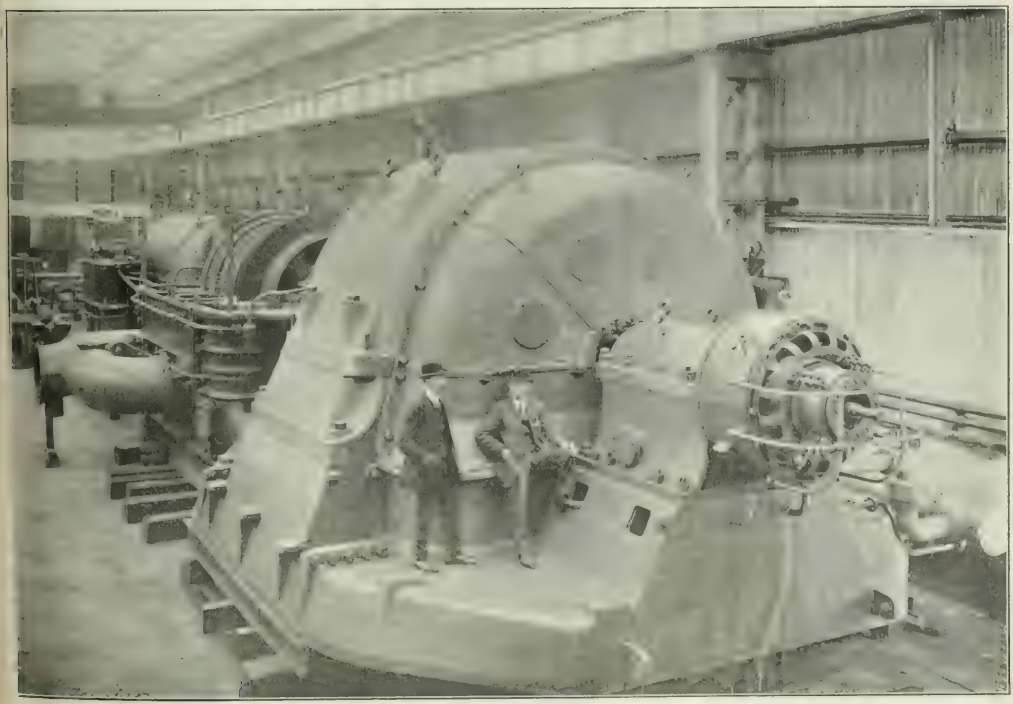


FIG. 1—GENERATOR END OF 25,000-KW ENGLISH UNIT FOR COMMONWEALTH EDISON COMPANY OF CHICAGO

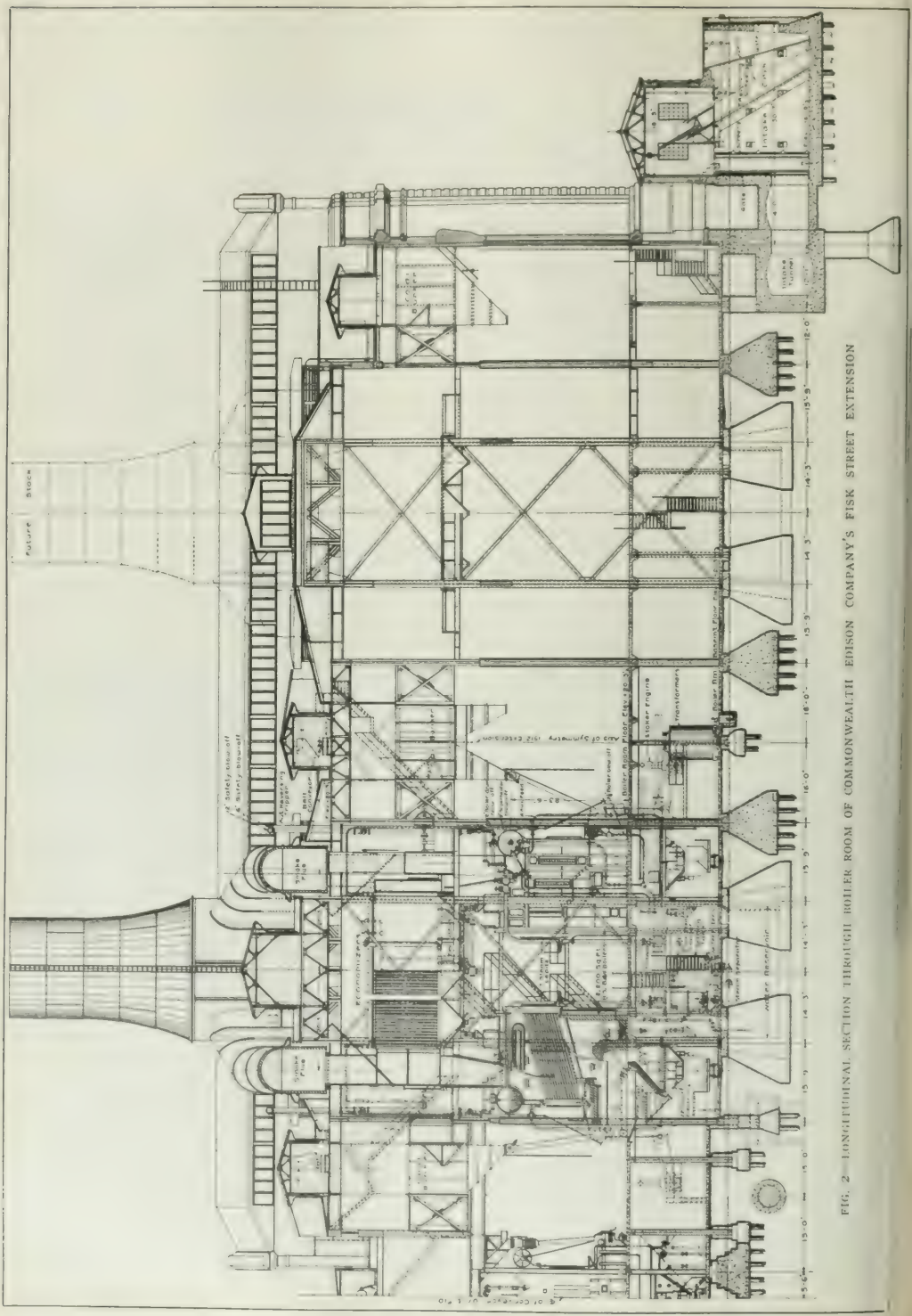



FIG. 2—LONGITUDINAL SECTION THROUGH BOILER ROOM OF COMMONWEALTH EDISON COMPANY'S FISK STREET EXTENSION

The equipment now in service at the Fisk Street station consists of ten vertical Curtis steam turbines and General Electric alternators rated at 12,000 kw each. The new turbo-alternators are of the horizontal type and space is left for two other horizontal units between the turbo-generators now going in and the west wall of the station. A row of boilers extending east and west provides steam for each of the new units. Two of these groups of boilers are now about to be installed, space being left for two others. One smokestack, 250 ft. high above the boiler-room floor and 19 ft. in inside diameter, will serve the boiler equipment for two units.

### Coal and Ash-Handling Equipment

Cars loaded with coal are brought into the train shed on the east side of the station. Two railroad tracks are provided and coal may be dumped directly from the cars into

Removal of ashes will be accomplished by means of small electrically driven ash cars operating in the boiler-room basement. These cars discharge into a receiving hopper which delivers the ashes to the bucket conveyors, by which they are elevated to a storage bunker above the tracks in the train shed. From this point the ashes are discharged into cars for removal.

The rating of the coal bunkers for the Parsons 25,000-kw unit is 225 tons per boiler. In addition there are four storage bunkers placed overhead in the train shed, with an aggregate rating of 3360 tons and receiving hoppers having a rating of 1320 tons. The ash storage in the train shed amounts to 1180 tons.

### Boilers and Economizers

For each of the new generating units the boiler equipment will consist of four marine-type Babcock & Wilcox

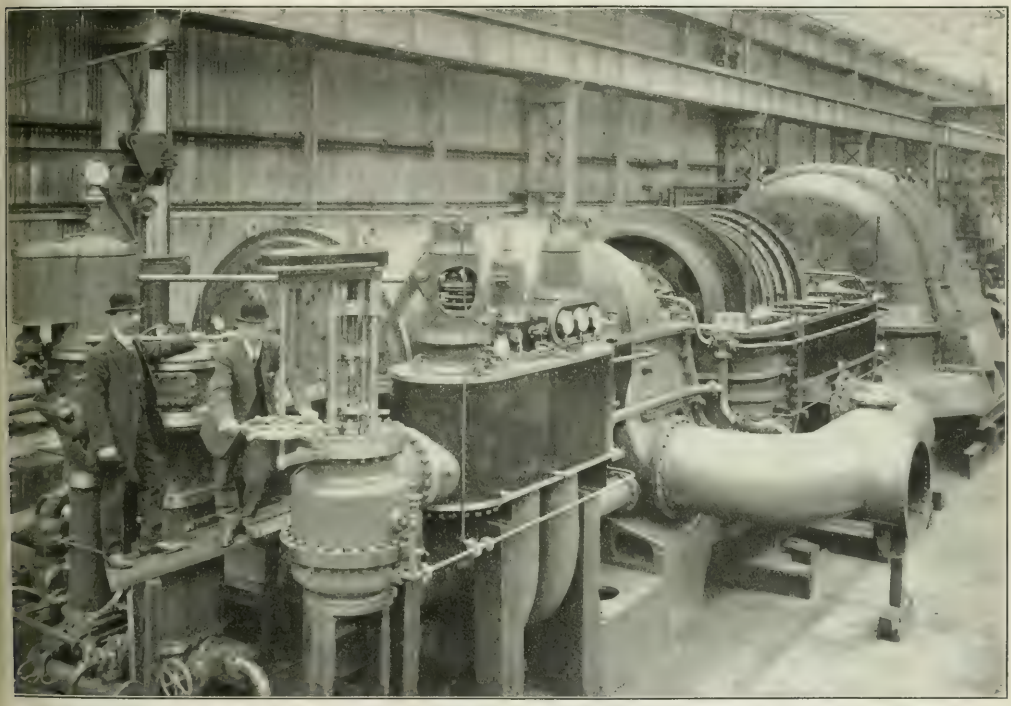


FIG. 4—STEAM END OF 25,000-KW ENGLISH UNIT FOR COMMONWEALTH EDISON COMPANY OF CHICAGO

ie receiving hoppers above the primary coal crusher. f gondola cars are used, the fuel may be unloaded by rab-bucket cranes and dropped from the side into the rusher hopper. The general arrangement is shown clearly 1 the general cross-section drawing. The primary 'usher is intended to reduce all lumps of coal to about in. or 4-in. pieces. By a system of bucket conveyors the al is elevated to a point above the boiler-room coal bunk-s and delivered to secondary crushers. After being re-ced to 0.75 in. size the coal is taken by a belt conveyor nnecting at right angles to the bucket conveyors and livered to the bunkers over the boilers. The bucket con-yors have a rating of 175 tons of coal per hour each at a eed of 45 ft. per minute. The belt conveyor will have a nilar rating at a speed of 250 ft. per minute. The bucket nveyors are furnished by the Mead-Morrison Company, e belt conveyor by the Robins Conveying Belt Com-ny, and the crushers by Messrs. Orton & Steinbrenner.

water-tube boilers. These boilers are to be equipped with chain-grate stokers, superheaters and steel-incased settings. The arrangement of the boilers is shown in the drawing giving the general cross-section and longitudinal section of the new portion of the generating station. The boilers are unusually wide, and each one contains 12,200 sq. ft. of heating surface with about 20 per cent of superheating surface. Each boiler is provided with two chain-grate stokers separated by a wall of fire brick, which comes slightly above the surface of the grates. These stokers are each 10 ft. 6 in. wide and 13 ft. long, and are designed to burn a maximum of 45 lb. of coal per square foot of grate surface. Each boiler is designed to evaporate 80,000 lb. of water per hour under maximum working conditions. The maximum working pressure is 225 lb. per square inch, and the normal pressure 210 lb. (gauge). The superheaters are designed to give about 225 deg. Fahr. superheat when operating at or near the maximum capacity.

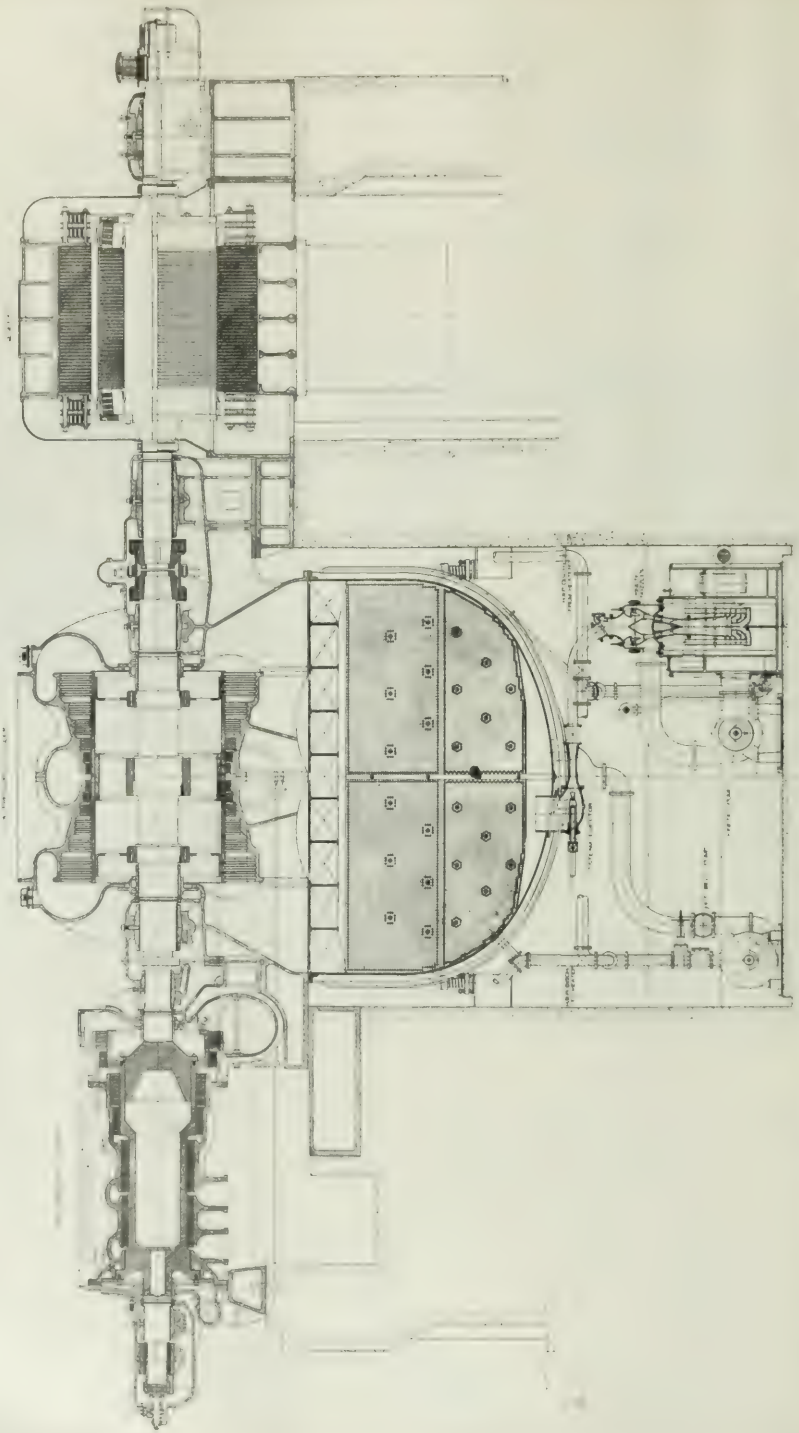
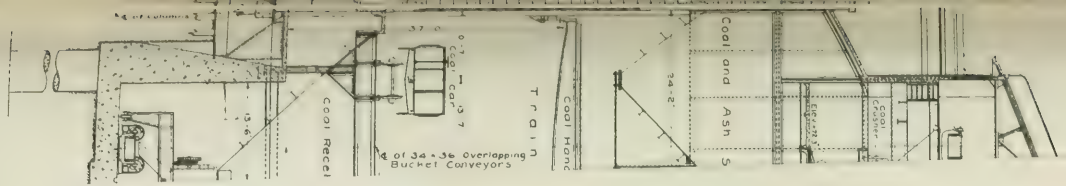


FIG. 5.—LONGITUDINAL SECTION OF 25,000-KW ENGLISH UNIT FOR COMMONWEALTH EDISON COMPANY OF CHICAGO, SHOWING ALSO CROSS-SECTION OF CONDENSING APPARATUS AND CONDENSER PIT


Coal and Ash S
Coal Recei
Train
Coal Hand
4 of 34 x 36 Overlapping
Bucket Conveyors

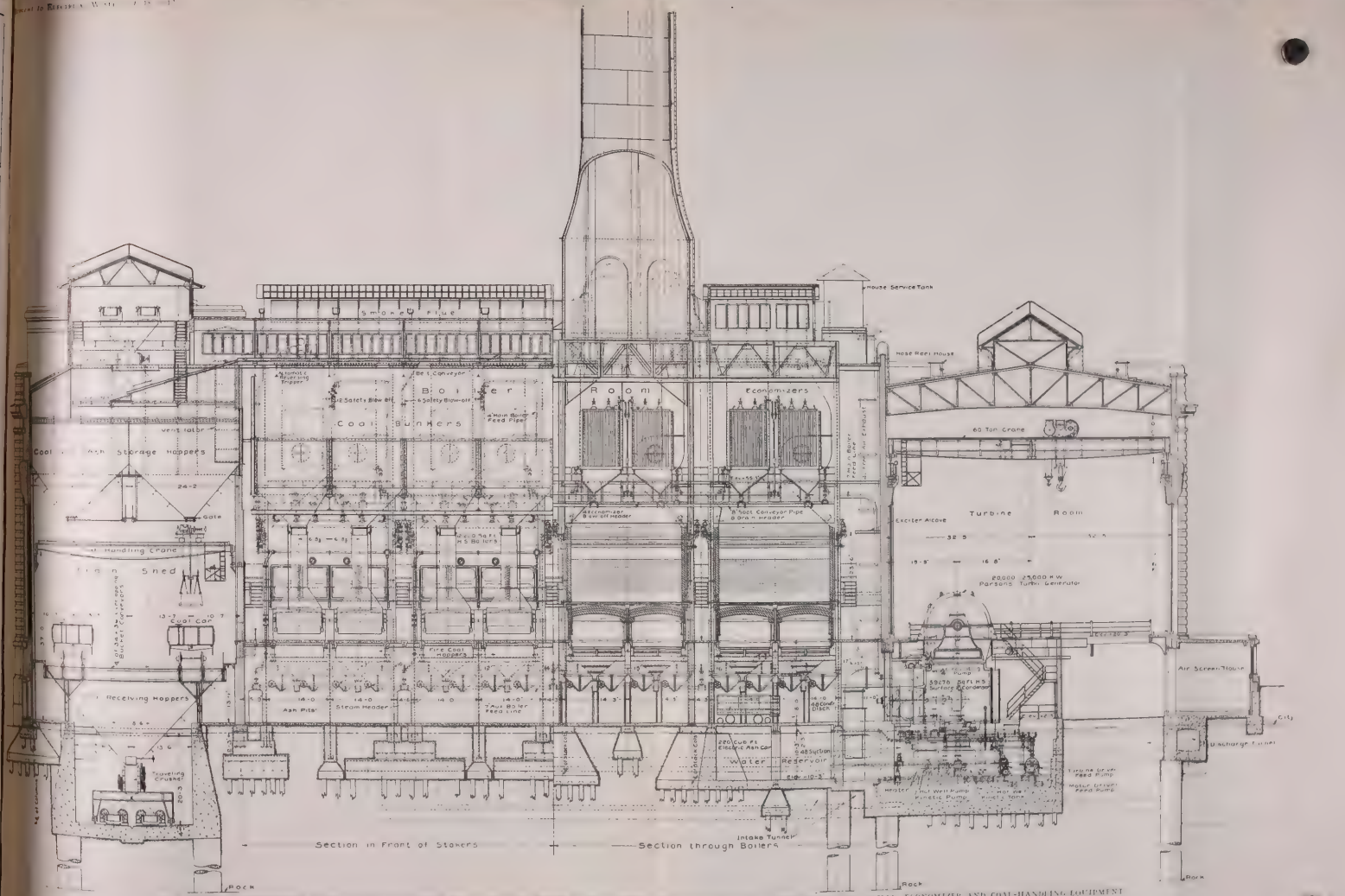



FIG. 3—GENERAL CROSS-SECTION OF COMMONWEALTH EDISON COMPANY'S FISK STREET STATION EXTENSION SHOWING ENGLISH TURBO-GENERATOR, BOILER, ECONOMIZER AND COAL-HANDLING EQUIPMENT

As shown in the sectional drawings, the economizers are placed above the boilers. There is one economizer for each boiler. Each economizer contains 8500 sq. ft. of heating surface, provided by 528 12-ft. tubes arranged in three groups and in staggered rows. The three groups are connected in series as regards water circulation. There are sixteen sections of tubes in each group. The circulation in each group is up the first eight sections, down the next four and up the last four. Each economizer is equipped with an induced-draft fan having a rating of 80,000 cu. ft. per minute and designed to maintain 1.5 in. draft in the uptake of the boiler. The economizers are designed to raise the temperature of the feed watr about 150 deg. under ordinary operating conditions. The equipment is furnished by the B. F. Sturtevant Company.

### Parsons 25,000-kw 25-Cycle Unit

Imported generating units are rare in electric-service stations in the United States. Much interest is taken, therefore, in Unit No. 11 of the Fisk Street addition, which is the one which has come from England. The machine has a maximum continuous rating of 25,000 kw. The steam turbine is a Parsons machine and is designed with separate high-pressure and low-pressure cylinders. The low-pressure cylinder is arranged on the double-flow principle, as is customary in units of this large size. Accompanying this article are two photographs of the completed unit set up in the Heaton works of the manufacturer in Newcastle. One picture shows the steam end of the great machine and the other the electrical end. The exciter, mounted at the end of the shaft, is shown in the latter picture. In each picture the top half of the low-pressure cylinder casing has been removed for purposes of inspection. A drawing is also given showing a longitudinal section of the new Parsons unit and a cross-section of the condensing apparatus and condenser pit. The arrangement of the condenser is entirely new in this country. The whole unit is about 75 ft. long and 18 ft. wide. The speed of operation is 750 r.p.m.

The generator will produce three-phase 25-cycle current at 4500 volts. It is not designed to be self-ventilating, and no vanes are provided on the rotating field. A separate motor-driven fan is to be installed for ventilating the generator.

Normal conditions of operation for the Parsons turbine contemplate steam pressure of 200 lb., superheat at 200 deg. Fahr. and a vacuum of 29 in. The turbine is designed to develop its best economy when the generator is delivering an output of 20,000 kw, but the unit is capable of delivering continuously a maximum output of 25,000 kw. Further, the machine is capable of caring for an excess demand of about 10 per cent in case of short fluctuations in the load.

The governing mechanism operates on the pulsating principle, giving 320 admissions of steam per minute. When the output is increased above 20,000 kw, a secondary governor valve comes into action, admitting high-pressure steam into the second stage. The atmospheric-relief connection is taken off from the pipe connecting the high-pressure and low-pressure cylinders of the turbine, but two safety valves are provided on the low-pressure casing.

Excitation is provided at a maximum potential of 250 volts. The potential of the station alternating-current busbars is 9000 volts, and therefore compensating transformers wound for 4500/9000 volts are to be placed between the generator terminals and the busbars. These compensators will have an effective reactance of 4 per cent.

### Condensing Equipment

As shown by the sectional drawing of the Parsons unit, the condenser shell is virtually suspended beneath the casing of the low-pressure turbine cylinder. Part of the weight of the condenser will be supported, however, upon spring bearings carried on beams set into the concrete foundations. The condenser is designed for a normal rating of 230,000 lb. of steam per hour, a maximum rating of 300,000 lb. and an ultimate maximum for abnormal conditions of 350,000 lb. per hour. It will contain 39,278 sq. ft. of tube surface, composed of brass tubes 15 ft. long and 1 in. in outside diameter. In addition to this main condenser a feed-water heater section is to be built in the steam entrance to the condenser and is to contain 470 sq. ft. of surface. The main condenser will be arranged for two passes of the circulating water.

### Kinetic Ejector

In addition to the motor-driven circulating and hot-well pumps the condenser will be equipped with a kinetic ejector for the removal of the air and non-condensable vapors. This piece of apparatus, which is not common in this country, takes the place of the so-called "dry vacuum" pump, which is used in the greater part of the large-condenser installations in the United States. It is furnished by Messrs. Richardson, Westgarth & Company, Ltd., of West Hartlepool, England. It comprises a set of water jets, annularly arranged, which entrain the water and non-condensable vapors, removing them from the lower part of the steam space of the condenser. Water is pumped through these jets under a pressure of about 40 lb. per sq. in. by a kinetic pump. It discharges through the nozzles into the kinetic tank just below them, carrying the air with it. The air bubbles up through the water in the tank and escapes through a vent. The kinetic pump has a capacity of 4000 gal. per minute, taking its suction from the kinetic tank. The hot-well pump takes the water of condensation from the bottom of the condenser and discharges it into the kinetic tank. In connection with the kinetic ejector there is a steam ejector between the condenser and the kinetic nozzles, which is used to augment the vacuum. Two sections in the kinetic tank serve the purposes of feed-water heater and hot-well tank. Arrangements are made to save the pure water of condensation in a reservoir, should the supply of water in the hot-well tank be greater momentarily than needed by the boiler-feed pumps.

### Pumping Equipment

Pumps to be used for condenser auxiliaries and for other purposes in connection with the Parsons unit are furnished by the firm of Henry R. Worthington. Nearly all of them are driven by squirrel-cage induction motors. These motors, together with other motors for driving the coal conveyors, coal crushers, etc., are supplied with three-phase current at 220 volts and 25 cycles from a bank of transformers connected to the main generator terminals. The transformer equipment is duplicated by transformers connected to the main station busbars to be used in starting up or for emergency service. The pumping equipment includes the following machinery: One horizontal tri-rotor volute motor-driven centrifugal pump for circulating water to condenser, rated at 42,000 gal. per minute; one horizontal two-stage motor-driven centrifugal hot-well pump, rated at 750 gal. per minute; one horizontal centrifugal motor-driven pump for use with kinetic ejector, rated at 4000 gal. per minute; two horizontal centrifugal motor-driven service pumps, each rated at 300 gal. per minute; one turbine-driven centrifugal boiler-feed pump and one motor-driven turbine-type centrifugal boiler-feed pump, each rated at 750 gal. per minute.

### Guarantees of Steam Performance

When operating at 200 lb. steam pressure at the throttle and with steam superheated 200 deg. Fahr. and exhausting against 1 in. of absolute pressure, Messrs. C. A. Parsons & Company give the following guarantees of steam consumption for the English-made unit:

| | |
|---|---|
| At 10,000 kw. | 12.50 lb. per kw-hour |
| At 15,000 kw. | 11.65 lb. per kw-hour |
| At 20,000 kw. | 11.25 lb. per kw-hour |
| At 25,000 kw. | 11.65 lb. per kw-hour |

These figures include the energy necessary for ventilation purposes, but do not include the energy needed for the ventilation of the generator. The fan for supplying purposes will be installed in the space under the generator foundation. It will deliver 80,000 cu. ft. of air per minute and will be driven by a 150-hp induction motor. An air-washing equipment will be installed for cleaning and cooling the air delivered for the ventilation of the generator.

GENERAL ELECTRIC 20,000 KW, 60-CYCLE UNIT.

Unit No. 14 in the Fisk Street extension will consist of a General Electric horizontal turbo-generator rated at 20,000 kw and having a surface condensing equipment including a condenser with 35,000 sq. ft. of cooling surface. This unit is really the twelfth in order of installation in the station, but its position is such that it is numbered 14. The steam turbine is of the Curtis single-flow type, the first wheel having two rows of buckets and the other single rows of buckets. The shaft bearings are provided with forced lubrication from an oil pump geared to the main shaft. Governing is accomplished by means of the hydraulic system heretofore used on Curtis turbines. The unit will operate at a speed of 1200 r.p.m.

The generator has a continuous full-load rating of 20,000 kw at 80 per cent power-factor, or 25,000 kva. Current is generated at 12,000 volts and 60 cycles. The generator is arranged for self-ventilation by means of vanes on the rotating field. Excitation is provided by means of a 250-volt direct-connected exciter.

Normal conditions of operation for this turbine provide for 200-lb. steam pressure, 200 deg. of superheat and a vacuum of 29 in. The turbine is designed to give its best economy at an output from the generator of about 15,000 kw.

AUXILIARIES OF AMERICAN-MADE UNIT.

The entire condenser installation for this unit is furnished by the firm of Henry R. Worthington. The condenser is placed directly beneath the turbine-exhaust outlet. It contains, as previously stated, 35,000 sq. ft. of cooling surface in tubes.

Two circulating pumps are driven from one motor mounted between them on a common baseplate. The combined rating of these pumps is placed at 36,000 gal. per minute at 375 r.p.m. against a total dynamic pressure of 15 ft. The arrangement is that both pumps will ordinarily be used during the warmer months, while in winter one pump will be sufficient. A similar arrangement of two centrifugal pumps and a motor is used in the case of the hot-well pumps. Each hot-well pump will have a rating of 750 gal. per minute and will be ample for the whole load, the second pump in this case being considered as reserve. The dry-vacuum pump is of the reciprocating angle type, as manufactured by the Laidlaw-Dunn-Gordon Company. At a maximum speed of 100 r.p.m. the pump will displace 3340 cu. ft. per minute. Two independent boiler-feed pumps are provided. These are of the horizontal turbine-driven type, each having a rating of 375 gal. per minute. The exhaust from steam-driven auxiliaries is carried to a feed-water heater rated at 300,000 lb. of water per hour, guaranteed to heat the water from 65 deg. Fahr. to 130 deg. Fahr.

[illegible]

It may be of interest to add that the new unit ordered from the General Electric Company for the Northwest station of the Commonwealth Edison Company, which is several miles from the Fisk Street station, will consist of a horizontal turbo-alternator rated at 30,000 kw, with a surface condenser having 50,000 sq. ft. of cooling surface, and the necessary auxiliaries. This turbine is designed with separate high-pressure and low-pressure cylinders, the latter being arranged on the double-flow principle. In other respects the construction of this turbine will be similar to that of unit No. 14 at Fisk Street, although a somewhat more economical steam consumption is expected. The speed of operation will be 1500 r.p.m. The generator will have a continuous full-load rating of 30,000 kw at unity power factor. Electricity will be generated at 9000 volts and 25 cycles.

The foregoing is a brief outline description of the very large generating units now in course of erection or on order for the Chicago generating stations. These large machines are selected not only on account of their steam economy, but because they are needed owing to the remarkable expansion of the business of the electric-service company of that city. A comparison may illustrate the latter fact. One of the English electrical journals, referring to a tabulation of its own, supposed to be complete, made the statement recently that the output of all the 303 electric-service undertakings in Great Britain and Ireland, both privately owned and municipal, was 1,127,499,742 kw-hr. for the year 1912, or 1911-12. The output of the Commonwealth Edison Company alone in 1912 was, in round numbers, 799,000,000 kw-hr., or two-thirds of that of the entire United Kingdom.

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## Electrically Operated Machinery in Office-Building Construction

Various hoisting and construction operations about office buildings in process of erection which were formerly performed by steam-driven or gasoline-engine-driven machinery are now being carried on with greater convenience and economy by electric-motor drive. An example of such modern building methods is seen in the First National Bank building in Milwaukee, now in course of construction. The structure is fifteen stories in height and is built of brick and terra cotta.

Located as it is close to the river, a large portion of the water used in the building for flushing temporary sewers and for mixing concrete is being pumped by electric. For these purposes two electrically driven pumps are installed. One is a reciprocating pump belt-connected to a 1-hp Roth 220-volt motor running at 1800 r.p.m., and the other is a centrifugal pump which is belted to a 2-hp, 220-volt Western Electric motor operating at 1200 r.p.m.

All of the cement used in mixing concrete is delivered at the street level and is wheeled into the main floor of the building, where with the proper proportions of sand and gravel it is dumped into an electrically driven concrete mixer, whose hopper is just below the floor level. After the concrete has been mixed it is delivered directly from the machine to a bucket elevator which conveys it up to the main floor again. From that place wheelbarrows are loaded and placed on an electrically driven elevator which carries them to the floor on which concrete is being poured.

The concrete mixer is connected by chains and sprockets to the bucket elevator and to the Fort Wayne motor which drives it. The latter is of the 50-hp, 220-volt direct-current crane type and operates at 600 r.p.m. Energy is supplied through waterproof cables temporarily suspended from the basement ceiling. The concrete mixer and the motor operating it are both located in the basement of the building.

Three electrically operated elevators are installed at present, and it is expected that another will be added shortly. All of the motors are Fort Wayne equipment, a 20-hp motor operating the material hoist, a 35-hp machine driving a brick and terra-cotta hoist, and a 20-hp motor operating the concrete elevator previously mentioned. In addition to this equipment a Crocker-Wheeler motor is installed on the mezzanine floor and drives a hoisting drum through a worm gear. The latter hoist is employed to raise elevator motors for the building up to the penthouse and for other work which may require heavy slow-speed hoisting.

# Carbon and Impregnated Electrodes for Arc Lamps

**Composition, methods of manufacture, physical nature, operating characteristics, life and light of electrodes designed for modern street lighting. By A. T. Baldwin**

CARBON electrodes for arc lamps fall into two main classes, depending upon the way in which they produce light. The first class, the pure carbon electrodes, depend upon the incandescence of a crater to produce light; the second class, the flaming-arc electrodes, yield light from a luminescent arc stream supplied by the electrodes. The present purpose is to treat briefly of the characteristics of these two classes of electrodes, devoting greater attention to the modern flaming-arc type. Attention will be confined mostly to those electrodes that are used in familiar types of arc lamps seen in street and large area lighting service. The characteristics of these various electrodes may be established by a consideration of their composition, method of manufacture, physical nature and operating behavior. These points will be considered in the order given.

## Composition

*Pure Carbon Electrodes.*—Since electrodes of this class depend upon an incandescent area of carbon for light, foreign substances of lower boiling point than carbon may be considered impurities since they would reduce the crater temperature, so that every effort is made to keep the electrodes free from materials other than carbon. The open arc electrodes are made of coke and a binder. The small amount of foreign substance in this coke makes it unsuitable for inclosed-arc electrodes because a heavy, light-absorbing globe deposit is obtained. As a result electrodes prepared from purer grades of carbon were developed for this service. Their ash content is about 0.10 per cent, which gives a very light globe deposit. Cored inclosed-arc electrodes contain a little more ash due to the salts added to aid in steadying the arc. It may be said here that these cores consist of fine carbon and the salts just referred to, the object being to secure an arc stream of lower resistance for alternating-current lamps and for intensified types of direct-current lamps. The binders used in making these electrodes are tars and pitches derived from coal or petroleum.

*Flaming-Arc Electrodes.*—In electrodes of this class use is made of any of the many modifications of carbon as a means of presenting at the arc the chemical compounds the luminescence of which in the arc stream yields the light. The cored type of electrodes consists of a shell and a core composed of a mixture of finely divided carbon and the chemical compounds referred to above. These chemical compounds may also be incorporated within the carbon body to make the solid impregnated electrodes now being used in long-burning inclosed-arc lamps. The light and color-giving materials used are essentially the same in either case, although the service demands that they be used in different amounts and relations to each other. The most commonly employed compounds are the fluorides of calcium, strontium and cerium giving yellow, red and white light respectively. Yellow and white flame electrodes are the most practical and the most highly developed, the red being nothing more than an advertising novelty. There are many kinds of "white" flame electrodes, varying in color from a light yellow to a blue white, made in attempts to secure pleasing white light without sacrificing the high efficiency of the yellow flame electrodes.

## Methods of Manufacture

The operations involved in making illuminating carbon electrodes fall under the following heads: Reducing all carbon or other solid materials to the desired fineness; mixing the solid ingredients with the binders; forcing the electrodes; baking the electrodes, and various finishing operations, including control testing.

The solid materials are reduced to the desired fineness by means of burr mills and bolting machines. The machines used for mixing the flour and the binders are designed so that the flour is completely covered and permeated by the binder and gives a plastic mass that may be forced into any desired shape by hydraulic presses. The mix is maintained in a plastic state, by keeping it hot, until it is forced through the die by a hydraulic press. As the forced electrodes cool they become rigid and may be handled with

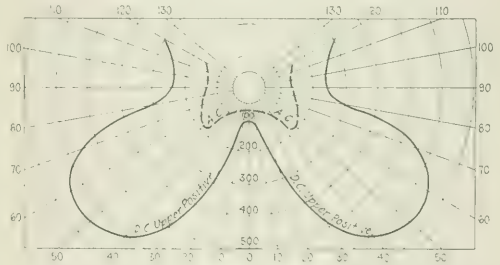



FIG. 1—CURVES OF INCLOSED ARC WITH PURE CARBON ELECTRODES

little fear of destroying their shape. In this condition they pass on to the furnaces to be baked; that is, to have the binder carbonized. Extraordinary care must be exercised in packing the electrodes in the furnaces so that no distortion of the pieces may occur, because they pass through a plastic stage during the bake. After baking, the solid electrodes of all sorts are inspected to eliminate all crooked or otherwise distorted pieces, are gaged to meet size requirements, and are then ready for shipment. Cored electrodes pass through the above steps, and then cores are squirted into the shells after baking. The coring is accomplished by forcing a very plastic mixture into the shell by pressure. After the material has become dry and hard the electrodes are ready for shipment.

## Physical Nature

Arc lamp electrodes must be straight, of uniform diameter and have a surface free from irregularities. Their hardness, density and specific resistance are more or less interrelated and are dictated by the service for which the electrodes are designed. Pure carbon electrodes having a low apparent density and a high specific resistance will give the most light since the heat will be conducted away from the crater along the electrode comparatively slowly. This type of electrode naturally will be consumed rapidly. The demands of the American consumer for long trim life require harder electrodes of higher apparent density and lower

specific resistance. This entails some sacrifice in candle-power, which, however, is more than compensated for by the life obtained.

The temperature at the arc ends of flaming electrodes must be kept as constant as possible because this is one of the conditions necessary to provide a uniform supply of vapor to the arc. If the apparent density is not uniform throughout the solid flaming electrodes the heat conduction from the crater end will not be uniform throughout the trim life. If the specific resistance is not uniform throughout the solid flaming electrodes, the heat developed at the crater ends will not be constant. The specific resistance should be low so that there will not be any appreciable change in voltage drop as the electrodes are consumed. Solid flaming electrodes have a somewhat higher specific resistance and real density than pure carbon electrodes owing to the flaming materials used. It is quite important to have the surface of these electrodes smooth and free from any irregularities that might increase the contact resistance at the holders since any unusual state that will vary the standard conditions at the arc will result in serious interference with the proper operation of the arc itself.

The poorly conducting soft core and small cross-sectional area of the long inclined trim type of cored flaming electrodes make their resistance high. Zinc or brass wires are run the length of the electrodes to offset this condition. Furthermore, the contact resistance of these carbons is kept as low as possible by having a metal contact between the electrode and the holder. Many manufacturers accomplish

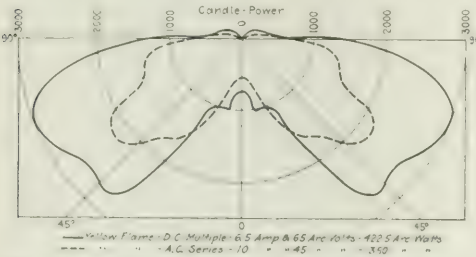



FIG. 2—DIRECT-CURRENT AND ALTERNATING-CURRENT ARCS WITH IMPREGNATED ELECTRODES

this by bending a flattened end of the core wire over the holder end of the electrode. This scheme is not successful since these flattened wires are easily broken and lost from the electrode so that good contact cannot be obtained. The disadvantages of the bent-over wire contact have been overcome by covering the entire holder end of the electrode with a metal tip in such a way as to provide good contact between the core wire and the metal tip. This scheme provides good contact between the holder and all parts of the holder end of the electrode itself instead of just along the narrow ribbon of flattened wire.

### Operating Characteristics

Having established the fact that an electrode is reliable and that it will burn satisfactorily under the conditions for which it was built, it is desirable to ascertain how long it will burn, what color light it will give and what candle-power will be obtained from it. In general, knowledge on all these points is necessary before one can determine the practical value of any electrode. The relative importance of these points remains very much as just given except that some commercial conditions may place more importance upon color and candle-power than upon life. In any case the reliability of the electrodes is of primary importance.

### Reliability in Operation

*Pure Carbon Electrodes.*—Electrodes give reliable operation when the arc may be started, stopped and re-started as desired, and burn normally without any interference arising from causes lying within the electrodes themselves. Pure carbon electrodes meet these demands when they are straight, of proper length and diameter for the lamp, and have uniform resistance values for any diameter and class, as is true of coke or lamp-black electrodes. There is very little chance of properly selected pure carbon electrodes not operating reliably, as is indicated by the discussion of these electrodes under previous headings. Most of the troubles encountered result from the use of electrodes of incorrect dimensions or from attempts to operate the lamps under conditions for which the electrodes were not designed. Graphitization of the points of pure carbon electrodes is one of the most common causes of irregular operation. A layer of graphitic carbon is deposited upon the points of one or both electrodes when the arc voltage drops to a certain value. With open-arc lamps this value is about 40 volts and with inclosed-arc lamps it is about 65 volts. After arcs have been operating at these low voltages and consequently with short arc lengths for some time, the graphitic coating appears and causes the arc to break frequently, the light becomes dim and blue, carbon particles are thrown off which blacken the globe and the electrodes spindle away in back of the graphitic layer. If the arc voltage and length become normal again the graphitic coating will gradually disappear. Any condition that will cause the arc voltage to be low or the arc length short, will produce graphitization.

*Flaming-Arc Electrodes of the Cored Type.*—Electrodes of this type depend upon a soft core to supply the flaming (light-giving and color-giving) materials to the arc. The cores must contain the essential materials in their proper proportion and must be securely held in place. The non-conducting slags such as are encountered with solid flaming electrodes do not appear if the lamps are operated properly. These electrodes are burned in an inclined position and at an angle of about 22 deg. to each other. The best operation is obtained when they are trimmed so that the arc is struck and maintained at certain arbitrarily chosen positions in the "economizer," a cup-shaped chamber placed above the arc to protect it from drafts and to prevent a too rapid dissipation of the heat. The electrodes as used in pairs must be of exactly equal lengths and of the proper diameter for the lamp in order to meet the conditions just given. The importance of the core wire and of good contact at the holders upon the lamp regulation has already been touched upon. Poor regulation of the lamps using cored-type flaming electrodes, whether brought about by any of the conditions just mentioned or by wrong adjustment of the lamp mechanism will result in the arc and the light being unsteady and of shortened life.

*Flaming-Arc Electrodes of the Solid Type.*—These electrodes, being much shorter and thicker than the cored type are not very liable to cause irregular operation from such conditions as occur with the cored electrodes. Solid flaming electrodes are burned in a vertical position, one electrode being directly superposed over the other so that any diameter or length may be chosen for each electrode, thereby giving greater flexibility to the design of the lamps. This method of burning the electrodes provides opportunities for the formation of non-conducting slags in positions where they can insulate the electrodes from each other. A slag is composed of flame materials which collect in a fused state in any position about the electrode points. It assumes well-defined forms which are due mainly to the nature of the materials used and to the conditions under which the electrodes are burned and are generally called "beads," "trees" or "rims," depending on their shape and position. It is possible for any one or more forms of slag to occur with the same trim of electrodes.

Slags may form either from the presence of excessive amounts of flaming materials at the points of the electrodes or from the condensation of the vapors of the arc stream

Any condition that will tend to lower the temperature of the arc will tend to form slag. Low current tends to form slag since there is not sufficient energy present at the arc to volatilize all the flame material. At present solid flaming electrodes are made for consumption in inclosed-arc lamps of a new type. Poor inclosure of the arc in these lamps due to any cause will increase the rate of carbon consumption, leaving an excess of flame material in a position to form a slag. An economizer is used in many makes of enclosed flaming arc lamps to decrease the burning rate of the upper carbon. Situated just above the arc it receives considerable deposit from the dust-laden gases which, when fused, may prevent the free movement of the electrodes. The arc must be situated in a neutral or symmetrical magnetic field to prevent it from being blown to some definite position where it might produce side-burned electrodes and slag.

### Life

*Pure Carbon Electrodes.*—The time taken to consume pure carbon electrodes is determined by the current density at the electrode ends and by the ease with which the supply of oxygen at the arc is replenished. The long life obtained from inclosed-arc lamps depends mostly on the second factor, since these lamps are built to supply as little fresh air (oxygen) to the arc as steady operation will permit. Increased current density increases the rate of consumption.

Many diameters and shapes of electrodes were made for open-arc lamps giving trim life values between six hours and twenty hours, depending upon the diameter and number of inches of the electrodes available for consumption. Ordinary electrodes had diameters from 7/16 in. up to ¾ in. and in most cases were round, although many elliptical, partly rounded, flat or plate electrodes were used. The standard length for the electrodes was 12 in. Copper and other metal coats were plated on the electrodes to decrease the rate of oxidization and thereby increase the life. With the smallest electrodes this scheme would add about one hour, or 15 per cent, to the trim life, and with the larger electrodes the life would be prolonged in approximately the same proportion. These metallic coats were more valuable, probably, in affording good holder contact and in reducing the voltage drop along the electrodes. As experience was obtained the importance of protecting these arcs from drafts of air which greatly shortened the life became apparent. It became obvious that a uniform trim life depended very largely on having the electrodes washed by only such drafts as would be created by the ascent of the hot gases from the arc.

The discussion covering open-arc electrodes has been written in the past tense as if such electrodes were no longer used. Such an impression would be incorrect, because many hundreds of thousands of these electrodes are consumed annually. In one of the best lighted cities in the United States use is made of a special plate type almost exclusively with quite satisfactory results. These electrodes are utilized in a specially constructed lamp, and a life of from twenty-five hours to seventy-five hours is obtained, depending upon the condition of operation and the size of the electrodes.

The inclosed-arc lamp, operating at lower currents and higher arc voltages than the open type, depends almost entirely upon the uniformity of its inclosure for uniformly high trim life values. While the current density of the electrodes does influence the life, its effect is secondary to that of the inclosure. As an illustration consider similarly made direct-current lamps operating at 5 amp and at 6.6 amp, with ½-in. by 12-in. solid pure carbon electrodes. The increase of 1.6 amp will decrease the trim life by about 1 per cent, while an almost imperceptible crack in the globe or chip along the gas cap surface will reduce the trim life by from 20 to 30 per cent. If fresh air enters at the bottom of the globe, this effect is most exaggerated.

Again, there are great differences between the trim life values obtained from the same lamp and similar electrodes when operated in-doors and out-doors. The effect of varying the inclosure upon the life may be shown to some extent by noting the effect of the weight of the gas cap in a lamp having a removable gas cap when other conditions are held constant. The tests recorded below were made in a 5-amp direct-current multiple lamp:

TABLE I—ELECTRODE LIFE

| Weight of Gas Cap, in Grams | Hours Burned | Hours per Inch |
|---|---|---|
| 260 to 275 | 222.5 | 26.3 |
| 170 to 180 | 162.9 | 19.4 |
| 45 | 147.25 | 17.3 |

It has already been pointed out that softer electrodes are consumed more rapidly. In so far as the electrodes are concerned, it is necessary that their diameter be uniform and of the exact size for the lamp in question, otherwise the air admitted to the globe around the electrodes may affect the life. An illustration of this will be given later.

### Flaming-Arc Electrodes

*Cored Type.*—The lamps burning cored flaming electrodes are of the open-arc type, showing many improvements over open-arc lamps burning pure carbon electrodes. The intro-

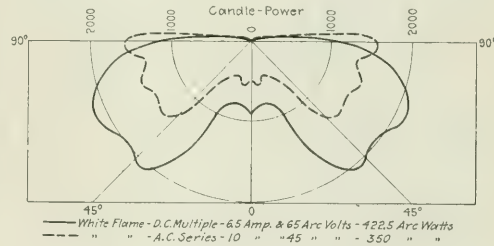



FIG. 3—DIRECT-CURRENT AND ALTERNATING-CURRENT ARCS WITH IMPREGNATED ELECTRODES

duction of deep protecting economizers and the use of globes admitting most of the fresh air around their top have been conducive to longer life and greater arc steadiness. Lamps are rated to burn from ten to thirty hours, the life being determined almost entirely by the length of the electrodes, although in some cases a partial inclosure of the arc is attempted in order to decrease the burning rate. The life may be prolonged somewhat by raising the arc in the economizer, while any lowering of the arc below its normal position will reduce the life materially. Electrodes short in length or small in diameter will not give the rated trim life. Any condition that will cause the arc to break frequently will tend to reduce the life because material will be pounded off the electrodes and unnatural drafts will be produced in the economizer.

*Solid Type.*—These electrodes are designed for service in inclosed-arc lamps built to burn from 70 to 125 hours, so that all that has already been said concerning the influence of inclosure upon the trim life of pure carbon electrodes applies here. The life is determined to some extent by the volt-amperes at the arc, higher wattage tending to give shorter life. Spindling of the carbons produced by high current, irregularly shaped points and the change of atmosphere accompanying arc rupturing all tend to shorten the life.

Table II illustrates the influence of inclosure on trim life, the variations in inclosure being made by varying the size of the gas-cap opening. Similar results will be obtained in

lamps using electrodes of diameters other than those used in this test, although the effect as expressed in percentage will not be the same. This experiment was performed in an inclosed flaming-arc lamp where it was possible to vary the size of the upper carbon passage (gas-cap opening) and in that way vary the inclosure.

The burning ratio between the two electrodes in focusing type lamps must be retained as designed by the lamp maker to secure the most advantageous use of the electrodes. Any change in the regularity of the electrode consumption that will alter this ratio will change the light steadiness and distribution, vary the globe deposit, and may result in the destruction of lamp parts from the heat of the arc. Globes that leak, and, in direct-current lamps, reversed polarity, are the most common causes of change of burning ratio.

### Color of Light

*Pure Carbon Electrodes.*—The light given by pure carbon electrodes has long been considered the nearest approach to daylight in color. The open arc was considered to give a nearer approach to daylight than the inclosed arc where the longer arc stream and higher arc voltage resulted in the emission of a greater amount of light at the blue end of the spectrum. Inclosed-arc lamps burning pure carbon electrodes at high current density have been developed which are now considered the nearest approach to average north sky daylight. In these lamps the effect of the blue rays is counterbalanced by those of longer wave-lengths emitted from the enlarged crater resulting from the high current



FIG. 4. EFFECT OF POLARITY ON INCLOSED ARC WITH IMPREGNATED ELECTRODES

density used. In general, it may be said that the ways in which the light given out by pure carbon electrodes may be varied are by changing the arc voltage, which increases the tendency to add blue to the light, and by increasing the

TABLE II.—EFFECT OF INCLOSURE ON EFFI

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | 8.3 | 0.900 | 6.16 | | 63.5 | | | 116.7 | 100 | |
| | 8.8 | | | | 62.9 | | 1.6 | 117.8 | 96 | |
| | 8.8 | 0.980 | 21.2 | 4 | 15.1 | 7.4 | | 98.4 | 84 | |
| | 8.8 | 1.000 | 31.6 | | | | 1.1 | 92.0 | 43 | |
| | 11.8 | 0.900 | | | 65.0 | | | 41.0 | | |

current density or using very soft electrodes to obtain red and yellow rays from the enlarged craters that are formed.

*Flaming-Arc Electrodes.*—As previously stated, electrodes of this type depend on certain chemicals incorporated within them for their color and also for their candle-power. Yellow and whites of various sorts are the colors most frequently used, and consequently are the kinds of electrodes most highly developed. Just what constitutes a yellow or a white is largely a matter of the personal opinion of each observer at present.

The yellow color of the cored type of electrodes in inclined open-arc lamps is accepted by many as a standard. If the arc operates normally throughout the burning period the color remains the same. Either inclosing the arc or increasing the current bleaches the color and it seems to fade. Yellow flaming arcs in inclosed lamps show this fading to a marked extent, as the excess air in the globe is consumed when the arc is started. As the current is increased the candle-power increases as does also the intrinsic brilliancy of the source, which may be considered the reason for the color becoming whiter, it being well recognized that the higher the intrinsic brilliancy of the source the whiter the light.

These same facts have been observed in general with white flaming arcs. The field for comparison is made more complex here, however, by the many different so-called whites, the most important of which may be called pearl whites (light yellows) and snow whites (blue whites). As a general observation it is more satisfactory to operate white flame arc lamps at 10 amp rather than at lower currents, the color being steadiest and most pleasing at this current.

In the most recent flaming-arc lamps for direct-current service, those of the inclosed, long-burning type, both electrodes are impregnated so that reversed polarity does not produce color changes and loss in candle-power such as is encountered in lamps using a neutral or very slightly impregnated negative electrode.

### Candle-Power

The property of commercial electrodes to yield light is their most important function, and some idea of the great efforts exerted to compare various light sources on a candle-power basis can be gained by even a casual glance through electrical literature. Mean spherical candle-power is the best basis for measuring the actual efficiency of various arc sources themselves, while a candle-power distribution curve of a given electrode in the lamp for which it was designed is the best measure of various arc-lighting units.

The candle-power of pure carbon arcs is determined by the size of the crater (the current density) and to some extent by the arc length. With flaming arcs the candle-power may increase somewhat with increased arc voltage, but this is not nearly so important as the current and the arc length where an increase in either, and especially in the current, is followed by an increase in the candle-power. As previously stated, white flame electrodes operate best at a current of 10 amp than at lower values. In addition to the steadier more pleasing color, the efficiency is greatly improved. Table III illustrates.

The writer has noticed in comments on the inclosed flaming-arc lamps in the recent literature that great concern was felt lest the high efficiency of the open-type flame-arc lamp would be sacrificed by inclosing the lamp, the various writers evidently having in mind the results that follow the inclosing of the pure carbon arcs. That such fears are groundless is shown by Tables IV and V, which compare inclosed pure carbon and flaming arcs with open-type (inclined electrode) flaming arcs, first in alternating-current multiple lamps and then in direct-current multiple lamps. In the case of the open-type lamps, where they were both to operate two in series across 110-volt constant-potential circuits, a resistor was submitted for the second lamp. The mean spherical candle-power readings noted in this paper relate to the arc itself, the proper corrections for glassware absorption having been made. The measurements were made on a standard sphere using the Sharp-Millar photometer box.

In alternating-current lamps it is clearly shown that even the least efficient solid-flaming electrode burning under in

closed-arc conditions is more efficient than the most efficient cored type electrode, while in direct-current lamps with two of the three colors measured, electrodes of the same color burn more efficiently under inclosed-arc conditions, and with the third color, the pearl-white electrodes, the difference in efficiency may fairly be considered insignificant.

These tables may be misleading, since they are built upon

TABLE III—OUTPUT AND COLOR OF LIGHT

| Type of Lamp | Current | Arc Volts | True Arc Watts | Mean Spherical Candle-Power | Mean Spherical Candles per Arc Watt | Color of Light |
|---|---|---|---|---|---|---|
| A. C. multiple, long-burning... | 7.9 | 57 | 417 | 985 | 2.36 | Pearl white |
| A. C. multiple, long-burning... | 10.2 | 47 | 443 | 1459 | 3.29 | Pearl white |
| A. C. multiple, long-burning... | 7.7 | 58 | 418 | 1020 | 2.44 | Snow white |
| A. C. multiple, long-burning... | 10.2 | 49 | 442 | 1396 | 3.16 | Snow white |
| D. C. multiple, long-burning... | 6.8 | 57 | 387.6 | 797 | 2.05 | Snow white |
| D. C. multiple, long-burning... | 10.0 | 48 | 480.0 | 1103 | 2.30 | Snow white |

a measurement of all the light rather than upon the useful light. For instance, the specific consumption of the inclosed arc would here be considered from three to eight times as high as that of flaming electrodes in alternating-current lamps and from three to five times as high as that in direct-current lamps. The facts under the conditions named are as shown, but do they truly represent the su-

TABLE IV—COMPARATIVE EFFICIENCY IN ALTERNATING-CURRENT LAMPS

| Type of Lamp | Electrodes | Color of Light | Amperes | Arc Volts | True Arc Watts | Mean Spherical Candles | Mean Spherical Candles per Watt |
|---|---|---|---|---|---|---|---|
| nclosed... | Pure carbon... | Blue white. | 16.2 | 72.6 | 409 | 231 | 0.58 |
| )pen..... | Cored flaming.. | Snow white.. | 10.0 | 46.0 | 399 | 752 | 1.88 |
| )pen..... | Cored flaming.. | Pearl white.. | 10.0 | 45.0 | 390 | 1062 | 2.72 |
| )pen..... | Cored flaming.. | Yellow..... | 10.1 | 44.0 | 384 | 1149 | 3.00 |
| nclosed... | Solid flaming.. | Snow white.. | 10.2 | 49.0 | 442 | 1396 | 3.16 |
| nclosed... | Solid flaming.. | Pearl white . | 10.2 | 47.0 | 443 | 1459 | 3.29 |
| nclosed... | Solid flaming.. | Yellow..... | 8.0 | 56.0 | 388 | 1538 | 3.96 |

TABLE V—COMPARATIVE EFFICIENCY IN DIRECT-CURRENT LAMPS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| nclosed... | Pure carbon... | Blue white. | 5.1 | 79.0 | 402.9 | 272 | 0.67 |
| )pen..... | Cored flaming. | Snow white.. | 10.0 | 45.0 | 450.0 | 732 | 1.62 |
| nclosed... | Solid flaming. | Pearl white.. | 9.8 | 49.0 | 485.2 | 976 | 2.03 |
| )pen | Cored flaming | Pearl white.. | 10.0 | 45.0 | 450.0 | 959 | 2.14 |
| nclosed... | Solid flaming | Snow white.. | 10.0 | 48.0 | 480.0 | 1103 | 2.30 |
| )pen..... | Cored flaming. | Yellow..... | 10.0 | 46.0 | 460.0 | 1223 | 2.69 |
| nclosed... | Solid flaming | Yellow..... | 7.0 | 60.0 | 420.0 | 1380 | 3.29 |

eriority of flaming arcs over inclosed pure carbon arcs? he accompanying distribution curves will give a truer mparison in so far as the interests of the arc lamp user re concerned. The curves of the inclosed arcs (Fig. 1) re quite characteristic, showing clearly the influence of ach crater and the arc stream on the distribution of the light. In each case the angle of maximum distribution is about 40 deg. below the horizontal, while with the flame lamps this angle lies between 20 deg. and 30 deg. below the horizontal, conditions recognized as giving a better light distribution. An analysis of the curves (Figs. 2 and 3) shows that the relative efficiency of the various types compared is practically the same in direct-current lamps whether based on the total flux or upon the distribution. In alternating-current lamps, however, it becomes quite apparent that a comparison based upon the total flux of light does not fairly show the superiority of modern alternating-current flaming-arc lamps over the older inclosed pure carbon arcs. In direct-current lamps flaming electrodes are from three to five times as efficient as inclosed-arc electrodes, while in alternating-current lamps the flaming electrodes are from five to fifteen times as efficient based upon their distribution and from three to eight times as efficient based upon their total light flux. These curves are not for lamps of the same current and arc voltage, but are taken as typical of each type of electrode in a lamp adapted for it.

The curves of Fig. 4 for the white flaming electrodes afford a comparison of the effect of the polarity upon the distribution. As is apparent to the eye of an observer, the curves clearly bring out the great increase in candle-power that accompanies the use of the lower carbon as the positive. In the curves shown the light output increases by more than 600 candles along the angle of maximum distribution when the only change is from an upper to a lower positive carbon. A better light distribution is obtained and the arc operates more steadily.

## Decreasing the Duration of Service Interruptions at Marion, Ind.

If a service interruption occurs on Sundays, holidays or at other times when most of the operating men and repair crew of a central station are enjoying a few hours' leisure, thirty minutes or more is generally required for getting together a sufficient force to attempt to repair the trouble. After experiencing several such delays in making necessary repairs after thunderstorms and similar occurrences, Mr. S. H. Smith, manager of the Marion Light & Heating Company, of Marion, Ind., evolved a system of organization which in a large measure reduces all such delays to a minimum.

According to the rules of this system, as soon as a storm cloud appears in the sky or the first clap of thunder is heard all of the operating and repair men telephone to the plant, giving their names, telephone numbers, whereabouts and their probable movements for a reasonable period of time as accurately as possible. These facts are recorded at the station by the man at the telephone, who is generally one of the operating force on duty, and if the occasion arises each man who has reported can be reached at the number he has given. The same rule has been adopted for holidays so that at all times it is possible to collect quickly a crew to repair almost any kind of service interruption.

All of the men in the operating and maintenance departments, including the manager, are included in the list of those required to make their whereabouts known. Following a service interruption the list of men calling can be referred to, and in case any man has failed to report it is shown on the record. When this man's attention has been directed to the breach of discipline by the manager and an explanation demanded it is very probable that the forgetful culprit will on the next occasion be the first to call the station and inform the man in charge of his telephone number and his immediate movements.

It is stated that instead of the thirty minutes which were formerly required to start to make repairs the present system usually shows a man close enough to the trouble to be "on the job" in less than one-third of that time.

# The Nitrogen-Filled High-Efficiency Tungsten Lamp

**Blackening of bulbs and its prevention -Introduction of nitrogen at atmospheric pressure to reduce filament evaporation and localize deposits by convection currents - Lamps of 4000 cp consuming 0.4 to 0.5 watt per candle over lives of 1500 hours**

BEFORE the meeting of the American Institute of Electrical Engineers held in New York City, Oct. 10, Dr. Irving Langmuir, Schenectady, N. Y., described the development and present status of the new nitrogen-filled tungsten incandescent lamp, presenting two closely related papers which President C. O. Mailloux in his introduction characterized as marking an epoch in electrical history and electrical progress. The first paper discussed the phenomenon of blackening in tungsten lamps and methods of preventing it. The second, prepared in collaboration with Mr. J. A. Orange, described in detail the high-efficiency tungsten lamps which have been produced by filling the bulbs with nitrogen vapor at about atmospheric pressure.

### Causes of Blackening in Tungsten Lamps

The modern tungsten lamp, as pointed out by Dr. Irving Langmuir in the first paper, has an absolute luminous efficiency of but 6 to 10 per cent based on perfect white-light production at 0.10 watt per candlepower, and monochromatic yellow-green production at 0.06 watts per candlepower. Tungsten lamps of to-day fail not by breaking of the filament, but by reduction in light-giving value due to blackening of the inner globe surface. With attempts to increase efficiency of lamp operation, this blackening process has been found to be greatly accelerated, thus heretofore placing a limit on the consumption efficiencies obtainable consistent with reasonable lamp life.



FIG. 1 — LOW-VOLTAGE NITROGEN-FILLED LAMP, 0.4 TO 0.5 WATT PER CANDLE

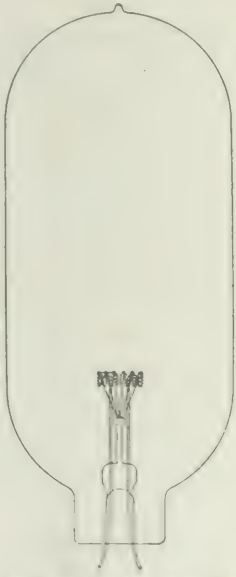


FIG. 2 — NITROGEN-FILLED LAMP FOR HIGH-VOLTAGE CIRCUIT.

Such blackening has generally been attributed to disintegration of the filament caused by traces of residual gas in the bulb, although in the case of lamps run at overvoltage evaporation of the filament was assigned as the cause. From analysis of possible sources of gas within lamp bulbs, the following gases were found by the investigators: Water vapor, carbon dioxide, carbon monoxide, hydrogen, nitrogen and hydrocarbon vapors. Further tests showed that water vapor is the only gas which produces perceptible blackening. Its part in this cyclic process is that of a carrier, the water oxidizing the tungsten and being itself reduced to atomic hydrogen. The tungsten oxide meanwhile becomes volatilized and deposits on the glass bulb where it is reduced by the atomic hydrogen back to metallic hydrogen with the formation of water vapor again.

But attempts to reduce the quantity of water vapor have resulted in failure, so that the author's conclusion is that while water-vapor reduces the life of poorly exhausted lamps, it can be nothing else than pure evaporation of the filament at high temperature which produces blackening in the case of well-exhausted bulbs. To prevent such blackening, due to evaporation, two methods are available; (1) to reduce the rate of evaporation by introducing into the bulb at atmospheric pressures such gases as nitrogen and mercury vapor, and (2) to change the location of the deposits by means of convection currents in gases inside the bulb, so that the glass opposite the filament will not darken. At atmospheric pressure this localized darkening effect of the convection currents in the gas becomes very striking, the globe on a level with the filament remaining perfectly clear, while a dark deposit gradually forms on the parts directly above the filament. Thus the introduction of an inert gas into the bulb at atmospheric pressure not only decreases the rate of filament evaporation, but by proper design of the lamp parts the presence of this gas may be made to prevent blackening of those glass surfaces through which light is transmitted, the result being to make possible increased lamp life at high efficiencies.

### Nitrogen-Filled Tungsten Lamps

In the second paper of the evening, Dr. Langmuir and Mr. J. A. Orange described practical applications of the principles already outlined. By the use of these they have been able to construct large tungsten lamps which, starting with an efficiency of 0.40 watt per candlepower, have run over 2000 hours, with an average efficiency of 0.5 watts per candle over that period.

Experiments with filaments of various sizes early indicated the desirability of using large diameters. The larger filaments gave not only a better efficiency at any definite temperature, but also a much longer life. Thus doubling the diameter decreased the consumption from 0.65 to 0.56 watt per candle, and increased the life from 90 to 300 hours. This improvement in efficiency is attributed to the relatively greater heat loss by convection from small wires. The life of the filament is determined largely by the loss of tungsten from the filament by evaporation, and has been found to be dependent on the relative decrease in diameter thus caused. The evaporation of tungsten in nitrogen is largely a diffusion process, and is nearly independent of the

size of the wire. The rate of evaporation per unit area is thus inversely proportional to the diameter. Relative lives of very small wires in nitrogen as therefore nearly proportional to the squares of their diameters.

But filaments of large diameter require very large currents to maintain them at the operating temperature, 2850 deg.; hence unless very low voltages are used, the power consumed by the larger wires is so large that only lamps of high candlepower could be made. To increase the effective diameter of the filament without decreasing its resistance, a tubular section might be used, but the more practical construction, and the one adopted, takes the form of winding the filament into a tightly coiled helix. Among the advantages incidentally obtained is the automatic correction of local overheating of thin spots in the filament, which would otherwise magnify themselves rapidly. But in the helical filament such an overheated soft spot will be pulled open by the normal tension and sag of the filament, preventing further progress of overheating by providing increased radiation and convection.

In ordinary lamps about 20 per cent of the energy radiated from the filament is intercepted by the glass and causes heating of the bulb. In the nitrogen-filled lamp, beside this radiated heat, there is an additional amount of heat carried to the bulb by convection—an amount varying with the type of lamp and ranging from 6 to 40 per cent. The convection currents carrying this relatively large amount of heat, travel vertically upward within the bulb, and if they strike a small area of glass, tend to overheat it. This overheating may liberate enough water vapor to cause attack on the filament and blackening of the bulb. The filament should therefore be placed in the lower part of the bulb, and sufficient area allowed in the upper glass surface for the deposit of tungsten nitride.

For bulbs of the same volume the nitrogen lamps give roughly from five to ten times the candle-power of evacuated lamps, but the bulbs of such filled lamps naturally run much hotter than those of ordinary lamps. The upper parts of the bulbs are often 100 to 200 deg. Cent. or more, while the lower parts are sometimes much cooler than this, although closer to the filament. Several special varieties of heat-resistant glass have been used for the bulbs, making considerably smaller sizes possible, as well as rendering it easier to get rid of water vapor.

Special lead-in wires have had to be devised to convey the heavy currents (20 to 30 amp) involved in the larger sizes of these new lamps. Platinum has been discarded entirely, even in the smaller lamp sizes, special alloys being substituted which have the same coefficient of expansion as the glass. Bulbs of special glass into which tungsten or molybdenum wire can be sealed directly, have also been tried. Where the leads enter from the top of the bulb, special precautions have to be taken to protect the wires against the high-temperature convection currents.

### Types of High-Efficiency Units

For the particular type of nitrogen-filled tungsten lamp at present furthest developed, lives of over 1500 hours at efficiencies better than 0.50 watt per candle have been obtained only in large units taking over 10 amp. Lamps running at 0.6 to 0.7 watt per candle, have been made in units taking at least 5 amp.

No serious difficulty has been met in making high-voltage lamps of this type, for in nitrogen at atmospheric pressure there is no tendency toward arcing, even at 250 volts. Many lamps taking 6 or 7 amp at 110 volts have been made up and run at 0.6 to 0.7 watt per candle, with a life of over 1000 hours.

A number of special types of nitrogen-filled lamps which have been made and tested are the following:

1. Large units of very high efficiency (0.4 to 0.5 watt per candle with a life of 1500 hours or more). These lamps take currents of 20 to 30 amp and (except in units over 4000 cp) are therefore best run from alternating-current circuits by means of small transformers or auto-transformers giving a voltage depending on the size of unit desired. Thus, with 30 volts and 25 amp, the power taken would be 750 watts and this, in a lamp of say 0.45 watt per candle, would give 1670 cp. Higher or lower candlepower may be obtained by using other voltages. A typical lamp of this kind is shown in Fig. 1.

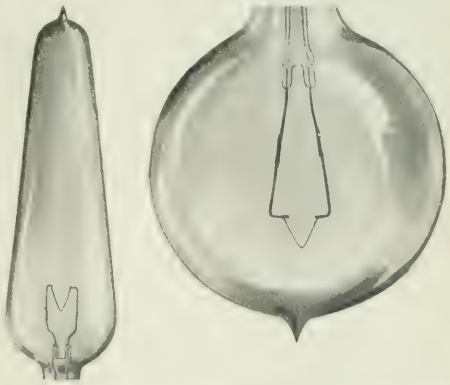
2. Small units of low voltage. These take currents of 10 amp or less and work at pressures as low as 4 or 5 volts. The efficiencies with 1000-hour life range from 0.6 to 1.0, or even 1.25 watts per candle, according to the current used. These lamps are adapted for series street lighting on 6.6-amp circuits (at 0.6 to 0.7 watt per candle), for stereopticon lamps, for automobile headlamps, and for use in general wherever a source of high intrinsic brilliancy, steadiness and white color is needed.

3. Lamps to run on standard lighting circuits (110 volts). Large units of this type (several thousand candle power) have efficiencies of 0.5 watt per candle or better. With smaller units the efficiency is ordinarily not so high. A type of this lamp is illustrated in Fig. 2. The leads may be brought in from the top, in which case they are preferably made very long so that the filament remains in the lower part of the bulb.

### Special Advantages of Nitrogen-Filled Lamps

Besides high efficiency, features of the new lamps which may prove of advantage are:

1. Color of the light. The temperature of the filament



FIGS. 3 AND 4—2000-CP AND 1500-CP NITROGEN-FILLED TUNGSTEN LAMPS

being 400 to 600 deg. higher than that of ordinary lamps, causes the light to be of a very much whiter color, so that it comes closer to daylight than any other form of artificial illuminant except the direct-current arc and the special Moore tube containing carbon dioxide. The color is almost exactly like that which can be had for a few minutes by running an ordinary tungsten lamp at double rated voltage.

Work is at present under way to develop special color screens which, when used with this light, will give a true daylight color (corresponding to the radiation from a black body at 5000 deg. Cent.). Such screens will absorb from 65 to 75 per cent of the light, so that the net efficiency will be about 2.0 watts per candle for a pure daylight color. With ordinary tungsten lamps, the absorption screens now used give a net efficiency of hardly 10 and 12 watts per candle.

2. High intrinsic brilliancy of the filament. At the operating temperature of the nitrogen-filled lamps the intrinsic brilliancy of the filament is about 1200 cp per sq. cm. In ordinary tungsten lamps, on the other hand, running at

[illegible] watts per candle, the filaments have a brilliancy of only about 1.50 candle power per sq. cm. This feature, combined with the high degree of filament concentration, renders these lamps particularly useful for projection work in head-lamps and stereopticons.

3. Constancy of characteristics during life. It is often possible to design these lamps so that their current, pressure, and candle power characteristics remain practically fixed during the greater part of their lives. In any case, however, since there is no deposit on the bulb to cut off the light, the candle power practically never falls below 75 per cent (this decrease sometimes being due to sagging). The lamp usually fails by the breakage of the filament, with the candlepower well above 80 per cent of its original value.

The spherical candle power of many of these lamps has been measured. The ratio of mean spherical to maximum horizontal (practically mean horizontal also) candle power has been found to average about 84 per cent for the lamps made with single loops of helically wound wire.

As an appendix to their paper, the authors also outlined methods of photometering the new high-efficiency lamps with the aid of blue-glass screens. The constants for these glasses having been once determined, there are available a number of standard temperatures ranging from 2250 to 3600 deg. K. By the use of these screens it is an easy matter to set a lamp up at a voltage such that the filament has a standard temperature, say 2850 deg. To do this it is simply necessary to adjust the voltage so that the color of the light from the lamp is the same as that which comes from the standard lamp when viewed through one of the special blue screens.

*Discussion*

Those who took part in the discussion of the two papers were Messrs. John B. Taylor, John W. Howell, Farley Osgood, J. E. Randall, William McClellan, John W. Lieb, Jr., H. M. Fales, and M. G. Lloyd.

Mr. Taylor projected on the screen an enlarged image of a nitrogen-filled lamp backed by a reflector, and called attention to the advantages of the new unit for projection-lantern purposes. Compared with the usual arc source, it is much more convenient and uniform in operation, and almost as white in color.

Mr. Howell complimented the researches of Dr. Langmuir, particularly his painstaking experiments giving rigorous proof of what were hitherto only theories. But taking exception to the author's statement that ordinary tungsten lamps fail chiefly by blackening of the bulbs, the speaker pointed out that this observation was intended to apply only to large lamps, and is not true of the small sizes which constitute 75 per cent of the present commercial output. Lamps like the 40-watt units remain useful until the filament breaks or weakens due to evaporation. Their bulb area, being relatively large, greatly reduces visible blackening. Mr. Howell said he had long recognized three kinds of blackening, the chief of these actions being that due to evaporation, which advances uniformly during the life of the lamp. Many lamp authorities have in the past held this theory. Irregular or mottled discolorations, on the other hand, may be traced to the presence of a residual gas. The presence of water vapor affects carbon and tungsten lamps very differently as shown by examples which the speaker exhibited. Water vapor in the carbon lamp renders the filament sooty and black, increasing its radiation and reducing its candlepower by one-half, although the globe remains clear. Later this soot is deposited on the glass, causing blackening.

Mr. Randall submitted a tabulation representing an attempt to evaluate recent progress in lamp development. If 90 per cent of the theoretical candlepower-hours are developed in 1000 hours' burning (candlepower maintenance and mortality being both considered) the advance from the raw carbon lamp, fixed as 100, he estimated as follows:

| | |
|---|---|
| [illegible] | 100 |
| [illegible] | 115 |
| [illegible] | 140 |
| [illegible] | 205 |
| [illegible] | 250 |
| [illegible] | 350 |
| [illegible] | 600 |

Mr. Lieb remarked that the central station has long since passed the period of showing fear at improvements in the state of the art, and now looks forward with cheerfulness and satisfaction to the introduction of more efficient lighting units as hastening the hoped-for day when electric light will be as accessible as kerosene in the humblest homes. Under competition with the new incandescent illuminant, the arc lamp, predicted Mr. Lieb, will itself shortly make rapid advances.

Mr. Fales pointed out that the telephone companies look to the new incandescent street lamps to replace arcs and thus to eliminate the "noise" troubles often caused by induction from humming in arc circuits.

In concluding the discussion Dr. Langmuir reviewed a number of the points brought up by the speakers. The greater brilliancy of the inner surfaces of the helix he attributed to cross reflection of light, rather than to reduced radiating aperture which, as he showed, could cause only 10 to 15 per cent difference. At very low pressures, uniform blackening deposits can be obtained on the glass, while convection currents are set up only at higher pressures. Dr. Langmuir expressed regret that his paper left the impression that he claimed to have been the first to attribute blackening to water-vapor causes, for this view, he said, has been held by others for many years. His own work, he explained, was intended only to demonstrate that all the other bulb gases are inactive and that water vapor is the only one to be feared.

As to the possibility of making nitrogen-filled lamps in small units, the speaker expressed doubt, although he expressed belief that beginning with the 500-watt size, or even smaller, the new lamps can be made in units ranging up to 25,000 or 50,000 cp, with ultimate efficiencies of possibly 0.3 watts per candlepower. Argon at higher pressures, he said, now holds promise of being a great improvement over nitrogen as a gas filler for incandescent lamp bulbs.

The results thus far obtained indicate that argon will be substituted for nitrogen in the lamps just as soon as the rarer gas becomes readily available on a commercial scale. Being one of the rare constituents of the atmosphere it is very difficult to produce in small quantities, but on a large scale it can be made very cheaply, comparatively speaking, and will, according to Dr. Langmuir, afford an improvement over nitrogen.

In the process of exhausting lamps, the author questioned whether the size of the constriction, however large, would have any effect on the completeness with which the water vapor is removed, unless a high temperature is maintained at the same time. On account of their heavy filaments the new lamps, he explained, are quite free from showing frequency flicker, even at 25 cycles.

The pressure at which the present "half-watt" lamps are filled with nitrogen—about two-thirds atmosphere when cold—was selected, said Dr. Langmuir, so that when hot the internal pressure becomes just about that of the atmosphere. No advantage would be gained by using higher pressures, which would only increase the likelihood of lamp explosions accompanied by outward-flying glass particles. The new lamps have proved to be extremely stable, he added, none having been broken in handling or shipment. In closing the author paid a generous tribute to the work of Dr. W. R. Whitney of the laboratory staff.

# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Toronto's Vehicle-Charging Rate to Encourage Large Use

For electric-vehicle charging service the Toronto (Canada) Electric Light Company, Ltd., tenders a special rate which is designed to encourage larger use of customers' cars by rapidly reducing the equivalent cost as the monthly consumption of kilowatt-hours increases. The Toronto schedule begins with a rate of 5 cents per kw-hr. for the first fifty hours' use of the month's maximum demand, while for the second fifty hours' use the charge is but 1 cent per kw-hr. For all energy consumed beyond 100 hours' use of the maximum demand in any one month the rate is but 0.5 cent per kw-hr. On this basis the average return ranges from $10 to $12 per month per vehicle. At the present time 125 pleasure cars and twenty electric trucks are in use in Toronto.

## Electric Operation of Pea-Viners in Michigan's "Cloverland"

Wallace, a community of eleven houses, two stores, two churches and a blacksmith shop, situated in the heart of Upper Michigan's "Cloverland" district, is probably the smallest village in the country receiving twenty-four-hour central-station service. Every house with one exception is lighted by electricity, energy being received over the 33,000-volt transmission line of the Menominee & Marinette



FIG. 1—OUTDOOR SUBSTATION AND ELECTRICALLY DRIVEN PEA-VINERS AT WALLACE, MICH.

ght & Traction Company from the latter's Menominee unt 16 miles distant.

But while Wallace may be the smallest electrically lighted wn, its chief distinction is in having the largest electrically erated pea-vining plant in the world, which is right at t farmers' doors. Five pea-viners were in operation this son and the number will be increased to fifteen next year. During the 1913 season one of the canning factories alone bought $35,000 worth of green peas from the farmers of the vicinity. As one of the illustrations shows, the green-pea vines are hauled in to the viners at Wallace by wagon. After being threshed, they are then loaded into boxes without handling and are transported to a canning factory at Menominee by motor trucks, as depicted in the



FIG. 2—ELECTRIC PEA-VINING PLANT OPERATED FROM CENTRAL-STATION 33,000-VOLT LINE

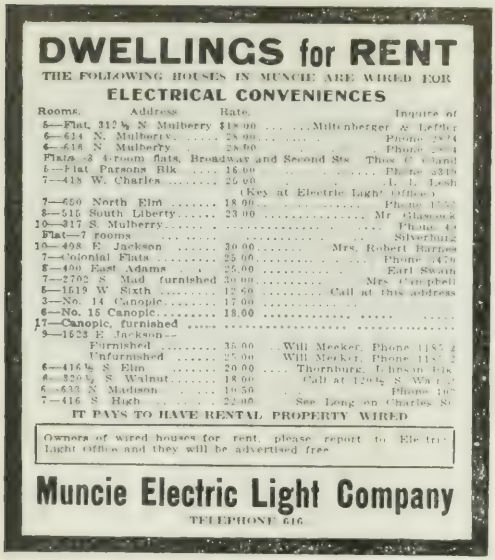
same illustration, which shows a familiar scene at Wallace during the canning season.

The electrical installation at Wallace comprises a bank of three 25-kw, 33,000/220-volt, 60-cycle, single-phase transformers, which, with the lightning-arrester equipment, are owned by the power company. There are two 20-hp, 220-volt, three-phase motors, each operating a pair of viners, and a 10-hp motor driving one viner. A rating of 7.5 hp per viner is considered ample, but the Michigan Refining & Preserving Company, which owns the plant, insisted on having abundant power capacity provided. The pea-vining plant was operated eight weeks during the season just closed.

The energy required by the vining machine varies with the yield and variety of peas, ranging from 166 watt-hr. for a 21-lb., twenty-four-can case of "Alaskas" down to 122 watt-hr for a case of "sweets." At 2.75 cents per kw-hr. the cost of vining an average case (144 watt-hr.) would therefore be 0.37 cent. One of these viners was operated by steam during a preceding season, and it is understood that electric drive has cost hardly half the outlay formerly necessary for engine operation. The chief reason for converting to electric drive was, however, the undesirable variation of speed inherent with the steam engine, which has been avoided with constant-speed motor drive. To shell peas properly, according to Mr. Edward Daniell, general manager of the power company, the viners must be run at a certain speed. If the speed is too slow some of the pods will not be opened, and if too fast the peas become bruised and are rendered unsuitable for canning. This matter of dependable, unvarying drive was, therefore, one of the principal considerations in giving up engine operation.

## Advertising Wired Dwellings for Rent

As an inducement to the owners of rentable property to have all of their houses wired the Muncie (Ind.) Electric Light Company is displaying in the daily papers a list of the vacant wired properties. The advertisement is headed "Dwellings for Rent," below which is the statement that the properties listed are wired for electric service. In addition to the address of each house that is for rent there are given in the "ad"the rent per month, the number of rooms and the address or telephone number of the owner or real estate broker in charge. The owners of wired houses are requested to report vacancies at the office of the company so that the property may be listed in the daily advertising. At one time in the early spring months the number of vacant wired houses was reduced to four by this method of advertising, but, as will be seen, at the present it has increased



**DWELLINGS for RENT**

THE FOLLOWING HOUSES IN MUNCIE ARE WIRED FOR

**ELECTRICAL CONVENIENCES**

| Rooms. | Address | Rate. | Inquire of |
|---|---|---|---|
| 8—Flat, 312½ N. Mulberry | | $18.00 | ....Miltenberger & Leffler |
| 6—614 N. Mulberry | | 28.00 | Phone 2874 |
| 6—618 N. Mulberry | | 28.00 | Phone 2874 |
| Flats—3 4-room flats, Broadway and Second Sts. | | | Thos. C. Laird |
| 5—Flat Parsons Blk | | 16.00 | Phone 3319 |
| 7—418 W. Charles | | 25.00 | L. L. Lash |
| | | (Key at Electric Light Office.) | |
| 7—650 North Elm | | 18.00 | Phone 1553 |
| 8—516 South Liberty | | 23.00 | Mr. Glascock |
| 10—317 S. Mulberry | | | Phone 47 |
| Flat—7 rooms | | | Silverburg |
| 10—408 E. Jackson | | 30.00 | Mrs. Robert Barnes |
| 7—Colonial Flats | | 25.00 | Phone 1479 |
| 8—400 East Adams | | 25.00 | Earl Swain |
| 7—2702 S. Mad. furnished | | 30.00 | Mrs. Campbell |
| 6—1619 W. Sixth | | 17.00 | Call at this address |
| 3—No. 14 Canopic | | 17.00 | |
| 6—No. 15 Canopic | | 18.00 | |
| 17—Canopic, furnished | | | |
| 9—1623 E. Jackson— | | | |
| Furnished | | 35.00 | Will Meeker, Phone 1185 J |
| Unfurnished | | 27.00 | Will Meeker, Phone 1185 J |
| 6—416½ S. Elm | | 20.00 | Thornburg, Johnson Blk. |
| 6—320½ S. Walnut | | 18.00 | Call at 120½ S. Walnut |
| 6—638 N. Madison | | 16.50 | Phone 106 |
| 7—416 S. High | | 22.00 | See Long on Charles St. |

IT PAYS TO HAVE RENTAL PROPERTY WIRED

Owners of wired houses for rent, please report to Electric Light Office and they will be advertised free.

**Muncie Electric Light Company**

TELEPHONE 616.

ADVERTISEMENT GIVING LIST OF WIRED DWELLINGS FOR RENT

owing to the building which has been done in the summer months. On account of the twofold results accomplished—that is, inducing owners to wire their property and keeping wired property occupied, so that it will be earning money for the company—the Muncie company deems it good policy to run the advertisement continuously and keep the list up to date.

## Results with Central-Station Vehicles at Memphis

In its own service the Memphis (Tenn.) Consolidated Gas & Electric Company now operates five electric vehicles. Two are 1000-lb. Urban trucks with lead batteries, and the other three, all Detroit cars with nickel-iron cells, comprise a 2000-lb. truck, a 3000-lb. truck and a light roadster. In service over gravel-paved streets in moderately hilly districts these cars have averaged energy consumptions of 0.6 kw-hr. to 0.9 kw-hr. per mile traveled. The Urban trucks perform about 25 miles per day and the Detroits 40 miles per day. Repairs and maintenance have cost about 6.25 cents per mile, divided as follows: Batteries, 2.75 cents; tires, 2.5 cents, and car, 1 cent. The dependability of these electric vehicles and the fact that they are ready for service whenever wanted are points named by the local electric company in expressing its satisfaction with the use of these cars for its own city service.

Thirty commercial vehicles and 150 pleasure cars are also in the service of customers of the Memphis company, representing a monthly battery-charging output of 35,000 kw-hr. The rate for this service is based on a monthly charge of $1 per kw connected plus 3 cents per kw-hr. used. The average monthly consumption is about 170 kw-hr. for pleasure vehicles, and the corresponding central-station return is $8.20. For customers' electric trucks the consumption ranges around 800 kw-hr. and the monthly income is about $35.

## Central-Station Energy for Ice Making

To the use of central-station electric energy for the operation of refrigerating plants hearty recommendation was accorded by several delegates to the third Western meeting of the American Society of Refrigerating Engineers held at Chicago during the recent International Congress of Refrigeration. Raw-water ice was the first subject up for discussion. Mr. H. D. Pownall, Canton, Ohio, declared his belief that electrically driven raw-water ice plants will be the final choice of all engineers in the future. Ice companies, he said, have a great opportunity to obtain desirable electric-service rates in the summer, when the outputs of central stations are low and the demand for ice is greatest. Electrically operated ice plants require less initial investment, less operating attention, a smaller depreciation allowance and less ground space. Cost of energy alone should not be the basis on which different motive powers are compared, since the interest on investment, the depreciation fund required and the amount of labor necessary must also be considered.

Mr. Louis Block, New York City, disagreed with Mr. Pownall on the practicability of using central-station energy, taken from the economic viewpoint, saying that it is cheaper to generate the energy at the ice plant.

In answer to this Mr. Pownall declared that he was ready to prove the economy of such operation to anyone who doubted it, as a number of plants erected by the Arctic Ice Machine Company, with which he is connected, have proved a financial success, operating on central-station energy. Electrically operated plants in New York built by this company are obtaining energy from the Brooklyn Edison company at 0.875 cent per kw-hr. This rate requires that the motors be kept off the lines from 4 p. m. to 8 p. m. during the winter months. Even if the electric-service cost were 50 cents per ton of ice manufactured against 20 cents per ton with steam or producer gas, Mr. Pownall insisted that it would often be found profitable to use central-station energy because of the elimination of large depreciation funds and interest on investment occasioned by the installation of isolated generating plants.

Mr. Thomas Shipley, of York, Pa., is a believer in distilled-water plants and said that people want pure ice. Remarkable results, he said, are being obtained in Germany, where 22 lb. of ice is being produced with 1 lb. of coal.

Such high economies, Mr. Pownall said, can be obtained only with distilled-water plants where multi-coil evaporators are used, and these involve heavy additional expense due to interest on investment and depreciation. He believes that raw-water ice lacks the peculiar taste of distilled-water ice. Furthermore, it is as pure as health authorities will likely ever require, since the impurities and bacteria are thrown off with the core water.

Mr. W. J. May said that the fuel cost in New York is from 50 cents to $1 per ton of ice manufactured, and that steam-driven plants cost from twice to three times as much to operate as motor-driven factories.

Mr. L. C. Nordmeyer, of St. Louis, gave a résumé of a paper delivered at one of the sessions of the Congress on Refrigeration, comparing the initial investment, interest

depreciation and operating cost of plants equipped with simple and compound engines and with oil-engine-driven generators supplying energy for electric drive.

Dr. D. S. Jacobus, of New York, spoke of the possibilities of combining electric generating stations with ice plants, operating the latter during off peak periods to utilize the by-product distilled water and electric power.

Mr. A. S. Stahl, of South Bend, Ind., described an electrically operated ice plant in that city which employs the vacuum principle and is commercially successful. The first one of its kind was erected in Baltimore several years ago but proved a failure owing to lack of refinements. The one which he described is a 30-ton plant, but he intends increasing its capacity to 150 tons. The total cost of manufacturing the ice by this method, including interest, depreciation, labor and energy, amounts to 47 cents per ton.

The meeting closed with a discussion on the "flooded" type of ammonia condenser invented by Mr. Block, which is said to be proving successful. Mr. Peter Neff, of Canton, Ohio, presided at the meeting.

## Formal Invitations to Brooklyn's Edison Shop

On Sept. 29 the Edison Electric Illuminating Company of Brooklyn, N. Y., held its first annual fall opening. News of the coming event was spread by mail among 5000 of the company's best residential and apartment-house cus-

**The Edison Electric Illuminating Company of Brooklyn**

Invites you to attend a demonstration of Electric Cooking and Heating Devices at the

**Edison Shop**

Three Hundred Sixty Pearl Street

On Monday, September the Twenty-ninth

From ten a. m. to five p. m.

The showing of goods electrical will be unusually interesting, including many new appliances that add greatly to the comfort of a modern home

A novel feature will be the first public demonstration of an electric fireless cooker which roasts, bakes, boils, steams, stews and fricassees—does anything any oven or fireless cooker can do.

Music, Two to Five — Refreshments Electrically Cooked

FIG. 1—FORMAL INVITATION TENDERED TO CUSTOMERS

mers by means of engraved invitations, one of which is reproduced herewith. For the occasion the Edison shop as decorated with artificial electrically lighted flowers id equipped with numerous household appliances ready operate. Several manufacturers of heating and domestic devices supplied the services of women demonstrators r the day, so that no interested visitor lacked attention d all devices were shown at their best. A motor-driven ano furnished music throughout the reception except during the hours from 2 p. m. till 5 p. m., when the orchestra ferred to in the invitation was in attendance. It was timated that the number of visitors calling at the Edison hop during the day was between 1500 and 2000.

Among the many devices shown in the exhibit the new styles of lamp fixtures seemed to attract most attention. The extensive use of pressed brass in these fixtures has reduced the cost of manufacture so that they are within the reach of the family of moderate means. The demonstration of the electric fireless cooker was also of much interest to the women visitors.



FIG. 2—BROOKLYN'S EDISON SHOP READY FOR ANNUAL FALL OPENING

## Monthly Consumption of Vehicles and Trucks

From the office of this journal inquiry blanks were recently sent out to central stations known to be doing a vehicle-charging business, replies being requested to questions concerning the monthly kilowatt-hour consumption of and monthly income derived from electric pleasure cars and commercial trucks. Tabulated herewith are some of the figures received, chosen from representative communities of various sizes in widely separated sections of the country. While the data obtained are not so complete as might be desired, the figures presented give a good idea of average conditions in this country. For example, the table reveals an average kilowatt-hour consumption for pleasure vehicles of 169 kw-hr. per month. The average rate earned per kilowatt-hour is 4.15 cents, and the average central-station income per car per month is $7.01. For electric trucks the average monthly energy consumption is 980 kw-hr., and the average monthly income per truck is $33.18.

ENERGY CONSUMPTION AND INCOME FROM VEHICLES AND TRUCKS

| City | Pleasure Vehicles | | | Commercial Trucks | | |
|---|---|---|---|---|---|---|
| | Number in Use | Kw-hr. per Month | Monthly Income | Number in Use | Kw-hr. per Month | Monthly Income |
| Brockton, Mass | 25 | 135 | $9.59 | 9 | 2180 | $52.32 |
| Columbus, Ohio | 400 | 200 | 8.00 | .... | .... | |
| Denver, Col | 822 | .... | .... | 52 | .... | |
| Memphis, Tenn | 150 | 170 | 8.20 | 30 | 800 | 35.00 |
| Meridian, Miss | 2 | 97 | 4.85 | .... | .... | |
| Mobile, Ala | 59 | 264 | 10.56 | 1 | 208 | |
| Montgomery, Ala | 8 | 180 | 3.60 | .... | .... | |
| Muskogee, Okla | 30 | .... | 7.00 | 10 | .... | |
| Portland, Ore | 55 | 165 | 7.00 | 35 | 1000 | 20.00 |
| Rochester, Ind | 2 | .... | .... | 2 | 750 | 30.00 |
| Schenectady, N.Y. | 14 | 100 | 5.00 | 1 | 716 | |
| Turner's Falls, Mass | 1 | 211 | 6.33 | .... | .... | |
| Worcester, Mass | 10 | | 20.00 | 14 | 1200 | 28.60 |

# Illumination and Wiring

## Inverted-Magnetite Lighting at Dixon, Ill.

Since Sept. 15 the main street of Dixon, Ill. has been lighted by a permanent decorative installation of forty inverted magnetite-arc lamps carried on brackets on the steel trolley posts. The lamps are spaced at intervals of 100 ft. and are suspended at a height of 18 ft. above the



NIGHT ILLUMINATION AT DIXON, ILL.

pavement. Merchants and adjoining property owners defrayed the cost of installation, the city paying for the operation of the lighting at the rate of $47 per lamp-year. The lamps burn from dusk until 11 p. m. daily, and until midnight on Saturdays. The citizens of Dixon are now paying at the rate of $1.50 per capita for their street lighting. So pleased were the merchants with the new ornamental lighting that on the second day after the first installation of forty was turned on a subscription was raised for installing twenty-seven more. Dixon has a population of about 10,000 and is the headquarters for the Illinois Northern Utilities Company, which operates in over 4500 sq. miles of territory in Northern Illinois, as described recently in these pages.

## Proposed Special Lighting for Monroe Street, Chicago

The Monroe Street Improvement Association has been formed in Chicago, and one of its objects is to bring about a private system of arc street lighting, similar to that in use on Dearborn Street and such as is proposed for Clark Street, all in the downtown Loop District. Mr. Herbert A. Seward is the consulting engineer. It is planned to install seventy-four multiple flame-arc lamps on Monroe Street for a distance of eight blocks between Michigan Avenue and the Chicago River. Some of the lamps will be attached to brackets on the tubular steel poles supporting the street-railway span wires. The lamps will be suspended 25 ft. above street grade and about 100 ft. apart. Estimating the cost from experience with the similar installation now in operation on Dearborn Street, the labor, material and wiring will cost about $180 a lamp, and the operating cost will be, including maintenance and electrical energy, about $33 per lamp per year. It is hoped to obtain electrical energy, through the city, from the Sanitary District of Chicago at cost, but inasmuch as the load on the hydroelectric system of the Sanitary District is rapidly approaching the total rating, there is some doubt whether electricity can be obtained from this source. If not it will have to be purchased from the Edison company.

## 148 Search-Lamps for Panama Exposition Lighting

For the Panama-Pacific International Exposition, to be held at San Francisco, Cal., in 1915, there has been ordered the largest installation of electric search-lamps ever assembled. This equipment includes 48 36-in., 100 30-in., 200 18-in. and 100 13-in. projectors. The total effective spherical candle-power of these lamps numbers over 690,000, and the total beam candle-power is rated at 3,500,000,000. Even with such a large amount of light available, the general intensity of the light on the buildings will not exceed 2 ft.-candles.

For supplying the direct current required for the search-lamps two 1000-kw and two 250-kw motor-generators will be installed. The 250-kw sets will be three-machine units and will be used as balancers in addition to generating direct current for the search-lamps. In order to minimize the quantity of copper required to carry the heavy currents required by the projector lamps, the motor-generator sets will be installed in small substations located in the various exposition buildings.

## Electric Sign for Town Identification

The use of electrically lighted billboards to advertise the commercial advantages of municipalities has now become a common practice. Less attention has, however, been given to the placing of electric signs on routes frequented by automobilists for the purpose of setting forth the names of communities. The accompanying photograph illustrates a sign of this kind erected a few days ago in the famous old Berkshire County town of Lee, Mass. The installation was made at the suggestion of a prominent selectman and has




LIGHTING A TOWN ELECTRICALLY

already brought results beneficial to hotel-keepers and business houses in the community. The sign is about 4 ft. long, 18 in high and 6 in. wide and is carried by a pipe-bracket arm. The wooden pole which supports it stands in the center of the town common, the lettering being about 12 ft above the ground. The sign is operated all night long by the Lee Electric Company, six 40-watt tungsten lamps f[illegible]

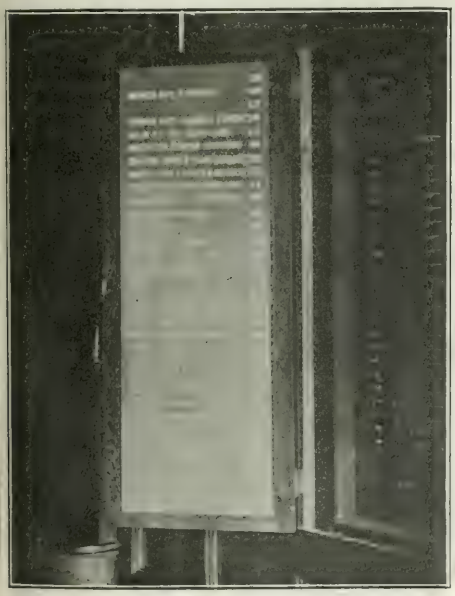
nishing the illumination. By the use of the raised electric letters the sign is equally useful by day or night and can be read from a rapidly moving automobile or interurban trolley car at a distance of over 100 yd. In a number of instances it caused travelers to interrupt their journeys and to spend several dollars before continuing their trips.

### Reducing Tungsten-Lamp Breakage

The method which was used by some central stations and railroads in the early days of the tungsten lamp for reducing lamp breakage is now being applied with success to tungsten units on traveling cranes in steel mills. In many instances the lamps are suspended from the crane by springs. This precaution having been found insufficient, one operator bridged a 32-cp lamp permanently across the terminals of the knife switch controlling the crane lamps. In this manner the filaments of the lamps received enough energy at all times to heat them to nearly a dull red. Under these conditions tungsten is much more ductile than when it is cold and, of course, the breakages due to vibration of the crane are reduced to a minimum.

### Improved Lettering in a Lighting Cabinet

In labeling the switches of lighting installations reliance is often placed upon mere typewritten lists of switch and circuit numbers in the wiring cabinets at important distribution centers, the result being that delays are caused on account of the difficulty met with in reading the labels. The accompanying photograph of a lighting cabinet in a New England church shows how this practice has been



LEGIBLE LETTERING OF PANEL CIRCUITS

improved by the tabulation of the switch numbers and corresponding circuits in white painted letters, ¾ in. in height, on the slate panel of the box door. Manipulation of switches is greatly facilitated by such large legible letters, since the cabinet itself is in a dark hallway and is not provided with special illumination.

# Letter to the Editors

### Two-Phase to Three-Phase Auto-Transformer

*To the Editors of the Electrical World:*

Sirs:—In the issue of the *Electrical World* for Sept. 20 there appears on page 589, a description by Mr. Roy E. Uptegraff of a "two-phase, three-phase auto-transformer." At the end of the article in question credit for the devising of this method is given to Mr. William T. Taylor.

On page 962 of the *Electrical World* for Nov. 16, 1907, there was published a description of a similar method of connections for three transformers. This article also credited the method to Mr. Taylor as his invention and mentioned the fact that a patent had been issued to him on Oct. 29, 1907.

That this method of connecting transformers is not new, that it did not originate with the above-named gentleman and that it was not new at the time it was reported that a patent was issued is evidenced by the fact that the writer installed such a system of transformers and connections for supplying energy over the entire distributing system of the Central California Electric Company (now a part of the Pacific Gas & Electric Company's system) in the city of Sacramento in 1903. This system of both two-phase and three-phase distribution from four conductors was in continuous operation for nearly three years, after which time it was altered to a straight three-phase system and merged with the parallel system of the Pacific Gas & Electric Company (at that time the Sacramento Electric, Gas & Railway Company).

Originally the Central California Electric Company had a three-phase system with Scott three-phase, two-phase transformation through two transformers. In making enlargements and other changes new transformers of 300-kw rating were installed, there being two sets of three each. The identical connection above referred to was employed on the secondary (2400-volt) side, and the transformers were built and specified for this purpose. In operation both two-phase and three-phase motor and single-phase lighting circuits received energy from the four-conductor leads.

The development and use of the three-phase to two-phase, three-transformer transformation in Sacramento was the result of peculiar local conditions which might be of some interest historically. How far this method may have been known or used in 1903 I do not know. It is extremely simple and might easily have been developed by anyone who wished to work out various methods of phase transformation. Conditions in Sacramento were such that I desired to use three transformers which could eventualy be star-connected on the primary side when the line voltage should be raised. After deciding that there could be no objection to this method of connections, although I had never heard of such being used in actual practice, I made some inquiry to ascertain if it had ever been used, but could obtain no record of such use. I thereupon made specifications for the transformers. Two sets were ordered, one from the Westinghouse company and the other some time later from the Stanley company, the designs being quite different. The taps and ratios were the same, and the transformers operated in parallel about three years with the secondaries connected in the manner in question, the performance being quite satisfactory.

I have no doubt that Mr. Taylor, even as late as 1907, had not heard of the use of the arrangement employed at Sacramento, and hence thought the idea to be original with himself. I do not desire to enter into any controversy or in any way to depreciate Mr. Taylor's efforts toward the advancement of electrical science. I desire simply to state facts and if credit is due to anyone, let it go where it belongs.

*San Francisco, Cal.* Rudolph W. Van Norden.

# Field of the Operating Engineer

**A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers**

## Locating Grounds and Open Circuits on Series Arc Systems

A clear and simply worded account of the standard methods of locating faults, grounds and open circuits in the case of outages on series arc circuits was presented before the recent convention of the Michigan Section, N. E. L. A., by Mr. D. W. Hayes, Ann Arbor, Mich.

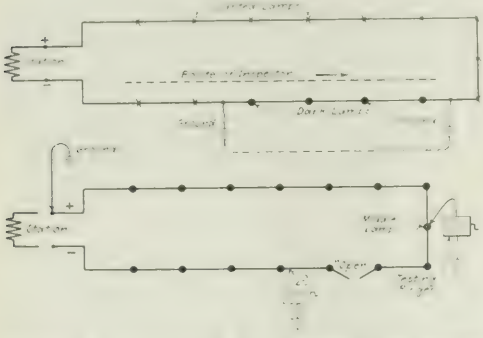


DIAGRAM OF CONNECTIONS FOR LOCATING DOUBLE-GROUND AND OPEN CIRCUITS IN SERIES ARC SYSTEMS

An "open," said Mr. Hayes, of course renders the circuit inoperative, extinguishing all lamps until repairs can be made. Two or more grounds will, on the other hand, put only part of the circuit out of commission. In case such a group of lamps is dark, the patrolman first tries one or more to see if current is flowing through them. If there is no current, the circuit is probably grounded in two or more places. The troubleman must then find the last lighted lamp in the circuit and the first one dark, and then carefully inspect the line between them, as one of the grounds must be between these two points. If the ground is in no immediate danger of causing damage, he then finds the last lamp out and carefully patrols the line from there to the first lamp burning. In this way he locates both grounds and can then remove them, clearing the circuit. If there are more than two grounds on the circuit, the others will show themselves as soon as the first grounds are cleared. They may then be located in the same way and cleared.

An open circuit shows itself when the short-circuit switch is opened at the station, an arc following the switch plug when the latter is pulled. The circuit is then tested with a magneto to find if it is actually open. If this is shown to be the case, the magneto test for open circuit is carried out. Circuit lists are provided showing each lamp on the circuit in its proper order. The positive side of the circuit is put to ground in the station and a tester proceeds to the middle lamp of the circuit, as shown by the list, and opens up the connection on the positive side of the lamp. He then tests to see if he can ring back to the station, using ground as one side of the circuit and the arc line as the other. If this circuit is complete, he knows that he has not passed the open and proceeds further in the circuit and tries again. In this way he finds a point from which the circuit is not complete to the station. He then goes back a short distance until he has a complete circuit. Working back and forth in this way, he narrows the possible location of the fault until it is possible to find it by inspection.

At Ann Arbor the trimmer patrols all circuits three times each week to replace burned-out tungsten lamps and to make a general inspection of the behavior of the arcs. He carries with him an insulated stool and rubber gloves, it being an inflexible rule that any man doing repair work without them on live arc circuits automatically discharges himself.

## Switchboard Reconstruction at Milwaukee

Among the recent plant changes being made by The Milwaukee Electric Railway & Light Company are those at its Oneida Street generating station, which furnishes energy to the local direct-current district. Heretofore this plant has been handicapped from the operating standpoint by its switchboard arrangement. These panels were mounted in three tiers one above the other, the machine panel being on the main floor of the station, the lighting and motor-service feeders and battery panels on the first gallery, and the railway feeders on the second gallery. Under these conditions it was practically impossible for one switchboard attendant to operate all the equipment without considerable inconvenience.

As laid out under the new arrangement, however, all switching apparatus will be controlled from two positions instead of three. The railway board will remain where it now is while the machine, feeder and battery panels are to be combined in one board on the first gallery. Fig. 1 is a view of the new board from a recent photograph.

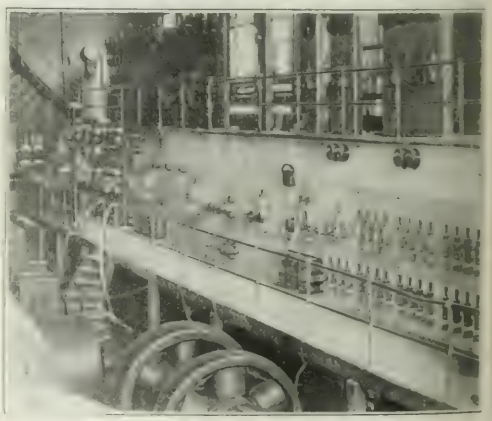


FIG. 1—FRONT OF SWITCHBOARD UNDER CONSTRUCTION

The new board is of marble and is a model of practical construction. It will have twenty-three panels when completed and will be 60 ft. 4 in. long. Two engine-driven 240-120-volt generators, three motor-generator sets, a balancer, two storage batteries and two booster sets will be controlled from the board.

Duplicate "high" and "low" buses are employed. Each main bus consists of five 10-in. by 0.25-in. copper straps in parallel. The feeder buses also have five straps in parallel, but they are only 5 in. wide. The bus structure on the switchboard, it is estimated, weighs about 6 tons.

Twenty inches of clearance is provided between the buses and the back of the board, so that the control and instru-



FIG. 2—BACK OF SWITCHBOARD AT ONEIDA STREET PLANT, MILWAUKEE, WIS.

ıent wiring is not cramped for space and any repairs or dditions which may be made in the future can be accomlished without danger to the wireman. The clearance pace between the buses and the switch studs is bridged by ımpers made of heavy copper straps similar to that used n the buses. All control and instrument wiring is of slow-ırning insulated wire.

At each end of the switchboard behind the feeder panels ch busbar is divided into two branches called the feeder ıses, which allow two horizontal rows of feeder switches be placed on each panel. The same clearance is left be-nd the machine panels. Because of the length of the mpers connecting the buses with the switch studs very lit-vertical support is obtained from them. Horizontal gle irons are therefore placed at intervals under each s, being supported at one end by brackets fastened to up-hts which are insulated from the switchboard framework d from the marble floor. All of the railway feeders m the board on the second gallery are carried down the ll back of the switchboard in clay conduits set in con-te. Similar construction is used in the basement, where cables run along the ceiling. The support for the ducts e consists of two rows of angle irons running parallel the cables and supported from the ceiling by steel rods. ween the angle irons and at right angles to them steel s are placed at intervals to support the ducts. When work is completed all four sides of the duct-run will be stered to give a finished appearance, the steel rods on bottom of the run furnishing reinforcement for the ter.

he switchboard installation has been done entirely by the Milwaukee Electric Railway & Light Company, the foreman on the job being Mr. P. G. Abraham. About thirty men have been employed in making the change, six of whom were wiremen, three were employed to bend copper straps for buses and the remainder were general electricians.

In addition to installing this new switchboard, the power plant department has completed erection of a new 500-hp Edge Moor boiler with a Jones stoker, which will be used to furnish steam for district heating. A machine shop has been added to the station equipment and will serve as a general power-plant machine shop for all of the stations. The other shops will not, however, be discarded. In the shop are both individual and group-drive machines. A shaper, two lathes, a drill press and a metal saw are driven from a single line shaft operated by a direct-current motor. A forge blower, sheet-metal rolls, grinder, two large drill presses and three pipe machines are driven by individual direct-current motors. Stockrooms are located above and below the machine shop.

## Load Indicator for Boiler Rooms

Indicating wattmeters and various forms of load indicators are coming to be used in boiler rooms for informing the firemen of the amount of steam needed. A home-manufactured device of this kind in use at the Waterside station of the Louisville (Ky.) Gas & Electric Company possesses several additional features besides reading the load.

The accompanying illustration shows the indicating panel placed in the boiler room where it can be seen the entire length of the firing aisle. It consists of a rectangular case about 6 ft. high, 1 ft. wide and deep enough to hold the incandescent lamps which illuminate the translucent figures. The cover is hinged so that lamps may be replaced or inspected.

The lamps are connected to an operating switch in the switchboard room, which consists of a sliding contact handle which can be placed on any one of twelve buttons, besides

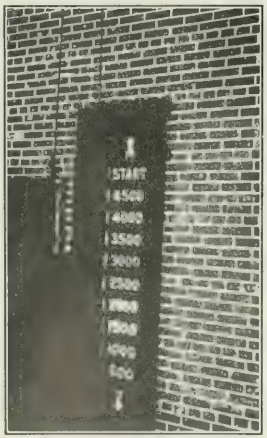



FIG. 1—INDICATING PANEL FOR USE IN BOILER ROOM

bridging any two consecutive ones, if desired. Each button, of course, corresponds with a panel on the indicating board as shown in the diagram. In conjunction with the apparatus mentioned there is a return-call bell system. Located in the boiler room beneath the indicating device and also in the switchboard near the operating switch are three-way, flush-type push switches for operating the bells.

To indicate 250-kw fluctuations in load the switch handle is placed so as to bridge two buttons, thus lighting two lamps and indicating that the load is half way between the figures lighted.

If the switchboard attendant finds it necessary to start up an extra turbine, he moves the handle to the button marked "Start" for a few moments before he is ready to divide the

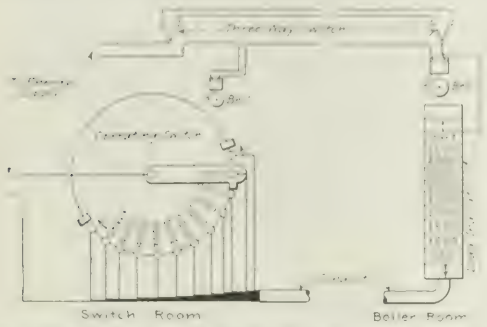


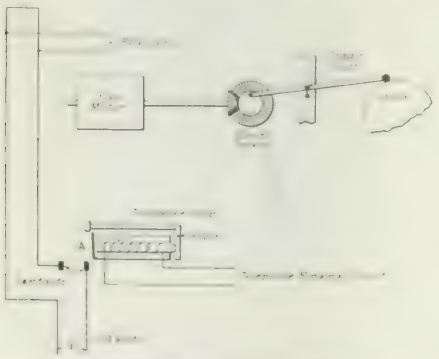

FIG. 2—CONNECTIONS FOR RETURN CALL BELL AND INDICATOR MECHANISM

load and then returns it to its normal position. The boiler-room attendant can then fire up an additional boiler if he finds it necessary or he can force the boilers already in operation so that they will be in condition to supply the additional steam to be required.

Sometimes the switchboard attendant fails to adjust the indicating apparatus when there is a change in load or the fireman thinks it is time for the load to change. When there is such doubt in the fireman's mind he presses the three-way push switch, previously mentioned, which lights up two arrows (similar to those on the boiler-room indicating device) on the switchboard attendant's signal board. The attendant at the board then either changes the indicator to agree with the load or else lights up one of the arrows in the boiler room to indicate that the load will soon decrease or rise.

## Gong Attachment for Station Telephone

The unavoidable noise in a busy generating station makes it impossible for a telephone bell to be heard without some sort of loud-ringing attachment. A home-made device for



GONG ATTACHMENT FOR TELEPHONE

this purpose which is in operation in the generating plant of the Marion (Ind.) Light & Heating Company is shown in the accompanying drawing. An ordinary telephone drop is bridged across the ringing circuit of the station telephone and arranged so that a call entering the station releases the small metal piece shown at *A*. When this drop closes the gap between the contacts the fan motor is started and continues to drive the gong through the bevel gears until some person answering the telephone restores the drop to the upright position. A red lamp connected in the motor circuit also gives a visual warning. The scheme was worked out by Mr. O. M. Drischel, who is general superintendent of the Marion plant and it has been giving satisfactory operation since its installation more than a year ago.

## Increasing Output of Boilers

Can boilers using anthracite coal be forced more readily than others? What is the simplest way to increase the steam output of such boilers? J. I. I.

The simplest way to increase the output of boilers under which low-grade anthracite coal is burned is to enrich the fuel by the addition of bituminous coal. By changing entirely from anthracite to bituminuous coal the boiler will give approximately double the output.

## Regulation of Lamp Circuits

On one of our long circuits, the motor load has increased to such an extent as to affect the lamps burning on the circuit. Can the lighting service be improved without great cost? C. C.

It would be better to use separate transformers for the motor circuit because the variable load on the motors produces a poorer regulation in the transformers than is desirable for incandescent-lamp operation. An automatic regulator can be attached to the single-phase circuit feeding the lamps. By the use of such a regulator lamp operation is possible from transformers feeding a motor load.

## Scale and Corrosion in Boilers

We are having trouble with the formation of scale in our boilers and would like to have you outline methods for its prevention. Are waters which produce scale also ordinarily corrosive in their action? L. H. F.

In the case of small plants where the outlay necessary for equipment to purify the water before it enters the boilers, cannot be justified, various compounds introduced directly into the boilers will often produce good results. Sodium hydroxide or caustic soda, sodium carbonate or soda ash, sodium fluoride, trisodium phosphate, tannin compounds, etc., combine with the scale chemically, converting it into compounds which are thrown down as soft sludges. On the other hand, organic materials, either gelatinous, as ground bones, hoofs, and horns, or starchy, as potatoes, slippery elm, etc., act mechanically on the precipitated scale, entraining it before a permanent hard scale has been formed. The quantity of compound to be used in any case can be properly determined only by chemical examination of the water supply, a fixed definite proportion of solution of known strength being delivered into the feed water as it enters the boiler. Blowing off the sludge should always be performed while the boiler is under low pressure, or if full pressure is on, the blow-off valve should be opened only slightly. The reason for this is clear. If the valve is opened wide under high pressure, the resulting rapid flow of water will scour only a narrow opening through the sludge, removing but little of that which would otherwise be carried off if a large slow-moving stream were set up. As intimated, waters are sometimes both corrosive and scale-forming, for corrosive waters usually contain scale-producing ingredients. Such corrosive action can be neutralized by adding caustic or carbonate alkalis, like caustic lime, although these reagents themselves introduce serious scale-forming properties if not administered with great care.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*Short Heat Tests of Electric Machines.*—W. R. Cooper.—A paper read before Section G of the British association. Theoretically, if heat is applied at a constant rate to a body its temperature will rise according to a logarithmic curve such as that in Fig. 1. Here the temperature is shown rising at a rate depending on the rate at which heat is supplied and upon the thermal capacity of the body, so that the tangent to the temperature curve at the origin is a line such as *OA*. As the temperature increases, however, the body begins to radiate heat more rapidly, so that the temperature will then continue to rise more slowly. The loss by radiation or otherwise increases until the rate of loss equals the rate at which heat is supplied, and the temperature then remains constant; in other words, the curve becomes asymptotic to the line *BC* of maximum temperature rise. The curve being logarithmic, as expressed by the equation $T = T_{max}(1 - e^{-at})$, where $T$ is the temperature and $t$ the time, it follows that after a certain time, *OD*, dependent on the nature of the body, the temperature rise is equal to 63 per cent of the maximum. This time *OD* is conveniently called the "thermal time constant" and is the reciprocal of the quantity $a$ in the above equation. Short heat tests depend for their accuracy on the extent to which the temperature curve follows the logarithmic law. The simplest graphical method is due to the fact that the sub-tangent of a logarithmic curve is constant. Thus, in Fig. 2, if ordinates are erected at points $P_1$, $P_2$, $P_3$, on the curve, then $A_1B_1 = A_2B_2 = A_3B_3$, etc., if the line $A_1B_3$ is the asymptote—that is, if it is the line of maximum temperature rise. The position of the asymptote is perhaps most easily judged by drawing several tangents at equal time intervals and noting on a scale the position where the intercepts $B_1B_2$, $B_2B_3$, etc., are all equal. Every sub-tangent (being equal to *AB* in Fig. 1) is theoretically equal to the thermal time constant. The slope of *AO*, or the tangent of the angle *OD*, gives the initial rate of heating, and equally the rate of cooling when the temperature stationary point is reached. It is rather more convenient, perhaps, to regard

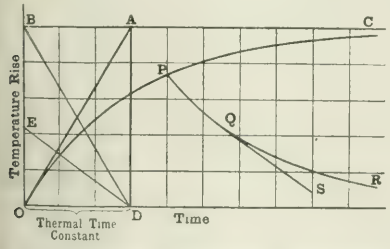



FIG. 1—CURVE SHOWING THEORETICAL TEMPERATURE RISE WITH HEAT APPLIED AT A CONSTANT RATE

*E* as giving the final rate of cooling. The rate of cooling for any rise *OE* is then given by the tangent of *ODE*, which is proportional to *OE*. Consequently half the maximum rise is proportional to the rate of cooling at a rise of ½*OB*, or at half the maximum rise; and thus, if the temperature rise *T* is found at which the rate of temperature rise (which is then equal to the rate of cooling) is half that at starting, the maximum temperature rise will be 2 *T*. This is the suggestion made by Prof. S. P. Thompson. Information is also readily obtainable from the cooling curve. Suppose the heating is stopped at a point *P*. The body will then proceed along a curve *PQR*. Let a point *Q* on this curve be taken at the same temperature as *E*, that is, on the same abscissa. Then the tangent *QS* will be

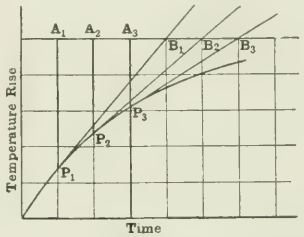



FIG. 2—CURVE WITH SUBTANGENTS SHOWN EQUAL

parallel to *ED*, because the slope of *ED* gives the rate of cooling at this temperature rise. Consequently the thermal time constant *OD* is at once obtained by drawing a tangent at a point on the cooling curve and then drawing a line parallel to this through the corresponding point *E* on the temperature rise axis so that it cuts the time axis. It also follows, since the curve of cooling is logarithmic, that if the temperature rise of a cooling body is *T*, the rise will fall to 37 per cent of *T* after an interval equal to the thermal time constant. Thus this important quantity can be found, at least theoretically, by taking any point on the cooling curve and finding when the necessary temperature drop has been reached. Several formulas based on such methods are given. Of course, short heat tests will not be practical unless the apparatus tested is of such a nature that it behaves like the machine in the assumptions. Transformers do not behave in this way, but field magnet coils do follow a logarithmic curve pretty fairly, and as the temperature of the field is frequently the temperature which limits the output of a generator, it appears that such tests might possibly be applicable to machinery of that class. The author describes tests which he has made with a protected direct-current dynamo, paying special attention to the determination of the thermal time constant because it is independent of the rate of heating and so allows one test to be compared with another. The results are given in tables and diagrams. For machines of this class a fair approximation can generally be obtained by testing for a period equal to about one and a quarter to one and a half times the thermal time constant, but the results are liable to vary. The best procedure seems to be to determine the thermal time constant from the cooling curve as the time taken for the temperature rise to fall through 37 per cent of any of its values. An ordinate is then erected at this time from the origin of the heating curve. The point where the heating curve is cut is then 63 per cent of the maximum temperature rise.—London *Electrician*, Sept. 19, 1913.

### Lamps and Lighting

*Arc-Lamp Electrodes.*—A note on a recent British patent (10,210. 1913) of J. Roubal. The electrode has high emis-

sity, and is not easily oxidized when burnt in an inclosed, but not air-tight, lamp. The carbon, before or after pressing, is impregnated with a mixture of sodium or potassium, aluminum phosphate and graphite containing earthly admixtures. Preferably, also, baked calcium saccharate is added to the core.—London *Elec. Eng'ing*, Sept. 4, 1913.

*Metallic-Filament Lamps.*—A note on a recent British patent (14,048, 1913) of the Allgemeine Elektricitäts Gesellschaft. To improve the efficiency of metallic-filament lamps a substance capable of giving off oxygen at a low pressure when the lamp is burning is introduced in the bulb before exhaustion. Suitable substances are oxides, peroxides, nitrates, nitrites, chlorates, perchlorates, chromates, bichromates, etc., but manganese superoxide and barium chlorate are found specially suitable. The only reaction product is tungsten trioxide, which is practically colorless, and even when deposited on the bulb cuts off but little light. As it is non-volatile, no increase in pressure takes place in the lamp.—London *Elec. Eng'ing*, Sept. 4, 1913.

*Sealing-in Lamp Leads.*—A note on a recent British patent (23,775, 1912) of the British Thomson-Houston Company and the General Electric Company of this country. The leading-in wires are provided with a coating of metal, the oxide of which is soluble in the surrounding glass at a relatively low temperature, the compound wire having substantially the same coefficient of expansion as the glass. —London *Elec. Eng'ing*, Sept. 18, 1913.

### Generation, Transmission and Distribution

*Rheinfelden.*—E. Frey and O. Albrecht.—A continuation of their illustrated detailed description of the Wyhlen power plant at the Rheinfelden transmission system. Details are given of the turbines, the generators and exciters, and the switchboard arrangement. There are ten generators, the pressure being 7000 volts, the speed 107 r.p.m., and the frequency 50. The rating of each generator under normal conditions at a power factor of 0.8 is 2600 kva. The maximum temperature rise of any part of the generator above the surrounding air is not above 45 deg. C.—*Elek. Zeit.*, Sept. 25, 1913.

*Use of Oxygen with Diesel Engines.*—A report by G. S. Taylor, British Inspector of Factories, on the causes of an explosion of a Diesel engine in a British electric station. As the accident happened, there had been considerable loss of air from both the blast vessel and the starting vessel of the engine in question, so that the pressure was insufficient for starting on the day of the accident. Acting in accordance with instructions issued by the makers, the engineer obtained a cylinder of oxygen from a firm of chemists, and by this means raised the pressure in the blast vessel to a normal figure, and also raised the pressure in the starting air vessel to some extent. By so doing, the air in the blast vessel became enriched so that oxygen was present to the extent of about 68 per cent. The engine was then started up, but almost as soon as the starting lever was put over to the "running" position an explosion appears to have occurred at the fuel valve on the cylinder, a blue flame was seen to travel along the blast pipe to the blast vessel and the latter exploded wih great violence and fatal results. The report discusses four alternative possibilities, and reaches the conclusion that the explosion of the blast vessel was caused by an oily deposit on its interior, and that ignition was transmitted by a flame explosion from the fuel-valve casing passing along the blast pipe. One of the final recommendations is that "compressed oxygen, on account of its intense chemical affinity, and combustible gases like hydrogen should not be used for the purpose of recharging air vessels, and a warning to this effect should be issued by the makers of Diesel engines."—London *Electrician*, Sept. 26, 1913.

### Traction

*Recent Progress in Electric Traction.*—The complete issue of 110 reading pages gives an account of recent progress in several important branches of the electric-railway industry. The first chapter deals with modern methods of installing track in paved city streets. A chapter on power generators and transmission follows with reference to the continuous increase of the rotative speeds and corresponding in rating of electric machinery. In the substation the introduction of commutating poles for rotary converters has not only made the use of 60-cycle energy a possibility, but has developed machines of such capacity and reliability as to obviate the necessity for storage batteries to reduce peak loads. Then follow chapters on the design of city cars, repair-shop design and operation, fare accounting, transportation of freight, electric-railway signaling, and self-propelled cars.—Annual convention number, *Electric Railway Journal*, Oct. 4, 1913.

*Electric Traction.*—G. Kapp.—His presidential address to Section G of the British association. The advantages of the various systems of electric traction, three-phase, single-phase and continuous current are first dealt with, some details being given of lines which have actually been electrified on one or the other of these systems. Figures with regard to electric traction on main lines of the Italian State Railways are set out, while some information about the St. Gothard line is also given.—London *Electrician* Sept. 12 and 19, 1913.

### Installations, Systems and Appliances

*Apparatus on Hire.*—T. C. Parsons.—While some think that electrical apparatus should not be hired out by a municipal station but should be left to private traders, the author discusses at some length the advantages of the hiring scheme for municipal stations. He first takes up motors and discusses in great detail the organization of the hiring department, special features, application forms, account forms, etc. He finally takes up electric heating.—London *Elec. Review*, Sept. 12, 19 and 26, 1913.

### Wires, Wiring and Conduits

*Rapid Calculation of Overhead Lines.*—A. Blondell.—In a continuation of his long illustrated serial on this subject the author discusses his new graphical method and its advantages over his former method. He shows that the use of one or the other is rather a matter of personal choice and explains in detail how both may be combined He then discusses the overload coefficient as a function of diameter and wind.—*La Lumière Elec.*, Aug. 16, 1913.—In the conclusion of his serial the author indicates the corrections of elasticity and expansion which must be applied in practice in the use of his graphical method in cases where the assumptions made as to elasticity and expansion of the metal are not exactly fulfilled. He then shows the rational procedure in making a transmission line calculation and finally indicates the simplest method for determining the height of the poles.—*La Lumière Elec.* Aug. 23, 1913.

### Electrophysics and Magnetism

*Range and Ionization of the Alpha Particles in Simple Gases.*—T. S. Taylor.—An account of an experimental investigation in which the ranges of the alpha particles from radium C and polonium were determined by the scintillation method in helium, hydrogen, oxygen and air. The rate at which the number of alpha particles from radium C diminishes near the end of the range was determined by the scintillation method in air, oxygen, hydrogen and helium The Bragg ionization curve was determined in helium and compared with the air and hydrogen curves obtained when the range of the particle was the same as that in helium The ionization curve is of the general form

$$I\,(r-x)^{1/n} = c,$$

where $I$ is the ionization, $c$ a constant depending upon the energy required to produce an ion, $r$ the average range, and

$x$ the distance from the source of rays. The ratio of the total ionization in helium to that in air or hydrogen is 1.05. —*Philos. Mag.*, September, 1913.

*Distribution of the Active Deposit of Actinium in Electric Fields.*—H. P. Walmsley.—An account of an experimental investigation in which it is shown that the distribution of the active deposit of actinium between the electrodes in an electric field is independent of the concentration of the emanation. Actinium A acquires its positive charge in the process of its creation, and in all probability the electrical charge of actinium B has the same origin. As regards their electrical properties, both actinium A and actinium B behave exactly like the positive ions produced by their radiations. They recombine in exactly the same way, and the activity collected by the anode in an electric field is due solely to deposit atoms which have recombined. Under favorable circumstances recombination continues until the whole of the active deposit is electrically neutral. The anomalous behavior previously noticed was probably caused by the use of emanations containing active deposit and by dust-laden gases.—*Philos. Mag.*, September, 1913.

*Mechanical Model of Coupled Oscillating Circuits.*—E. W. Marchant.—An illustrated article describing a model for demonstrating some of the effects in coupled oscillating electrical circuits. The primary and secondary circuits in this model are represented by two oscillating pendulums.—London *Electrician*, Sept. 26, 1913.

### Electrochemistry and Batteries

*Lead Coating of Iron and Steel.*—A note on a new process of Cowper-Coles for electrolytically coating iron and steel with a lead deposit up to 0.125 in. in thickness as protection against corrosion.—London *Electrician*, Sept. 26, 1913.

### Units, Measurements and Instruments

*An Electrical Instrument for Use in Graphical Mathematics.*—An illustrated article pointing out the extreme delicacy and accuracy of "electrical touch" as applied to measuring machines, and describing as the first application of this delicacy and accuracy to graphical mathematics the "aphegraph"—an instrument designed by M. R. Guillery primarily for the investigation of inertia forces in moving parts, but equally applicable to any procedure involving graphical differentiation.—London *Elec. Review*, Sept. 26, 1913.

*Motor Meters.*—A note on a recent British patent (19,118, 1912) of S. Holden and Chamberlain & Hookham. Instead of employing solid brushes in direct-current motor meters of the eddy-current brake type, the armature spindle is inclined so that the commutator dips into mercury at its lower side. An open-coil winding in which one end of each coil is permanently connected to the armature spindle so that only one brush is required is used. Cupro-nickel is used for the commutator. An inclosed chamber is provided for the mercury, and arrangements are provided for expelling this when necessary. By means of floats attached to the spindle and immersed in a liquid, the weight on the pivots is reduced.—London *Elec. Eng'ing*, Sept. 25, 1913.

### Telegraphy, Telephony and Signals

*Telephonic Measurements.*—A. Ebeling.—An illustrated description of the latest form of A. Franke's apparatus for the measurement of currents of telephonic frequency. The principle of the apparatus is described, together with the reasons of the latest improvements.—*La Lumière Elec.*, Aug. 30, 1913.

*Fire Alarm.*—J. Simey.—An illustrated description of a new fire alarm devised by Dafan. The novel features are the use of selenium, the device being actuated by light, and the fact that the alarm bell is set in action as the result of the opening of a circuit.—*La Lumiere Elec.*, Aug. 23, 1913.

### Miscellaneous

*Sensitiveness of the Human Skin as a Detector of Low-Voltage Alternating Emfs.*—H. Stansfield.—A paper read before Section A of the British Association. On moving recently into a house with alternating-current supply for lighting at 200 volts' pressure, and a frequency of 50 cycles, the author found that the alternating emf could be detected by the vibration felt when the metal fittings carrying the lamps were lightly rubbed by the back of the hand. On substituting the ear for the hand, the vibration is heard as a musical note, but it is more convenient to rub with the hand and to employ a wooden stethoscope to detect the vibration of the metal. A paper punch connected to a live wire was generally employed, the end of the metal handle being rubbed by the observer's hand and the sound conducted to his ear from the wooden base by the stethoscope. Some variations of the experiments are described.—London *Electrician*, Sept. 26, 1913.

*Ghent Exhibition.*—Ernst Schulz.—An illustrated description of the electrical exhibits at the exposition in Ghent, Belgium.—*Elek. Zeit.*, Sept. 25, 1913.

# Book Review

Shop Mathematics. Part II. Advanced shop mathematics, prepared in the extension division of the University of Wisconsin. By Earle B. Norris and Ralph T. Craigo. 214 pages, 218 illus. Price, $1.50 net. New York: McGraw-Hill Book Company, Inc.

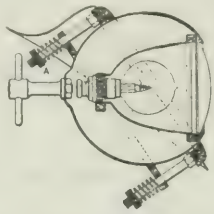
This volume presents the second half of the instruction papers in shop mathematics as developed and used in the extension division of the University of Wisconsin. The reader's knowledge of algebra, geometry and trigonometry is clearly assumed to be an almost negligible quantity, but after being introduced to the elements of these subjects he is gradually carried forward until—if he have properly assimilated the intellectual food here set before him—he should be able to apply with quickness and understanding any formula likely to be encountered in engineering workshop practice. More than this, he should be able to undertake an appreciable amount of intelligent calculation on his own account. The writing of a book such as this one, which obviously assumes the reader to be without the advantages of a university course or advanced technical training, is an extremely difficult task, and it is almost equally difficult to judge of the value of such books to the worker whose mind is not trained to follow the scientific or mathematical presentation of a subject. The authors, however, have had experience in teaching this course during a period exceeding five years, and the results have been satisfactory. They believe the book to be suitable for home study, and for this purpose it appears to be admirably adapted, seeing that the subject is clearly and systematically presented, the only requisites on the part of the reader being a mental equipment and tenacity of purpose capable of carrying him well forward in a subject not usually considered to inspire perseverance in its earlier stages. The book begins with an explanation of the nature and uses of formulas and the value of letters in representing physical quantities and numbers. Then follow the elements of algebra, the uses of curves in expressing equations and the derivation of equations from curves, geometric construction, areas and volumes. Four chapters are devoted to trigonometry and its applications, while the principle and uses of logarithms are explained in two short chapters at the end of the book. Many useful tables and formulas are included, and the examples used for illustration and for the application of the mathematical principles and formulas are in all cases carefully chosen and of special interest to the practical worker.

# New Apparatus and Appliances

**An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers**

## Orbicula Lantern for Automobiles

The accompanying illustration shows an interesting form of electric lamp for motor-car use recently brought out in France. It is known as the "eye" orbicula lantern and is the design of M. Cannevel, 14 Rue Reval, Levallois-Perret, near Paris. The lamp is of a type designed to be embodied in the body-work of the car, the feature being that it can at the will of the driver be turned in any direction, the socket being so arranged that it can be swept



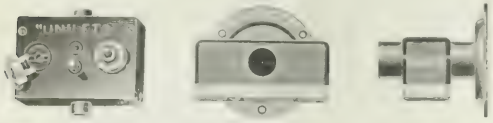
ELECTRIC LAMP FOR MOTOR-CAR

over an arc of 80 deg. both from left to right and up and down.

The lamp is held in any position by two small clamps which are removable from the inside and can be adjusted instantaneously so as to illuminate the signposts at the side of the road, milestones and even the motor in front. The entire lamp can also be pulled out of the socket and used to light the inside of the dashboard under the footboard and as a general trouble lamp. A slight loosening of the milled nuts, shown in the illustration at *A*, permits of turning the eyeball by means of the handle in any desired direction throwing the center of the beam where the strongest light is desired.

## Conduit-Box and Bracket Fittings

The conduit-box fitting shown in Fig. 1 is a combination plug receptacle and push-button switch which is being made in units with one to three push buttons as desired. The boxes fit conduit of any size from 0.5 in. to 1 in. inclusive. Figs. 2 and 3 are respectively front and side views



FIGS. 1, 2 AND 3—NEW CONDUIT BOX FITTING AND FRONT AND SIDE VIEW OF FITTING FOR PIPE LAMP BRACKETS

of bracket fittings for pipe lamp brackets, floor standards, and similar installations, where the conduit which is to be supported by these fixtures ranges between 0.5 in. and 1 in. in diameter.

All of these so-called "unilet" fittings are manufactured by the Appleton Electric Company, Chicago, Ill.

## Carboy Inclinator

The improved carbon inclinator which is now being manufactured by Horace M. McCord, Minneapolis, Minn., provides an easy and economical means of pouring acid from carboys in central-station storerooms. The device

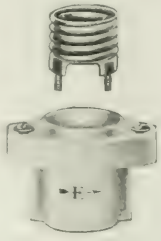


FIGS. 1 AND 2—INCLINATORS FOR POURING ACID

requires no more floor area for rocking or travel than would be taken by the carboy itself. The inclinator is built of spruce or hard pine and the 0.625-in. hanger bolts which carry the load bear on metal sleeves. An adjustable safety key prevents backward tilt. At the rear of the inclinator is an adjustable clamp rod which retains the carboy in position when it is tilted. All metal parts are painted black. The manufacturer states that the services of only one man are required for pouring fluid with this inclinator where otherwise two or three men are employed. The inclinator weighs 50 lb.

## Sign Receptacle with Removable Screw Shell

By making removable from the front of the receptacle the screw shell which holds the lamp in place, the Arrow Electric Company of Hartford, Conn., has introduced another feature into its line of sign receptacles. With this

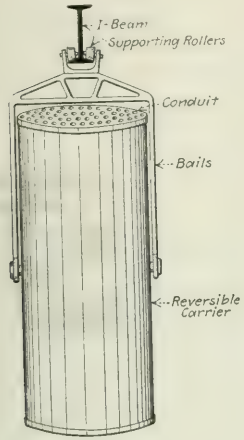


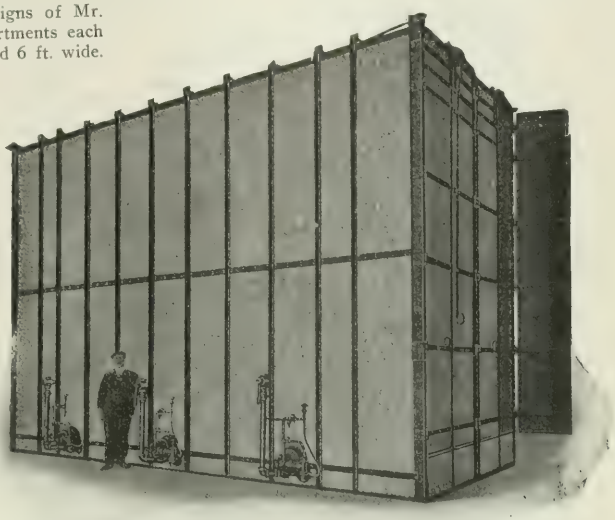
SIGN RECEPTACLE WITH REMOVABLE SHELL

type of receptacle the screw shell may, therefore, be replaced if necessary without disturbing other parts or without removing the receptacle from the sign. The illustration presented herewith shows the method by which the shell is taken from the receptacle. This change in design has also been applied to all weatherproof outlet-box receptacles manufactured by this company.

## Oven for Japanning Conduit

A conduit-japanning oven which is interesting not only by reason of the large amount of conduit which can be treated but also on account of the novel methods of handling the pipe is shown in the illustration. This oven, which was made by the Oven Equipment & Manufacturing Company, New Haven, Conn., from designs of Mr. Ronald Crawford, is divided into two compartments each measuring 30 ft. in length, 18 ft. in height and 6 ft. wide.



FIGS. 1 AND 2—CONDUIT CARRIER AND JAPANNING OVEN

The oven is capable of holding 86,000 lb. of material. The conduit is transported into and out of the oven on 15-in. I-beams in the center of each compartment. The doors fit these I-beams closely so that no heat is lost when the oven is in operation.

The conduit is manufactured in lengths of 12 ft. to 13 ft. and is japanned before being cut to lengths convenient for use. Heat is supplied by three inclosed-flame gas burners in each compartment. The ends of the burners in the left compartment are indicated in the illustration. By using air under a definite pressure from a positive pressure blower and regulating both the air and the gas, the temperature within the oven is easily maintained at any point which may be desired. Circulation of superheated air in the oven is assured by a pressure of about 1 lb. per sq. in. and by the natural draft through the vents at the top of the oven.

The sketch (Fig. 1) shows the method of handling the conduit, several hundred pieces, aggregating more than 7000 lb., being carried in each framework. The whole load, framework, conduit and all, depends from bails as shown, but runs on the I-beam mentioned. Six of these groups are placed in each compartment of the oven. When the time for complete baking has half elapsed the doors are opened and the loads of conduit run out, turned end for end and then returned to the oven where the process is completed. This method of treatment neutralizes any tendency there may be for the material to run toward the lower end of the conduit during the time that the raw japan is in the process of baking.

The temperature maintained in the oven is about 200 deg. Fahr. greater than was formerly used in steam-heated ovens designed for this purpose. New forms of japans have had to be developed to withstand this temperature, but the great advantage of using the intense heat lies in shortening the process, the saving in time being in some cases as much as 80 per cent.

## Reversible Electrician's Glove

Much of the lineman's opposition to the use of rubber gloves has been due to the fact that they were difficult to work in. This objection has been in a large measure overcome by the Alliance Rubber Company, of Alliance, Ohio, which is making a soft, pliable, seamless glove of red rubber. These gloves are reversible and may be worn on either hand, eliminating the necessity of having individual "lefts" and "rights" Each pair is numbered, identifying them on a certificate of test which accompanies each set. This certificate guarantees the particular pair to withstand a specified voltage. The testing and checking is done by two individuals because no one man is infallible. The gloves are made in several weights. The lightest is guaranteed to withstand 1000 volts, another 4000 volts and a third 10,000 volts. The 1000-volt and 4000-volt gloves are tested to 150 per cent over-voltage and the 10.000-volt gloves are tested to 20,000 volts.

## Thin Plate Batteries for Automobile Starting and Lighting

The thin-plate batteries made by the Baltimore Electric Storage Battery Company, Baltimore, Md., for automobile



FIG. 1—THIN PLATE BATTERY

starting and lighting purposes, are assembled in hard-rubber jars encased in wood. Batteries for self-cranking motors are made with ratings ranging from 35 amp-hr. to 120 amp-hr. at 6 volts, 12 volts, 16 volts, 18 volts, or 24 volts. Lead-covered copper connectors and copper cores in the pillar posts reduce the voltage drop at the terminals

and the rubber covering on the pillar posts prevents the creeping of acid and consequent corrosion of the connections.

The lighting batteries are of the 6-volt type and are manufactured in the following sizes: 60 amp-hr., 80 amp-hr., 100 amp-hr. and 120 amp-hr. All posts are brought up

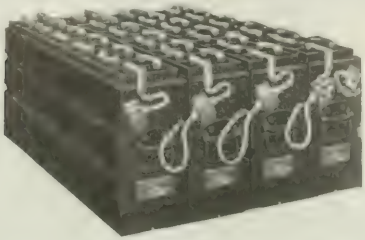
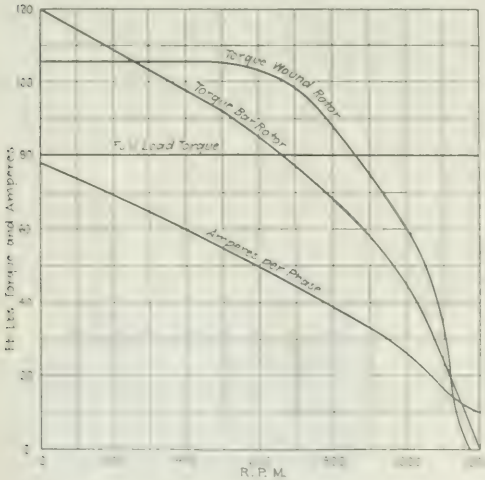


FIG. 2—BATTERY SHOWING END CONNECTIONS

through the cover so that any cell may be examined without disturbing the others. An over-flow chamber between the inside and outside battery covers catches the acid sprayed out during the charging period. It is stated that the active material used in these batteries and in the vehicle batteries of the company is specially pasted and formed to withstand the shocks and vibrations to which they are subjected in the operation.

## Motors for Elevator and Hoist Duty

On account of special features in design of the squirrel-cage motors recently developed by the Lincoln Electric Company, Cleveland, Ohio, the starting current necessary to deliver a certain starting torque is explained to be from 5 per cent to 25 per cent less than would be the case with a slip-ring motor of the same rating. With an equal weight of iron and copper it has also been possible to obtain from

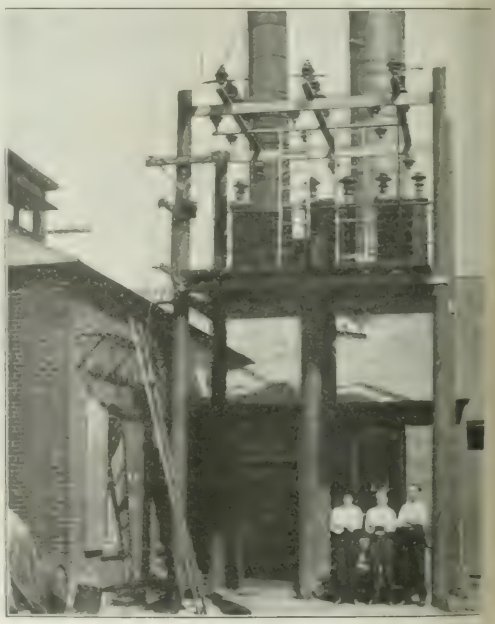



SPEED-TORQUE CURVES

10 per cent to 40 per cent more torque than could be delivered from a slip-ring motor. It is further stated that these machines will deliver twice full-load torque at current values not exceeding twice full-load rating. The manufacturers recommend these new squirrel-cage motors in sizes up to 25 hp for elevator and hoist duty except where low or variable speeds are maintained or where slow starting is required. The curve herewith shows for comparison the speed-torque curves of the slip-ring and the squirrel-cage motor.

## A 300-kw. 33,000-Volt Outdoor Sub-Station

The outdoor sub-station shown in the accompanying illustration consists of three 100-kw, 33,000/2200-volt, 60-cycle transformers connected in delta. A three-pole air-break switch operated by a vertical rod, easily accessible from the platform, comprises the high-tension switching equipment. Fuse protection is secured by the use of chemical fuses easily reached by the two ladders, and protection against excessive voltage disturbances or surges is provided by adjustable discharge horn gaps. Between the discharge gaps and the transformers are located heavy inductors consisting of specially designed choke coils which serve to flatten out abrupt static waves or other disturbances. The choke coils reflect these surges back to the gaps, where they are quickly discharged to ground. When the gaps dis-



OUTDOOR SUBSTATION

charge the carbon-tetrachloride fuses are in series wit the circuit to ground so that in case of abnormal curre flow these fuses operate to prevent a local disturbance fr affecting the main line.

This particular installation is located outside of an steam-driven plant which formerly supplied the small to in which it is located with electric lighting and mot service.

The 2200-volt circuits are carried into the building the left and distribution made through a switchboard fc merly used for the steam-driven plant. With this arrang ment energy can be supplied from the 33,000-volt line, a the local generating plant can be shut down, or the lo plant can when desired be used as a generating point fe ing the main line through the outdoor substation. T apparatus shown in the illustration was furnished by Delta-Star Electric Company, Chicago, Ill.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Paying for Electric Wiring on the Instalment Plan.**—Everybody is familiar with the instalment plan as used to boom the furniture business, but the application of this method of payment to electrical wiring work is decidedly novel. The Alexander M. Knauber Company, an electrical contracting firm doing business in and around Chicago, Ill., has recently issued a statement in which it offers to do wiring and the installing of electrical fixtures on an easy payment plan, which allows the customer two years in which to pay for this service.

**Street Lighting Plans in Three Small Cities.**—Among the small cities which have recently contracted for or increased the installation of "White Way" systems are Virginia, Minn., where 114 five lamp ornamental posts are to be supplied by the Star Electric Company; Lakeland, Fla., where Caldwell & Feighley are to furnish 50 posts of the same type, the top lamp being of 100 watt and the lower four of 80 watt rating; and Hagerstown, Md., where 35 three-lamp ornamental posts are to be installed by the Central Garage & Electrical Supply Company. The latter system is to be so wired that the lower lamps can be turned off at any desirable hour, leaving the top center lamp in each cluster burning. It is expected that this installation will be largely extended in the near future.

**Westinghouse Company Receives Large Order for Generating Equipment.**—For use in connection with the electrification of the Norfolk & Western Railway which has been previously announced, the Westinghouse Electric & Manufacturing Company has received orders for the following power station apparatus: three 9000 kw, 25-cycle, 11,000-volts, 1500 r.p.m., single-phase, turbo-alternators with two 150 kw 250-volt, turbo exciters and one motor generator exciter of the same rating; one 200 kva, 3-phase, 25-cycle, 11,000/440 volt transformer; three 1500 kva, single-phase, 25-cycle, 33,000/11000-volts auto-transformers and six 2500-kva, and four 3000 kva auto-transformers of similar characteristics; one 10 per cent reactance for the 11,000-volt feeder circuit and one type TA voltage regulator for the turbo-generators.

**St. Paul Supply House to Build.**—The Northwestern Electric Equipment Company, of St. Paul, Minn., announces that it has purchased land and awarded contracts for a new building to be erected for its own use on Sixth Street, between Jackson and Sibley Streets. The structure will be 80 ft. wide, 150 ft. deep and six stories high with a basement. It will have about 50,000 sq. ft. of floor space and its owners think that it will be the largest building west of Chicago, exclusively devoted to electrical machinery and supplies. The first floor will be devoted to city sales and to show rooms. The second will be used for general offices, while the basement and upper floors will be utilized for shops and storing goods. The company does a general supply business. F. B. Thompson is president, J. M. Whalen, vice-president, and A. J. Anderson, secretary.

**Standard Catalog Numbers Wanted for Electrical Supplies.**—A prominent electrical contractor in the Middle West has recently given expression to a sentiment which is doubtless shared by all in his line, and others whose work involves the investigation of manufacturers' pricelists and catalogs on electrical supplies. In large part each manufacturer has his own private method of indicating and numbering the various standard articles which he makes, such as cut-outs, sockets, switches, fuses and similar apparatus. Probably in each case the system adopted is admirably suited to the manufacturer's own business needs, but the result of the whole system is to bring the contractor, engineer or purchasing agent endless confusion in dealing with a chaotic nomenclature. This multiplicity of names and numbers for the same piece of apparatus is the thing to which the above mentioned contractor objects. Possibly a little special investigation and cooperation between manufacturers along the line of a standard listing system would prove of as much advantage to them and to the industry as a whole, as has the progress made so far in standardizing designs on these staple electrical supplies.

**Gas Engines Sold for Electric Generator Drive.**—The Northwestern Electric Equipment Company has recently purchased two 50 hp producer gas engines from the Bruce-Macbeth Engine Company, of Cleveland, Ohio, one for each of two installations of lighting generators at Volga and at La Moure, North Dakota. The latter company numbers among its larger recent shipments seven gas engines of 40 hp rating or over, aggregating 970 hp, in addition to the engines first mentioned. The biggest single sale reported is of two 300 hp producer gas engines for the Metropolitan Building, Philadelphia, Pa.

**General Electric Apparatus in Demand for Power Plant Equipment.**—Among the recent orders for generating and auxiliary power equipment received by the General Electric Company, of Schenectady, N. Y., the following are of special note. The Winooski Valley Power Company, Essex Junction, Vt., will add to its station equipment four 1500 kva alternating current generators, a 100 kw motor-generator, seven 1000 kva water-cooled transformers, switchboard and accessories. The Hannawa Falls Water Power Company, Potsdam, N. Y., will install additional electrical apparatus in its station consisting of a 450 kva alternating current generator, two 2000 kva water-cooled transformers and switchboard panels. At the Eagle Falls, N. Y., station of the Beaver River Power Corporation, Beaver Falls, N. Y., there will be placed in operation two 1500 kva alternating current generators with 26 kw exciters, three 1500 kva water-cooled transformers, switchboard and accessories. The Northern Power Company, Potsdam, N. Y., will add to the equipment of its station at Canton, N. Y., three 1000 kva water-cooled transformers and a switchboard. The Wisconsin River Power Company, Madison, Wis., will install a 2800 kva water-cooled transformer.

**Bell Telephone System Under Fire.**—Following the recent Government suit, started at Portland, Ore., against the American Telephone & Telegraph Company, charging violation of the Sherman Anti-trust Law by monopolizing the means of telephone communication between and within the states of Oregon, Montana, and Idaho, comes the announcement that complaint has been filed by the Postal Telegraph-Cable Company in Baltimore, Md., against the Chesapeake & Potomac Telephone Company, a subsidiary of the American Telephone & Telegraph Company, charging that it has diverted business from the Postal to the Western Union Telegraph Company, in which it has a financial interest. This latter action only echoes a similar complaint recently made in New York City, where partial relief was obtained by action of the Public Service Commission. It seems probable from all indications at this time that the Bell system will shortly be investigated by the Federal Department of Justice, to determine exactly its status under the present laws. Considerable attention has been paid of late to the question of government ownership of telephone and telegraph facilities and their operation in conjunction with the present postal system. This idea has grown to sufficient size to have found backing by the Postmaster General under the last administration and it certainly has some advantages from the standpoint of service. Whether or not it would be economically feasible at this time is another question, but in all events a detailed investigation of the operation of the present system will

probably throw much light on the subject. Rumors to the effect that confiscatory measures are proposed by the Government are too wild to be given any serious consideration and the fact that no fears of this nature are entertained by the American Telephone & Telegraph Company is shown by the recent statement of President Vail, in which he said that the company has little fear that the Government will attempt to take over the telephone and telegraph system of the country, except after long discussion, while any attempt to build up a government system to compete with the existing lines would be more expensive than to buy them up. A possible result of the present agitation is the complete divorcement of the American Telephone & Telegraph Company from the Western Union Telegraph Company, as far as finances are concerned.

**Italian Electrical Manufacturers Plan Invasion of American Field.**—Ercole Morelli & Company, electrical manufacturers, of Milan, Italy, have opened a temporary branch office and show room at 35 Broadway, New York, where they are showing a stock of standard alternating and direct-current oscillating fans, and also a line of motors of capacity from a fraction up to 250 hp, as well as a number of electrically driven centrifugal pumps for operation on either direct or alternating current and designed for varying pressures from 19 to 520 ft. The office is in charge of L. A. E. Frankel.

**Surprising Sale of Refrigerating Machines.**—It might be supposed that during September, after the worst heat of the summer had passed and there was every promise of an early winter, the sales of refrigerating apparatus would fall to a low figure. The York Manufacturing Company did a very good business during this period, however, and an aggregate capacity of nearly 750 tons in refrigerating machinery, besides a large amount of auxiliary equipment, was sold between Aug. 21 and Sept. 23. The largest single order filled in this time was for three 65-ton horizontal double-acting Corliss steam-driven refrigerating machines, a 90-ton flooded freezing system complete, a 100-ton distilling system, and a 400-hp boiler, all of which apparatus went to E. A. Keisewetter, of Homestead, N. J. Foreign sales included in the above aggregate figures were to the International Cold Storage & Warehouse Company, Ltd., of Southampton, England; Enrique M. Barrette, of Manila, P. I., and the Manitoba Agricultural College, Fort Garry, Manitoba, Canada.

**Power Plant Installation for Railway Shops.**—The National Transcontinental Railway Commission, in building the large general repair and locomotive shops at Transcona, Man., decided that the best interests of the railway, in economy, efficiency and reliability, could be served by the erection of a modern central power plant in which steam and electrical apparatus of sufficient capacity to supply the present demands should be located. This power house has been built and equipped throughout. The generating apparatus consists of 9 units with a total normal capacity of 2030 kw, 1600 kw alternating current and 430 kw direct current. The generators were manufactured and installed by the Canadian General Electric Company, and the Goldie & McCullock Company supplied and installed all engines. The units supplying the electrical power consist of three 500-kw alternating-current, 600-volt, 60-cycle generators, running at 150 r.p.m., each one directly connected to a horizontal cross compound, non-condensing Corliss engine; one 250-kw, alternating-current, 600-volt, 60-cycle, 150-r.p.m. generator and a 150-kw, direct-current, compound-wound, 250-volt, 150-r.p.m. generator, each directly connected to a simple Corliss engine. There was installed, also an auxiliary 150-kw motor generator set, consisting of a 225-hp, 900-r.p.m. induction motor directly connected to a 150-kw direct-current, 250-volt compound wound interpole generator. All the steam engines operate non-condensing, because their exhaust is required in the low pressure steam system for heating the shops. The generator switchboard was manufactured and installed by the Canadian Westinghouse Company, and consists of 21 blue Vermont marble panels, 7 ft. 8 in. high, and 2 in. thick, the entire board being 52 ft. long. There are 7 generator panels, 1 alternating-current totalizing panel, 1 direct-current feeder, 1 alternating-current general lighting, 1 arc lighting and 10 alternating-current feeder panels, the only special apparatus on the switchboard being the motor-operated rheostats with which each of the generator panels is supplied. As all the power and light distribution is underground, the necessary cables pass through 38 ducts in the east and west walls to the various buildings. The conductors between all generators and switchboards are rubber-insulated, lead-covered cables, run in iron conduits from the oil switches to generator terminals. All feeder circuits to the various buildings are paper insulated and lead covered, run in fibre or tile conduit. There is at present 2560 kw in motor and lighting load connected to this power plant, and this amount will be increased to approximately 4060 kw when the car shops are fully equipped. The low-load factor common in this type of shops still gives the power plant a reasonable margin for emergencies. The artificial lighting of both the engine and boiler rooms is performed by Cooper Hewitt type H mercury vapor lamps for general illumination, and incandescent lamps in the pump pit, pipe tunnel and in the boiler room basement. Extension cord receptacles are also located at various places in the building. This power plant was designed under the supervision of W. J. Press, mechanical engineer for the National Transcontinental Railway, and the construction was carried out under the direct supervision of D. A. Evans, assistant engineer.

**Electricity and the Copper Industry.**—The production of copper in 1912 by smelters in the United States was 1,243,268,720 pounds, valued at $205,139,338, the largest annual figures in the history of the industry. Of this amount about 29 per cent was smeltered in Arizona, about 25 per cent in Montana, and about 18.5 per cent in Michigan, the rest being divided between twenty-three other states and territories. It is interesting to note the extent to which electric energy has been applied to both mining and smelting operations. In California electric power is used almost exclusively in both the mines and smelters, and the mines of the Mammoth Copper Mining Company are connected with its smelter in part by an electric railroad. At the High Ore shaft of the Anaconda Copper Mining Company, in Montana, there are electric pumps in operation, an electric haulage system is being installed, and it is estimated that the use of electric power is materially reducing the cost of operation. Electric haulage was also installed on the lower levels of the North Butte mine, operated by the same company. During 1912, arrangements were completed for the substitution at the mines and mills of the Utah Copper Company, in Utah, of hydro-electrically generated energy for the steam power previously used. This electricity is to be furnished by the Utah Power & Light Company and it is expected that by the close of the present year the latter will be able to furnish the power for all operations. The refinery output of the United States during 1912 was made by 13 plants, 9 of which employ the electrolytic method and turn out a large proportion of the total copper produced.

## NEW YORK METAL MARKET PRICES

| | Oct. 7 Bid | Oct. 7 Asked | Oct. [illegible] Bid | Oct. [illegible] Asked |
|---|---|---|---|---|
| [illegible]* | | | | |
| | Selling Prices | | Selling Prices | |
| | £ s d | | £ s d | |
| London, standard, spot* | 7 0 7 6 | | 7 0 10 | |
| [illegible] | 16.75 to 16.87½ | | 16.60 | |
| Electrolytic | 16.50 to 16.60 | | 16.15 to 16.25 | |
| [illegible] | 16.25 to 16.37½ | | 16.00 to 16.12½ | |
| Copper wire base | 17.25 | | 17.25 | |
| Lead | 4.60 | | | 4.65 |
| Nickel | 40.00 to 45.00 | | 40.00 to 45.00 | |
| Sheet zinc, f. o. b. smelter | 7.75 | | | 7.75 |
| Spelter, spot | 5.45 to 5.55 | | 5.35 to 5.45 | |
| Tin, spot | 40.35 to 40.60 | | 40.25 to 40.45 | |
| [illegible] | | | | |
| Prompt delivery | 20.00 to 21.00 | | 20.00 to 21.00 | |
| Future | 20.00 to 20.50 | | 21.00 to 21.50 | |

## *OLD METALS

| | | |
|---|---|---|
| [illegible] | 15.00 | 15.00 |
| Brass, heavy | 9.75 | 9.75 |
| [illegible] | 8.50 | 8.50 |
| [illegible] | 4.50 | 4.50 |
| [illegible] | 4.75 | 4.75 |

## *COPPER EXPORTS

[illegible] 14 [illegible]

[illegible] tions on the New York Metal Exchange.

# Corporate and Financial

**American Telephone & Telegraph Subsidiaries Issue Short Term Notes.**—The American Telephone & Telegraph Company has recently endorsed and sold through J. P. Morgan & Company and Kidder, Peabody & Company, $10,000,000 in six months' notes of some of its subsidiary companies. The loan cost the company about 5½ per cent per annum, since interest was discounted in advance.

**Organization Changes in the Alabama Power Company.**—In connection with the resignation of W. W. Freeman, former vice-president and general manager of the Alabama Power Company, the principal subsidiary of the Alabama Traction, Light & Power Company, it is announced that Mr. Freeman will retain his membership in its board of directors as well as in those of the other American properties in which Sperling & Company, of London, are interested. Frederick Darlington, a director and vice-president of the Alabama Power Company, is giving considerable time to the commercial end of the company's business and has greatly increased the size and scope of the new business department.

**Electric Traction Finances in New York City.**—The summary of reports of street railway companies, operating in the city of New York, for the quarter January to March, inclusive, has just been issued by the Public Service Commission for the First District. Some of the totals are of interest as indicating the size of the traction problem in that city. There are 36 separate companies involved in the system. The total revenue car miles amounted to 78,876,156 and 434,329,530 fare passengers were carried. The total operating revenue for the above period was $22,354,855 and the total operating expenses were $12,141,352. The gross income on these properties amounted to $9,763,506, and the net income amounted to $2,464,396. The total liabilities of the companies comprising this immense traction system aggregate $601,040,557.

**Commonwealth Edison Company Increases Dividend.**—Supplementing the note in the Sept. 13 issue of the *Electrical World*, in which it was stated that the director of the Commonwealth Edison Company had virtually determined on making that an 8 per cent stock, it is now learned that definite action in this direction was recently taken when the quarterly dividend, payable Nov. 1 to stockholders of record Oct. 18, was declared at 2 per cent, instead of the previous figure of 1¾ per cent, thus changing the annual dividend rate from 7 to 8 per cent. The announcement of this dividend increase, following so soon after the control of the People's Gas Light & Coke Company passed into the hands of the Commonwealth Edison interests, seems to indicate that the properties, which combined dominate the power and lighting industry in Chicago, are in a strong financial condition.

**Merger of Atlantic Gas & Electric Subsidiaries Planned.**—The directors of the Eastern Pennsylvania Power Company have approved a plan to consolidate that concern with the Pennsylvania Utilities Company, forming a new Pennsylvania Utilities Company with a capital stock of $1,000,000 common and $1,000,000 preferred. At the present time the Eastern Pennsylvania Power Company has outstanding $4,500,000 stock, of which $3,500,000 is common and $1,000,000 preferred, and the Pennsylvania Utilities Company has $85,000 stock outstanding, which is controlled by the former company. A considerable scaling down of stock will be necessitated by this move, and it is announced that the stockholders of the power company will hold a meeting on Oct. 25 to vote on the proposition and to determine the rate at which the old stock will be exchanged for the new. The Atlantic Gas & Electric Company controls the Eastern Pennsylvania Power Company through stock ownership.

**Pacific Light & Power Corporation Matters.**—It is expected that the Big Creek hydro-electric development with its initial capacity of 66,000 hp will be in partial operation by Jan. 1, adding materially to the earning power of the company. While the interest charges on the $10,000,000 per cent first mortgage and refunding bonds and the 2,500,000 of 6 per cent one year notes issued in connection with this development are being charged against construction account, the earnings of the company for the year ending Aug. 31 were sufficient to care for this interest in addition to that on the other bonds of the company. Gross earnings for that period were $2,772,732, and the net earnings were $1,244,751, out of which was paid $469,561, leaving a balance of $775,189, more than enough to pay the interest on the securities issued in connection with the Big Creek development. The company's operating expenses increased $170,829 over the figures for 1912, but this item is expected to show a material decrease comparatively, as soon as the new hydro-electric stations get into operation.

**Interborough Rapid Transit Bond Issue.**—The Interborough Rapid Transit Company, of New York City, is offering through Lee Higginson & Company, Harris Forbes & Company, Kissel Kinnicutt & Company, W. A. Read & Company, and White Weld & Company, at 98½ and interest, $30,000,000 of first and refunding mortgage 5 per cent gold bonds. These bonds are dated Jan. 1, 1913, and mature Jan. 1, 1966, but are callable at 110 and interest. The returns from this sale are to be used in connection with the new subway construction, and the agreement between the city and the company is such as to make the bonds in effect a quasi-municipal security. Before the city receives any return on its investment of $66,000,000 in the new lines, the contracts entitle the company to take out of net income approximately $14,769,000 per year for its own purposes, which sum is $5,409,000 in excess of the amount required for payment of the 5 per cent interest and 1 per cent sinking fund on its entire $156,000,000 issue of bonds. It is understood that over $22,000,000 of the $30,000,000 issue has already been sold.

**Financial Status of the Consumers' Power Company of Minnesota.**—In connection with the sale of $100,000 first mortgage 5 per cent bonds of the Consumers' Power Company of Minnesota, H. M. Byllesby & Company have issued a statement of the earnings of that utility company for the year ending Aug. 31. Gross earnings of $3,794,884 were realized, on which net earnings were obtained amounting to $1,931,651. These figures represented increases of 28 per cent and 32 per cent, respectively, over the figures for 1911. The Consumers' Power Company owns and operates various utility properties, serving about 40 communities in Minnesota, North Dakota, Illinois and Wisconsin, with a total population of approximately 750,000. During the fiscal year, ending Aug. 31, a total of 52,200 customers were served, energy was supplied to 55,524 hp in stationary motors and a connected load of 93,982 kw was recorded. Minneapolis and St. Paul are the largest cities in the territory supplied by this concern, and it owns undeveloped power sites in the vicinity of those cities, said to have a capacity of 60,000 hp, for future expansion of its generating system.

**Annual Report of the Western Union Telegraph Company.**—The annual report of the Western Union Telegraph Company for the year ending June 30, which was approved by the stockholders at their annual meeting on Oct. 8, is of particular interest at this time. As a matter of general convenience in the administration of the company's affairs, its fiscal year has been changed to cover the period from Jan. 1 to Dec. 31, so that this report is confined to the balance sheet and income account. A complete report under the new fiscal arrangement will be given at the annual meeting on the second Wednesday in April, 1914. The current assets of the company on June 30 were $9,414,483, and its current liabilities $4,364,132, while the surplus on the same date was $9,532,626. The total earnings for the year amounted to $46,385,993, of which sum $4,463,508 represented net profit. Dividend payments for the year aggregated $2,992,166, and bond interest payments amounted to $1,337,229, leaving a balance of $134,113 to be added to the surplus account. During the year ending June 30, the company's land line plant was extended by 26,020 miles of wire and 2174 miles of poles. The large office building under construction for the company in New York City will be completed about May 1, 1914. The company's policy is being continued of carrying to depreciation reserve all earnings over and above the present dividend requirements and charging reconstruction expenditures to that reserve. The existing board of directors and inspectors of election are to be continued in office until the stockholders' meeting in 1914, or until their successors are elected and qualified.

## Business Notes

**The Moloney Electric Company,** of St. Louis, Mo., has opened an office at 1716 Fisher Building, Chicago, Ill. L. H. Keller will be in charge.

**The Lindstrom Smith Company,** of Chicago, Ill., has entered the electrical field and will do a jobbing business in all standard electrical supplies.

**The New Process Specialty Company** announces the removal of its office from 709 M. & M. Bank Building to 602-4-6 Enterprise Building, Milwaukee, Wis.

**Hodenpyl, Hardy & Company,** bankers, of 14 Wall Street, New York, announce the opening on Oct. 10 of a Chicago office at 621-22 First National Bank Building, under the management of H. M. Tingle, formerly with the First National Bank of Detroit, Mich.

**Thomas A. Edison, Inc.,** announce the election of E. Hudson to the office of fourth vice-president of the company. Mr. Hudson will continue as heretofore in charge of the sales of the primary and battery department and will make his headquarters in Orange, N. J.

**The U. S. Light & Heating Company** announces the departure of its president, J. A. Smith, on Oct. 11, for a second trip to Europe this year. Mr. Smith's first trip was very successful in a business way, and the present trip is taken to attend to pressing company matters in England and on the Continent.

**The Hurley Machine Company,** of Chicago, has secured the services of Mr. George R. Purvis as special representative for its electrically operated washing machines and vacuum cleaners. Mr. Purvis was formerly manager of the appliance department of the Union Electric Light & Power Company, of St. Louis, Mo.

**Fairbanks, Morse & Company,** of Chicago, Ill., announce several organization changes. Their Southern department headquarters have been moved from Chicago to Atlanta, Ga., E. D. West remaining in charge. A New England office has been opened at 109 Lyman Street, Springfield, Mass., and R. F. Koops has been made manager.

**The Cutler-Hammer Manufacturing Company,** of Milwaukee, maker of electric controllers, has recently opened a new district office in Cincinnati, Ohio, located in the Fourth National Bank Building. The general increase in business has made it necessary to establish a permanent office in Cincinnati. Mr. Horace L. Dawson, formerly of the engineering department of the Cutler-Hammer Manufacturing Company, and recently one of the sales engineers connected with the Chicago office, will be in charge of the new office.

## New Industrial Companies

**The Penn Pressed Metal Company,** of Merchantville, N. J., has been incorporated by F. A. Kuntz, J. D. Baker and F. S. Saurman, of Merchantville. The company is capitalized at $25,000 and proposes to manufacture pressed metal goods of all kinds for mechanical and electrical engineers, etc.

**The Reeves-Cubberley Engine Company,** of Trenton, N. J., has been incorporated with a capital stock of $50,000 for the purpose of carrying on business as electrical engineer, machinist, etc. The incorporators are: C. Reeves, of Trenton; A. A. Taylor, of Allentown, and W. P. Cubberley, of Robbinsville.

**The American Electroscope Company,** of Chicago, Ill., has been incorporated with a capital stock of $2,500 to manufacture and deal in electrical machinery and to conduct a general advertising and publishing business. The incorporators are George R. McIntrye, William H. Williamson and Stanley Kubbeener.

**The J. & H. Electric Company, Inc.,** of Providence, R. I., has been incorporated with a capital stock of $10,000 to deal in and manufacture all machinery, appliances, devices and supplies used in electrical pursuits. The incorporators are Clarence E. Harmon, Warren M. Hodges and Lawrence E. Whitehead, all of Providence.

## Trade Publications

**Lighting Fixtures.**—The George Cutter Company, South Bend, Ind., has recently issued a 16-page illustrated catalog telling about its Idealite fixtures for controlling light distribution.

**Roller-Bearing Boiler-Tube Cleaner.**—Bulletin X, recently issued by the Lagonda Manufacturing Company, Springfield, Ohio, describes a new type of water-driven boiler-tube cleaner.

**Bolts.**—The Van Expansion Bolt Mfg. Company, Fort Dearborn Building, Chicago, Ill., has published a little hand book which will familiarize the recipient with the Van specialties. Considerable information regarding the Van expansion unit is given.

**Belt Dressing.**—The Cling-Surface Company, Buffalo, N. Y., has issued a booklet with the title "Wherever you go the world over, a package of Cling-surface sits beside the belts." It describes and illustrates installations of Cling-surface in many foreign countries.

**Electrical Supplies.**—The Pacific States Electric Company, San Francisco, Cal., has published some additions to its loose-leaf catalog giving the latest price lists of a number of specialties which it handles. These take the place of price lists and discount sheets previously issued.

**Conduits.**—A sixteen-page booklet recently issued by the Sprague Electric Works of the General Electric Company, 527 West Thirty-fourth Street, New York, gives information respecting Sprague flexible-steel armored conductors and Greenfield flexible-steel conduit fittings and tools. The pamphlet also contains dimensions and prices of the devices and materials listed.

**Pyrometers.**—The Brown Instrument Company, Philadelphia, recently sent a letter to 4000 users of Brown electric pyrometers asking if the results from their use were satisfactory. A copy of this letter, with copies of 100 replies, has been printed in pamphlet form. The replies are arranged under headings of the various industries in which the pyrometers are being used.

**Lighting the Home.**—The National X-ray Reflector Company, Chicago, has published in pamphlet form the article by Evelyn Marie Stuart on "The Lighting of the Home," which recently appeared in the *Fine Arts Journal*. The account is very interesting, and the excellent illustrations show the pleasing effects obtainable by indirect illumination with specially designed bowls.

**Porcelain Insulations.**—J. H. Parker & Son, 17 Highland Street, Chelsea, Mass., in a forty-two-page publication recently issued illustrate their line of porcelain insulations. One section is devoted to knobs, cleats, bushings, switch bases, insulators and other devices made by the dry process, and another section refers to tubes, insulators and special appliances manufactured by the wet process.

**Electricity on the Farm.**—"Electricity on the Farm," the title of a bulletin recently issued by the General Electric Company, represents an exhaustive treatise on this subject and contains a wealth of practical statistical information of a nature not hitherto available to the farmer, the central station manager, or the sales agent. For these reasons the publication should prove of unusual interest to all engaged in the extension of electrical service on the farm.

**Electric Drills.**—The Standard Electric Tool Company, Cincinnati, Ohio, in its Bulletin D-9 shows illustrations of and describes the "Standard" high-power direct-current portable electric drills. These drills are built on the unit plan, consisting of five simple parts. They can easily be dismembered without disturbing any electrical connections In Bulletin D-A 10 high-power two-phase and three-phase alternating-current portable electric drills are described.

**Turbines.**—Bulletin No. A4137, recently issued by the General Electric Company, illustrates and describes Curtis steam turbines of 100 to 2500 kw. capacity, for driving 60-cycle generators at 3600 r.p.m. These generating sets are of the horizontal-shaft rigid-frame type and either two or four impulse wheels are used, depending upon the capacity of the generator. The bulletin is fully illustrated, showing details of turbine construction, path of steam flow and a number of typical installations.

# Personal Mention

**Mr. H. J. Willis,** for six years superintendent of the La Crosse (Kan.) municipal electric light station, has been appointed superintendent of the new municipal plant at Scott City, Kan.

**Mr. A. L. Scott,** assistant sales agent of the Metropolitan Electric Company, of Reading, Pa., has been appointed sales agent of the Edison Electric Illuminating Company of Lebanon, Pa.

**Mr. H. J. Pettingell, Jr.,** for four years commercial agent of the Paducah (Ky.) Light & Power Company, has been appointed manager of the commercial department of the Stone & Webster interests at Woonsocket, R. I.

**Mr. M. J. Warner,** of the firm of Young & Warner, will assume the post as general manager of the Rockville-Willimantic Lighting Company, of Willimantic, Conn., as successor to Mr. W. M. Lewis who has resigned.

**Mr. David H. McCormick,** vice-president of the Rockville (Conn.) Gas & Electric Company, has been appointed agent of the company, assuming part of the duties of Mr. William M. Lewis who recently resigned to accept the post of general manager of the Grand Rapids-Muskegon Power Company.

**Mr. T. C. Martin,** secretary of the National Electric Light Association, is taking a vacation trip abroad of about a month, sailing on the *Lusitania.* He will visit two or three capitals to study the central station industry and dispose personally of the many inquiries that have arisen in regard to the new class of foreign company membership in the Association.

**Mr. Herbert C. Tinker,** of Jackson, Mich., who during the summer months has been temporary manager of the Grand Rapids-Muskegon Power Company at Muskegon has returned to Jackson and resumed his duties with the Au Sable Electric Company. Mr. Tinker has been succeeded at Muskegon by Mr. W. M. Lewis until recently manager of the Rockville-Willimantic Lighting Company.

**Mr. M. A. Carter,** who during the summer was in charge of the Salisbury Beach division of the Amesbury (Mass.) Electric Light Company has been placed in charge of the new business department and reconstruction work of the recently formed electric light company in Provincetown to be known as the Provincetown Light & Power Associates. Mr. Carter was for years manager of the Weymouth Light & Power Company and his associates in Amesbury presented him with a fine traveling bag as he left for his new field of endeavor.

**Mr. William M. Lewis** has resigned as manager of the Rockville-Willimantic Lighting Company, of Willimantic, Conn., to accept the position as manager of the Grand Rapids-Muskegon Power Company at Muskegon, Mich., successor to Mr. H. C. Tinker. Mr. Lewis joined the Rockville-Willimantic Lighting Company which owns and operates the Rockville Gas & Electric Company, the Stafford Springs Electric Light & Gas Company and the Willimantic Gas & Electric Company several years ago from Summerville, N. J., and during his incumbency has built the Rockville plant as well as the plants at Stafford and Willimantic. A farewell dinner was tendered to him on Oct. 4 at which Mr. Lewis was presented with a gold watch from the employees of the company.

**Mr. E. B. Burritt,** of the Washington Railway & Electric Company, who has taken up his new duties as secretary-treasurer of the American Electric Railway Association in New York, was presented with a traveling bag by the officials of the Washington Railway & Electric Company on severing his connections with the utility. During the past seven years Mr. Burritt has occupied important positions with the Washington company serving as private secretary to Gen. George H. Harries during the latter's connection with the company and recently as an executive officer attached to President King's office where important details of street railway management were placed in his hands. Mr. Burritt succeeds Mr. H. C. Dueker, an account of whose resignation was published on June 14, 1913.

**Mr. R. S. Hale,** the originator of the idea of "get together" meetings of the sales managers of the big Edison companies, has just rounded out twenty years of service with the Edison Electric Illuminating Company, of Boston. At the recent meeting of the sales managers at Association Island, N. Y., Mr. Hale, after four years of service, resigned as chairman, and as a memento of his work for that organization he was presented with a handsome gold and platinum cigarette case during the Edison convention at Cooperstown, N. Y. Mr. Hale, who is a graduate of Roxbury Latin School, and holds the degree of A. M. from Harvard and of M. E. from Cornell, entered the service of the Boston Edison Company in October, 1893, and was engaged in making engine and boiler tests. In 1895 he was engaged by the Steam Users' Association to report on the cost of steam in the United States and Europe. He acted as consulting engineer for the Mutual Boiler Insurance Company, and was a member of the firm of Hale & Cotton, which was interested in general electrical work. At practically every electric light convention Mr. Hale was present as consulting engineer for the Boston Edison Company, and in 1904 he was made assistant to the general superintendent. He later became superintendent of the sales department and was recently made superintendent of the research department, in which capacity he now serves. While at Harvard and at Cornell, Mr. Hale was interested in athletics. He was captain of the track team at Cornell, and holds the Harvard record for the mile and three-mile walks. Last year he was elected a trustee of the Roxbury Latin School, founded in 1645, the oldest endowed school in America. Mr. Hale is a member of the American Society of Mechanical Engineers, American Institute of Electrical Engineers, Boston Society of Civil Engineers, Illuminating Engineering Society, National Electric Light Association, Electric Motor Car Club of Boston, Tennis and Racquet Club, Exchange Club, Engineers' Club, Brookline County Club, Dedham County Club, Hoosick Whissick Club, Harvard Club of New York, University Club of New York and the Century Association of New York.



R. S. HALE

# Obituary

**Dr. Rudolph Diesel,** who disappeared from an English Channel steamer Sept. 29, as noted in our issue of Oct. 4, is believed to have fallen overboard and been drowned. A body washed ashore Oct. 13 at the mouth of the River Scheldt near Flushing, Holland, has been identified as that of Dr. Diesel by his son and by persons who knew the dead inventor. At the time of his disappearance Dr. Diesel was on his way from Antwerp to Harwich to attend a meeting of the Diesel company at London. Rudolph Diesel was born in Paris in 1858, and received his higher education in Augsburg, Germany, and at the Polyclinic College, Munich. He was the inventor of the internal-combustion type of engine identified with his name, although in recent years he had taken a less active part in the manufacture of these units. Dr. Diesel last visited America in April, 1912, and presented papers at meetings in St. Louis, Chicago and New York.



RUDOLPH DIESEL

# Construction

## New England

BECKET, MASS.—The Berkshire & Becket Silk Companies, Ltd., are planning to install an electric generator in their plant to generate electricity for lighting the mill.

HOLYOKE, MASS.—Bids will be received by P. M. Judd, chairman of Board of Fire Commissioners, Holyoke, Mass., until Nov. 18 for furnishing underground fire alarm cable, combination fire alarm and cable posts and cable boxes; also for fire alarm telegraph system. Further information may be obtained at the office of Thomas F. Monaghan, superintendent of fire alarm.

LAWRENCE, MASS.—The Board of Selectmen has awarded the Lawrence Gas Co. a contract for lighting the streets of the city for a period of three years. The contract provides for replacing the present lamps with 368 tungsten incandescent lamps of 40 cp, to cost $16 each per year.

SPRINGFIELD, MASS.—Plans calling for the installation of a duplicate steam plant for the United States Armory in Springfield, have been submitted by Col. William S. Pierce, commandant of the armory, to the Ordnance Department of the United States Army. The plans call for an expenditure of $50,000 and provide for the installation of two steam turbo-generator sets with a rating of 500 hp each. It is proposed to replace the present shaft transmission system with electric motors.

SPRINGFIELD, MASS.—The stockholders of the Union El. Lt. Co., of Springfield, have voted to increase the capital stock of the company from $1,500,000 to $1,750,000. While the increase in capital stock is only $250,000 the amount will be $500,000 as the new stock is to be sold at $200 per share in accordance with the decision of the Gas and Electric Light Commissioners. The proceeds of the stock will be used for extensions to plant, the purchase of a 4500-kw turbine, four new boilers and to meet the cost of underground work.

PAWTUCKET, R. I.—Plans are being prepared for the construction of a new three-story building for the What Cheer Chemical Co., on Grotto Avenue. A power house and boiler room will be erected.

MIDDLETOWN, CONN.—The proposed change in the street-lighting system on Main Street has been approved by the Business Men's Association, which will submit the proposition to the Council. The plans provide for the installation of 44 ornamental standards carrying cluster lamps to replace the present arc lamps from St. John's Square to the South Church.

NORWICH, CONN.—The Board of Lighting Commissioners expects to erect within the next two months one gas container (500,000 cu. ft. capacity), contract for which has been awarded to the R. D. Wood Co., of Philadelphia, Pa. S. J. Kehoe is superintendent.

## Middle Atlantic

BINGHAMTON, N. Y.—The Afton-Windsor Lt., Ht. & Pwr. Co., of Binghamton, has applied to the Public Service Commission for permission to erect a transmission line for the purpose of furnishing energy for lamps, heat and motors in the village of Afton, and the village and town of Windsor, and the town of Colesville; also for permission to increase the capital stock of the company from $5,000 to $50,000 and to issue $60,000 in bonds.

BROOKLYN, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 8 for changes in the lighting system, United States post office building, Brooklyn, N. Y., in accordance with drawings and specifications, copies of which may be obtained at the above office or at the office of the supervising engineer. O. Wenderoth is supervising architect.

JAMESTOWN, N. Y.—Preparations are being made by the Jamestown St. Ry. Co. for the construction of an addition (75 ft. by 62 ft.) to its power station to provide space for 18 transformers. In December the company expects to install a 5000-kw Westinghouse-Parsons turbo generator set in the present power station.

NEW YORK, N. Y.—The contract for installing lighting fixtures in the new post office in New York City has been awarded to Wahle-Phillips Co., of New York, at $10,622.

NEW YORK, N. Y.—Plans have been filed by the New York Edison Co. for an electric-light and power station in the Bronx. The building will be erected at 327 to 341 Rider Avenue, and will cost about $20,000. William Weissenberger, Jr., is architect.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities, foot of East Twenty-sixth Street, New York, N. Y., until Oct. 24 for furnishing labor and material required for the construction and installation of additional mechanical equipment for the power house and laundry building at Randalls Island, city of New York. Blank forms and further information may be obtained at the office of Frank J. Helme, architect, 190 Montague Street, Brooklyn, where plans and specifications may be seen.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, N. Y., until Oct. 20 for installing electric equipment in new Public School 22, on the corner of Washington and Columbus Avenues, Graniteville, borough of Richmond. Blank forms, plans and specifications may be seen or obtained at the office of the superintendent, Park Avenue and Fifty-ninth Street, borough of Manhattan; and also at branch offices, 69 Broadway, Flushing, borough of Queens; Borough Hall, New Brighton, borough of New Richmond.

NEW YORK, N. Y.—Bids will be received by the Panama-Pacific Commission of the State of New York, at the office of the commission, 140 West Forty-second Street, New York, until Nov. 8, for construction of the New York State Building on the grounds of the Panama-Pacific Exposition, San Francisco, Cal., as follows: (1) For erecting building; (2) installing plumbing, water supply and gas fitting in above building; (3) installing steam heating system; (4) installing the electric work. Forms of proposals, together with copies of contracts and specifications may be had at the office of the commission, and drawings may be obtained from Charles B. Meyers, architect, 1 Union Square West, New York. Norman E. Mack is chairman of commission.

OSWEGO, N. Y.—The Minetto-Meriden Co., it is reported, will apply for a franchise to erect a transmission line from its plant at the Minetto dam into Oswego to furnish energy for manufacturing purposes.

ALTOONA, PA.—A special meeting of the stockholders of the Penn Central Lt. & Pwr. Co. will be held Oct. 20 to vote on the proposition to increase the capital stock of the company from $5,000,000 to $7,500,000.

EASTON, PA.—The directors of the Eastern Pennsylvania Pwr. Co., of Easton, have approved a merger with the Pennsylvania Utilities Co., of Nazareth. The new company will be known as the Pennsylvania Utilities Co. and will operate the light, heat and power companies in Easton, Nazareth, Bath, Penargyl, Bangor, Stroudsburg and Columbia. Carl M. Pihl, of Easton, president of the Eastern Pennsylvania Co., will be president of the new company, A. D. Lord, of Summit, N. J., vice president; F. B. Shannon, treasurer, and A. B. Cheadle, secretary, both of New York, N. Y.

PHILADELPHIA, PA.—The contract for the installation of an electric-lighting and power system at the Dock Street pier, has been awarded to the Thompson El. Co., 1606 Samson Street, Philadelphia, for $6,488.

PORTVUE, PA.—The Borough Council has granted the West Penn El. Co., Pittsburgh, a franchise to install an electric-light system in Portvue. Post office address Portvue, R.F.D. McKeesport.

SHARON, PA.—Papers have been filed with the State Department announcing the absorption by the Mercer County Lt., Ht. & Pwr. Co. of the Stoneboro Pwr. Co., Lake Pwr. Co., Fairview Pwr. Co., Sandy Lake Pwr. Co. and Sandy Lake Suburban Pwr. Co., all recently chartered in Mercer County.

MORRISTOWN, N. J.—The Morris & Somerset El. Co. has begun work on the erection of a new three-phase, high-tension trunk line between Morristown and Whippany. The company proposes to furnish electric service in Hanover Township.

NEWARK, DEL.—The Water and Light Commission expects to purchase within the next six months some lamps for use in connection with the municipal electric-light plant.

LONACONING, MD.—The Home El. Lt. Co., of Lonaconing, has applied to the Public Service Commission for permission to issue $20,000 in bonds, the proceeds to be used to purchase the plant and holdings of the Lonaconing El. Lt. & Pwr. Co.

MOUNT AIRY, MD.—The town of Mount Airy is considering the question of establishing a municipal electric-light plant.

RICHMOND, VA.—Investigations are being made by a committee of the Council into the advisability of purchasing the Pocahontas Cotton Mill property in Battersea, with a view of drawing the city's water supply from that source. In connection with this matter it is said that investigations are being made with a view of establishing a municipal electric-light plant at that point.

WASHINGTON, D. C.—Tenders will be received until Nov. 15 by the Agent General for Victoria, Melbourne Place, Strand, London, W. England, for overhead electrical equipment of permanent way and overhead transmission mains in connection with equipping the Melbourne Suburban Railways for electrical operation now being carried out.

WASHINGTON, D. C.—The Commissioners of the District of Columbia [illegible] recommendation to Congress asking an appropriation of $3,000,000 to provide for the purchase of the Potomac River water falls and for the beginning of the work. It is proposed to develop water power to generate electricity for lamps and motors in Washington. The total cost of the work is estimated at $15,000,000.

## North Central

CHEBOYGAN, MICH.—The Cheboygan El. Lt. & Pwr. Co. has applied to the State Railroad Commission for permission to issue $250,000 [illegible].

COLON, MICH.—Within the next nine months the United El. Co. of Colon, expects to erect 20 miles of 13,200-volt transmission line, to purchase within the next eight months one 30-kva, 60-cycle, three-phase, 2300-volt revolving field (belted) generator, 1200 r.p.m. E. Seaver is manager.

DUNDEE, MICH.—The Dundee Hydraulic Pwr. Co. is making extensive changes at its plants and rebuilding its electric lines for lamps and power. All machinery and equipment have been purchased. H. G. Gray is manager.

DURAND, MICH.—The Water and Light Commission expects to purchase within the next eight months a 150-hp engine for the municipal electric-light plant. D. M. Trumbull is secretary.

FREEMONT, MICH.—A proposition has been submitted to the Village Council by Walter Snow, who owns a water power site on the White River, to serve this village with electrical energy for lamps and motors. Mr. Snow states that 1500 hp can be developed and asks for a contract for 1000 hp before beginning the development.

KALAMAZOO, MICH.—Steps have been taken by the property holders on South Street to secure an extension of the ornamental street-lighting system.

MILLINGTON, MICH.—Oliver B. Whipple, owner of the local electric-light plant, expects to erect within the next two months one 6000-gal. to 8000-gal. oil storage tank. A new oil-engine-driven plant is now being installed, consisting of one 25-hp and one 35-hp Alamo oil engine. As soon as improvements are completed energy will be generated at the plant, instead of being purchased as at present.

ATHENS, OHIO.—Bids will be received by the Board of Trustees of the Ohio University at Athens until Nov. 5 for furnishing materials, construction and installation of a plant for the Ohio University to be used for lighting, power and experimental purposes, according to plans and specifications prepared by A. A. Atkinson and George McLoughlin, engineers, of Athens, which are on file at the office of the secretary of the Board of Trustees, Athens, at the office of the engineers, and at the office of the auditor of state and H. H. Hannig, treasurer. I. M. Foster is secretary of board of trustees.

CANTON, OHIO.—The Barber Mining & Fertilizer Co., recently organized, it is reported, will ask for a franchise to furnish electrical energy in Canton. The company proposes to erect a plant at Howenstein, to cost about $150,000. Homer B. Briggle is general manager.

CINCINNATI, OHIO.—The Cincinnati, Lebanon & Northern R.R. Co. is contemplating equipping its railroad for electrical operation. The present plans, it is said, provide for the erection of a power plant in Cincinnati, at Fourth and Canal Streets, and extending the service to Monroe, Bethany, Mauds, West Chester and other villages on the way to Middletown.

CLEVELAND, OHIO.—The Cleveland El. Illg. Co. will erect a switch house addition to its new plant at 782 East Seventieth Street. The building will be 35 ft. by 168 ft., three stories high, and will cost about $5,000.

CLEVELAND, OHIO.—Bids will be received at the office of the secretary to the director of public service, 204 City Hall, Cleveland, until Oct. 25, for general building construction for the municipal electric-light plant of Cleveland. Plans and specifications may be obtained at the office of the engineer of construction, 419 City Hall. W. J. Springborn is director of public service and W. H. Kirby, secretary.

DEFIANCE, OHIO.—Authority has been granted to the Defiance Gas & El. Co. by the State Utilities Commission to issue $114,000 in bonds, the proceeds to be used for improvements and extensions to its system.

LIMA, OHIO.—An Auxiliary power house, it is reported, will be erected on North Main Street by the Ohio El. Ry. Co. The plans provide for a building 40 ft. by 60 ft.

LIMA, OHIO.—The City Council has adopted a resolution authorizing the submission of a $40,000 bond issue to the voters on Nov. 4 for the purpose of installing an ornamental street-lighting system and to construct a municipal electric-light plant.

LIMA, OHIO.—The Schoepf syndicate, it is reported, has announced that improvements involving an expenditure of $78,000 will be made in its system in this section, including the erection of a sub-power house in Lima. Energy for operating the railways of the Toledo, Fort Wayne & Defiance in this vicinity has been purchased from the Western Ohio Ry. Co. The new plant will have sufficient output to operate all the lines, even to Springfield on the south.

NATIONAL MILITARY HOME, OHIO.—Bids will be received at the office of the treasurer, central branch, National Home, Disabled Volunteer Home, National Military Home, Ohio, until Oct. 23 for furnishing motor-generator set, motors, transmission line, power pumps and piping for improvement of water supply at lake pumping station, in accordance with instructions and specifications, copies of which with blank proposals, etc., may be obtained upon application to W. H. Ortt, treasurer.

PORT CLINTON, OHIO.—The City Council has decided to submit the proposition to issue $30,000 in bonds to establish a municipal electric-light plant to the voters at the election to be held Nov. 4.

ST. BERNARD, OHIO.—The City Council has adopted an ordinance authorizing an issue of $30,000 in bonds for improvements to the municipal electric-light plant. It is proposed to change the system from 133 cycles to 60 cycles.

WILSON, KY.—The installation of an electric plant in connection with the flour mill is being considered by Melton Brothers, of Dixon.

HICKMAN, KY.—The Hickman El., Ice & Wtr. Co. has recently enlarged its deep wells, drilled an additional well and increased the capacity of its ice plant, and it is now installing water meters and making various extensions to its water mains and electric lines. Window-lighting service has been inaugurated and an ornamental street-lighting system is being developed. A. D. Brinkerhoff, of St. Louis, is secretary and treasurer of the National Lt. & Pwr. Co., of St. Louis, which controls the Hickman company.

HODGENVILLE, KY.—The Hodgenville Lt. Co. expects to purchase within the next four or five months boiler, engine and dynamo and to establish a 24-hour service; also to furnish energy for motors. D. E. Paterson is owner.

JENKINS, KY.—The Consol. Coal Co., which has large electric power plants at its mines in Jenkins and also at its Van Lear operations, near Paintsville, is now erecting a high-tension transmission line from Jenkins via Beaver Creek, to Van Lear, a distance of 65 miles, to connect the two plants. When this line is finished the local power stations in Pikeville and Prestonburg will be closed down and energy will be obtained from the transmission line. Another transmission line will be erected along the Elkhorn Creek from Jenkins to Elkhorn City for the purpose of furnishing electrical energy in Elkhorn, Marrowbone Creek, for mining operations and for lamps in the town of Shilbiana.

INDIANAPOLIS, IND.—Arrangements are being made by the Electric Steel Co. of Indiana (recently incorporated), for the erection of a new steel plant in Indianapolis. The company is capitalized at $100,000 and it will use an electric furnace patented by H. H. Buckman, Jr., of Indianapolis. Hugh McK. Landon, J. D. Forrest, George A. Weidely, Chester P. Wilson and H. H. Buckman, Jr., are interested in the company.

BLUE ISLAND, ILL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 10 for the construction complete, including mechanical equipment, interior lighting fixtures and approaches of the United States post office at Blue Island, Ill. Drawings and specifications may be obtained at the above office or from the custodian of site at Blue Island. O. Wenderoth is supervising architect.

CHICAGO, ILL.—Bids will be received by the city of Chicago until Oct. 22, at room 406, City Hall, for furnishing nine direct-current electric motors at the water works shops, at 2304 South Ashland Avenue, Chicago. Motors to vary in size from 2 hp to 15 hp, according to plans and specifications on file in the office of the Department of Public Works, Room 406, City Hall. L. E. McGann is commissioner of public works.

DIXON, ILL.—Within the next three months the Illinois Northern Utilities Co., of Dixon, expects to erect four 33,000-volt outdoor substations and to purchase electrolytic lightning arresters, high-tension disconnecting switches, fuses, etc., for above stations and central stations feeding same; also lightning arresters, insulators, transformers and poles, necessary for extensions and maintenance in 39 towns which it supplies with energy; series incandescent lamps and regulators for upward of 600 street lamps; also electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machine, etc., as requirements demand. The company has recently installed 40 ornamental street lamps in Dixon, using Magnetite luminous arc-lamps. L. E. Marshall is manager.

EDWARDSVILLE, ILL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 18 for construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Edwardsville, Ill. Drawings and specifications may be obtained at the above office or from the custodian at Edwardsville. O. Wenderoth is supervising architect.

PANA, ILL.—The City Council has authorized the light committee to investigate the cost of installing and operating an electric-light plant.

CORNELL, WIS.—We are informed that no definite action has yet been taken toward the installation of a municipal electric-light plant. L. G. Arnold, of Chippewa Falls, Wis., is consulting engineer.

DELAVAN, WIS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 14 for the construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Delavan, Wis. Drawings and specifications may be obtained from the above office or from the custodian of site at Delavan. O. Wenderoth is supervising architect.

GREEN BAY, WIS.—The Wisconsin Public Ser. Co., of Green Bay, has purchased the electric utility property of the Minahan Building and is now operating the same, having taken possession on Sept. 12. C. R. Phenicie is general superintendent.

MILWAUKEE, WIS.—The joint committee on finance and street lights has adopted a resolution to ask for bids from the electric service companies for lighting the city with electricity for the next five or ten years. This action was taken by the committee in conformity with the recommendation of the Wisconsin Railroad Commission, whose experts reported that the city could save at least $46,000 per year by entering into a contract with an existing concern rather than establishing a municipal plant for street lighting.

OSSEO, WIS.—Application has been made to the Village Board by J. N. Lee & Sons for a franchise to construct and operate an electric-light system in Osseo. The plant will be operated in connection with the mill. A 30 hp oil engine will be installed to be used when the water-power gives out. Storage batteries will be used to supply power for day

[illegible] proposed street-lighting system provide for the installation [illegible] at a cost of $600 per year.

BLUE EARTH, MINN.—An ornamental street-lighting system will be [illegible] of the business portion of the city. Tungsten lamps will be used. The citizens have subscribed $2,000 toward the project.

FERTILE, MINN.—The City Council has decided to call a special election to vote on the proposition to install a municipal electric-light plant in Fertile.

INTERNATIONAL FALLS, MINN.—The City Council has awarded the contract for conduits, lamp standards and lamps for the ornamental street-lighting system in the business section to F. O. Peterson, of Duluth, for $4,962. Arc lamps will be used.

EARLVILLE, IA.—The question of enlarging the municipal electric-light plant is under consideration.

McGREGOR, IA.—An election will be held Oct. 20 to submit the proposition to grant the McGregor El. Lt. & Pwr. Co. a franchise to erect and maintain transmission lines to Monona for the distribution of electricity in Monona and villages and farmers along the line.

MALVERN, IA.—At an election held recently the proposition to grant the Red Oak El. Co., of Red Oak, a franchise in Malvern was defeated.

OELWEIN, IA.—The City Council has granted a franchise to T. J. Mulgrew, A. F. Heeb and T. J. Fitzpatrick, all of Dubuque, to install and operate an electric-light plant in Oelwein. A special election will be held to submit question of granting the franchise to the voters.

PERRY, IA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 20 for the construction, including mechanical equipment, interior lighting fixtures and approaches of the United States post office at Perry, Ia. Drawings and specifications may be obtained at the above office or from the custodian of the site at Perry. O. Wenderoth is supervising architect.

ALBANY, MO.—The contract for construction of a new municipal power plant has been awarded to the Commercial Construction Co., of Kansas City, Mo., at $12,000. W. E. Noonan is superintendent.

MANDAN, N. D.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 18 for the construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Mandan, N. D. Drawings and specifications may be obtained at the above office or from the custodian of site at Mandan. O. Wenderoth is supervising architect.

WAHPETON, N. D.—Bids will be received at the office of the auditor of Richland County, Wahpeton, N. D., until Oct. 28 for furnishing and installing furniture and fixtures, electric-light fixtures and decorating the new Richland County court house. Separate bids to be submitted as follows: (a) For furniture and fixtures and window shades; (b) for steel counters in offices and vault tables (not including vault fixtures); (c) electric-light fixtures; (d) for decorating. Plans and specifications may be seen at the office of Buechner & Orth, architects, 500 Shubert Building, St. Paul, Minn., and at the office of F. A. Burton, county auditor, Wahpeton; copies may also be secured upon application to the architects.

PLANKINTON, S. D.—The local electric-light plant is reported to have been purchased by J. B. Jones, of Presho. The new owner, it is understood, will improve and extend the system.

DORCHESTER, NEB.—Plans are being prepared by C. O. Martz, 1208 S Street, Lincoln, Neb., engineer, for an electric-light plant (distributing system only) and transmission line and water works system in Dorchester, bonds for which have already been voted. Energy for operating electric system will be obtained from private plant. Bids, it is said, will be called for the latter part of December. The cost of the electric system is estimated at $15,000 and the water works at $5,000. W. W. Wall is city clerk.

GREELEY, NEB.—A special election will be called to submit the proposition to grant a franchise to F. J. Buckley to install an electric-light and power plant in Greeley to the voters.

CHERRYVALE, KAN.—Preparations are being made by the Kansas Gas & El. Co., of Wichita, for the erection of a high-tension transmission line between Cherryvale and Independence.

GARNETT, KAN.—At an election to be held Oct. 14 the proposition to issue $15,000 in bonds for a municipal electric-light plant will be submitted to the voters. The purchase of the local electric plant, owned by the Garnett El. Lt. Co., is under consideration. J. Q. McAfee is president of the company.

HUTCHINSON, KAN.—The United Wtr., Gas & El. Co., of Hutchinson, is installing a new ornamental street-lighting system, and also contemplates some extensions to the street series arc-lamp lighting system; also to the water system. The company does not contemplate the immediate purchase of any considerable amount of additional equipment. J. F. Springfield is general manager.

## Southern States

CAMDEN, S. C.—Bonds to the amount of $125,000 have been sold, of which the proceeds of $35,000 will be used for the installation of a municipal electric-light plant and $90,000 for construction of water works and filtration system. T. C. White is consulting engineer for the city commission.

WALHALLA, S. C.—Preparations are being made by the Linler Pwr. Co., of Walhalla (recently incorporated with a capital stock of $100,000), for the construction of a hydroelectric power plant on Little River, 8 miles north of Walhalla. The equipment of the proposed plant will consist of two pairs of turbines with a rating of 325 hp each, two water wheel governors, two 300-kw (each), 60-cycle, three-phase, 22,000-volt generators, switchboard, six 150-kva (each), 2200-22,000-volt transformers, outdoor type; two substations will be erected, one at Walhalla and the other at Westminster; 400 poles and 24 miles of No. 2 copper wire will be used for overhead distribution system; 40 General Electric 6.6 amp. arc lamps will be used. Contracts for construction of plant will be let Oct. 18. John Q. Linder is interested in the company.

HIGH SPRINGS, FLA.—The contract for the construction of the proposed municipal electric-light plant has been awarded to the J. B. McCrary Co., of Atlanta, Ga. Bonds to the amount of $35,000 were recently voted for the installation of an electric-light plant and water works system.

JUPITER, FLA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 1 for the construction of power house at the United States radio station, at Jupiter, Fla. Specifications may be obtained upon application to the above bureau. The amount available for the work is $2,400. H. R. Stanford is chief of bureau.

BAY MINETTE, ALA.—The installation of an electric-light plant in Bay Minette is under consideration. Frank S. Stone, of Bay Minnette, is reported to be interested in the project.

GEORGIANA, ALA.—The city of Georgiana contemplates the installation of a municipal electric-light plant and water works system. For further information address W. H. Holloway, secretary of Commercial Association.

HUNTSVILLE, ALA.—The contract for the installation of a conduit and wiring system in the United States post office in Huntsville, Ala., has been awarded to the Herman Andrae El. Co., 139 Sycamore Street, Milwaukee, Wis., at $5,015.

POCAHONTAS, ARK.—Arrangements are being made by the Pocahontas Lt., Pwr. & Ice Co. to improve the electrical service in Pocahontas. As soon as the transmission line between here and Walnut Ridge is completed both plants will be combined and a 24-hour service established. B. Morrison is manager.

PLAQUEMINE, LA.—The Dunlap El. Co. expects to erect an ice plant within the next six months. F. E. Hubbard is secretary and treasurer.

CHICKASHA, OKLA.—The Chickasha Lt., Ht. & Pwr. Co. has awarded the contract for construction of addition to its electric-light plant to the Deming Construction Co., for $10,000.

FORT WORTH, TEX.—The Fort Worth Pwr. Co. has awarded contract for construction of power house (brick and concrete) to the Cleveland Construction Co., of Cleveland, Ohio, for $6,000.

GALVESTON, TEX.—At a special meeting held recently the stockholders of the Galveston-Houston El. Co. authorized an increase of $2,000,000 in capital stock, the proceeds to be used for extensions and improvements.

PITTSBURG, TEX.—Steps have been taken to erect a new electric light and ice plant in Pittsburg. About $15,000 has been subscribed by the local business men.

SAN DIEGO, TEX.—The local electric-light plant which was destroyed by fire will be rebuilt. S. G. Smith is interested in the enterprise.

## Pacific States

RAYMOND, WASH.—The Willapa El. Co., of Raymond, recently organized, will purchase the properties and franchises of the Willapa Harbor Ry. Co., of Raymond, and the Twin City El. Co. The power stations are located in Raymond and South Bend. New equipment will be installed including a 1000-kw, three-phase, 2300-volt Curtis turbine and switchboard apparatus. J. S. Thornton is interested in the company.

SPOKANE, WASH.—Plans, it is reported, have been completed for the installation of a cluster lighting system on Riverside Drive, to cost about $25,000.

KENO, ORE.—State Engineer John H. Lewis announces that preliminary surveys have been made for a large water project on the Klamath River, below Keno. The surveys were made under the new law authorizing the co-operation of state and federal governments. The project provides for the construction of a canal 10½ miles long, terminating about 2 miles above the California-Oregon boundary line, with the development of about 100,000 hp.

IMPERIAL, CAL.—The proposition to issue $26,000 in bonds for the installation of a municipal electric-light plant in Imperial will soon be submitted to the voters.

[illegible], CAL.—The City Council has authorized the Board of Public Works to advertise for bids for lighting the city for a term of two years, the city to reserve the right to annul the contract at the end of one year upon paying the lighting company for the 550 lamps to be installed during the year 1914.

OROVILLE, CAL.—Preparations, it is reported, are being made by the Great Western Pwr. Co. to extend its electrical service to Grass Valley and Nevada City. The proposed transmission line would furnish electrical energy in Forbestown and a large number of mines in that vicinity.

SAN FRANCISCO, CAL.—Application has been made to the Board of Supervisors by the Universal Gas & El. Co. (controlled by Spreckels interests), for permission to extend its electric and gas service throughout the city.

SAN FRANCISCO, CAL.—Application has been made to the State Railroad Commission by the United Lt. & Pwr. Co., of San Francisco, for permission to issue a note to the amount of $6,000, to provide funds for an extension in Oakland.

SONOMA, CAL.—The Railroad Commission of California has granted the Sonoma Valley Wtr., Pwr. & Lt. Co., of Sonoma, permission to issue $30,000 in bonds, of which the proceeds of $9,000 will be used for refunding existing indebtedness, and the remainder for extensions and improvements to its property.

BOISE, IDAHO.—The Idaho Pwr. & Lt. Co., of Boise, recently organized, has taken over the holdings of the Beaver River Pwr. Co. in Boise and southern Idaho, together with all franchises of its power and transmission lines, including the 7500-hp plant on the Malad River and the distribution systems in Boise and other Idaho towns. The officers of the company are: L. L. Nunn, president; W. L. Biersach, treasurer; E. P. Bason, general manager, and Jesse B. Hawley, general counsel.

NEW MEADOWS, IDAHO.—The Adams County Lt. & Pwr. Co., of New Meadows, will construct a hydroelectric power plant on the Little Salmon River and will also erect a 22,000-volt transmission line (80 miles long) to furnish energy in Meadows, New Meadows, Tamarack and Council in Adams County, McCall in Boise County, and Cambridge and Midvale in Washington County. B. Gustad is president and general manager.

BAKER, MONT.—If granted a satisfactory franchise, R. R. Pearce, it is reported, will install an electric-light plant in Baker.

SIDNEY, MONT.—The construction of an electric-light plant in Sidney is under consideration. Dr. Beagle, W. L. Bell and others are interested.

STERLING, COL.—The Sterling Consol. El. Co., of Sterling, expects to erect next spring about 10 miles of cross-country transmission line, developing a pumping service for irrigation purposes. H. L. Titus is manager.

RENO, NEV.—Secretary Houston has granted the Truckee River General Electric Co., of Reno, Nev., permission to develop water power in the Eldorado National Forest, California, to supply energy in Sacramento, Stockton and other surrounding towns. The initial installation of the proposed plant will provide for 16,000 hp, which will be doubled as the demand increases. Water will be secured from the Rubicon River. The plans provide for the construction of a tunnel 1½ miles long.

## Canada

MEDICINE HAT, ALTA.—Plans are being considered by the City Council to increase the output of the municipal electric-light plant by 2500 kw, at a cost of about $250,000.

MEDICINE HAT, ALTA.—The city of Medicine Hat is considering the question of improving the street-lighting system and would like to receive catalogs from reliable firms giving detailed information and full description of their street-lighting outfits and general data in connection with the distribution of lamps and the cost of installation. A. K. Grimmer is city engineer.

PORT MOODY, B. C.—The British Columbia El. Ry. Co. will install 10 100-watt tungsten lamps for street-lighting purposes under a 10-year contract recently awarded the company.

SOUTH VANCOUVER, B. C.—The report of L. F. Rawdon, municipal electrician, in regard to the establishment of a municipal electric light and power plant has been adopted by the City Council. The proposition of issuing bonds for the construction of the proposed plant will be submitted to the taxpayers at an early election.

SYDNEY, B. C.—Negotiations have been closed between the City Board of Trade and the British Columbia El. Ry. Co., of Vancouver, whereby the company agrees to install electric lamps on the principal streets of the town immediately.

ASSINIBOIA, MAN.—The application of the city of Winnipeg to furnish energy for lamps and motors in the municipality of Assiniboia has been granted.

ROSSER, MAN.—The Winnipeg El. Ry. Co. has been granted a franchise to furnish energy for lamps and motors in Rosser for a period of 30 years.

BATHURST, N. B.—The Bathurst El. & Wtr. Co. expects to purchase this month four motors, one 12-hp, one 20-hp, one 30-hp and one 50-hp, with meters and transformers; also 20 new lightning arresters. The company has erected 6 miles of 6600-2200-220-110-volt transmission line. J. P. Tiger is manager.

TRURO, N. S.—We are informed that most of the material has been purchased for the municipal electric-light plant being installed in Truro. C. McDowell, town engineer, has charge of the work. H. McDougall is town clerk and treasurer.

DUNDAS, ONT.—The town has taken over the street-lighting system and will make a number of improvements and additions.

L'ORIGNAL, ONT.—K. Marston, proprietor of the local electric-light plant, expects to purchase within the next 30 days one 5-kw pole transformer, 10 poles, one arc-lamp and bracket and four street-lamp fixtures for incandescent lamps.

NIAGARA FALLS, ONT.—Application has been made to the Queen Victoria Niagara Falls Park Commission by the Ontario Pwr. Co. to build a pipe line through the park. Preparations are being made by the company to build a third pipe line from its gate house above the falls on the Canadian side of the river to the power house just below the "Horseshoe" Falls, a distance of about 1¼ miles. The proposed line will be 18 ft. in diameter and will cost about $1,000,000.

ST. MARYS, ONT.—The electric light commissioners expect to purchase within the next six or nine months wire, transformers, graphic meter for customer taking about 400 hp, one 250-hp motor and 150 hp in four motors; also wire brackets and hoods for 25 100-cp series tungsten lamps. H. M. Miller is superintendent.

TORONTO, ONT.—The wires of the Toronto Hydro-Electric system will be placed underground on Melinda Street from Bay to Yonge Street and on Victoria Street from Queen Street to lane north of Loew's Theater, where the transformer pit will be located. The Toronto El. Lt. Co. will place its wires underground on Shaw Street, north of Dupont Street, under the Canadian Pacific Railway tracks, and at the intersection of Yonge and Temperance Streets.

TORONTO, ONT.—The Hydro-Electric Power Commission of Ontario has deposited with the Department of Public Works for Canada plans for a high-tension transmission line to be erected across the St. Lawrence River at Morrisburg. The Hydro-Electric Power Commission has secured an option of 15,000 hp from the New York & Ontario Pwr. Co., Waddington, and as soon as the plant is ready a portion of this power will be imported into Canada.

MONTREAL, QUE.—The Montreal Wtr. & Pwr. Co. is building a second transformer house (20 ft. by 40 ft.) at its plant in Point St. Charles. The company is supplied with energy by the Montreal Lt., Ht. & Pwr. Co. at 2200 volts, the latter furnishing three transformers of 1000 kva each. It is proposed to erect a duplicate line and also to duplicate the transformers and other equipment, the water company building the transformer house.

ESTEVAN, SASK.—By-laws appropriating $36,000 for the installation of a street-lighting system and for extensions to the power plant have been passed by the City Council.

REGINA, SASK.—The city of Regina expects to erect within the next three months a new power house and to install 8000-hp boilers and engines with a rating of 12,000 hp. Within the next two months the city expects to purchase coal and ash-handling machinery, and within the next six months yearly supply of transformers, poles, lightning-arresters, insulators, wire, cable and meters; also 500 arc-lamps, either alternating-current or direct-current, not yet decided.

## Miscellaneous

PEARL HARBOR, H. I.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 8 for furnishing one 100-kw motor-generator set and switchboard accessories at the naval station, Pearl Harbor, Hawaii. Specifications can be obtained upon application to the bureau. H. R. Stanford is chief of bureau.

# New Incorporations

GERMANTOWN, NEB.—The Germantown Lt. & Pwr. Co. has been incorporated with a capital stock of $2,000 by F. W. A. Roehrkasse, M. B. Palmer and others.

HARRISBURG, PA.—Charters have been granted by the State Department for eight new electric companies, seven to operate in Schuylkill County and one in Northampton County, to interests allied with the Lehigh Valley Transit Co. Those issued in Schuylkill County were granted to W. B. Rockwell, Ira G. Walborn and Van Dusen Rickert, of Pottsville, for the Eastern Pennsylvania Lt., Ht. & Pwr. Co. to operate plants in Ryon, Centralia, Girardville, Butler, Gilberton, Conyngham and West Mahanoy Townships. Each company is capitalized at $5,000. The charter of the Edison Illuminating Co. of Easton was issued to H. R. Fehr, president of the Lehigh Valley Tran. Co., H. J. Steele and S. H. Hackett, of Easton; W. H. Walters, of Phillipsburg, N. J.; J. C. Dawson, Thomas Newhall, W. A. Sterne and A. L. Smith, of Philadelphia. The company will be capitalized at $350,000 and will operate in Northampton County.

READING, PA.—Charters have been granted by the State Department to J. H. Bucher, G. L. Roller and Harry H. Riegel, of Reading, for five electric companies to operate in parts of Berks and Lebanon Counties, to be known as the Jackson El. Lt., the Newmanstown, the Prescott, the Quittapahilla and the Schaefferstoen El. Co. Each company is capitalized at $5,000 and the offices will be located in Reading.

The companies were formed for the purpose of securing the right for the erection of a new transmission line from the large power plant of the Metropolitan El. Co. in West Reading to Lebanon and also to furnish electrical energy for lamps and motors in the towns for which the different companies are named. The proposed line will be erected on steel towers over a private right of way, 28 miles long, and will be a duplicate line. The cost of the work is estimated at about $125,000. C. C. Long, electrical engineer for the Metropolitan company, will have charge of the work; W. S. Barstow & Co., of New York, will do the construction work.

PIERRE, S. D.—The Niobrara Wtr. Pwr. & Ry. Co. has been incorporated with a capital stock of $16,500 by Charles W. Baker, of Omaha, Neb.; O. S. Christian, Madison, Neb.; Peter Mangold, Bennington, Neb.; Herman P. Bruhman, Leigh, Neb., and Glen W. Martens, Pierre. The company proposes to develop power from the Niobrara River and to construct and operate a railway in Yankton County, South Dakota, and in the counties of Holt, Knox, Cedar, Dixon, Thurston, Burt, Cuming, Stanton, Antelope, Pierce, Madison, Colfax, Dodge, Washington and Douglas, in Nebraska.

MEMPHIS, TENN.—The Interstate Ltg. Co. has been incorporated with a capital stock of $20,000 by W. S. Parks, C. F. Sinkle, C. A. Ferguson, J. W. Jones and F. J. Jachs.

WAUZEKA, WIS.—The Wauzeka El. Lt. & Pwr. Co. has been incorporated with a capital stock of $3,000 by Frank Kedl, James Tesar and Louis Wittrock.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED SEPT 26, 1911

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,074,179. VAPOR ELECTRIC APPARATUS; A. M. Jackson, Schenectady, N. Y. App. filed Apr. 8, 1904. The tubular mercury container is rotated on its axis by an electromagnet to start the lamp.

1,074,599. ELECTRIC SYSTEM FOR OPERATING SPEED VARYING POWER TRANSMISSION; R. W. Bradley, Fort Collins, Col App. filed Jan. 28, 1913. Shiftable element of the automobile transmission is automatically adjusted in accordance with the load or resistance encountered.

1,074,602. OVERLOAD DEVICE; H. R. Canfield, Cleveland, Ohio. App. filed March 22, 1911. Adjustable overload device which for equal increments of adjustment gives substantially equal increases in the amount of current at which the device operates or trips the circuit breaker.

1,074,654. THERMOSTATIC HEAT OR FIRE ALARM; G. S. Simpson, Morgantown, W. Va. App. filed May 23, 1912. Push button operated by expansible members.

1,074,672. METALLOIDAL MATERIAL; E. Weintraub, Lynn, Mass. App. filed Oct. 27, 1909. Electrically conductive and fusible material produced by interaction of boric chlorid and hydrogen at high temperatures.

1,074,677. ENUMERATION OF TELEPHONE CALLS; S. D. Williams, Newport, Wales. App. filed Oct. 31, 1908. On making a call the subscriber's enumerator and an enumerator in the subscriber's circuit at the exchange are simultaneously operated.

1,074,713. MAIL-BOX; U. C. Greggs and E. H. Falls, Terra Haute, Ind. App. filed Jan. 10, 1913. Push button on mail box sounds alarm in the house to give notice of placing mail in the box.

1,074,773. ELECTRIC REGULATOR; W. H. Clarke and O. A. Ross, New York, N. Y., and Chicago, Ill. App. filed Feb. 6, 1902. Particularly for headlights of electric cars; solenoid controls adjustable resistance.

1,074,782. SILVER CLEANER; I. L. Ennis, Reading, Pa. App. filed Feb. 25, 1913. Flat sheet with up-bent edges and a plurality of supports for the silver, slidably engaging the up-bent edges.

1,074,806. INCLOSED ELECTRIC FUSE; W. J. Morgan, St. Louis, Mo. App. filed Aug. 5, 1912. A removable closure in one side of the fuse casing permits access for the purpose of renewing the fuse.

1,074,807. ELECTRICAL SUSPENSION-RAILWAY; H. Müller, Leipzig, Germany. App. filed Feb. 7, 1906. The conductor line and two auxiliary lines are divided into blocks.

1,074,831. TELEGRAPH-KEY; R. L. Boulter, Los Angeles, Cal. App. filed Aug. 13, 1912. Of the vibratory reed or pendulum type, adjustable to slow or fast work, single dot produced as in the ordinary Morse key and plurality of dots are produced automatically without possibility of sending "split" dots.

1,074,841. ELECTRIC LOCOMOTIVE; J. Le C. Davis, Pittsburgh, Pa. App. filed Feb. 21, 1911. Frames of the driving motors constitute the entire frame of the locomotive.

1,074,859. ELECTRIC SIGNAL FOR RAILWAYS; J. H. Gunn, Cortland, N. Y. App. filed Aug. 3, 1908. Automatic open-switch signal.

1,074,860. ELECTRIC REVERSING-SWITCH AND CIRCUIT-CLOSER; C. Haas, Strassburg, Germany. App. filed Sept. 19, 1912. Switch members on a rock shaft, dip into mercury cups.

1,074,874. CONTROL SYSTEM FOR ELECTRIC MOTORS; J. H. Klinck, Pittsburgh, Pa. App. filed Jan. 26, 1910. Particularly for driving printing presses; a low-speed and a high-speed motor with means for controlling them jointly and severally.

1,074,878. ELECTRIC CURRENT CONTROLLER; H. W. Leonard, Bronxville, N. Y. App. filed March 24, 1906. For motors, etc.; controlling action is dependent upon and conforms to the condition of the motor.

1,074,882. REVERSING MECHANISM FOR ROLL-RAMMING APPARATUS; H. T. Macdonald, Montclair, N. J. App. filed Jan. 22, 1912. Reduces shocks and strains and limits the movement of the ramming roll positively.

1,074,911. CIRCUIT-CHANGER; E. Unverricht, Hamburg, Germany. App. filed May 23, 1911. System of interconnected electromagnetic circuit-changers.

1,074,925. CONTROLLER FOR ELECTRIC MOTORS; R. F. Baerlocher, Manchester, Eng. App. filed Feb. 3, 1910. Operating mechanism is automatically returned to predetermined position in case handle is released during a certain portion of its travel and in another part of its travel the handle may be left at any desired step.

1,074,928. ELECTRIC HEATING ELEMENT; T. M. Caven, Milwaukee, Wis. App. filed Aug. 1, 1911. Coiled resistance element embedded in plastic insulation disposed in plate of refractory material, with a metallic surface plate in cohesive relation with the plate and insulation.

1,074,961. MOTOR-CONTROLLING MEANS; H. W. Leonard, Bronxville, N. Y. App. filed July 22, 1907. Push button control.

1,074,962. AUTOMATIC CIRCUIT-CONTROLLING SYSTEM FOR ELECTRIC ELEVATORS AND THE LIKE; N. O. Lindstrom, Nutley, N. J. App. filed Oct. 18, 1911. Automatically varies circuit connections in accordance with direction of travel, load and speed of travel of elevator car.

1,074,988. APPARATUS FOR ELECTROLYSIS OF FUSED ALKALI CHLORIDS; E. Steinbuch, Monthey, Switzerland. App. filed Aug. 23, 1910. Obtains molten alkali metal and chlorin by electrolysis of a molten mass containing alkali chlorid.

1,074,999. METHOD AND APPARATUS FOR MAGNETIC SEPARATION; O. A. Zander, Stockholm, Sweden. App. filed Feb. 9, 1911. Ore is fed to a series of overlapping supports and a field of magnetic force is traveled in a direction transverse to the supports and substantially parallel with the direction of feed of the ore.

1,075,002. SURGICAL INSTRUMENT; J. Bandieri, Cincinnati, Ohio. App. filed Jan. 11, 1912. Syringe in which the liquid employed is electrically sterilized at the point of use.

1,075,007. TELEPHONE SYSTEM; J. G. Blessing, Chicago, Ill. App. filed Oct. 21, 1911. Combined quick and slow acting line relay for use in the selector and connector switches of automatic or semi-automatic systems.

1,075,026. PROCESS OF ELECTROLYSIS; H. M. Du Bois, Detroit, Mich. App. filed April 11, 1910. Flows the liquid across the electrolytic field within a space between the diaphragm and cathode.

1,075,032. TROLLEY WIRE CROSSING, SWITCH, AND THE LIKE; S. S. Goldman, St. Louis, Mo. App. filed April 24, 1912. Intersecting trolley tracks V-shaped in cross-section.

1,075,079. COUPLING FOR CABLE SECTIONS; S. A. Armstrong and P. T. Aumend, Niles and Warren, Ohio. App. filed Aug. 14, 1912. Includes annular members fastened to the cable ends and connected by an enclosing barrel or sleeve.

1,075,093. CYCLIC PROCESS OF EXTRACTING METALS FROM CUPRIFEROUS MATERIALS; A. David, Brooklyn, N. Y. App. filed July 9, 1913. Leaches the material with a solution containing a ferric salt, precipitates the dissolved copper by electrolytic iron and electrolyzes the spent solution under conditions to precipitate iron in highly reactive form.

1,075,098. CIGAR LIGHTER AND CUTTER; A. Gray, New York, N. Y. App. filed April 26, 1912. As lamp is shifted forward, contact is made to ignite wick.

1,075,209. WELDING MACHINE; J. H. Gravell, Philadelphia, Pa. App. filed Jan. 17, 1913. One of the welding terminals is bent back upon itself so as to handle various-shaped articles without increasing the length of the secondary circuit.

1,075,217. HIGH VOLTAGE INSULATOR; M. P. Maxwell, Brooklyn, N. Y. App. filed July 12, 1911. Insulator units provided with hooks by which they may be linked together, together with gravity-operating pins closing the open sides of the hooks.

1,075,238. ELECTRICAL SWITCH; O. N. Wiswell, Snoqualmie, Wash. App. filed July 12, 1911. Compound spring jaws adapted to receive a switch blade between them.

1,075,257. TELEPHONY; M. L. Johnson, Chicago, Ill. App. filed Aug 10, 1911. A party line taken for use, is guarded against the intrusion of the other stations upon the same line.

1,075,258. TELEPHONY; M. L. Johnson, Chicago, Ill. App. filed Dec 4, 1912. Calling subscribers may signal an operator, whose function it is to pass upon the propriety of permitting such calling subscribe to have free connection.

1,075,259. TELEPHONY; M. L. Johnson, Chicago, Ill. App. filed Aug 10, 1911. Telephone exchange system in which some of the lines ar party lines and in which common batteries are employed at th exchanges.

1,075,260. TELEPHONY; M. L. Johnson, Chicago, Ill. App. filed Aug 10, 1911. Communication between party line stations to the exclusio of the exchange.

1,075,270. ELEVATOR SIGNALING APPARATUS; T. Porter, New York, N. Y. App. filed April 17, 1913. Automatic switch cause the signal at the floor to remain on until a car actually stops a the floor.

1,075,292. COLLECTOR-RING FOR DYNAMO-ELECTRIC MACHINES; A. Kingsbury, Pittsburgh, Pa. App. filed July 28, 190 Metal body ring and a pair of segmental contact rings seated thereon

1,075,295. ELECTROMETALLURGICAL PROCESS OF REDUCIN METALLIC OXIDS; D. A. Lyon, Palo Alto, and E. R. Cox, Jr Heroult, Cal. App. filed April 13, 1909. Reduces a metallic oxi by subjecting the same to the combined action of carbon and a electric current.

1,075,314. ELECTRIC FIRE-ALARM SYSTEM; J. L. Flagg, Hackensack, and F. T. Towers, Hawthorne, N. J. App. filed June 7, 191 Normally open alarm circuit is automatically connected to one the other of two sources of energy upon the interruption of a signal circuit.

1,075,315. AUTOMATIC TRANSMITTER FOR TELEGRAPHIC SYSTEMS; J. Gell, London, Eng. App. filed Jan. 24, 1911. Special action.

1,075,318. LAMP SOCKET; T. R. Willwerscheid, St. Paul, Minn. filed Sept. 27, 1911. For housings or outdoor signs.

# Electrical World

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**Protection of Foreign Exhibitors**

For the purpose of inducing foreign manufacturers to exhibit their products at the Panama-Pacific International Exposition at San Francisco in 1915, Congress has passed a law, known as the Kahn act, which provides that articles imported shall be admitted free of duty for exhibition purposes, although not for sale. This provision seems excellent and will doubtless meet with universal approval. Considerable dissatisfaction has arisen over another section of the same bill which provides that it shall be unlawful for any person, without authority of the proprietors, to copy within three years any exhibited article protected by the laws of any foreign country. It is asserted in some quarters that the effect of the law will be to vest all foreign governments with the right to grant all kinds of protection within the United States and make our own citizens liable to penalties for infringing alleged rights under the laws of any foreign government. There can be no doubt that this effect was not intended by the framers of the law, and it is earnestly to be hoped that the law will either be amended or interpreted by the courts in accordance with the well-understood intentions of its framers.

**Employees' Scholarships**

The employee who seeks to improve himself by education and training is worth encouraging in every legitimate way. By increasing his own value he not only augments his immediate usefulness to the company but he makes himself moreover a marked man, bound to rise in any organization of which he is a part. Recognizing this ambitious spirit, many far-sighted business houses are offering liberal facilities and encouragement to employees who desire to undertake, in their own time, class-room studies of value in connection with their daily work. Some have even gone to the extent of defraying tuition expenses outright in order to stimulate workers' interest. One of the most practical of these philanthropies, and one which has the advantage of letting the student earn his scholarship by his own industry, is that offered to the staff of the Brooklyn Edison company. Any employee of that company may take up work in any local school or college approved by the scholarship committee, and his tuition, if due in advance, will be paid by the company, which then deducts in instalments the amount from his salary. If at the end of the course the student has passed his examinations with a grade of 66 per cent or better, the company returns the amount deducted, so that the industrious scholar receives his schooling without cost. Women as well as men are entitled to share in the plan. The policy is a generous one, but in its wisdom and its power to stimulate lies its distinction, for it makes the employee not a ward of corporate philanthropy but a prize-winning student who purchases knowledge with the scholar's coin of industry.

**Magnetic Testing and Elastic Strain**

The measurement of the magnetic properties of iron, steel and other magnetic materials is beset with many minor difficulties, and, like the testing of rubber, is appreciably influenced by technique. An instance in point has recently been given in a paper by Messrs. A. Campbell and H. C. Booth, read before the Physical Society of Great Britain and recently abstracted in *The Electrician*. It is shown that the mere bending of a strip of steel into a closed hoop or ring, with the attendant mechanical stresses imposed on the substance of the strip, involves very considerable changes in the magnetizing field required to elicit flux densities between 5 and 10 kilogausses. In all of the cases reported the impressed field has to be increased, in order to elicit as much flux density under temporary stress as in the unstressed state. In some cases with weak fields the impressed field had to be doubled. Clearly samples of magnetic metal tested either for permeability or for hysteretic loss should be as free as possible from mechanical stresses. In fact, it may be considered that the well-known magnetic benefits derived from annealing iron are due to the consequent elimination of internal molor or molecular stresses. It is not surprising, therefore, that the permeability of the specimens tested by Messrs. Campbell and Booth diminished under temporarily impressed stress, but it is surprising that the diminutions in permeability thus observed were so great.

**Some Features of Station Design**

The account of the new turbo-generator station in Louisville published elsewhere in our columns brings out some interesting details. In a general way the steam-driven generating station of the present day is more or less a cut-and-dried affair. The present development of standard turbo-generators is one which uniformly leads to satisfactory results, and in comparing station with station the most conspicuous and by far the most interesting differences are usually to be sought in the equipment outside of the generating room. The Waterside station at Louisville is a case in point. Generally well designed and equipped with first-class electrical apparatus, its situation gave opportunity for some unusual features in other particulars. Most noticeable of these is the deep pit for containing the condensers, a pit located 53 ft. below the turbine-room floor in order to insure full efficiency at all stages of the Ohio River, which is only too well known as a very variable

stream. The intake tunnels for condensing water are likewise unusual, with their duplicate lines of concrete pipe connecting to the cast-iron pipe with flexible joints leading out to concrete cribs in the river. No chances were taken with these intakes, since they are located low enough to be of service even if the government dam, which ordinarily steadies the flow at Louisville, should be carried away. Another good point in the station is the very complete coal-handling equipment, including even a crusher in case run-of-mine coal should later be used, and with full opportunity for unloading river barges whenever it is found desirable to install the necessary equipment. Similarly, the ash disposal conveyer system is thoroughly worked out, a very important matter for a plant using, as does this one at present, rather low-grade coal. It is altogether likely that the secret of economy in steam production in the future will lie in the efficient use of the cheaper grades of coal, and an equipment which permits and facilitates such use is a valuable asset for the future. Another unusual feature of the equipment is a load indicator of very simple character, serving to signal the fire room when more steam is likely soon to be needed. The signal system is not merely automatic but also enables the operator, foreseeing the trend of the load, to send word ahead of time to the boiler room. The station throughout is built with an eye to the future, both with respect to increased output and to variations in the distributing voltage which will follow along with increasing load. The electrical design details are thoroughly worked out, and the whole station is an excellent example of the good results following a merger of isolated companies and the physical union of the systems involved.

## Monopoly and Rate Discrimination

Apparently the Uniform Electric Rate Association has been formed for the purpose of leveling all rates for electric energy to a common figure. Its propaganda is designed to prevent the establishment of such rates from central stations as will compete with existing isolated plants and will prevent the installation of new isolated plants. It is supported by an opinion of Mr. Louis D. Brandeis in which certain questions founded on a declared "statement of facts" are answered. Although the "statement of facts" and the opinion are somewhat confusing in their interpretation of well-known conditions in the electrical industry, there is enough apparent show of reasonableness about the situation which they picture to require discussion. The array of "facts" begins with the assertion that there is a general movement to secure for some electric service company in each city a substantial monopoly of the electric business in that city. This is amplified by the statement that "in order to secure business adequate to feed central stations equipped with steam turbines, it is ordinarily deemed necessary to suppress competing supplies of electricity."

No one will deny that conditions are tending toward monopoly of each form of public-utility service in every city. This is the tendency, not because the public-service utility may by this means suppress competition, but because it is economically more practicable for one agency to supply a community than for a number to do so. Where one agency has a monopoly it can make its costs of production and transmission less than the combined costs of two or more competing agencies and there is a resulting advantage to consumers. If the small plant serving a single building within a community gradually expands its activities it may become in time a utility furnishing a service that duplicates in part that of the company occupying the larger area of the city. It is for this reason that small plants selling any energy are placed within the reach of the public-utility commission laws. The commissions recognize that it is economically disadvantageous for a city to have two competing utilities of one class, because experience shows that eventually their duplicating facilities are always merged with resultant duplication of capital investment on which the public is asked to pay a return. Where the service and rates of an existing utility are satisfactory the commissions promote monopoly of the kind which Mr. Brandeis criticises by refusing to grant permits to new companies seeking to compete. By their adherence to this policy they serve the public interest.

The "statement" on which Mr. Brandeis bases his opinion deals with the cost of the service and apparently leaves out of consideration the value of the service. It is so worded as to create the impression that the real issue involved lies between the large and the small consumer. In other words, the question of whether the public-service corporations are discriminating in favor of the large user as against the small is the final legal problem to be solved. Approached from this angle the declaration of the attorney is that the precise questions "have not been authoritatively decided in the United States, but the principles which must govern are definitely established." Perhaps he is not informed that they have been authoritatively decided by commissions vested with broad powers. The language of his opinion is in effect that if the costs for large and small users of energy are the same, all things being taken into consideration, no legal justification exists for discriminating between them. This is obscure and it fails to support the argument underlying the movement. Mere differences in rates are not discriminatory. As we understand the spirit of the public-service commission laws and the public temper of the times they demand like rates under like conditions of service. With this demand we are in full accord, and if the companies have not made their rates conform to this principle they should do so as soon as possible. However, we believe that the value of the service is a necessary factor in rate-making in any scheme of variable rates. But even if an indefinite factor of this nature is designated as something other than "value" of the service, it is clear that wholly reasonable grounds exist for variable rates.

Mr. Brandeis has had enough experience in the study of conditions on steam railroads to enable him to appreciate the fact that the same kind of "discrimination" which he discusses so suavely in electrical plants exists also in those great public-utility corporations. If the wholesale user of steam railroad service within the commutation zone did not get a lower rate than the retail user of a single ride, he could not afford to live in the country. The whole-

e user of mileage books also gets a lower rate than e retail single rider. Similarly, the opinion states that "great weight of authority as well as of reason seems posed to permitting any discrimination based upon the e to which the electric energy is put; and therefore upon facts assumed in the question such discrimination be- een charges for electric energy used for power and arges for electric energy used for light should be held egal." Yet when we refer again to the railroad rate ucture, which in the essentials now under consideration s stood the tests of time, the courts and public opinion, find that the railroad has a very keen financial con- rn in the use to which a freight car is put. Will it be ed for the transportation of silk? Or is coal the com- dity to be transported? It seems to us that there is re a perfect analogy to the question regarding the use energy for lighting or industrial service, and that in both ses the value of the service or some factor not resting olly upon a uniform cost must be taken into considera- n. When all of the facts are marshaled the controlling e appears to be that the production of energy on a large le, with resultant cheapening of costs, is part of the nomic march of progress. However much sympathy feel for those whose plants become obsolescent because improvement in the art, the greatest good of the atest number should be the dominating consideration; this demands, and will not be denied, those conditions ch produce most successfully the needed economy and fection of service.

## The Absorption of Energy in the Eye

erhaps no subject in physiological optics has been le misunderstood and less thoroughly studied than the al effect of radiation received by the eye. A great deal of abor, in no small degree useless, has been expended on the subject without reaching conclusions of final value. The weak point of investigation has nearly always been the utter absence of any quantitative data. An experi- menter finds that some kind of energy, heat energy, strictly luminous energy or ultra-violet energy, does or does not produce certain effects on the eye and immediately pro- claims the fact entirely regardless of the actual quantity of energy responsible for the result or lack of it. One can count on the fingers of one hand all the researches which are upon a quantitative basis, and therefore every addi- tion to this list is a matter of interest and probable value. In the article in this issue Mr. M. Luckiesh takes up the much-neglected question of the possible effect on the eye of the absorption of energy, chiefly other than luminous. With most artificial illuminants, at least those giving con- tinuous spectra, by far the greater part of the radiation is in the infra-red invisible portion of the spectrum. Hence the possible effect of infra-red radiation and its absorption by the media of the eye may have importance.

An often-quoted statement of Dr. C. P. Steinmetz as to the importance of energy effect of this sort has served to direct attention to the subject, although as a matter of fact there is not one bit of practical experimental evi- dence one way or the other connecting this energy effect with eye strain or irritation. To tell the honest truth, the cause of the ordinary eye strain in poor natural or artificial illumination is very far from being really under- stood. Nevertheless, Dr. Steinmetz's suggestion is worth attention, and the actual absorption of radiant energy by the media of the eye is a very desirable thing to know. This Mr. Luckiesh has given us in a measure of the ab- sorption of the media, considered as water, for the total radiation received from radiators at different temperatures. The chief seat of absorption is shown to be in the cornea, this being the first layer encountered and consequently in obedience to the general laws of absorption producing the maximum effect. Not only does the cornea absorb a large amount of the incident energy in general, but it also has a strongly selective absorption for the extreme ultra-violet, cutting off entirely rays below 300 $\mu\mu$ in wave length. Most of the remaining ultra-violet is cut off by the lens, but the whole ultra-violet factor in the luminous sources considered by Mr. Luckiesh is practically rather small. The radiation is absorbed largely by the cornea, but this superficial layer, of course, is cooled with exceptional readiness, so that in a degree it is self-protected. If the whole effect of radiation on the eye were expressible in terms of this absorption by the media, one could very read- ily figure out in any given case the actual incidence of energy in ergs per second per square cm and get a very satisfactory measure of the amount of energy effect with which one has to deal.

Recent investigations have shown it to be highly prob- able that the general energy radiation, rather than any specific kind of radiation, is responsible for some ocular troubles which have been noticed, especially glass blower's cataract, in an earlier state of knowledge ascribed to ultra- violet radiation. Mr. Luckiesh's figures, however, show that the total amount of energy received from this particu- lar source in bodies, like molten glass, at rather low temperature must be very small and that the cornea cuts off a large proportion even of the heat radiation.

The two points which Mr. Luckiesh's investigation does not throw light upon, and which may be justification for Dr. Steinmetz's statement, are that the concentration of energy, owing to the refraction of the media, increases very rapidly from the front to the back of the eye. Perhaps three-quarters of the total refraction is at the surface of the cornea, so that there is some concentration at the front of the lens, more still at its back, and most of all on the retina, where the pigmentation insures the absorption of practically all radiation that reaches it. Hence there may be discomfort or even damage, as in eclipse blindness, produced under strong general radiation even in spite of the large absorption of the superficial layers. Incidentally it should be mentioned that in dealing with solar radiation at an equivalent temperature of about 6000 deg. the point of maximum intensity is no longer in the infra-red or in the part of the spectrum vulgarly supposed to be the seat of heat radiation, but in the region of the blue, so that for this particular source any distinction between visible radia- tion in general and heat radiation becomes utterly lack- ing in significance. Mr. Luckiesh has done well in putting before us in clear quantitative form the fundamental facts as to the absorption of the media of the eye.

# The News of the Week

**Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.**

## Government Investigation of All Public Utilities

According to a statement made by Secretary Redfield of the Department of Commerce Oct. 22 in a speech before the Flint (Mich.) Board of Commerce, his department proposes to begin an investigation of public utility corporations. The inquiry will be made by the Bureau of Standards and will be conducted in a spirit of entire friendliness and with the object of aiding both the corporations and the public service commissions of the various states and cities. Congress is to be asked for an appropriation of $100,000 to enable the Bureau of Standards to carry on such investigations as would fix standards of service for public utility companies and thus assist public service commissioners and other authorities in the regulation and control of these utilities.

## The Uniform Electric Rate Association

An announcement stating that the first annual meeting of the Uniform Electric Rate Association, promoted by manufacturers of apparatus for isolated plants, would be held on Oct. 20 was published in the *Electrical World* for Oct. 4, 1913. Numerous efforts to obtain information regarding the place of the meeting made at the office of the secretary, Room 1107, 114 Liberty Street, New York, proved unsuccessful, and all information concerning the proceedings and the personnel of the officials has been withheld. At the office of the secretary it was stated that instructions had been received to make no public statements concerning the matter, and information was courteously declined on all points, although it was admitted that the meeting was held on the date set.

## Joint Rubber-Insulation Committee Report

At a meeting on Oct. 15, 1913, of the committee on rubber insulation appointed by manufacturers and users of this material in December, 1911, under the chairmanship of Major S. Reber, of the United States Signal Corps, a preliminary report of work accomplished during the past two years, leading to a specification for 30 per cent Para compound and an analytical procedure to be put in use for one year, was presented and adopted. The committee was authorized to make arrangements for the publication of the report, which has already been incorporated in committee reports of the American Electric Railway Association and the Association of Railway Electrical Engineers.

It is the intention of the joint rubber-insulation committee to urge the acceptance of the report by other national societies to the end that the manufacturers shall have to work to only one specification for 30 per cent Para compounds, a result that would bring considerable economies to the manufacturers and corresponding gain to the consumers. The meeting which resulted in the formation of this committee was held upon the invitation of Mr. E. B. Katté, of the New York Central Railroad, and was participated in by representatives of the United States Signal Corps, the United States Bureau of Standards, the American Chemical Society, the New York Central lines, the Pennsylvania Railroad, the General Electric Company, the Hazard Manufacturing Company, the Lederle Laboratories, the Simplex Wire & Cable Company and the Standard Underground Cable Company.

## Prospects for the 1915 Electrical Congress

History shows that the world's trade was profoundly affected by the cutting of the Suez Canal and the consequent supersession of the maritime highway round the Cape of Good Hope. The short-circuiting of that old route greatly reduced the commercial impedance of the Eastern Hemisphere. It is therefore only reasonable to expect that the opening of the Panama Canal will exercise a yet greater effect upon the trade of the Western Hemisphere. The short circuit of the Horn is more significant than the short circuit of the Hope; because the maritime route of the former runs to 53 deg. of south latitude, whereas that of the latter runs only to 35 deg. Moreover, the Suez Canal lies across a flat sheet of desert, only a few meters above ocean, whereas at Culebra the Panama Canal cuts through the vertebral column of the great American mountain chain. From every point of view, there can be no doubt that the opening of the American canal at Panama will constitute one of the great events of history and should therefore be attended with commensurate observances.

From the electrical engineering standpoint, the occasion is to be commemorated by an international electrical congress at San Francisco, in conjunction with a meeting of the International Electrotechnical Commission, under the auspices of the American Institute of Electrical Engineers and during the period of the universal exposition at San Francisco. The electrical congress is to be held during the week beginning Sept. 13, 1915, and immediately preceding the general engineering congress of Sept. 20 to 25. The general engineering congress is supported by the American Societies of Civil Engineers, of Mining Engineers, of Mechanical Engineers and of Electrical Engineers; but the American Institute of Electrical Engineers has undertaken only a minor share in this support, because the Institute stated that the international electrical congress would receive its especial consideration, more or less to the exclusion of the general engineers' congress, which, being fostered by several other national engineering societies, would have ample consideration.

Preparation for the international electrical congress San Francisco has been kept in view by the two last presidential administrations of the A. I. E. E., and particular attention is now being given to it by President Maillou Dr. C. P. Steinmetz has already consented to serve as honorary president of the congress, and Dr. E. B. Rosa the honorary secretary. Mr. H. G. Stott is chairman the committee of organization, and Mr. Preston S. Mil is the secretary-treasurer.

Twelve sections of the congress have been provisiona arranged for, and a number of papers have already be promised by electrical engineers of world-wide reputati It is expected that the organization committee will shor set systematic plans in operation both for enlisting mem and for securing a good list of papers from all parts of world. An international congress differs essentially fro national congress in the fact that the membership, atte

ance, proceedings and publications must to a great extent be international and be participated in by countries other than that in which the congress is held. The chairmanship of the organization sub-committee on foreign relations is fortunately held by Mr. Mailloux. We hope to be able to furnish our readers with particulars concerning the program and plans of the congress as these are settled by the organization committee and are made known to the technical press.

## Electrical Co-operation

In an address before the Jovian Congress in New York on Sept. 16 Mr. James H. Collins stated that "co-operative effort in the electrical industry will probably save this country from what many regard as the fallacy of state ownership of utilities. Where the central station, the jobber, the contractor and the manufacturer work at cross purposes, or even without a mutual understanding as to what they want to accomplish, public sentiment is likely to grow toward public ownership. Much is said and written about its advantages every day by people who either overlook the truth or are not hampered by the facts, and the public accepts glittering generalities without knowing the exact details.

"This is a very serious issue, undoubtedly, to be met in the near future. It can be met best on a basis of co-operation among electrical men. It will not be settled by any influence that can be brought to bear on legislation, or the press, or anywhere else. But when the electrical men in each community, instead of fighting for ready-made business competitively, get together to develop new business through the advancement of the community in the broadest possible way, then it will be clear to the public that the electrical interests are really public servants, even though ownership be in corporation form.

"There are other issues of the same sort—big, broad, growing issues that call for the kind of co-operative spirit that develops with co-operative action. It will be found that discounts will adjust themselves and be forgotten, and who is to sell lamps and appliances will be settled congenially, and then those interested will begin to build up the industry on such broad lines that the public will see it as a whole and trust it as an institution, whether the dealing is with the central station, or contractor, or manufacturer, or jobber. It will be clear that all these interests belong to the same thing, and that they are working toward the same big end, and that any transaction with one is a transaction with all."

## Protection of Foreign Exhibits

A convention of manufacturers, merchants and importers will be held at the Hotel Astor, New York, on Nov. 21, 13, at 2 p. m., to advocate the enactment of an American gistration law to protect manufactured products of iginal design, to consider the recently enacted Kahn w, and to advocate amendments to eliminate the objectionable features of this law. This convention has been alled by the officers of the National Registration League d a committee of the Federation of Trade Press Associaons.

The Kahn law has just been passed by Congress for the otection of foreign exhibitors at the Panama-Pacific International Exhibition. In addition to admitting articles e of duty for exhibition purposes, it provides a penalty imprisonment or fine of from $100 to $1,000 for copying, itating, reproducing or republishing in three years any ttern, model, design, trade-mark, copyright or manufactured article protected by the laws of any foreign country.

The National Registration League, which has its headquarters at 1309 Race Street, Philadelphia, contends that under the provisions of this law it is not only possible but probable that many exhibits at the exposition will be the subject of foreign protection of some kind, notwithstanding that the same things have been free from all character of protection in this country for many years. The law will make effective within our country laws governing the grant of patents, trade-marks and registrations of every country on earth and will make our own citizens liable to the penalties of this bill for infringing alleged rights under the laws of any and all foreign governments.

The effect of the law, it is contended, will be to throw the patent and trade-mark situation into great confusion and to do untold injury to owners of American patents, trade-marks and design property, as well as to manufacturers of articles which any one is now free to make. It will also afford opportunity for unscrupulous persons to harass and blackmail reputable manufacturers and merchants in many ways.

## Boiler Explosion in Staten Island Power Plant

The explosion of a 330-hp vertical water-tube boiler in the Livingston plant of the Richmond Light & Railroad Company, Staten Island, N. Y., Oct. 21, tore a 60-ft. hole in the roof of the boiler house and carried away a large section of the breeching, cutting off the remaining boilers from the stack. Although the force of the explosion killed six men and injured four others, the damage inflicted on the plant was not widespread, probably owing to the fact that the main force of the explosion seemed to be directed upward. As soon as the officials of the company learned of the disaster an old railway plant at Grasmere, a property of the company, was pressed into service to supply energy to the electric railways of the island. As this issue goes to press negotiations are under way with the Public Service Corporation of New Jersey and the Edison Illuminating Company of Brooklyn for the purchase of sufficient energy to carry the lighting load until operation is restored at the plant. Some delay has been caused in making these connections as it is necessary to obtain the consent of the War Department before a submarine cable can be laid across the Narrows to Brooklyn or across the Kill von Kull to the New Jersey stations.

Mr. S. F. Hazelrigg, vice-president and general manager of the company, stated that the repairs would probably occupy the greater part of three days as the twisted mass of débris must be entirely removed before the breeching can be replaced.

## Meeting of Executive Committee of the Commercial Section, N. E. L. A.

The executive committee of the Commercial Section of the National Electric Light Association met at association headquarters in New York Oct. 16 in an all-day session at which fifteen out of the eighteen members of the committee were present. At this meeting it was determined to standardize the size of the "Electrical Salesman's Handbook," the revised edition of which will appear on Jan. 1, and the dimensions of which will be 4.5 in. by 9 in. As intimated in these columns some time ago, the publications committee, of which Mr. Douglass Burnett, of Baltimore, is chairman, is at present engaged in revising the Handbook and the work has been placed in the hands of the following sub-committees: Mr. C. J. Russell, Philadelphia, general data; Messrs. S. E. Doane, Cleveland, Norman Macbeth, New York, and G. H. Stickney, Harrison, N. J., lamps and illumination; Messrs G. H. Jones, Chicago, and C. H. Stevens, Brooklyn, power and heat, and Mr. M. S. Seelman, typography. The executive committee in its efforts to induce manufacturers of electrical apparatus to issue catalogs and data sheets on standard 4.5-in. by 9-in.

sheets has sent letters to eighty manufacturing companies, fifty of which have agreed to co-operate with the committee in the matter.

It was determined to issue the annual year book of the Commercial Section, which will contain all the names, addresses and affiliations of members of the section, on Jan. 1. The following committees were also appointed: Committee on the wiring of existing buildings, Mr. R. S. Hale, Boston, chairman, Mr. S. E. Doane, Cleveland, vice-chairman, and Messrs. C. E. Robertson, Baltimore, M. E. Turner, Cleveland, W. A. Donkin, Pittsburgh, W. P. Lyon, Chicago, G. Wiederman, Brooklyn, and M. C. Rypinsky, New York; committee on interurban lighting of highways, Mr. G. B. Tripp, Harrisburg, chairman, Mr. C. G. M. Thomas, Long Island City, vice-chairman, and Messrs. H. J. Gille, Seattle, C. N. Stannard, Denver, E. S. Marlow, Washington, P. S. Young, Newark, S. M. Kennedy, Los Angeles, W. H. Lott, Boston, R. S. Wallace, Peoria, and N. R. Birge, New York; committee on electrical merchandising and advertising, Mr. Parker Kemble, Cincinnati, chairman, Mr. L. D. Gibbs, Boston, vice-chairman, and Messrs. G. B. Johnson, Chicago, W. H. Hodge, Chicago, H. K. Mohr, Philadelphia, W. G. Stetson, Boston, M. O. Dell Plain, Syracuse, S. L. Nicholson, Pittsburgh, F. B. Rae, New York, W. Gould, New York, F. H. Gale, Schenectady, and a representative of the Canadian Electrical Association; committee on the education of salesmen, Mr. F. C. Henderscott, New York, chairman, F. R. Jenkins, Chicago, vice-chairman, and Messrs. R. N. Ballard, Los Angeles, J. A. Britton, San Francisco, C. A. Howlett, New York, A. Larney, Minneapolis, H. D. Shute, Pittsburgh, G. Webster, Conneaut, and F. S. Balyeat, Pittsburgh; committee on development of non-peak load, Mr. G. H. Jones, Chicago, chairman, J. C. Meyer, Philadelphia, vice-chairman, and Messrs. J. Parker, Rochester, A. C. Smith, Buffalo, R. H. Tillman, Baltimore, E. L. Crosby, Detroit, F. D. Beardslee, St. Louis, R. L. McClellan, Chicago, C. A. Greenidge, New York, and G. N. Tidd, New York.

It has been announced by Chairman T. I. Jones of the Commercial Section that the "Electrical Salesman's Handbook" and the data sheets to be issued from time to time will be distributed gratuitously to all members of the Commercial Section. The section has also recently brought out two booklets, one dealing with farm appliances and the other with church lighting.

The next meeting of the executive committee of the Commercial Section will be held at Nela Park, Cleveland, during the week of Dec. 8.

## Boston Edison Welfare Work and Employees' Statistics

At the recent convention of the New England Section of the National Electric Light Association, held at Burlington, Vt., Mr. Herbert W. Moses, head of the Welfare Bureau of the Edison Electric Illuminating Company of Boston, Mass., outlined the results obtained during the first year of the latter's work. This bureau now has a superintendent, a librarian, a medical director, a chief clerk, an outside inspector and a stenographer. Its employment division was opened on Feb. 1 last, and up to July 1, 1566 applicants had been received. Medical examinations were given to 497, of whom 435 were accepted, the ratio of rejected applicants on this examination being about 10 per cent. Such preliminary scrutiny later saves the company from paying sick and death benefits.

An analysis of the payroll shows that 837 persons left the company's employment during the first year of the Welfare Bureau's work, and 1002 new employees were added to the organization. Of those who left the service 472 resigned and 365 were discharged. Mr. Moses outlined the scheme of sick and death benefits in force at Boston which has previously been described in these columns. The company provides even more liberally for its staff than is required by the Massachusetts workmen's compensation act. During the year ended June 30, 1913, the company paid $4,201 in accident benefits, including two deaths. In five months it paid sick benefits to the amount of $2,534 and in nine months there were nine deaths, on which $2,917 in benefits was paid.

The company doctor saw 878 patients among the employees during the year and made 1343 calls, giving free medical attention in each case. Employees lost 1707 days on account of illness and in all there occurred 720 accidents on the system during the year, counting minor injuries. Of this number 450 were accidents to employees, two having been fatal. The remaining 270 accidents were suffered by the general public, nine being fatal. The latter class of accidents is largely attributable to the fact that the company has much of its construction work done by contract; for of these accidents all but ninety-three were incurred by the employees of sub-contractors. No time was taken from work in 343 of the accidents to employees, while in the remaining 105 cases 1387 days were lost. The maximum time lost was 187 days for one employee. Further study of the company's accidents shows that the maximum number occur between noon and 6 p. m.

On March 15 last the company started to lend funds to employees in certain cases in amounts up to a maximum of $100 without charging interest, a fund of $1,500 being set aside for this purpose. The total loans under this arrangement have been forty, aggregating $1,860, of which ten have been repaid in full, leaving thirty-four outstanding aggregating $1,113. The work of the bureau for its first year has cost the company about $30,000, but the result contribute to increased efficiency and *esprit de corps*, and the company expects to expend about $50,000 in the work during the second year. Fewer and shorter absences and quicker recuperation in case of illness have been secured and the standard of employees is constantly being raised

## Meeting of the American Physical Society

On Saturday, Oct. 18, a regular meeting of the American Physical Society was held at Fayerweather Hall, Columbia University, New York, with a morning and an afternoon session, at which the following papers were presented:

"The Vapor Pressure of Metallic Tungsten," by Dr. Irving Langmuir, General Electric Company, Schenectady; "The Form of the Ionization by Impact Function," by Prof. Bergen Davis, Columbia University; "Change of State Solid-Liquid at High Pressure," by Prof. P. W. Bridgman, Jefferson Physical Laboratory, Cambridge, Mass.; "Notes on Some Integrating Methods in Alternating-Current Testing," by Prof. Frederick Bedell, Cornell University; "Silvered Quartz Fibers of Low Resistance Obtained by Cathode Spray," by Prof. Horatio B. Williams, Columbia University; "The Critical Ranges A2 and A3 of Pure Iron," by Prof. G. K. Burgess and Mr. J. Crowe of the Bureau of Standards; "A Spectrophotometric Study of the Absorption, Fluorescence and Surface Color of Magnesium Platinum Cyanide," by Dr. Frank G. Wick, Vassar College; "Examination of the Omicolored Screen Plate by Means of Microscope and Spectroscope," by Mr. John B. Taylor, General Electric Company, Schenectady; "Relativity Theory: General Dynamical Principles," by Prof. Richard C. Tolman, University of California; "The Hall Effect in Liquid and Solid Mercury," by Prof. W. N. Fenninger, Pratt Institute; "The Electrolytic Determination of the Ratio of Silver to Iodine and the Value of the Faraday," by Messrs. G. W. Vin-

of the Bureau of Standards, and S. J. Bates, of the University of Illinois; "The Effect of Amalgamation on the Contact Emf of Metals," by Prof. F. J. Rogers, of Leland Stanford, Jr., University; "Relativity Theory: The Equipartition Law in a System of Particles," by Mr. Richard C. Tolman, University of California; "Failure of Color Photography by Commercial Screen-Plate Methods for Spectroscopic Records," by Mr. John B. Taylor, General Electric Company, Schenectady; "Condition Involving a Decrease of Primary Current with Increasing Secondary Current," by Prof. F. J. Rogers, Leland Stanford, Jr., University; "Some Experiments on the Magnetic Field of Two Electromagnets in Rotation," by Prof. S. J. Barnett, Ohio State University, and "The Effect of Space Charge and Residual Gases on the Thermionic Current in a High Vacuum," by Dr. Irving Langmuir, General Electric Company, Schenectady.

A regular meeting of the society will be held in Chicago on Nov. 29, and the annual meeting will take place at Atlanta, Ga., from Dec. 29, 1913, to Jan. 3, 1914. Prof. A. D. Cole, Ohio State University, Columbus, Ohio, is secretary of the society.

## Chicago Section of Illuminating Engineering Society

At the meeting of the Chicago Section of the Illuminating Engineering Society held in the rooms of the Western Society of Engineers, Monadnock Block, Chicago, Oct. 15, Mr. J. R. Cravath gave a comprehensive review of the papers and discussions presented before the recent Pittsburgh convention of the society, reported in our issue of Oct. 4. His abstracts of the general sessions were followed by the presentation in full of two of the Pittsburgh convention papers which were the work of Chicago authors—"The Proper Lighting of Show Windows," by Mr. H. B. Wheeler, and "Factory Lighting," by Messrs. M. H. Flexer and A. O. Dicker. The papers were read by their authors and were illustrated with lantern slides.

As announced by Dr. M. G. Lloyd, chairman, future sessions of the Chicago Section will be opened with brief lectures on fundamental illuminating-engineering theory. New apparatus and illuminants will also be exhibited.

## Telephone Pioneers Meet at Chicago

Fully 400 veterans of the telephone industry, all of whom were engaged in the business prior to the year 1890, attended the third annual convention of the Telephone Pioneers of America held at Chicago Oct. 17 and 18.

Among the men of prominence in the telephone field who made addresses during the sessions were Messrs. Theodore N. Vail, New York, who is president of the Pioneers' Association; Frank H. Bethell, New York, vice-president; Bernard E. Sunny, Chicago; Thomas D. Lockwood, Boston; N. C. Kingsbury, New York; Thomas B. Doolittle, New York, and Thomas A. Watson, Braintree, Mass. Mr. Kingsbury discussed some of the problems confronting the telephone industry, enumerating among these the development of apparatus for long-distance transmission, securing of capital for investment and methods of satisfying the public. Public-service commissions, he declared, furnish a safeguard against unjust rate regulation.

Following were the officers elected for the coming year: President, Mr. Theodore N. Vail, New York (re-elected); first vice-president, Mr. Thomas D. Lockwood, Boston; second vice-president, Mr. Thomas B. Doolittle, Branford, Conn.; third vice-president, Mr. C. F. Sise, Montreal, Que.; fourth vice-president, Mr. George E. McFarland, Montreal, Que.; secretary, Mr. H. W. Pope, New York (re-elected). Mr. Charles D. Dubois, of New York, was elected chairman of the executive committee.

On Friday evening at the Studebaker Theater the central group of Bell companies entertained the convention with a humorous skit based on the past and future of the telephone industry. On Saturday the delegates had luncheon at the Hawthorne Works of the Western Electric Company, returning to a banquet at the Congress Hotel in the evening.

## Informality of Indiana Commission Proceedings

Mr. James L. Clark, a member of the Public Service Commission of Indiana, in a recent address before the Indianapolis Lawyers' Club, commented upon the lack of formality which the Indiana commission has decided shall mark its proceedings. He said the very purpose intended to be accomplished by the Indiana law requires the practice to be entirely void of technicalities.

"The public utility act regulating public service corporations has added another corner to the already large field for the lawyer," Commissioner Clark said. "Some have hastily concluded that it is a field for the specialist. To some extent that is true, but not to the extent that some have imagined. It will not require a specialist to construe the statute. Simplicity is one of the strong features of the law."

## Pittsburgh Section, A. I. E. E.

A paper by Mr. H. O. Swoboda on the design, construction and operation of electric heating devices was presented before the Pittsburgh Section of the American Institute of Electrical Engineers Oct. 14, the meeting being the first to be held under the auspices of the newly elected officers of the section, of which Mr. A. M. Dudley is chairman and Mr. E. R. Spencer is secretary. The board of local directors also includes Messrs. F. Wiley, J. W. Welsh, W. O. Oschman, G. M. Eaton and M. C. Turpin.

Mr. Swoboda opened his address with a review of the history of electric heating and exhibited a number of devices using resistors of nickel, chromium, etc. During the last few years, said the speaker, the bare-wire heater has in Germany received competition from the "silundum" and "silit" heaters. These terms are trade names for rods and tubings of carbon treated with silicon vapor at high temperatures, the air being excluded. Such resistance materials are claimed to be practically indestructible if not used at temperatures higher than 1200 deg. C.

Insulated-wire heaters have been employed for such devices as heating pads. One method is to cover the resistor wire with an insulating material like enamel or asbestos. The wire can then be disposed without any attention to spacing, being wrapped around vessels, tanks, tubes, pipes, rods, etc., without further precaution. Another method is to embed the wire in enamel, cement, fire-clay, fire-sand, carborundum or other fireproof material. In this way sections of the wire are not only insulated from each other, but the air is excluded also. Heaters employing the induction principle were next shown and described. These avoid the use of special resistance wires, since by means of eddy currents induced in the material or vessel to be heated the heat is delivered directly where needed. Such devices are, of course, limited to use on alternating-current circuits.

Mr. Swoboda then passed to a discussion of resistance, induction and arc types of electric furnaces, describing the advantages and disadvantages of each.

Forty years ago the only resistor materials in existence were copper, platinum and German silver. With platinum out of the question on account of its costliness, it was then not feasible to construct a durable heater for use in the open air at a temperature higher than 250 deg. to 300 deg. C. When the copper-nickel alloys appeared on the market temperatures from 300 deg. to 500 deg. C. were made pos-

sible, and a little later the nickel-steel alloys raised the limit to 600 deg. Ten years ago the discovery of nickel-chromium alloys extended the maximum working temperatures up to 1200 deg. C. With the increase of working temperature the resistivity of the materials also increased, the specific resistance of nickel chromium being about three times that of German silver and sixty times that of copper. A well-designed heating device using nickel-chromium resistors will not burn out.

Mr. Swoboda made a strong plea for the standardization of contact plugs so that different makes of heating devices may use the same type of attachment plug. There are now about fifty manufacturers of heating appliances, each of whom has established his own standard plug. A similar condition formerly prevailed in Germany, but owing to the efforts of the national electrical engineering society five standard types of plugs have now been adopted. In closing, the author gave a number of interesting figures on the cost of operation of electrical devices compared with coal-heated and gas-heated apparatus, and declared his belief that the adoption of electrical heat for general use is bound to come ultimately.

Discussion of the paper was participated in by Chairman A. M. Dudley and Messrs. T. S. Perkins, W. L. Waters, E. E. Rose and M. C. Turpin.

Mr. Perkins divided heating apparatus into three classes —necessities, conveniences and luxuries. He declared that they have passed through the first stage and are now in the stage of conveniences and that people are beginning to recognize them as such. He also called attention to the small cost of electric cooking figured as a percentage of the value of the material under preparation. For instance, a 75-cent steak costs only 5 cents for cooking. The reverse is, however, true in the case of a cereal, which is costly to cook. The speaker predicted that the investment in heating apparatus will soon exceed that in incandescent lamps, which amounts to over $10,000,000.

Mr. Waters observed that while electric cooking is still in the class of luxuries, his own belief is that a range will soon be found which will be applicable to the use of the man of moderate means.

Mr. Turpin referred to the success of central stations in selling electrical appliances and cited the case of one whose peak comes on Tuesday morning owing to the town's electric-ironing load.

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## Proposed Sale of Toronto Utilities to the City

Owing to franchise stipulations which are considered restrictive by the city, the municipal authorities of Toronto, and particularly Mayor H. C. Hocken, are desirous of purchasing the street railways within the city limits. These railways are nearly all the property of the Toronto Railway Company, although portions of the lines of the Toronto & York Radial Railway Company and the Toronto Suburban Railway Company are within the city limits. Sir William MacKenzie is the president of the Toronto Railway Company, and he and his associates also own or control the Toronto Electric Light Company. The Mayor desired only to secure the street railways originally, but Sir William MacKenzie refused to sell the railway properties without the lighting property, so that the purchase of both is under consideration.

Mayor Hocken retained consulting engineers to make valuation reports on the two sets of properties. The report on street railways was made by Mr. Bion J. Arnold, of Chicago, and Mr. John W. Moyes, of Toronto, and was made public on Oct. 13. The report on the electric-light property was made by Mr. R. A. Ross, of Montreal. It fixed the total value of the property of the Toronto Electric Light Company at $6,132,754. The price asked is $8,000,000, which leaves $1,867,246 as the amount to be paid for the franchise and the business. The total amount asked for the street railways within the limits of Toronto is $22,242,405.73. However, the report of Messrs. Arnold and Moyes fixes the total value of the railways at $20,944,478. The difference in the case of the railways is caused by adding other items, such as estimated increment in the value of real estate during the eight years that the franchises have still to run.

The report of Messrs. Arnold and Moyes includes an investigation of the cost new and the present value of the railway properties, as of July 1, 1913, together with a study of the operation of the properties. The investigation was made to determine the value of the properties, including rights under franchises expiring in general on Sept. 1, 1921, in order to determine a fair price in case the city decides to purchase. The valuation includes both physical values and intangible values, the latter being the estimated present monetary values of the net profits, after all deductions for operation, taxes and interest. The Toronto Railway Company, it may be remarked, has practically a monopoly of the street-railway business of the city. It has been assumed in the Arnold-Moyes report that such rights as the suburban railway companies now have to distribute electrical energy for light, heat and power in a limited area in the city of Toronto shall be delivered to the city if the properties are purchased.

In a letter to Mayor Hocken supplementing the report, Mr. Bion J. Arnold says that if suggested conditions are complied with he believes that it will be well for the city of Toronto to enter into the proposed arrangement for purchasing the railways. This conclusion applies, however, to the local conditions only. Mr. Arnold says: "In thus advising I do not wish to be understood as taking any position whatever upon the broad question of municipal ownership and operation versus private ownership and operation, but am simply advising what I believe would be best for the city of Toronto, as a city, to do under the conditions that surround it at present."

In the Arnold-Moyes report the total value of the Toronto Railway Company is fixed at $20,608,036, of which $9,894,483 is the present value of the physical property as of July 1, 1913, and $10,713,553 is the intangible value of the property as of the same date. The total value of the portions of the property of the Toronto & York Radial Railway Company within the city is placed at $285,298, of which $91,604 is for physical property and $193,644 is for intangible value. The total value of that portion of the property of the Toronto Suburban Railway Company within the city is placed at $51,154. Thus the grand total value of all the railway properties, as fixed by the Arnold-Moyes report, is $20,944,478.

In arriving at the cost to reproduce the railways new Messrs. Arnold and Moyes applied unit prices to inventory and added certain percentages. These percentages, varying from 5 per cent to 15 per cent, were for "organization," "engineering" and "incidentals." The average percentage was 6.4 per cent. There were also added 5 per cent for the cost of securing money and 5 per cent for carrying charges during construction work and general legal expense.

Depreciation percentages taken in the Arnold-Moyes report may be of interest. Some of them are as follows: Coal-handling apparatus, 6 per cent; grates and stokers, 5 (that is, 10 per cent a year for five years, no further depreciation being figured after that if the apparatus is still in use); horizontal tubular boilers, 8; water-tube boilers, 3.5; steel smoke breeching, 10; brick and concrete stacks, 3; heaters, 3 to 6; pumps, 5; air compressors, 5; Corliss slow-speed engines, 3; automatic high-speed engines, 5 to 8; piping, 3.5; generators, 4 and 5; transformers, 5; rotary converters, 5; switchboards and interior wiring, 3; iron poles, 2.5 to 3; cedar poles, 5; pole brackets, 4; wooden cross-arms, 5; iron cross-arms, 3.33; weatherproof cable, 3.33; lead cables, 3; transmission-line material, 5.

Mayor Hocken appears to be strongly in favor of the purchase of the street-railway and electric-service systems of the city for the total sum of about $30,000,000. The matter will undoubtedly come up for decision by vote of the electors of the city and, of course, arrangements will have to be made for financing if the project is indorsed by the citizens. The Toronto Electric Light Company has about 23,000 customers.

## Railway Electrical Engineers at Chicago

*By Telegraph*

About 200 delegates, representing the electrical departments of the principal railroads of the United States and the allied manufacturing and supply interests, attended the opening sessions of the Association of Railway Electrical Engineers' convention, held at the LaSalle Hotel, Chicago, Oct. 21 to 24.

Following a brief address by President D. J. Cartwright, electrical engineer of the Lehigh Valley Railroad, the association adopted amendments to the constitution which will increase the list of eligibles, change the membership fees and affect the voting privileges of members. The committee on standard report-forms then submitted a system of reporting the performance of electrically lighted cars, which is designed to eliminate considerable clerical labor and to act as an automatic check on the work done by the different divisions of railway electrical departments. Mr. F. E. Hutchison, of Chicago, is chairman of the committee. Considerable discussion followed, during which several members described the systems of reporting employed by their respective companies. Mr. D. J. Cartwright, Philipsburg, N. J., explained in detail the methods used by the Lehigh Valley road in reporting trouble, condition of storage batteries and electrical inspections.

Mr. Joseph A. Andreucetti, Chicago, secretary of the association, followed with the report of the committee on head-end equipment. This paper contained a general analysis of the construction and equipment used with head-end lighting systems and described the practice of several railroads in the lighting of cars. The committee urged that a standard type of head-end construction be adopted. The report was referred to the committee on standards in order that such action might be recommended if deemed desirable.

The report of the committee on terminal facilities for handling car-lighting equipment was next read by Mr. George B. Colegrove, Chicago. It described approved types of construction and equipment for battery houses and enumerated the kinds of tools required. Electric soldering irons and furnaces were recommended in preference to those heated by gas or charcoal. The use of electric trucks was also advised for transferring batteries between cars and battery racks. In the discussion which followed, the advisability of locating battery houses at terminal stations and at car shops was brought out. On account of the indefinite and infrequent periods at which cars are "shopped," some of the members favored terminal battery houses rather than those located in car shops. About an equal number of members favored the plan of cleaning batteries when the cars are in the shops. In all cases it was conceded that battery work should be in charge of competent electrical foremen. Among those taking part in the discussion were Messrs. Cartwright, Colegrove, E. S. MacNab of Montreal, D. B. Pastor of New York, Fred McGary of Chicago, and H. C. Meloy of Cleveland.

Tuesday's session closed with a report from the committee on electric head lamps, read by Mr. Charles R. Sugg, chairman. The report tabulates the laws in effect in different states regulating the intensity of locomotive headlamps. In most cases, however, the statutes require certain intensities at definite distances, without specifying the conditions under which these intensities shall exist. A wide divergence in requirements for head-lamp intensity is shown. The committee suggested that the association express itself as opposed to laws in which indefinite specifications are given. The report also contains a general description of electric head-lamp equipment and construction and includes forms for tabulating head-lamp performance and maintenance. The general opinion expressed was that the Interstate Commerce Commission should enforce a federal law giving head-lamp specifications comprehensive in character. Mr. Suggs explained that superintendents of motive power and master mechanics of a number of railroads are investigating this subject thoroughly at the present time.

A complete report of the papers and discussions presented at the subsequent sessions will be published in a later issue of the *Electrical World*.

The Railway Electrical Supply Manufacturers' Association held an elaborate exhibit of train and terminal lighting equipment in conjunction with the electrical engineers' convention. The display was considerably larger than in previous years, and each individual booth indicated the progress made in the development of appliances for the railway field. About fifty manufacturers were represented at the exhibition.

## Signal Engineers at Nashville

The Railway Signal Association held its eighteenth annual convention at the Hotel Hermitage, Nashville, Tenn., on Oct. 14, 15 and 16. President B. H. Mann, of the Missouri Pacific, St. Louis, uttered a word of warning in his opening address. He said that a number of railroads have not adopted the association's standards and specifications. He urged individual work to bring about wider recognition of the approved methods of signaling adopted by the association. There should be less talk about the relative importance of this committee or that and more missionary work for the whole association.

A minute was adopted expressing regret at the sudden death of Mr. W. McC. Grafton, signal engineer of the Pennsylvania Lines West of Pittsburgh, on Oct. 10. Secretary C. C. Rosenberg, of Bethlehem, Pa., reported the membership to be 1209. The thanks of the association were extended to Mr. A. D. Cloud, of Chicago, editor of the *Signal Engineer*, and to the secretary for special work done for the association.

### Alternating-Current Signaling

The report of the committee on electric railways and alternating-current signaling was presented by Mr. W. Morrison, of the New York Central, New York, in the absence of Mr. H. S. Balliet, of the same railroad. Specifications were presented relating to an alternating-current automatic block signal system, impedance bonds where alternating current is used for car propulsion and where direct current is so used, single-phase transformers for signaling, motors, relays, motor-generators, switchboards, etc. The specifications are applicable for this type of signaling as used on steam roads as well as electric roads. Mr. Howard, of the Union Switch & Signal Company, was called on for his advice on this rather complicated subject. The specifications were adopted for submission to letter ballot substantially as presented except that at the suggestion of Mr. W. H. Elliott, of the New York Central, the specifications for impedance bonds used in alternating-current signaling on railroads using alternating-current propulsion were labeled to show that they applied to 11,000-volt train-operating systems. It was also made clear that the figures given in brackets in the specifications are to be regarded as tentative. Mr. A. G. Shaver, of the Rock Island, Chicago, doubted whether the art of alternating-current sig-

naling has progressed far enough to warrant the making of recommendations for the manual, but nevertheless the committee's specifications were accepted for letter ballot as stated. A large part of the committee's report was devoted to descriptive matter relating to alternating-current signal systems on both electric and steam roads. There was no discussion on this part of the report.

### Specifications for Wires and Cables

On recommendation of the committee on wires and cables, some changes were accepted in the specifications relating to mineral-matter rubber compound for signal wires. The galvanized messenger-wire specifications were also revised. New specifications for enameled copper magnet wire, virtually those used by the General Electric Company in making its own purchases, were accepted as presented except that it is stipulated that the diameter of the core of the spool on which the wire is wound shall be not less than 1.5 in. A letter was read from Mr. Hugh T. Wreaks, of the Wire Inspection Bureau, urging a more rigid inspection of signal wire.

### Storage Battery and Charging Equipment

The committee on storage-battery and charging equipment presented its specifications for a pure-lead-type stationary storage battery for signaling. Mr. H. M. Beck, of the Chicago office of the Electric Storage Battery Company, objected to the new dimensions proposed as standard for lead plates for stationary signaling batteries. After some discussion the drawing and text references relating to these dimensions were withheld for further consideration, the remainder of the specifications being accepted for submission to letter ballot. In the discussion Mr. Clarence C. Bailey, of the General Electric Company, pointed out the necessity of using auto-transformers on the motor panels of battery-charging equipment.

### Various Subjects Discussed

The committee on method of recording signal performance (Mr. W. N. Manuel, Grand Rapids & Indiana, chairman) was instructed to continue its work of preparing a revised form. A complete report is expected at the stated meeting of next March.

On request for an expression of opinion, nineteen members manifested a desire for an investigation of low-voltage switch-operating mechanisms.

The wire-crossing specifications of the Association of Railway Telegraph Superintendents were indorsed. These relate to aerial crossings over railroad rights-of-way of wires carrying not more than 550 volts.

### Concluding Business

The next annual convention will be held in the Hotel Champlain, Bluff Point, N. Y., on Lake Champlain, beginning on Sept. 22, 1914, provided approval is obtained in a letter ballot. The entire hotel will be turned over to the convention. The setting ahead of the date may avoid conflict with the convention date of the American Electric Railway Association.

Officers were elected as follows: President, Mr. F. P. Patenall, Baltimore & Ohio; vice-presidents, Messrs. T. S. Stevens, Santa Fé, and W. J. Eck, Southern Railway; secretary and treasurer, Mr. C. C. Rosenberg, Times Building, Bethlehem, Pa.

### Entertainment

The Signal Appliance Association, composed of affiliated manufacturers and dealers, did not make an exhibition, but instead gave a pleasing program of entertainment, consisting of buffet luncheons at the Hotel Hermitage, sight-seeing trips and a theatrical performance. On Oct. 17 nearly the whole party went to Chattanooga, and here the supply men were entertained by a trip to Lookout Mountain, buffet luncheon at the Hotel Patten and an excursion to Chickamauga Park and Fort Oglethorpe.

The total attendance at the convention was 410, including 115 ladies.

## Public Service Commission News

### Maryland Commission

The Postal Telegraph & Cable Company has petitioned the Maryland Public Service Commission to compel the American Telephone & Telegraph Company to sell its controlling interest in the Western Union Telegraph Company. Pending action by the commission the Postal company asks that the Telephone company be ordered to abolish the use of names for calls for the two telegraph companies. It asks that numbers be substituted and be used, as was the case several years ago before the Telephone company acquired its interest in the Western Union system. The Postal company asserts that discrimination is practised and that employees of the American company inform Postal customers that the latter's telephone lines are busy when they are free.

### New Hampshire Commission

The Public Service Commission has authorized the purchase of the Cascade Light & Power Company, of Berlin, Gorham and Milan, by the Twin State Gas & Electric Company, of Dover, for $240,825. Under the decision rates in the territory involved in the purchase are not to be increased without the consent of the board. The commission has disapproved the petition of the Twin State company for authority to purchase the Berlin Electric Company for $172,000 but sanctions the transaction at $74,154. The board has authorized the Twin State company to purchase the Berwick & Salmon Falls Electric Company for $27,000 and has further approved the issue by the former of bonds not exceeding $1,232,000 par value to provide for the foregoing and other purchases authorized by the commission.

### Wisconsin Commission

The Wisconsin Railroad Commission has authorized the Wells Power Company, of Milwaukee, to issue $136,000 common stock and $35,000 notes. The notes are to mature ten years from date and to bear 6 per cent interest. This is the first certificate granted under the new law which permits a corporation that is under-capitalized to raise the total of its outstanding stock, bonds, notes and other evidences of indebtedness more nearly to an equality with the value of its property. The commission found upon investigation that the value of the petitioner's property, including all leases and a reasonable sum for working capital as $378,200. The sum of the outstanding stocks, bonds, notes, etc., is $207,000. The difference is provided for in the stock and notes which may now be issued.

The Wells Power Company is further authorized to issue $265,000 in 6 per cent notes, to be sold for not less than 75. The proceeds from the sale of $190,000 of the notes shall be used to retire $143,000 of demand notes now outstanding, which were issued for the construction and acquisition of the property now owned by the corporation. The proceeds of $75,000 of the notes shall be used to pay for extensions, additions and improvements to the plant and property.

That part of a recent order of the commission which denied the petition of the Citizens' Telephone Company, of Eau Claire, to issue and sell stock to enlarge and extend the plant of the Chippewa County Telephone Company, which it had acquired, has been declared unlawful in a decision rendered by Judge Stevens of the Circuit Court. The opinion stated that the court must follow the statute without regard to the question of whether it authorizes wasteful and useless duplication of plants, and that the question is one for

the Legislature and not the commission to determine. The commission denied the certificate on the ground that the Wisconsin Telephone Company already occupied the field and to permit a second utility to enter it in competition would be a violation of the statutes. Previous to its acquisition by the Citizens' Telephone Company the Chippewa County Telephone Company did practically no local business.

### Massachusetts Commission

The Public Service Commission gave a hearing last week upon its recent tentative order requiring railway, trolley and telephone companies to file sworn monthly statements in detail as to funds exended for advertising, legal matters, legislative and general expenses. Representatives of the principal street railways and telephone companies appeared in oposition to the proposed order on the ground that the cost of such frequent statements would far exceed their value. Mr. Bentley W. Warren, counsel for the Massachusetts Street Railway Association, stated that no objections are held by the companies to the purpose of the order as it seems proper that the commission should secure all desired information, but that the board's powers of examination are suffieient to enable it to obtain data at all times and to any degree of detail desired. Mr. James F. Jackson opposed the order on behalf of the Bay State Street Railway, and Mr. E. K. Hall objected on behalf of the New England Telephone & Telegraph Company.

### Indiana Commission

The Corydon Light & Water Company has petitioned the Indiana Public Service Commission for permission to sell its electric light, water and ice plant to the Interstate Public Service Company, which operates and owns many of the southern Indiana utility companies. The proposed purchase price is $26,500 plus a mortgage indebtedness of $14,500.

The Indiana commission has ordered the Central Union Telephone Company to reduce a new schedule of tariffs it filed for Marion County, raising the rates on telephones in state, county and city offices from $40 to $54 per year. The latter rate is the rate for business telephones. Commissioner John F. McClure declared in his opinion that city, county and state offices are entitled to lower rates than business houses, because of the public nature appertaining to their work.

A committee of auditors from the leading utilities of Indiana was appointed at a meeting of presidents and other officials of the companies on Oct. 16 to confer with the Public Service Commission of Indiana and attempt to reach a satisfactory conclusion in regard to questions which have arisen in connection with the proposed uniform system of accounts.

The Interstate Public Service Company filed a petition before the commission asking that it be allowed to keep all of its books and records in its headquarters at Indianapolis. It controls many utilities in the State. It showed that in order to introduce economies of service it needed some freedom in the matter. Several officials of other systems appeared before the commission at the same time as the representatives of the Interstate company. The result of the meeting was the appointment of the committee of auditors to meet with the commission and its accountants to settle the present difficulties and thereafter to handle other questions of a similar nature as they might from time to time arise.

### California Commission

The Railroad Commission of California has directed the Pacific Telephone & Telegraph Company to reduce its rate for telephone service within the city of San José and neighboring territory. In its decision the commission eliminates the $5 deposit required for telephone service. The commission finds further that the company has been paying an abnormal percentage of its gross receipts to the parent company, the American Telephone & Telegraph Company.

## Current News Notes

Commission Form of Government for Nashville.—The commission form of government succeeded the City Council of Nashville, Tenn., on Oct. 14. The latter body and its predecessors had been in existence more than 100 years. There are five commissioners. One, Mr. Hilary E. Howse, is Mayor. Nashville has a population of about 175,000.

* * *

Useful Life and Smashing Point of Lamps.—In reporting certain remarks made by Mr. Ward Harrison in discussing his own paper before the Illuminating Engineering Society convention, we stated on page 619 of our issue dated Sept. 27 that the "useful life is independent of the energy cost or lamp cost." It was the "smashing point expressed in per cent of the initial candle-power" and not the "useful life" which Mr. Harrison said was independent of the energy cost or lamp cost.

* * *

General Electric Company of Budapest Twenty Years Old.—To mark the twentieth anniversary of the founding of the Budapest General Electric Company, of Hungary, Mr. Etienne de Fodor, its general director, on Oct. 9 tendered a banquet to about 150 of the most distinguished men of Hungary. Mr. de Fodor received an ovation following the speeches of the Minister of Commerce, Baron J. Harkanyi, and others. The occasion was a brilliant and extraordinary affair in which there was more than local interest.

* * *

Sixty-Ton Electric Cantilever Crane.—A large cantilever crane is in use loading masonry blocks for building the harbor at Valparaiso. The crane lifts its full load of 60 tons at a distance of 52 ft. from its center in transporting blocks from the railroad to a barge moored alongside the jetty. The lifting motor is rated at 40 brake-hp, and there are two separate lifting motions each capable of dealing with loads of 7.5 tons and operated by two 30-brake-hp motors. This latter equipment permits the crane to deal with tipping skips, the intention being that the skip and its contents, weighing 15 tons, might be lifted by the two 7.5-ton hoists operating synchronously and tipped as desired by working them separately, each hoist being fitted with an independent brake. For the main hoist there is a powerful solenoid brake as well as rheostatic brake and a mechanical emergency brake.

* * *

Report on Chicago Railroad Terminals.—Mr. John F. Wallace, consulting engineer, presented his report on the railroad terminal situation in Chicago to the City Council committee on railroad terminals on Oct. 20. Mr. Bion J. Arnold is to present a report soon reviewing Mr. Wallace's findings. Mr. Wallace considered the seven routes of steam-railroad approach to Chicago and the six existing passenger terminals. He recommends two general locations for passenger terminals—one on the South Side near Michigan Avenue and Twelfth Street and one on the West Side near Canal Street and between Van Buren and Madison Streets. These would be in addition to the Chicago & Northwestern terminal at West Madison Street and Canal Street. A single union station is impracticable. Mr. Wallace recommends that the pending ordinance for the proposed Pennsylvania-Burlington-Alton-St. Paul union

station at West Jackson Boulevard and Canal Street be approved. The depression of freight tracks is advised in certain localities. No reference is made in the report to the electrification of railroad terminals.

* * *

Ontario Water-Powers Under Commission Control.—At a recent meeting of the Ontario Municipal Electrical Association held in Toronto the following resolution was passed unanimously: "In view of the comprehensive schemes outlined by the Dominion government for the improvement of highways in connection with the St. Lawrence River, Welland Canal, French River, Sault Ste. Marie, Trent, Ottawa and others, involving a large expenditure of public money, and in view of the extensive power developments which are possible in consequence thereof, also in view of the rapidly increasing power requirements of the Province, be it resolved that this association request the Dominion government to put all such water-powers under the jurisdiction of the Hydro-Electric Power Commission of Ontario, to be developed by it for the use of the municipalities of the Province for the benefit of the people."

* * *

Canadian Electrical Exhibitions.—Two electrical exhibitions will be held in Montreal and Toronto respectively early next month. "Canada's First Electrical Exposition," which will have the active support and co-operation of the Montreal Light, Heat & Power Company, will be held at Montreal Arena, Nov. 1 to 8 inclusive, and the Toronto Electrical Show will be held in the Arena Gardens, Toronto, from Nov. 10 to 15. In the Montreal exhibition a representative showing will be made by manufacturers, dealers and jobbers of electrical supplies and appliances for the purpose of demonstrating to the public all modern uses of electricity in the home, factory and office, also in medicine and surgery, as well as in many other departments. The purpose of the Toronto exhibition is to give the exhibitors a means of advertising and selling to the public, including central-station men and the entire electrical trade of Toronto and the Province of Ontario.

* * *

Eggs Fried on Ice.—Considerable attention was attracted to the booth of the Ozone Pure Airifier Company at the International Refrigeration Exposition by the demonstration of frying eggs on ice. This feat was not performed to demonstrate any device manufactured by the company but to call attention to the apparatus which it had displayed and, as the representative in charge jokingly said, to show that even more difficult things than purifying air with ozone can be accomplished. Although bystanders offered several explanations of the phenomenon, they were usually wrong. As a matter of fact, the aluminum plate on which the egg was fried was heated by induction. In a case beneath the slab of ice (which was 2 in. or 3 in. thick) was an auto-transformer. A person holding his hand over the ice could feel no heat and the griddle was cold to begin with. By placing the aluminum griddle on the ice over the coil, however, alternating currents were induced to flow in it, and the metal became heated.

* * *

Attitude of Forest Service on Utilization of National Forest Lands.—In our issue dated Sept. 6, on page 467, it was stated, in connection with a suit brought by the Pacific Gas & Electric Company against the Secretary of Agriculture, that "the Forest Service objects to further elevation of the reservoir on the ground that the water will overflow parts of the Tahoe National Forest. It also opposes the construction of an aqueduct across the forest reserve." We have learned from official sources that the Forest Service does not object to the construction work which the company is doing or to the flooding of national forest lands for reservoir purposes, provided only that the company will comply with the requirements of the law under which such use of national forest lands may be permitted. This the company has so far declined to do, claiming that the act of Feb. 15, 1901, under which a permit might be secured is unconstitutional. The Forest Service therefore has not even had the opportunity to pass upon the question of issuance of the permit for the construction work which the company contemplates.

* * *

## SOCIETY MEETINGS

Chicago Electric Club.—Captain C. C. Healy of the Chicago traffic police addressed the members of the Chicago Electric Club Oct. 16 on the subject of traffic regulation in Chicago's "loop" district, comparing American methods with those of the police departments of European countries.

* * *

Special Train to Electric Vehicle Convention.—En route to the Electric Vehicle Association convention at Chicago with several carloads of delegates from New York City, Boston and Philadelphia, a special all-steel train is scheduled to leave the Grand Central Terminal, New York City, at 8:02 p. m. Saturday, Oct. 25, reaching Chicago at 9 o'clock Sunday evening. The fourth annual convention of the Electric Vehicle Association of America will be held at the Hotel LaSalle, Chicago, Oct. 27 and 28, as announced in last week's issue, which reproduced the program for the two-day session.

* * *

Officers of Signal Appliance Association.—At Nashville, Tenn., on Oct. 15 the Signal Appliance Association elected officers for the ensuing year as follows: Chairman, Mr. W. P. Hawley, New York, United States Light & Heating Company; vice-chairman, Mr. L. T. Thomas, Chicago, General Railway Signal Company; secretary and treasurer, Mr. F. W. Edmunds, New York, Dressel Railway Lamp Works. Executive committee—Messrs. W. J. Gillingham, Chicago, Hall Switch & Signal Company; George H. Porter, Chicago, Western Electric Company; W. T. Kyle, New York, Duplex Metals Company, and F. E. Cameron, Corning, N. Y., Corning Glass Works. Committee on convention arrangements—Mr. E. E. Hudson, Orange, N. J., Thomas A. Edison, Inc.; Mr. Cameron and Mr. George Blackmore, New York, Union Switch & Signal Company. Committee to confer on place of convention—Mr. Gillingham. This association is the manufacturers' auxiliary to the Railway Signal Association.

* * *

Montreal Electrical Society.—The winter season of the Montreal Electrical Society began on Oct. 6, and meetings will be held during the winter on the first and third Mondays of each month. Some of the papers to be presented before the society during the year are as follows: "X-Rays," by Mr. L. R. McDonald, of the X-Rays, Ltd., Nov. 3; "Telegraph Talk," by Mr. W. J. Camp, assistant manager of the Canadian Pacific Railway telegraph department, Dec. 1; "Rolling Metal Equipment," by Mr. C. A. Ablett, general manager Siemens Company of Canada, Ltd., Jan. 5. Prof. A. M. Gray, of McGill University, Montreal, will address the society on Feb. 16. "Recent Advances in Illumination" will be the topic of Mr. C. A. Howe on March 2. Mr. W. C. Lancaster, electrical engineer for the Canadian Northern Railway Tunnel, has promised a paper, and Mr. Coombes, of the Babcock & Wilcox Company, will speak on "Boilers." Mr. F. C. Burrett, of the Canadian Cement Company, will speak on "Industrial Applications." No dates have been assigned to the last three speakers.

# The Waterside Turbine Station at Louisville, Ky.—I

**Special arrangement of condensing equipment in pit 53 ft. below turbine-room floor—Labeling of electrical circuits—Consolidating the physical equipment of former competing companies**

SINCE the consolidation of the various gas and electric interests in Louisville, Ky., by H. M. Byllesby & Company, the combined utilities have been operated under the name of the Louisville Gas & Electric Company. This merger represents a combination of five electric generating systems, two of which were originally operated by the Louisville Lighting Company and the remaining three by the Kentucky Electric Company, the George G. Fetter Lighting & Heating Company and the Campbell Electric Company respectively.

The several electric distributing systems are now being rearranged to be fed from the merger company's Waterside station (formerly the plant of the Kentucky Electric Company) and the former Louisville Lighting Company station in the interior of the city. These two plants will be connected by tie-lines and the remaining small generating stations shut down. Where, as the result of the recent competition, duplicate distribution lines traverse identical territories the plans will be to continue in use only the newer equipment to serve the entire district.

### Features of Design and Construction

Of the two large generating plants to be operated by the merger company, the Waterside station on the river front is the more modern, having been erected only a year ago. Designed for an ultimate rating of 64,000 kw, one 4000-kw and one 2000-kw turbine unit are already installed, and extensive additions are now being planned.

From an engineering viewpoint, the feature of the former Kentucky Electric Company plant is, however, its unusual arrangement of condenser equipment, made necessary by the 45-ft. rise and fall in the stages of the Ohio River at Louisville. To meet this difficulty the extraordinary departure adopted was that of installing the condensers at the bottom of a concrete well extending 53 ft. below the turbine-room floor, from which location they are connected with the turbine exhausts by 60-in. pipes dropping vertically from the turbine casings.

The plot on which the station is located measures 305 ft. wide and 396 ft. long. It is adjacent to the Ohio River and also to spurs of the Louisville & Nashville and Illinois Central railroads, so that any one of these means may be used for bringing in the station's coal supply. For distribution purposes the plant is desirably located, being within one-half mile of the electrical load center of the city. Should it ever be required to furnish steam for district heating, it

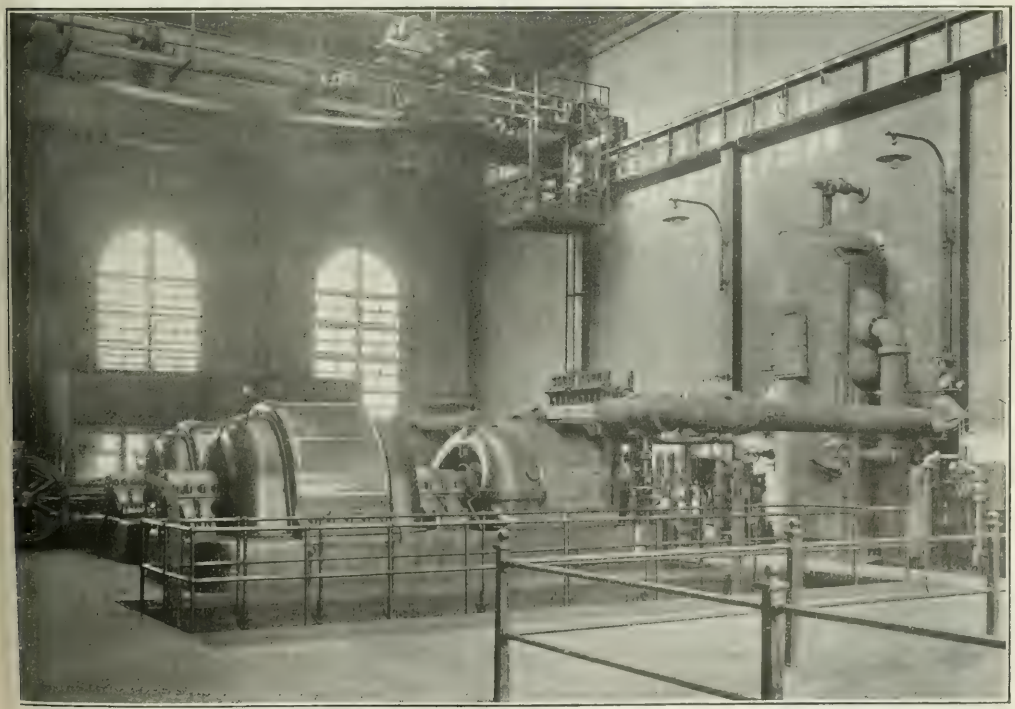


FIG. 1—TURBINE ROOM OF WATERSIDE STATION, LOUISVILLE GAS & ELECTRIC COMPANY, LOUISVILLE, KY.

will also be within 1500 ft. of the probable center of demand.

The portion of the Waterside station already completed measures 134 ft. wide and 107 ft. long, and is three stories high, not including its basement and roof penthouse. The floors of the boiler room, turbine room and switchboard room are all on the same level. Two galleries and the penthouse located above the switchboard room are occupied by the switch compartments, bus compartments and lightning-arrester equipment.

### Boiler Room

The boiler room is of special interest because of the comfortably low temperature maintained under operating conditions due to its design. Three batteries of two boilers each are arranged in a single row at present, but ultimately the building will be widened 27 ft. to accommodate another row. The Babcock & Wilcox boilers installed, each having 5087 sq. ft. of heating surface and 103.5 sq. ft. of grate area, develop steam at 200 lb. pressure. Superheats as high as 125 deg. Fahr. can be maintained by the superheaters installed in each boiler, although the degree of superheat is varied according to the load carried. Each unit is equipped with a chain grate, operable by either an electric motor or a steam engine.

At one end of the firing aisle is a load-indicating device controlled from the switchboard, which shows the fireman the electrical load which is being carried or which it is expected to carry, in order that demands on the boilers may be anticipated. The rectangular case, 6 ft. high and 1 ft. wide, has a glass front on which figures are printed indicating the load in steps of 500 kw. The figures are large enough to be easily discernible from the opposite end of the firing room, and behind each division is an incandescent lamp. The switchboard operator can by the same means inform the fireman in advance whether the load is going to increase or decrease and when another turbine is about to be started up.

One 250-ft. steel stack arranged centrally with relation to the existing boilers carries aloft the combustion gases. This stack has a minimum diameter of 12 ft. and is lined with firebrick throughout its entire height. At the bottom the lining is 6 in. thick and at the top 4 in. thick. The space between the lining and the stack proper is filled with grout to prevent the steel from being corroded by moisture. As additional boilers are installed new stacks will be erected, the plan being to provide one stack for each set of six boilers.

Boiler-feed water can be supplied either by two reciprocating pumps or by a centrifugal pump, all placed in the turbine room. The reciprocating pumps are of the Worthington

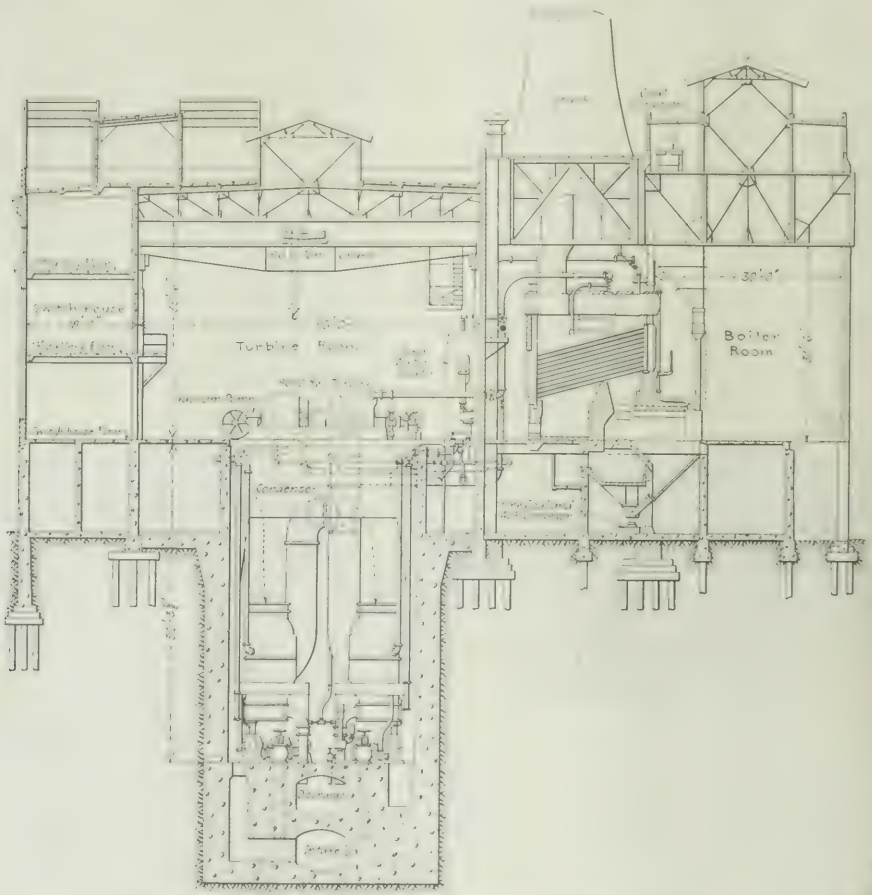



FIG. 2.—ELEVATION CROSS-SECTION OF WATERSIDE STATION, SHOWING CONDENSER PIT AND CIRCULATING TUNNELS

marine type and are capable of delivering 275 gal. per minute each. The four-stage centrifugal unit is driven by an Alberger Curtis turbine and delivers 450 gal. per minute. Water required for the boilers in excess of that obtainable from the hot wells is passed through two Jewel filters. The water used in the cooling jackets of the vacuum pumps and the turbine bearings is also passed through these filters.

### Coal-Handling Equipment

As already mentioned, coal can be received by boat or by rail, but facilities for unloading river barges have not yet been developed. Except during the recent flood, all fuel has been received by rail, the cars being dumped into concrete bunkers beneath the tracks. Mounted on a turntable on the roof at the north end of the plant and above the level of the bunkers is an Orton-Steinbrenner hoist with a 1.5-cu. yd. bucket which raises the coal from the bunkers to a crusher on the roof. This crusher was in-

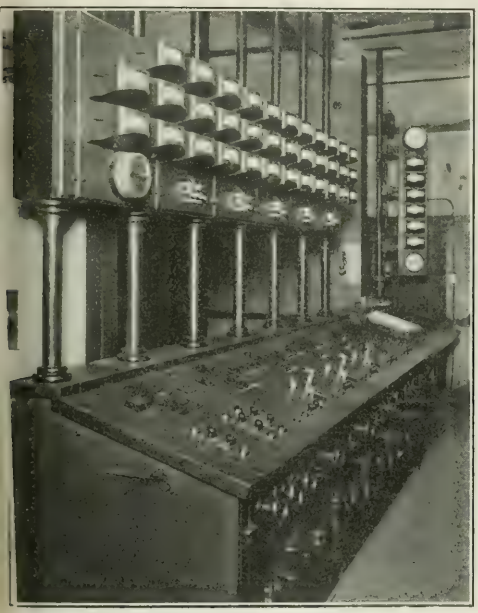


FIG. 3—CONTROL BENCHBOARD, SHOWING WATTLESS COMPONENT SWITCHES BELOW METERS

stalled with the intention that "run-of-mine" coal should be used at some future time, although Western Kentucky coal containing 11,550 lb.-Fahr. heat units per pound is being used at present. The crusher is capable of handling 65 tons of fuel per hour.

When other than mine-run coal is used the crusher rolls are separated and the coal is allowed to pass directly through the machine onto a Robbins belt conveyor, which travels over the 65-ton coal bunkers located above the boilers in the firing room. This 24-in. belt conveyor is equipped with a traveling tripper, which permits unloading all the coal into one hopper or unloading into several in succession. The coal hoist, crusher and belt conveyor are operated by 220-volt, three-phase, wound-rotor induction motors. The motor operating the coal hoist is rated at 112 hp, and the motors on the crusher and belt conveyor are rated at 30 hp and 5 hp respectively. Ultimately an elaborate coal-handling device will be installed, with an electric traveling crane spanning the whole coal yard.

Ashes, as well as fine coal which sifts through the chain grates, are delivered to separate compartments beneath the grates. In the basement beneath these compartments is a 30-in. six-ply belt conveyor which is at different times used for disposing of the ashes and fine coal. A twenty-four-hour run of ashes can be thus disposed of in fifteen minutes. The ash conveyor discharges into concrete ash bunkers outside of the plant, from which the ashes are loaded



FIGS. 4 AND 5—COAL HOIST ON ROOF OF STATION, AND BOILER ROOM

into cars by the coal hoist, already referred to above.

### Header Arrangement to Avoid Steam Traps

To avoid the use of steam traps, an ingenious arrangement of drainage for the high-pressure steam mains has been adopted. There are two steam headers, the main header and the auxiliary header. For each of the main generating units a large connection is taken from the main header, dropping vertically down to the level of the turbines and then passing horizontally through the division wall. From the bottom of each of these elbows a smaller pipe continues down to feed the auxiliary header located in the turbine-room basement.

From the top of this auxiliary header steam is taken for all the auxiliaries located on the main floor, and from its

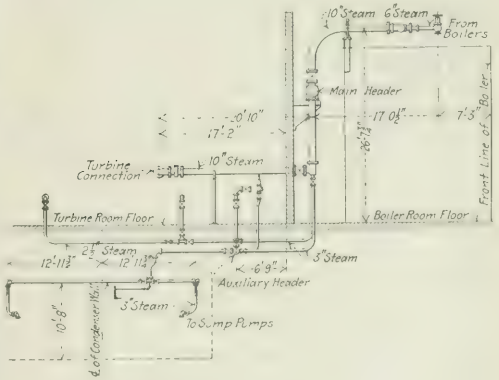



FIG. 6—ARRANGEMENT OF STEAM PIPING WHICH ELIMINATES STEAM TRAPS

bottom two connections are made to feed the turbine-driven pumping units located in the condenser well. Below these pump connections the pipes continue down to feed the slow-speed reciprocating service pumps, 53 ft. below the level of the turbine-room floor. All water thus eventually reaches the service pumps, where it can do no damage, being disposed of through their exhaust.

### Turbine Room and Condensing Equipment

Adjoining the boiler room on the west is the turbine room, which measures 65 ft. wide and 107 ft. long, having been designed for the immediate installation of four 4000-kw turbo-generators. Only two units are installed at present—one is rated at 2000 kw and the other at 4000 kw—but it is expected that additional sets will be installed shortly. Both of the present units are 2300-4600-volt General Electric alternators, driven by Curtis horizontal turbines running at 1800 r.p.m. With the aid of the 2300-4600-volt windings, as soon as the high-tension distribution district enlarges, the machines will be connected to supply 4600 volts.

As already mentioned, the arrangement of the condensing equipment in this plant is quite extraordinary, as made necessary by the 45-ft. rise and fall in the level of the Ohio River, from which the circulating water is obtained. To accommodate this varying level, the main turbine condensers are themselves installed at the bottom of a 30-ft. concrete well, 53 ft. deep, opening into the center of the turbine-room floor. The condensers are connected with the turbines by vertical 60-in. exhaust lines. The one pit provides condenser space for four turbine sets, as it was feared to excavate additional pits which might give the building too large displacement during floods. Details of construction of the condenser pit, with the tunnels for water supply, are shown in the cross-section sketch of the plant reproduced herewith.

Intake from the river is through a screen well on one corner of the plant property. This well is built of concrete and is situated 535 ft. from the concrete intake cribs in the river. Its tunnel connections with the condenser pit are also illustrated by drawings herewith. Two 42-in. concrete pipes extend from the well to the water line of the river, where they connect to two cast-iron flanged pipes with flexible joints, which extend to concrete cribs located 75 ft. apart in the river. Here the pool level is ordinarily maintained at 412 ft. above sea level by the government dam below Louisville, but the intake pipes are so placed that they would remain covered with water even if the dam should be carried away by floods or ice.

The screen well is separated into two compartments by a concrete wall, each section connecting with one of the pipes leading into the river. The screens are placed diagonally across each compartment. Leading from the well to the condenser pit are two arched-roof concrete tunnnels, the discharge tube being superimposed upon the intake tube. Since the top of the upper tunnel is about 5 ft. below low-water mark, the siphon principle is utilized to assist in circulating the water through the condensers. By an arrangement of valves, the pipes leading to the river can alternately be made intake and discharge tunnels, enabling sediment that collects in them to be removed by reversing the direction of flow.

The condensing equipment installed in the pit comprises a pair of vertical-tube double-pass condensers, each having a total of 10,000 sq. ft. of cooling surface. They were especially designed for this plant and are made up of 1-in. tubes of No. 18 gage, 14 ft. 9 in. long. Both condensers were designed for 4000-kw machines, although the one used with the 2000-kw unit contains only 6000 sq. ft. of tube area. Sixty-inch pipes connect the turbines with the condensers, the exhaust steam passing through a steam dome from which it flows across the condenser while the air is removed on the opposite side.

Each condenser is provided with an Alberger-Curtis turbine driving a 20-in. tri-propeller circulating pump and a 4-in. two-stage hot-well pump on the same shaft. The tri-propeller pump is capable of supplying 9000 gal. of water per minute, and the hot-well pump delivers 200 gal. per minute.

On the main floor there is a rotative dry-vacuum pump which is connected with the condenser by an 8-in. pipe. Tests have shown that the circulating pump is requir overcome a friction head of about 7 ft. under normal ditions, giving a vacuum within 1 in. of the barometer

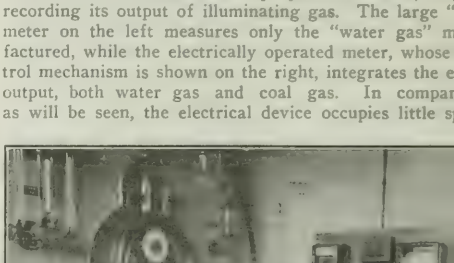
To ascertain the condition of the screens in the i well, floats are installed in the tunnels and connect graduated tapes brought up through vertical pipes t engine-room floor and counterbalanced by weights. reading the tape markings the difference in level o water in the pipes is obtained, which corresponds t friction head required to force water through the tu and screens. It is hoped to perfect this apparatus, mak recording device which will chart its own readings.

The second part of this article, which is to appear subsequent issue, will describe the electrical equipmer the Waterside station, giving a detailed account of switching apparatus, bus layout, facilities for making system of labeling and use of colored wire, and other tures of special interest in connection with the plant.

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## Electrically Operated Gas Meter at Waterloo

Shown herewith are the two station meters used by Citizens' Gas & Electric Company of Waterloo, Ia., recording its output of illuminating gas. The large " meter on the left measures only the "water gas" m factured, while the electrically operated meter, whose trol mechanism is shown on the right, integrates the e output, both water gas and coal gas. In compar as will be seen, the electrical device occupies little s



STATION GAS METERS AT WATERLOO, IA.

although it has a capacity of 100,000 cu. ft. per hour, times that of the huge wet meter. The electric met of the Thomas type, built by the Cutler-Hammer Manu turing Company, Milwaukee, Wis., and was installed March. Its accuracy has been tested with Pitot tubes, found satisfactory under varying pressures and temp tures.

In its operation the Thomas meter utilizes the prin of heating electrically, through a small fixed temper rise, the gas traversing its measuring chamber. The perature of the gas before and after passing the he grid is determined by two electric resistance thermom which control relays, adjusting the current flowing thr the main heater grid so that the temperature difference be held constant at all times. The energy require maintain constant temperature rise at various rates of is thus proportional to the quantity of gas passing, sc the electrical power taken by the heater becomes an of the number of cubic feet of gas traversing the m A watt-hour meter on the panelboard reads direct total cubic feet of gas, and a curve-drawing ammeter r a continuous record of the rate of gas flow.

# Application of Electric Drive in Greenhouses

**Extensive use of motors, both alternating and direct-current, in a large floral establishment near Chicago—Operation of refrigerating machines, fertilizer unloaders and pumps, soil mixers, etc.**

AMONG the industrial applications of electric drive which show decided economies over other forms of motive power is the use of motors in greenhouses. Constructed as they are with only one story, such hothouses are of necessity distributed over considerable ground area. To lay steam mains sufficiently large to care for future steam-engine installations or to install additional piping as new engines are required is unsatisfactory. Moreover, the radiation and friction loss attending such long stretches of pipe present additional objections to the use of steam.

Gasoline engines, on the other hand, have not met with the approval of the owners of some greenhouses, owing to the malingering attitude of workmen, who take advantage of the prevailing notion that gasoline-engine service is unreliable. Instances have occurred where engine adjustments have been purposely tampered with or an overload put on the engine until it stopped. Sometimes as many as twelve or fourteen laborers, whose continuous occupation depended on the operation of the engine, would assert that they knew nothing about starting it and would remain idle until the engineer or a mechanic was summoned to start the machine. The electric motor, with its protective devices, its absence of any fine adjustments which can be tampered with and its simplicity of operation, has therefore been increasingly applied to various phases of the flower and plant-growing industry.

The greenhouse owned by the Poehlmann Brothers Company, of Chicago, is located at Morton Grove, Ill., a suburb north of Chicago. The hothouses cover an area of about 2,000,000 sq. ft. and are arranged in two groups, A and B, separated by approximately 3000 ft. Three heating plants are located on the grounds, two at Plant A and one at Plant B. Twenty-four high-pressure boilers are installed in these plants, and steam pressures of 85.5 lb. and 5 lb. per square inch are maintained for engine and heating purposes re-

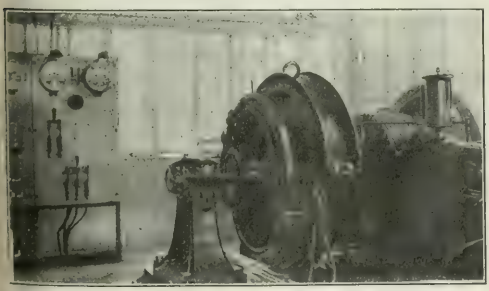


FIG. 1—GENERATING ROOM AT POEHLMANN GREENHOUSES

pectively. In all, 1500 hp can be developed by boilers of he water-tube type, and 2600 hp can be developed by fire-ube boilers. Electricity for operating apparatus in Plant and in its proximity is supplied by a private generating lant operated by the company. Energy for Plant B is rnished by the Public Service Company of Northern linois.

### Power House and Coal-Handling Device

One of the heating plants at Plant A, completed recently, contains six boilers in batteries of pairs, and space for six additional units. Coal for the boilers is brought to the plant in freight cars over a spur of the Chicago, Milwaukee & St. Paul Railroad. The cars are pulled up a 7 per cent grade to a track which is located 16 ft. above the level of

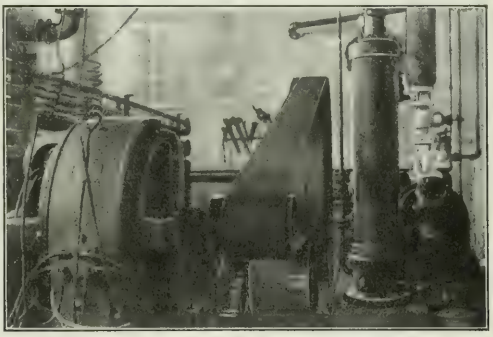


FIG. 2—MOTOR REFRIGERATING MACHINE

the firing aisle, and from this point are dumped into bins beneath the tracks. The coal in these bins is accessible for hand firing in case the automatic apparatus which is used for filling the stokers should fail to operate. Ordinarily the coal is hoisted from the bins to the overhead bunkers by electrically operated bucket conveyors. There are three of these conveyors, one for each pair of boilers. The coal is fed to the stokers from the overhead bunkers by gravity through individual spouts. One 5-hp shunt-wound motor is belted to a shaft running the full length of the firing aisle. Any one of the coal hoists can be operated from this shaft by moving a lever which engages a friction clutch.

Two 30-kw, 250-volt direct-current Thompson-Ryan generators are installed at Plant A, being directly connected to McEwen reciprocating steam engines, each rated at 58 hp. The generators are 3.5 per cent over-compounded and show no evidence of sparking at 50 per cent overload. The switchboard consists of two panels, one for each machine, on which are mounted voltmeters, ammeters and the necessary line switches.

The direct current thus generated is transmitted at 220 volts to the various distribution centers of Plant A by overhead lines carried on insulators supported on poles and on the peaks of the hothouse roofs. Terminal boxes, connected with these distribution lines, are also located on the ends of the hothouses, about 100 ft. apart, so that electricity is available for portable apparatus outside of the buildings.

### Refrigeration at Plant A

The refrigeration apparatus at Plant A is located about 1000 ft. from the generating station and is near the cold-storage and shipping rooms. A 15-ton Linde ammonia compressor driven by a 25-hp General Electric shunt-wound

motor is installed in this room. The motor has been in continuous service for five years, and it is said that the repairs have amounted to only 80 cents in that time. Water for cooling the ammonia condenser coils is pumped from two 1500-ft. wells on the premises by the air-lift principle, at the rate of 800 gal. per minute from each well. Compressed air for operating the wells is supplied by a Bury compressor belted to a 10-hp Northern Electric Manufac-

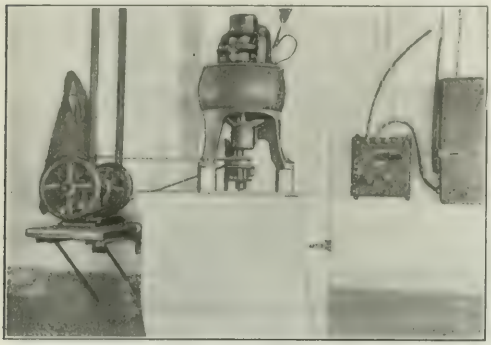


FIG. 3 MOTOR-DRIVEN BRINE CIRCULATOR AND COLD-AIR BLAST

turing Company's shunt-wound motor. The water direct from the wells has a temperature of about 56 deg. Fahr. and would be too cold for watering the flowers in the hothouses. Returning warm water from the ammonia condensing coils is therefore drained into a 115,000-gal. storage reservoir, from which it is pumped to the various watering taps throughout the greenhouse.

Refrigeration is required in two cold-storage rooms, in the bloom-chilling room, and for making artificial ice. Immediately after cutting the flowers it is necessary to put the blooms in the bloom-chilling room, where the air is cold and dry. This precaution is necessary in order to prevent the flowers from turning blue or blighting. An air draft is maintained by a ventilating fan directly connected to a 1.5-hp Northern Electrical Manufacturing Company's motor. The fan is inclosed in an air shaft, in the outlet of



FIG. 4—ELECTRIC FERTILIZER UNLOADER

which are calcium-brine cooling coils. Belted to the motor which drives the fan is a brine-circulating pump, which keeps the cooling coils at the proper temperature. The circulating fan is capable of supplying 1000 cu. ft. of air per minute, which is maintained at 38 deg. Fahr.

The cold-storage room is used for storing roots of perishable plants or bulbs. This company imports lily-of-the-valley "pips," which have to be kept in a cool place. At present there are 1000 cases, each containing 2000 of these pips, stored in the cold-storage rooms. The air in the rooms is kept at a temperature of about 25 or 28 deg. Fahr. by direct-expansion coils.

### Fertilizer Unloader and Liquid Pumps

For storing the fertilizer, which is shipped to the grounds in freight cars, several thousand square feet of concrete platform are used. On account of the extreme heat generated by the decomposition of the fertilizer during the summer months, it has been found impossible to hire a sufficient number of laborers to unload the fertilizer from the cars on hot days. For this reason a motor-driven mechanical unloader has been devised which dispenses with the human element in the process of unloading. Six 30-ft. tubular steel poles were erected at various points in the fertilizer stack and stranded galvanized-iron wire cables are stretched from these poles over a spur of the railroad track to a single pole erected near the track but on the opposite side from the other poles. A "grapple fork" (the action of which is similar to that of a grab-bucket) is supported from wheels which can be run along the cables from the car containing the fertilizer to the stacks. The grapple fork is operated by a 10-hp, 220-volt Robbins & Myers electric motor housed in a small wooden structure erected at the foot of the pole from which the six cables radiate.

The pressure of the fertilizer on the lower layers of the stack causes the richest part of the fertilizer to be pressed

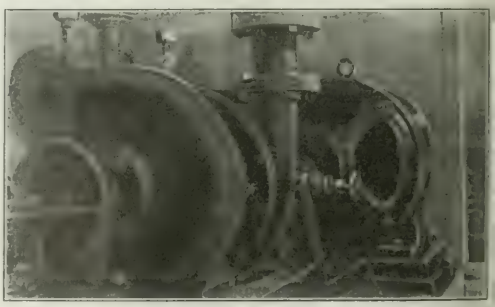


FIG. 5—MOTOR-DRIVEN LIQUID FERTILIZER PUMP

out in the form of a liquid. This liquid is drained into a storage tank from which it is pumped back onto the stack to impregnate the remainder of the fertilizer. The pump is of the centrifugal type and is operated by a 5-hp General Electric motor. A float switch installed in the drain tank makes the operation of the motor entirely automatic.

### Electric Soil Mixers

Different mixtures of soil and fertilizer are required for the different species of flowers. To facilitate the mixing of the soil, an electrically operated soil-mixing machine was designed and constructed under the supervision of the company's engineer, Mr. E. G. Goodwin, who is also to be credited with the other applications of motor drive which have been made. The latest design of this apparatus consists of two traveling belts and a rotary mixer, which are connected by gears or chains and sprockets to a 5-hp, 220-volt motor. One of the belts is fed with fertilizer and earth by men standing on each side of the machine. This belt conveys its charge to the rotary mixer, which in turn deposits the mixed material on the second belt. The latter belt travels at a slightly faster speed than the first one as the mixed soil occupies more space than the original constituents. The frame supporting the second belt can be adjusted in its position so that the mixed soil can be deposited on any desired stack.

Three of these machines have been constructed by the company and have given perfect satisfaction, whereas similar machines driven by gasoline engines were not satisfactory for the reason mentioned in a foregoing paragraph. The machines are portable and can be transported to any part of the field in which a mixture of soil is desired. The motor is inclosed in a small wooden case supported on a steel frame consisting of 8-in. channel irons. This frame also supports the intermediate reduction gears, which reduce the speed from 1100 to 90 r. p. m., and in addition the rotary mixer and the two ends of the traveling belts. In the case with the motor are the starting switch, with the necessary fuses, and the reduction gears. A terminal box is secured to the outer wall of the motor housing, from which a cable can be run to one of the terminal boxes on the walls of the greenhouse already described.

Another mixing machine is to be constructed soon and will be equipped with an alternating-current motor which can be operated from the Public Service mains at Plant B. When the latter is completed the company will own two alternating-current and two direct-current machines each of which can do the work of about ten men.

### Central-Service Supply to Plant B

The electrical equipment at Plant B is supplied with energy from the Public Service Company's mains through three 50-kw General Electric transformers installed on the premises. The voltage is stepped down from 2200 volts to 220-110 volts and is distributed on lines supported on insulators in a manner similar to that used at Plant A. The applications of electric drive are similar to those at Plant A, with the exception that Allis-Chalmers alternating-current motors are used instead of direct-current motors.

The refrigerating plant at Plant B consists of a 10-ton Boland ice machine driven by a 10-hp wound-rotor-type induction motor. The motor is equipped with the usual starting device and speed-control apparatus. Being located in a vestibule through which there is considerable traffic, the motor is fenced off from the remainder of the hallway by a guard screen. The refrigeration at this plant is all accomplished by direct expansion instead of by brine circulation.

All of the fertilizer used in Plant B has to be conveyed



FIG. 6—ELECTRIC SOIL-MIXING MACHINE (FIRST TYPE)

wagons from Plant A, as the railroad spur has not been ended into this vicinity. Practically all of the fertilizing ich is done in this plant is accomplished by forming a ter solution of the fertilizer and circulating it through es in the same way as water to taps located at different nts in the greenhouse.

Vagons containing the solid fertilizer are pulled up inied tracks made of angle irons and are unloaded into tanks 25 ft. wide, 50 ft. long and 7 ft. deep. The contents of the tanks, or "boilers" as they are called, are submerged in water and live steam is allowed to circulate through the mass. The heat of the steam kills any germs or insects which might be harmful to plants and the bubbling of the steam agitates the mass so that the water soon becomes a saturated solution of fertilizer.

There are three of these tanks, and a separate track runs



FIG. 7—ELECTRIC SOIL-MIXING MACHINE (IMPROVED TYPE)

up over each one. One 5-hp squirrel-cage motor is used for pulling the wagons up any pair of these tracks. The motor is belted to a shaft, which runs across the upper end of the tracks and in turn may be connected to the car-pulling cable drums by friction clutches. In case the friction clutches fail to release when a wagon is pulled to the top of the tracks, a foot lever is operated which opens the line switch on the motor.

When a concentrated solution of the liquid fertilizer is obtained it is drained into a 1000-gal. reservoir below the surface of the earth at the northern end of the greenhouse. Over this reservoir is a small wooden structure housing a motor-driven centrifugal pump. The pump is used to convey the liquid fertilizer from the tank to the different taps throughout the Plant B greenhouse. The motor has a rating of 30 hp, and the pump is capable of supplying 300 gal. per minute. Because of the regularity of the flow and the absence of hammering which sometimes accompanies the use of reciprocating pumps, it has been found feasible to run the liquid fertilizer mains on overhead supports through the greenhouse, and no vibration has been noted.

Mr. Goodwin, the company's engineer, declares that there are various other possibilities of applying electric drive around a greenhouse and says that more improvements are contemplated in the future at the Poehlmann plants. In addition to the apparatus already mentioned, there is a 5-hp motor in the machine shop which drives all of the machines through belting. The lighting load consists of about 600 lamps, some of which are 16-cp carbon lamps and the rest are 50-watt tunsten units.

## Smoke Damage in Cities

According to a recent smoke-loss investigation conducted by the University of Pittsburgh, the economic cost of the smoke nuisance in Pittsburgh is about $10,000,000 a year, or about $18 per capita per annum. Mr. John O'Connor, Jr., author of the report, asks the people of Pittsburgh to believe that black smoke is not the economic asset that they have long held it to be. Mr. O'Connor mentions the investigation by Mr. Paul P. Bird, formerly smoke inspector in Chicago, to show that the smoke damage in that city is over $7 per capita per year, and the researches of Mr. E. P. Roberts, consulting engineer, Cleveland, to show that the corresponding figure in that city is over $10.

# Radiant Energy and the Eye

**Where energy is absorbed and how the factor varies with luminous efficiency for various parts of the eye. By M. Luckiesh**

NOT all the radiant energy which enters the eye is active in the process of producing the sensation of light. No doubt it is fair to assume that at least this "inactive" energy is absorbed by the eye media and transformed into heat. This should cause an increase in temperature in the eye, which has led some to hold that this is the cause of irritation and fatigue. Dr. Steinmetz

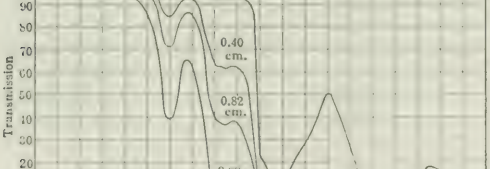



FIG. 1—TRANSMISSION OF VARIOUS LAYERS OF WATER CORRESPONDING TO THE EYE MEDIA

says: "The harmful effect of working very much under artificial illumination is largely due to this energy effect." Others share this belief, but the writer is unaware of any data on the subject which serve to support this conclusion.

There is a general feeling that artificial light is more fatiguing than daylight, which contains far less energy per lumen-second than the light from ordinary artificial illuminants. Of course, if it be true that artificial light under the same conditions of diffusion, intensity, surroundings, retinal adaptation, etc., is really more irritating and fatiguing than daylight, it is wise to look to the spectral character of the radiation as a probable cause. However, there are no actual data which prove that artificial light is more discomforting than daylight when all conditions excepting the spectral character of the radiation are the same. Pr C. E. Ferree[1] has found natural light from windows to less fatiguing than illumination from a glaring installati of tungsten lamps, but the conditions were far different the two cases. However, he has later stated that a diffe ence was found between carbon and tungsten lamp install tions of the same character, the light from the carb lamps being more fatiguing.

Any one familiar with the spectral distribution of ener in the radiation from ordinary light sources is certain th less energy per lumen is incident upon the eye as the te perature of the radiator is increased, provided that the lig is due to purely temperature radiation. The computatio in this paper will be confined to purely temperature radi tion or radiation from bodies which deviate but little fro it. Just what relative amounts of energy are absorbed the various eye media and how the amount of absorb energy varies with the temperature of the source have n

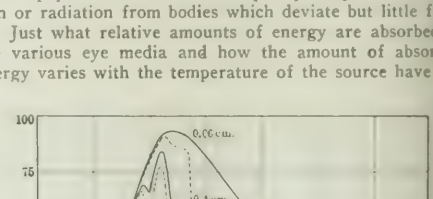



FIG. 3—TRANSMISSION OF RADIANT ENERGY FROM A 1.2 WATT-PER-CANDLE TUNGSTEN LAMP THROUGH VARIO LAYERS OF WATER

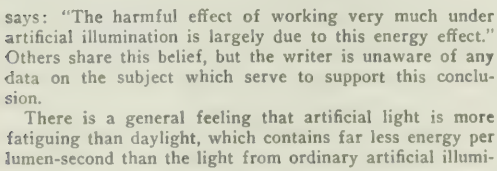



FIG. 2—TRANSMISSION OF RADIANT ENERGY FROM A 4-WATT-PER-CANDLE CARBON LAMP THROUGH VARIOUS LAYERS OF WATER

been determined, although Vogt[2] has described elabora experiments which show roughly the transmission of t eye media in various regions of the spectrum. His resu roughly confirm the more refined experiments of Asc kinass.[3]

Fortunately, Aschkinass has clearly established t transmission of the eye media throughout a wide spect range and has obtained other data which enable certa computations to be made. He found that the various e media transmitted the visible and infra-red rays in the sa manner as like thicknesses of water. The only discrep cies found were for the transmission of the cornea for t visible and "near" infra-red rays. The differences found that case he attributed to the film which rapidly forms o the dead cornea, rendering it less transparent, for absorption bands were well defined and in the same posit as for water.

The intensity of radiation after traversing any depth $l$ can be computed from the following equation:

$$I' = Ie^{-\mu l}$$

where $I$ and $I'$ are the original and final intensities

[1] *Trans.* Ill. Eng. Soc., January, 1913.
[2] [illegible] 1912, page 155.
[3] *Ann. der Physik*, Bd. 55, 1895, page 401.

spectively, $e$ is the base of Naperian logarithms, and $\epsilon$ is the extinction coefficient. This can be further simplified for purposes of calculation thus:

$$\frac{I'}{I} = T = e^{-\epsilon d}$$

where $T$ is the transmission coefficient. If $I$ is taken as unity, of course the value of $I'$ is numerically equal to the transmission coefficient. Aschkinass gives a table of extinction coefficients for water for radiant energy of wave-lengths from 0.45 μ to 8.49 μ. It is thus possible to compute the transmission of the various eye media for this range of wave-lengths. Aschkinass did this for the total eye but not for the various media. For the purpose of computation thicknesses of water corresponding to the various eye media were taken. These are reproduced in Table I on this page.

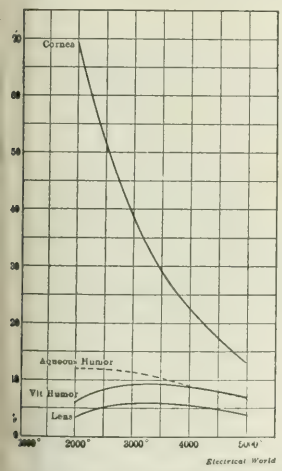
Transmission curves were really obtained for four thicknesses of water, namely, 0.06 cm, 0.4 cm, 0.82 cm and 2.28 cm. The first thickness corresponded to the cornea, the next to the cornea plus the aqueous humor, and so on. Obviously the amount of energy absorbed in the aqueous humor is readily found by obtaining the absorption of the first two thicknesses and taking their difference. This was

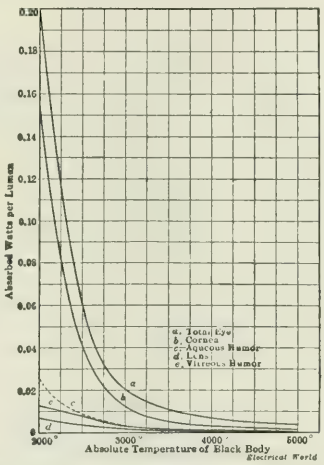
TABLE I—THICKNESSES OF WATER CORRESPONDING TO VARIOUS EYE MEDIA

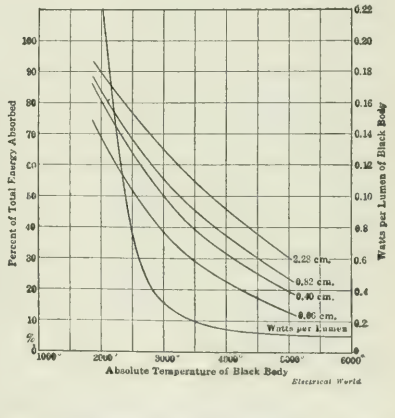
| | Cm. of Water |
|---|---|
| Cornea | 0.06 |
| Aqueous humor | 0.34 |
| Crystalline lens | 0.42 |
| Vitreous humor | 1.46 |
| Total depth of eye | 2.28 |

aqueous humor and so on. These percentages are found in Table II and plotted in Figs. 6 and 4 for black bodies at temperatures ranging from approximately 2000 to 5000 deg. C. absolute. At temperatures above 5000 deg. the ultra-violet energy becomes appreciable, so no computations are given for higher temperatures. The curves would rise again for temperatures beyond 5000 deg. The energy of shorter wave-length than 0.35 μ radiated from a black body at 5000 deg. absolute was found to be 3.8 per cent of the total energy.

Though the eye media are found to transmit the visible and infra-red rays in the same manner as water, this is not true for ultra-violet radiation. Water is transparent to short-wave radiation far into the extreme ultra-violet. In




FIGS. 4, 5 AND 6—PERCENTAGE OF TOTAL RADIANT ENERGY ABSORBED IN VARIOUS EYE MEDIA, WATTS ABSORBED IN EYE MEDIA PER LUMEN IN USUAL PERCENTAGE OF LIGHT, AND PERCENTAGE OF TOTAL RADIATED ENERGY ABSORBED IN VARIOUS LAYERS OF WATER

general procedure. The transmission curves of the four thicknesses of water are shown in Fig. 1.

The next point of interest was to apply these transmission curves to the curves representing the spectral energy distribution of black bodies at various temperatures and also to those of various illuminants. This was done by multiplying the ordinates of the energy curves by the corresponding transmission coefficients. Figs. 2 and 3 show the results of the process with the energy curve of a 4-watt-per-candle carbon incandescent lamp and that of a 1.25-watt-per-candle tungsten lamp respectively. The numbers on the curves represent the thickness of water. For instance, the percentage of total energy radiated from the carbon lamp which is transmitted by the cornea is found by obtaining the ratio of the area under this curve (0.06 cm) to the total area under the radiation curve. The difference between this and unity gives the absorption of the cornea. The same process with the curve 0.4 cm gives the percentage of energy transmitted by the cornea and aqueous humor. Obviously the difference between the two transmission ratios gives the percentage of total energy absorbed in the fact, no noticeable absorption was found for any of the ultra-violet radiation from the mercury arc in a quartz tube. It has been concluded by some that ultra-violet light is chiefly absorbed in the eye lens owing to the fact that it strongly fluoresces under the influence of these rays. This conclusion has been strongly confirmed by spectro-photographic evidence. However, for black-body temperatures below 5000 deg. absolute the ultra-violet rays need not be considered from the standpoint of the temperature effects due to absorption of this energy. In Fig. 4 are plotted the percentages of total black-body energy absorbed by the various eye media. It will be noted that for the cornea these percentages rapidly decrease with increase of temperature of the source, but much less rapidly for the aqueous humor, while the percentages of absorbed energy are a maximum for the lens and vitreous humor at about 3500 deg. absolute. This would hardly be foreseen without computation. It is seen that most of the energy is absorbed in the outer portion of the eye. In reality this absorption rapidly decreases as the depth of the absorbing layer increases. This, of course, is to be expected from the ex-

potential character of the foregoing equation relating thicknesses of the eye media with the transmission coefficient.

So far only percentages of energy absorbed have been considered. However, it is important to reduce the data to a common basis, that is, to find the actual watts absorbed per lumen. This was readily done by combining the foregoing percentages with the lumens per watt of the various sources. In Fig. 6 are plotted the values of watts per lumen for the black bodies at various temperatures. Multiplying these values by the corresponding values from the curves in Fig. 4, the actual watts absorbed per lumen are found in each case. These values are plotted in Fig. 5. Curve *a* represents the absorption for the total eye (2.28 cm of water), curve *b* that of the cornea. Curves *c*, *d* and *e* represent respectively the absorption of the aqueous humor, lens and vitreous humor. These data are also found in Table III. These curves indicate the actual power absorbed in the eye media per lumen of light flux in the entering beam. The computations considered only a beam of light of such dimensions that it enters the pupil; however, the exterior portions of the eye must absorb much energy in rays which could not possibly enter the pupillary aperture. The cornea and aqueous humor, besides absorbing most of the energy in the useful beam, no doubt thus absorb a great deal more energy.

TABLE II.—PERCENTAGE OF ENERGY ABSORPTION

| Source | Percentage of Total Energy Absorbed in | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Water of Depth | | | | Cornea | Aq. Humor | Lens | Vit. Humor |
| | 0.06 Cm. | 0.4 Cm. | 0.82 Cm. | 2.28 Cm. | | | | |
| Black body at 2000 deg. absolute | [illegible] | 80.6 | 83.8 | 89.7 | 68.8 | 11.8 | 3.2 | 5.9 |
| Black body at 2500 deg. absolute | [illegible] | [illegible] | 68.3 | 76.7 | 51.7 | 11.6 | 5.0 | 8.4 |
| Black body at 3000 deg. absolute | [illegible] | [illegible] | 55.7 | 65.1 | 38.5 | 11.3 | 5.9 | 9.4 |
| Black body at 4000 deg. absolute | 22.8 | 31.7 | 37.2 | 45.9 | 22.8 | 8.9 | 5.5 | 8.7 |
| Black body at 5000 deg. absolute | 13.0 | 19.6 | 23.4 | 30.4 | 13.0 | 6.7 | 3.8 | 7.0 |
| 4 w.p.c. treated carbon lamp | 64.1 | 77.3 | 81.0 | 87.9 | 64.1 | 13.2 | 3.7 | 6.9 |
| 1.25 w.p.c. tungsten lamp | 50.4 | 64.5 | 70.5 | 80.0 | 50.4 | 14.1 | 6.0 | 9.5 |

it were not for the moisture in the atmosphere which absorbs much of the infra-red rays before they reach the eye. This is perhaps fortunate considering the enormously greater intensities of illumination encountered in daylight. For instance, according to F. E. Fowle,[4] the amount of precipitable water existing in the form of water vapor between the top of Mount Wilson and the outer limits of our atmosphere during fair weather from June to November 1910 and 1911, was found to vary from 0.2 cm to 2.8 cm. The average quantity present was 0.69 cm.

Another point worthy of consideration is the energy density at various points in the eye along the pencil of rays. Obviously owing to the optical system through which the pencil passes the energy density varies in different parts of the eye. Where the energy is more concentrated the more serious effects might be expected.

This paper does not support or condemn the theory that the power absorbed causes fatigue and irritation. Its object has been to show where the energy is absorbed and

TABLE III.—ABSORPTION IN WATTS PER LUMEN

| Source | Watts per Lumen Absorbed in | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Water of Depth | | | | Cornea | Aq. Humor | Lens | Vit. Humor |
| | 0.06 Cm. | 0.4 Cm. | 0.82 Cm. | 2.28 Cm. | | | | |
| Black body at 2000 deg. absolute | 0.153 | 0.179 | 0.186 | 0.20 | 0.153 | 0.026 | 0.007 | 0.013 |
| Black body at 2500 deg. absolute | 0.04 | 0.049 | 0.053 | 0.061 | 0.04 | 0.009 | 0.004 | 0.008 |
| Black body at 3000 deg. absolute | 0.012 | 0.0156 | 0.0174 | 0.0202 | 0.012 | 0.0036 | 0.0018 | 0.0028 |
| Black body at 4000 deg. absolute | 0.0035 | 0.0049 | 0.0057 | 0.0071 | 0.0035 | 0.0014 | 0.0008 | 0.0014 |
| Black body at 5000 deg. absolute | 0.0015 | 0.0023 | 0.0027 | 0.0035 | 0.0015 | 0.0008 | 0.0004 | 0.0008 |
| 4 w.p.c. treated carbon lamp | 0.247 | 0.297 | 0.312 | 0.338 | 0.247 | 0.05 | 0.0015 | 0.026 |
| 1.25 w.p.c. tungsten lamp | 0.064 | 0.082 | 0.089 | 0.101 | 0.064 | 0.018 | 0.007 | 0.012 |

It is thus seen that the outer layer of the cornea absorbs a large portion of the energy which is not active in producing the sensation of light, and, as is to be expected, the absorbed energy per lumen of light flux incident upon the retina rapidly decreases with increase of temperature of the source. There would be an increase again for temperatures higher than about 6000 deg. due to the increasing amount of short-wave radiation. This, however, is not of interest here, because a large amount of the short-wave radiation would not be tolerated on account of its destructive effect. It will be noted that about thirty times as much energy is absorbed in the total eye per lumen of tungsten light as per lumen of light from a black body at 5000 deg. This same ratio would hold approximately for sunlight

how the factor varies with luminous efficiency for various parts of the eye.

The writer acknowledges the assistance of Mr. Leonard Krill, who made many of the computations used in this article.

# Central Station Management

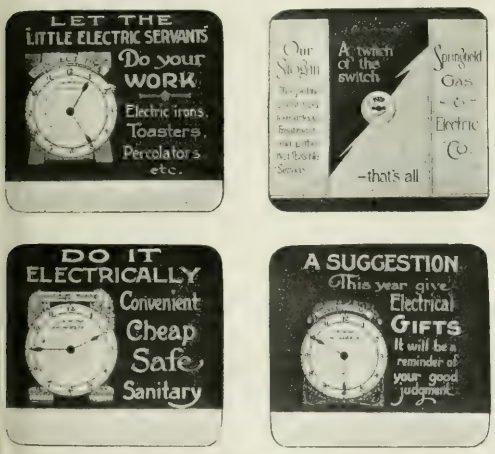
**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## County Newspapers and Twenty-Four-Hour Service

County newspapers throughout the central district of Kentucky are discarding former methods of operation in favor of electric drive since the Kentucky Utilities Company has arranged for twenty-four-hour service to both lighting and motor-service customers in those communities. The *Henry News*, at Eminence, and the *Anderson News*, at Lawrenceburg, have recently put in motor-driven equipment, and other papers in that part of the State are following the example thus set them.

## Advertising Slides for Moving-Picture Shows

Ever alert for novel advertising ideas, the Federal Light & Traction Company, New York, recently sent out to all of its subsidiary companies several sets of lantern slides with an imitation clock attachment for giving the correct time. These slides are being used in local motion-picture theaters, and the central-station managers report excellent




LANTERN SLIDES FOR MOTION-PICTURE SHOWS

publicity results from the novelty. A photograph of one of the slides is reproduced herewith.

The slides show the dial of a clock with two small movable hands affixed thereto. In his booth the picture-machine operator ascertains the correct time, sets the hands of the clock accordingly, and the slide is then flashed on the screen for the benefit of the audience.

Such moving-picture shows are well supported by women, most of them without watches, and the clock slides are of value in giving the correct time. Patrons carrying watches often strain their eyes in the darkness trying to read from their own timepieces, so that the slides are greatly appreciated by this class of the public. The advertising value of the slides to central stations can therefore readily be seen.

The Levi Perfection Slide Company, 1560 Broadway, New York, controls the patent to the clock slide, although, according to Mr. H. W. Alexander, publicity manager of the Federal company, the cost of the slides, notwithstanding that they are protected by patent, is very low.

## Peak-Period Supply to Municipal Plant

Arrangements are being discussed between the municipal lighting board of Westfield, Mass., and the Amherst Power Company for the purchase of hydroelectric energy by the town plant between the hours of 5 p. m. and 8 a. m. The growth of electrical service at Westfield has forced the board to consider plans for either purchasing additional service or securing an appropriation of $25,000 for a new turbo unit boiler and chimney installation at the local station. The power company offers to deliver electricity to the town at 1.3 cents per kw-hr., the cost of manufacture at the municipal plant being now 2.2 cents.

According to the plan which is now undergoing consideration, the town will appropriate $8,000 for the construction of a receiving transmission line between the local plant and the town boundary, where a 750-kw transformer and metering station will be located. The Amherst company will deliver energy to the town at 13,200 volts. By running the town plant on a nine-hour daily shift during the period of its greatest economy of operation and purchasing energy for the remaining fifteen hours each day, it is estimated that the municipality will save at least $2,000 per year in the operating and other expenses connected with the municipal installation.

## Cost of Repairs and Maintenance of Electric Trucks

Following an inquiry conducted from the office of this journal among central-station companies that operate electric vehicles in their own service, the accompanying figures have been chosen from the returns received in reply to

COST OF REPAIRS AND MAINTENANCE OF ELECTRIC TRUCKS

| | Average Miles per Day | Cost, in Cents per Mile | | |
|---|---|---|---|---|
| | | Batteries | Tires | Car |
| 700-lb. wagon | 7 | 2.9 | 1.1 | 1.9 |
| 750 lb. delivery wagon, lead cells | 20 | 8.6 | 1 | 0.5 |
| 1000-lb truck | 16 | 5.6 | 2.1 | 0.5 |
| 2000-lb truck, lead cells | 21 | 3.9 | 1.7 | 1.9 |
| 2000-lb truck, lead cells | 18 | 14.6 | 3.9 | 2.9 |
| 3000-lb. truck, nickel-iron cells | 18 | 1.5 | 0.9 | 3.9 |
| 7000-lb. truck, lead cells | 22 | 3.2 | 6.7 | 8.2 |
| Five cars and trucks, 3000-lb. to 700-lb., lead and nickel-iron cells | 85 | 2.8 | 2.5 | 1.0 |
| Thirteen cars and trucks, 750-lb. to 4000-lb., lead, and nickel-iron cells | 35 | 2 | 2 | 2 |

questions concerning unit costs per mile for the maintenance and repairs of batteries, tires and cars. The results as tabulated show little consistency, for the cars referred to were performing a variety of service and were working under various conditions of paved streets, steep grades, etc.

In the instances where the battery-repair charge was high it was usually noted that renewals or extensive replacements of plates and parts had been made.

To secure significant maintenance results it is, of course, desirable that all parts of the equipment should have previously gone through an entire cycle of renewal, including the replacing of tires, renewal of cells, repainting, etc. Such a complete cycle requires in any event from two to three years of service, and it affords the only basis on which to place a conservative estimate of electric-vehicle operating costs. Until the improved modern electric truck is a little older in commercial use it will be difficult to obtain such figures in numbers which make possible useful comparisons.

## Refrigeration and Central-Station Service

At the last session of the fourth section of the International Congress of Refrigeration held in Chicago on Sept. 23 Mr. Charles J. Carlsen, of the contract department of the Commonwealth Edison Company, read a paper entitled "Refrigeration in Central-Station Service." He said that in Chicago alone there are at present nine large ice-making plants, with an aggregate rating equivalent to 1900 tons of refrigeration and a connected load of 3628 hp, supplied with energy by the central-station company. In addition, refrigerating machines of various sizes, having a rating of about 2625 tons and a connected load of about 5500 hp, are operated by central-station electrical energy. The total of this central-station load in Chicago is 4525 tons of refrigeration and 9128 hp.

Mr. Carlsen pointed out that the most difficult refrigerating business for the central station to obtain today is undoubtedly that where exhaust steam may be used as a by-product. But only a short time ago a large packing concern in Chicago "signed up" for central-station service covering not only its refrigerating equipment but electric service for its entire factory as well. Here the saving in investment and operating expenses more than offset the exhaust-steam value. Excessive value is sometimes given to exhaust steam; engineers are learning more about such things from day to day. Even the absorption plant is not immune from central-station influence. A recent investigation of a 100-ton (duplicated) absorption plant, with all auxiliaries electrically operated from an isolated plant, showed an annual saving of nearly $500 when the entire plant was operated from the central station. This saving was exclusive of overhead charges.

Some of the advantages of central-station electric service cannot be set down in dollars and cents. This refers, among other things, to continuity of operation and readiness-to-serve twenty-four hours of every day throughout the year. Simplification of bookkeeping and general supervision are items seldom taken into account but recognized by customers after they have been on central-station service for a time. Another advantage is that the customer has the advice and assistance of technical and engineering men in working out his problems. Again, the installation of equipment can usually be made in a manner suitable to available space requirements. Furthermore, with electric operation it is possible to meter the various loads so as to determine absolutely the cost of operation in each branch of the industry.

The author concluded by giving tabulated data on several refrigeration and ice plants in various parts of the country using central-station service.

Mr. A. B. Grubmeyer, of the Consolidated Gas, Electric Light & Power Company, Baltimore, opened the discussion. In considering the possible use of central-station energy he said that owners of refrigeration and ice plants should give careful consideration to three points. These are the present tendency toward increase in the cost of labor, the tendency toward increase in cost of fuel, and the general agitation in relation to smoke nuisance and the allied annoyances of coal haulage and ash cartage. The tendency in the case of electric service is toward lower rates. The ice manufacturer need have little fear that central-station rates will be increased. In Baltimore the company will take contracts for five, ten or twenty years with a guarantee that the rates will not be increased during that time, also pledging the customer that he shall get the benefit of any reduction in rates that may be made. Where central-station energy is used the amount of labor required in the machine end of ice plants is relatively small. Furthermore, it is possible to locate plants in many residential districts where steam plants would not be tolerated. Mr. Grubmeyer said that there seems to be a tendency toward the use of the raw-water can system of producing artificial ice. Most large cities have a practically pure water supply, and satisfactory ice should result from the freezing of this water.

Mr. Carlsen commented on the fact that the Commonwealth Edison company in its studies leading up to the present contract offered to ice manufacturers had discovered that the 80-ton plant is the most economical. This size of plant forms the basis of the figures offered in the existing form of contract. It is an interesting coincidence that Mr. Peter Neff, consulting refrigeration engineer of Canton, Ohio, in his paper read at the congress on "The Cost of Manufacture in Distilled-Water Ice Plants," also found that the 80-ton plant is the most economical to operate, all things considered.

Mr. R. H. Tait, of St. Louis, a consulting refrigeration engineer, said that if the central-station companies would guarantee the cost of energy for a term of years that fact would certainly have considerable weight with owners of plants. However, it is to be remembered that the owners have to consider the cost of their existing steam plants. As to raw-water versus distilled-water ice, Mr. Tait remarked that the question as to which type of plant is to be used is determined by commercial considerations entirely. In some places it is cheaper to distil water than to put in a raw-water plant. In other cases good ice can be obtained and the question of purity of the ice obtained from one system as compared with the other does not enter into the problem to any great extent.

Mr. Carlsen remarked that there are more distilled-water ice plants electrically operated in Chicago than raw-water plants.

Mr. Tait made the point that the low rates offered by the central-station companies in large cities are not available in the smaller towns.

Mr. Peter Neff, of Canton, Ohio, said that each refrigeration or ice plant must be studied on its own merits as to power requirements, as well as in relation to other conditions. The purchase of electrical energy will receive consideration from many engineers wherever possible.

## Selling Display Window Lighting "on Trial"

The method of the "free-trial offer," which has proved so successful in other forms of merchandising, has been extended by the Denver Gas & Electric Light Company to the promotion of electric show-window lighting.

After getting permission from the proprietor or manager of a given business establishment to allow a trial window-lighting installation to be put in his store, the company dispatches one of its wiremen to the job with instructions to follow the wishes of the owner in the arrangement of the lamps. Installations are in this way made in stores even where no service is yet available, the window lighting being temporarily supplied through stage cables connected to the service mains outside.

The display lighting is then operated on trial for a week, during which period a man is stationed outside the store to

count both the number of passers-by and the number of those who stop to look in the window. These data, when compared with similar data taken before the window illumination was installed, invariably furnish conclusive evidence of the value of electric show-window lighting in increasing the sales of merchants who install it.

## Electric Cooking with a Unity-Load-Factor Range

At the recent Cedar Point convention of the Ohio Electric Light Association an interesting talk and demonstration of electric cooking by the stored-heat principle was given by Mr. M. E. Turner, contract agent for the Cleveland Electric Illuminating Company. The cooking outfit on exhibition during the convention consisted of one 300-watt range, two 300-watt stoves and one 200-watt compartment cooker. Ten of these sets were built by hand at the General Electric Company's factory and have been distributed among as many central stations in the United States for demonstration purposes. The outfit shown was installed and used in Mr. Turner's home in Cleveland for three months, during which time all of the family cooking was done by means of electricity.

The continuously connected stove is about the size of an ordinary gas range, and contains an oven but no griddle heaters. The oven interior is lined with an iron casting about 1 in. thick which stores the heat received during twenty-four hours of the day from a heating cartridge inserted from the back of the range and sealed to prevent heat radiation. Between the casting and the outer casing of the stove there is placed about 2 in. or 3 in. of heat-insulating material. At the top of the oven is a broiling device which consists of an 1100-watt grid-heating unit. The switch controlling the broiler is located under the oven door in such a position that the latter cannot be closed without shutting off the broiler element, the heat of which might prove destructive in the tightly closed oven. With continuous supply of energy to the regular oven heater, a temperature of 600 deg. Fahr. is maintained in the oven.

Each of the two 300-watt stoves are vertical cylindrical bodies containing about 190 lb. of cast iron apiece, which are used to store the heat continuously supplied by a heating unit placed near the bottom of the stove. The casting terminates at the top of the stove in a sort of griddle on which the various cooking utensils can be set. When the stove is not in use a hinged insulated cover prevents radiation of heat from the iron casting.

The compartment cooker is in outward appearance similar to the stoves, but when the insulating cover is raised, the cavity in which to set the compartment cooking utensils is seen.

## Central-Station Steam-Heating Costs Under Average Conditions

Data on operation of combination steam-heating and electric-lighting plants showing steam-heating auxiliaries to be highly profitable and desirable were presented at a recent convention of the Atlantic Gas & Electric Company by Mr. W. H. Yeomans, of the Eastern Pennsylvania Power Company, Easton, Pa. His figures, given in the accompanying table, were taken from the daily report of an Eastern central station where the revenue derived from the sale of steam for heating paid the total operating cost of the station for the month and left a net balance of $1,160.23.

Aside from direct profit, as exemplified above, the combination station has the advantage that it can offer steam-heating service to the owner of an isolated plant when an effort is being made to solicit his electrical load. In many instances, said Mr. Yeomans, this point has been important in enabling solicitors to close contracts shutting down isolated plants.

At present there is no set rule governing charges for steam-heating service, but the price is controlled in many

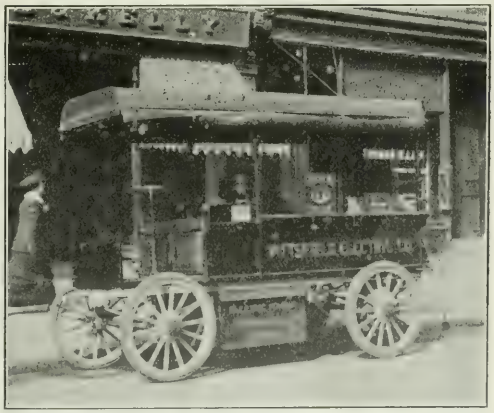
DATA FROM DAILY REPORT

| | |
|---|---|
| **General Data.** | |
| Average temperature in deg. Fahr. for November | 43 |
| Electrical output in kw-hr | 159,630 |
| Water evaporated in lb | 19,289,000 |
| Steam sold in lb | 10,772,000 |
| **Cost Data** | |
| 1161.76 tons of coal at $2.14 | $2,486.16 |
| Labor cost at plant | 1,032.62 |
| Superintendence and maintenance | 168.64 |
| Total cost of operation | $3,687.42 |
| Receipts from steam sold | 4,847.65 |
| Balance | $1,160.23 |

communities by the cost of coal. In some places rates per 1000 lb. of steam are based on a charge of 0.1 of the cost of 1 ton of coal, for it is estimated that the average isolated plant will evaporate about 5 lb. of water per pound of coal. But the rates from this charge would heat the customer's building for practically the cost of his fuel bill, and in addition he would receive all of the benefits derived from the central-station service. In view of this fact, the author thought that rates based on such a charge were too low.

## Advertising on the Battery Box

Not a few of the central stations and merchants using electrical vehicles have already appreciated the merits of the battery box as an advertising display space, although in many instances the inscription consists merely of the words "Electric Wagon." The Pittsfield (Mass.) Electric Company has lately taken up the electric-vehicle cause with



THE BATTERY BOX AS ADVERTISING SPACE

enthusiasm, and the accompanying photograph illustrates how by adding the words "Economical" and "Reliable" on the side of the battery box of one of the company delivery wagons the public is constantly reminded of these two most important attributes of the electric automobile. The cost of thus emphasizing the advantages of the electric machine is probably less than 25 cents a year. While there is nothing unique about this method of advertising it is so often neglected as to warrant mention at this time.

# Illumination and Wiring

## Battery-Room Wiring of Electric-Vehicle Factory

By T. W. Poppe

By building an extension equal in size to the former battery room, which was of quite recent construction, having been completed in 1911, the General Vehicle Company, Long Island City, has recently increased its floor area twofold. The electrical equipment was also doubled. Two



FIG. 1—SWITCHBOARD FOR CONTROLLING CHARGING OUTLETS IN THE BATTERY-FORMING ROOM

45-kw motor-generator sets were installed to supply direct current at 110 volts to the busbars of the switchboard in the battery-forming and charging room. The main switchboard, containing the controlling apparatus for the motor-generator sets, is illustrated in Fig. 3. This view also partly shows one of the motor-generator sets. At the right are to be seen six rheostats constructed as one unit, each rheostat being controlled by one of the single-pole circuit-



FIG. 2—BATTERY-FORMING ROOM

breakers on the bottom of the first panel. Directly over each circuit-breaker is provided a receptacle containing a lamp connected to its own individual circuit, so that when the energy is desired at an outside point the lamp is lighted automatically. This panel and the rheostats are used to recharge the batteries of all vehicles after they receive the several severe tests to which they are subjected before delivery to the customer. As will be seen in Fig. 3, ea circuit is numbered on the panel. The charging receptacl controlled by these rheostats are placed at convenient poin throughout the main floor and are numbered in a corr sponding manner, so that as soon as one of the lamps lighted the switchboard attendant knows that a battery waiting to be charged and knows at what point it is locate The second and third panels contain the switches and cor pensators controlling the induction motors of the moto generator sets. The bodies of the compensators a mounted on the rear of the panels and the operating handl on the front. The motor-generator set in the foregrou is shown in operation, the compensator handle being on t running position, as shown in the second panel. Pane Nos. 4 and 5 contain the generator control apparatu These panels are of standard construction, each supportir a double-pole switch for the negative and equalizing lea and a circuit-breaker in the positive lead, in addition to ammeter and a voltmeter receptacle. Panel No. 6 carri two watt-hour meters used for checking the consumption energy in the battery-forming room and the charging vehicles in the factory.

Panel No. 7 is the feeder panel controlling two sets

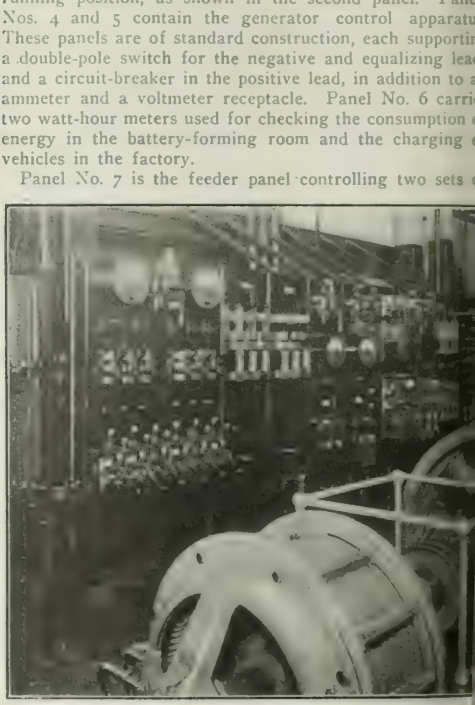
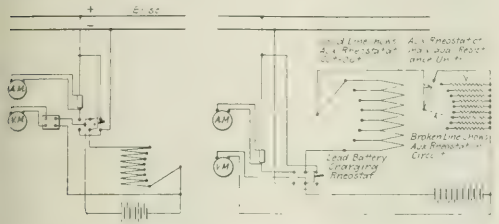


FIG. 3—MAIN SWITCHBOARD

500,000-circ. mil cables which transmit energy to the ba tery-room switchboard. Panels 8 and 9 are used exclusive for the charging of nickel-iron batteries.

Fig. 1 shows the rheostats, switches and instruments the switchboard for controlling the various charging ou lets in the battery-forming room. Some of these are shov in Fig. 2. There are eighty-four of these 150-amp r ceptacles, six of which are for nickel-iron batteries. T meters in the background are used for measuring t potential at the individual battery terminals and the curre into each battery as it is being charged. The individu charging circuits are wired as shown in Fig. 4. By thro ing the double-pole double-throw switch to the left the a meter is placed in circuit with the rheostat and batte The rheostat is then adjusted to the proper current val When the switch is thrown to the right the battery placed across the busbars in series with the rheostat. T arrangement permits the use of one ammeter with almost infinite number of circuits. The voltage of the b tery can be ascertained at any time by placing a plug in receptacle provided for each circuit and shown at the of each switch in Fig. 1.

The panel to the extreme left in Fig. 1 is used for charging nickel-iron batteries. Over this panel are mounted six rheostats constructed to form one unit. Each rheostat has a range of from 60 amp to 200 amp. At the upper end of the pole held by the attendant in Fig. 1 is a rheostat connected in series with one of the resistors used for charging lead batteries. This rheostat has individual resistance units at each contact and is used for charging batteries containing a smaller number of cells than the




FIGS. 4 AND 5—DIAGRAM OF INDIVIDUAL CHARGING CIRCUITS AND DIAGRAM OF CONNECTIONS FOR RHEOSTATS

standard battery. Fig. 5 is a diagram of the connections.

In wiring from this switchboard to the receptacles in the battery room exposed wiring is installed, since it was feared that the acid fumes from the batteries would have a detrimental effect on conduit. As shown in Fig. 8, the compartment containing the switchboard is 30 ft. long. The length of the switchboard, which is 27 ft., determined the horizontal distance in which wires could be taken through the wall. The minimum spacing for wires according to the rules of the Board of Fire Underwriters and the Department of Water Supply, Gas and Electricity is 2.5 in. Having eighty-four two-wire circuits on 168 individual wires to install at this spacing, a horizontal distance of 35 ft. was necessary. Thus, in order to confine these wires to a smaller space, it was decided to run 2-in. conduit through the brick wall in the rear of the switchboard and provide conduit fittings with porcelain covers containing holes to provide for six wires. Through these separate conduits six

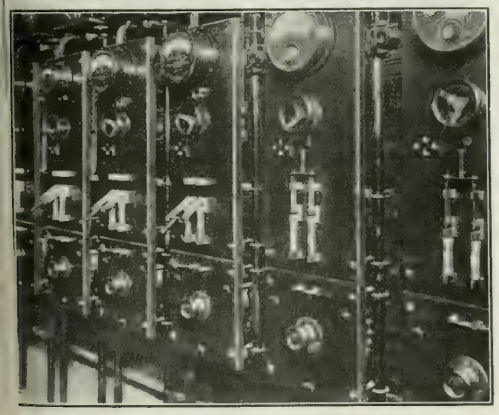


FIG. 6—SWITCH PANELS FOR DISCHARGING BATTERIES

ires were drawn. From the conduit fittings in the switch-oard compartment to the rheostats and individual witches the wires are separately wrapped throughout their tire length with marlin cord and are treated with several ats of fireproof paint or compound. The marlin rapping adds insulation and protection to the wires and is chosen because of its flexibility and neat appearance.

On the battery-room side of the wall wires of one polarity are carried from the conduit fittings upward over the top of a hanger constructed of wood. The wires of the opposite polarity are taken downward and fastened to the bottom of the support. As this wooden beam is 5 in. thick, it separates the wires of opposite polarity 7 in. when they are fastened in the insulators, the insulators being of a type



FIG. 7—KNOB AND CLEAT CONSTRUCTION

that holds the wires 1 in. from the surface of the support. All wires of the same polarity are separated by 3 in. to preserve a neat appearance. In Fig. 7 are shown the wires as they emerge from the wall through the conduit fittings and pass over and under the wooden hanger. The castings of the conduit fittings are set flush with the brickwork, leaving only the porcelain covers projecting into the battery room. This precaution was taken to protect the iron of the fittings from the action of the acid fumes.

The circuits are distributed in such a manner that no crossing of wires is necessary. Fig. 8 shows the locations of the various receptacles and the manner in which the circuits are installed to obtain the above result. Fig. 11 shows the manner in which the circuits are brought down the columns and the method employed to maintain clearance between the charging circuits and the discharge circuits. The receptacles shown in the various photographs were chosen because of their rugged construction and their current-carrying capacity and because the contacts where the wires are attached could be protected from acid fumes

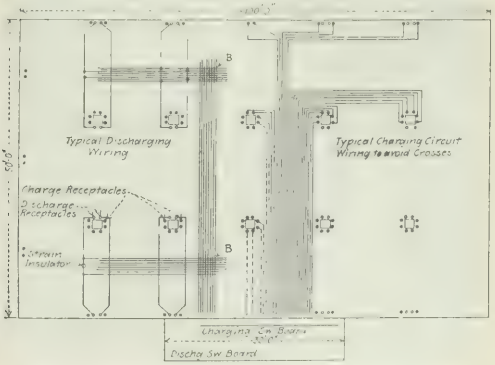



FIG. 8—COMPOSITE WIRING LAYOUT, BATTERY ROOM

by filling the cavity formation around the contacts with acid-resisting compound. The inspection departments having jurisdiction insisted that no contacts be exposed to the action of acid fumes.

In Fig. 6 are shown panels, containing the switches and rheostats necessary to discharge batteries at rates of more than 5 amp. The lower handwheel controls a rheostat

having twenty contacts with a total resistance of 18 ohms. This rheostat is used to discharge batteries at the rate of from 5 amp to 15 amp. The handwheel directly under the ammeter controls a rheostat of 6.4 ohms resistance, used to discharge batteries at the rate of from 15 amp to 60 amp. The construction of the rheostat is such that the next higher current value following 50 amp is 60 amp. As a

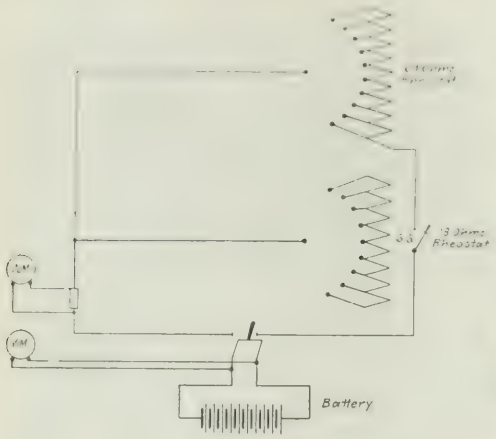



FIG. 9—DIAGRAM OF CONNECTIONS OF RHEOSTATS

53.5-amp value is sometimes desired for a discharge, the two rheostats are connected as shown in Fig. 9. By this means, when it is desired to use the higher resistance rheostat only, the single-pole switch shown in Fig. 6, directly over the lower handwheel, is opened. When the other rheostat is used this switch is closed, which places the two rheostats in multiple. Thus the desired discharge is acquired, together with a very fine adjustment of current values. From these eight panels cables are carried through the wall in a manner similar to that described above. The

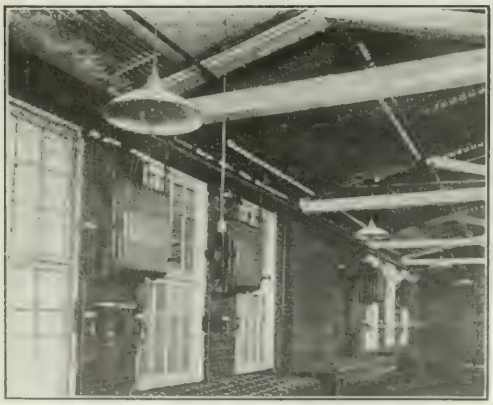


FIG. 10—250-WATT LAMPS USED TO ILLUMINATE BUILDING

circuits are carried directly across the battery-room ceiling, as shown in Figs. 2 and 7. Each of these eight circuits has four receptacle outlets.

In order to avoid any contact of the discharging circuits with the charging circuits, the discharge wires are strung lengthwise of the building under the upper beam of the roof truss and connected to the wires from the panels and the receptacles, which both run parallel with the end of the building and at right angles with the wires mentioned above. Where wires cross at right angles connections are made with short pieces of cable, as they are separated vertically by the thickness of the roof truss. These connections or jumpers are shown in Figs. 7 and 8. Because of the large number of charging circuit wires on the ceiling it was necessary to install the discharge circuits so that none of the wires would be actually attached to the ceiling. Fig. 11 shows a discharge circuit which continues down the column to two receptacles. The two central receptacles under the radiator in Fig. 11 are also discharge-circuit outlets. By tracing the discharge circuit on the right of the column in this illustration a strain insulator will be seen in the circuit. The connections made to wires going to the left give two distinct discharge circuits, and while they are electrically separated by the insulator, the cables are supported by the porcelain cleat insulators on the beams. This arrangement permits the discharge cables to be installed without providing a ceiling support where the connections are made. The value of this method can be appreciated by tracing the

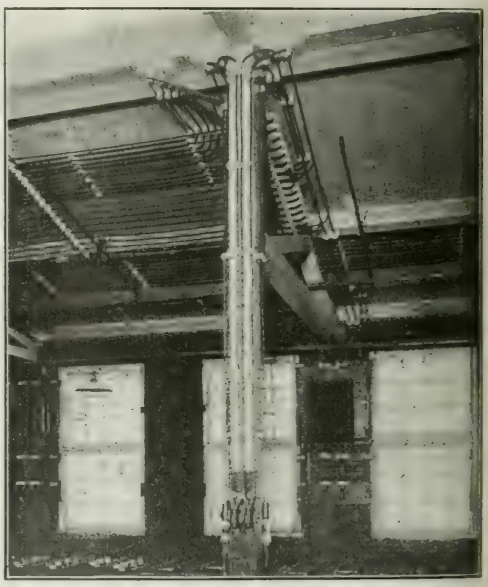


FIG. 11—CIRCUITS ON UPRIGHT COLUMNS

cables on the column in Fig. 11 and noting the large number of wires fastened to the ceiling at this point.

The arrangement of the wires going down the left and right sides of the column in Fig. 11 represents a typical method of installing charging wires at these points and shows clearly the space between the charging-circuit and discharging-circuit wires. At the middle of each bay angle-iron hangers are fastened to the roof beams and insulators attached to them to support the discharge circuits at these points. The absence of non-metallic flexible conduit and porcelain tubes is noticeable, but as there are no wires crossing one another at a spacing less than 3 in., additional insulation is unnecessary.

In wiring this building 24,000 ft. of No. 4 and No. 6 cable was used. As the building measures 50 ft. by 100 ft., it will be evident that 24,000 ft. of wire was installed in 5000 sq. ft. of space. Should this 5000 sq. ft. be laid out as a strip 1 ft. wide, four wires 2.5 in. apart, as required by the rules of the inspection departments, could be placed side by side over the full 5000 ft. and there would still be 4000

ft. of cable left over. The installation of this large amount of wire in a comparatively small space was made possible by arranging wires of one polarity at a higher point than the wires of the opposite polarity and placing the discharge-circuit wires under all. In fastening cleats and knobs square-headed lag screws were driven into the woodwork. No slotted screws were used. As 6600 lag screws were employed, it was necessary to devise a means of installing them in a quick and easy manner. This feat was accomplished by furnishing socket wrenches to fit the lag screws with square shanks to allow them to be used with carpenter's braces. A blow from a hammer on the head of the lag screw started it and the socket wrench in the brace allowed the workman to screw it home rapidly. During the installation of the wiring the charging and discharging of batteries was not interrupted. For lighting the building 250-watt lamps in steel-enameled reflectors, as shown in Fig. 10, are used. These lamps are wired three across the building in every bay, each bay being controlled by the porcelain pendent switches shown in Fig. 10.

# Letter to the Editors

## Rates for Electricity

*To the Editors of the Electrical World:*

Sirs:—The subject of rates for public utilities is in a state of chaos. One of the New York Public Service Commissioners says: "One fact stands out clearly in so far as rates for electricity are concerned, viz., they have no scientific basis." Rate systems vary from the easy, simple flat-rate systems of the gas companies, where all gas is charged at a fixed rate per 1000 cu. ft. regardless of all other considerations, to the elaborate sliding-scale and multiple-rate systems of the electric companies, requiring (speaking literally and without the least exaggeration) a chart and a slide rule for the computation of a bill.

Hardly two electric companies have the same schedule, and companies as closely associated as the Edison companies of New York and Brooklyn have different bases from which to figure their rates, with the result that a consumer in one borough pays twice as much for the same quantity of electricity as in the other borough of the city.

The difference between the highest and lowest rates are almost incredible and are met in the sale of no other public utility. In some localities the retail rate paid by occupants of small stores, workshops or residences is eight times the rate paid by the consumer of large quantities, and ratios of six to one are quite frequent. In some localities carbon and tungsten incandescent lamps are supplied free; in others only carbon lamps are furnished, and in still others no free renewals are made.

Some companies do wiring work, lend motors, and lend and care for arc lamps, taking their pay from the rate charged for electricity, while others perform one or more of these functions. In one town a fixed monthly charge is made for each meter connected, while in the next town no such charge is made. Some companies make a flat rate per lamp connected in signs and residences, and companies whose main business is the supply of energy for mills make a flat rate based on the number of horse-power of motors or on the greatest use at any one time.

No attempt has apparently been made to determine the cost of supplying different classes of service and, generally speaking, rate-making has resolved itself into each company getting all the business it can, without knowledge of whether it is really profitable or not, and charging for the service what the competitive conditions or legislative regulation will allow it to charge.

Such a condition leads inevitably to unfair discrimination between consumers costing substantially the same to supply, and it causes the companies, in their desire to increase gross receipts regardless of investment charges, to take on quantities of large business at or below the real cost of manufacturing and delivering the energy.

Some of the more enlightened managers of electric companies are realizing this condition, and many of the technical magazines recognized as representative of the central-station industry have published editorials pleading for fairer treatment of the small consumers.

Some rates (such as those of the New York Edison Company) are based solely on the quantity of electricity purchased by a consumer, while other companies (such as the Chicago and the Brooklyn Edison companies) base their charges to some large classes of consumers on the greatest demand by such consumer for any twenty-minute period, the rate in these cases being modified by discounts based on the quantity used.

The injustice of quantitative discounts is strikingly shown by the condition which has developed in New York city, where landlords and even outside companies purchase all the electricity used in a building in bulk, so to speak, and retail it to the tenants; and, more than this, owners of several buildings combine to purchase through one of their number and obtain additional discounts by so doing, running as high as 40 per cent, without any change in the cost to the company supplying them except the item of rendering one bill instead of three or four.

In a system of rates where larger discounts are given for quantity the result is necessarily to favor the rich at the expense of the poor, to add to the handicap of the manufacturer or storekeeper, in a small way, in attempting to compete with the larger manufacturer or storekeeper, and this is contrary to the spirit of the time, which, if it mean anything, means equal opportunity to the less favored in their struggle with the more fortunate.

It will be urged that this difference in rates is only the usual advantage a purchaser at wholesale has over a purchaser at retail, and this brings up the point at issue. On what basis shall rates for electricity be based? Here is the parting of the ways.

The electric company says: "Our rates should be such as will bring us the maximum of business, as in the end this will result in the lowest price to the consumer." The enlightened consumer says: "No; your rates must be based upon equal treatment to each of us. You must exact no more profit from any one class of consumers than from any other class. Our payments for electricity, while it is true they are made to a private corporation, are in the nature of a tax, and no group of citizens merely because it is powerful is to be favored."

The electric company rejoins: "If we are not allowed to make very low rates to consumers of large quantities of electricity, they will manufacture it for themselves, and it is only by increasing our gross sales that we can reduce our average cost and, in time, our average selling price."

This appears to be reasonable and sound, because it is a matter of general knowledge that doubling the gross output of a business seldom results in doubling the expense, and as a matter of fact it would be sound if the reduction necessary to obtain the large consumers' business was a small proportion of the selling price or, in fact, if the selling price was sufficient to cover the increase in operating expenses necessary to supply the large consumer with the interest and amortization charges on the necessary investment and a reasonable part of the overhead expenses and profit.

As all these items of expense will be found by a careful investigator to be nearly the same *per unit sold*, whether the consumer be large or small, it becomes equally apparent *that there could be possible no great difference in the selling price to large or small consumers unless the selling price to small consumers was excessively high.*

A great deal of testimony has been given before the

various public service commissions on these points, such as the case of Lowell against the New York Edison Company, before the Public Service Commission of the First District, New York, the testimony showed clearly that the only difference in cost due to wholesale or retail quantities was in the very minor items of metering, billing and collecting and lamp renewals, the whole difference between the groups of largest and smallest consumers being less than 1 cent for each kilowatt-hour sold, whereas the testimony showed that in order to obtain the large business a difference in rate of over 7 cents was made, or 700 per cent of the difference in cost.

Along these lines, the opinion of Louis D. Brandeis, the Boston lawyer, known particularly for his handling of the freight rate cases and the New Haven railroad matter, is particularly interesting. This opinion was given to a few manufacturers of apparatus used in private power plants who wished to obtain legal advice before forming an association to defend what they considered to be their rights and protect their business, which is vitally affected by the cut-rate competition of the central electric stations. The following extracts are from this opinion, the italics being the present writer's:

"In the past the common commercial view of selling cheaper in large lots prevailed to some extent in the public services; but the tendency toward equality of treatment of all customers has grown ever stronger. Indeed, even in progressive private businesses, particularly those operating under patents, copyrights or trademarks, the need of treating all customers alike, regardless of the quantity of their purchases, is becoming widely recognized. It seems clear that the tendency in our public service commissions and our courts must be toward an ever stricter enforcement of the rules against discrimination. I am therefore of opinion:

"First—Assuming that the cost of producing and delivering electric energy is the same per unit (kilowatt) regardless of quantity supplied, and in the absence of any statute regulating or limiting the price at which it may be sold, a public service corporation *cannot legally charge a lower rate for a larger (wholesale) than for a smaller (retail) quantity delivered at the same time and under similar conditions.*

"Second—Assuming that the cost of producing and delivering electric energy is the same per unit (kilowatt) regardless of quantity supplied, and in the absence of any statute regulating or limiting the price at which it may be sold, a public service corporation cannot charge A 10 cents per kw for 200 kw per month and B 2 cents per kw for 20,000 kw per month, delivered at the same time and otherwise under similar conditions, assuming that the entire cost of service to each is 4 cents per kw.

"Third—*Assuming that there is a difference* between the cost of making, delivering and selling electric energy between the wholesale and retail consumer, a public service corporation can, in the absence of any statute regulating or limiting the price at which it shall be sold, make a higher price to the retail customer, *but the difference in the selling price may not be substantially greater than the difference in cost.*

"Fourth—As to the right of a public service corporation to make a substantial difference in its charges based upon the broad purpose for which it is used, namely, a difference between light and power, there is more doubt. Some decisions in the state courts would seem to justify such discrimination, but the great weight of authority as well as of reason seems opposed to permitting *any discrimination based upon the use* to which the electric energy is put, and therefore upon the facts assumed in the question such discrimination between charges for electric energy used for power and charges for electric energy used for light should be held illegal.

"On the other hand, the difference between day use, when the demand upon the station is small, and evening use, when the demand upon the station is large, seems a proper basis of classification of service, and a court might for this reason upon the facts disclosed in a particular case hold that use for power, as calling mainly for day use, fell within a different class of service from use of light.

*It seems clear, however, that mere difference in the time of the service or its character to the user does not afford any justification for discrimination as to rates.*"

It will be seen that Mr. Brandeis takes a broad stand for equal rates regardless of quantity, and he further lays down the maxim that no greater difference in rates is justified between any classes of consumers than the reasonable difference in the cost of supplying them.

Here, then, is a logical and fair basis for rate making: *Determine the cost of supplying as nearly as can be any group or class of consumers, and fix the rate for this class at a reasonable profit above this cost.* While a single flat rate, similar to the rates for gas and water, would be ideally simple, it appears to be true that for the complete development of the use of electricity different rates for different services are essential, and if such differences are based upon the cost of supply there would seem to be no valid objection to their use.

The schedules should be easily understood by every purchaser of electricity, and for the multiplicity of rates and schedules should be substituted a very few. The greater necessity for difference in rates in the sale of electricity than in the sale of gas or water arises mainly from the inability to store sufficient electricity for any large, long-continued demand. The effect of this lack of storage capacity has been tremendously and wilfully exaggerated. The lack of storage capacity can affect materially, in a large system, only the fixed charges on the power plant and substations, and the fixed charge on the whole amount of such investment does not usually amount to 1 cent for each kilowatt-hour sold.

There would seem, however, to be a justifiable difference in rate between a consumer using electricity twenty-four hours a day seven days a week and one using it one hour a day, because the fixed charges in one case are apportioned among 8760 hours, whereas in the second case they are apportioned among 365 hours. A consumer who uses electricity mainly for lighting and whose greatest use coincides with the greatest demand on the electric company's whole system costs the company much more to supply than the consumer who uses electricity mainly for power and shuts down his shop before the heaviest load on the whole electric system comes on. This difference is the foundation of many different schedules, having for their basis the "maximum demand" of a consumer, which will be discussed later on.

The unfairness of the quantitative discount is most clearly evident in this latter example, because with the quantitative system the large consumer of light obtains a rate from two to three times *lower* than the small consumer for power, although the cost to the company of supplying the latter would be less than the cost of supplying the former.

A consumer who could arrange to use electricity from midnight until eight in the morning would cost the electric company very little more than the cost of fuel and similar materials needed for its supply, and would aid in improving the efficiency of operation by building up the load of that light-load period; hence a low rate given for such period would be justified, as it would aid in reducing the average cost per kilowatt-hour sold. Similarly, to consumers using electricity for driving compressors of refrigerating plants, for vehicle charging, for electroplating or for hoisting a lower rate might be given to encourage development, provided the hours in which the electricity was used did not coincide with the heaviest load on the system.

There does not, however, appear to be any justification [illegible] greater difference in rate to a group of fifty apart-

nents than to a single apartment except the difference in the cost of billing and collecting, nor between a group of businesses combined as a department store and a single store of similar character. That the tenants of a building or the owners of a number of buildings adjoining combine their purchases offers no reasonable basis for a difference of from 30 to 40 per cent in the price, nor should a large hotel receive a materially lower rate than a small one, because the cost to the company for each unit quantity supplied is substantially the same in each case.

The schedules of rates based on quantity have, therefore, it would appear, no valid foundation, and their result is discrimination between consumers clearly entitled to equal treatment.

As has been noted, another group of schedules has for its basis the maximum demand of an individual consumer. In this class of rates the use by a consumer is recorded continuously and the greatest quantity used by him at any moment—or more usually for any twenty-minute period—is made the basis of the rate. The usual method is to charge the maximum rate for an average use of one hour a day of this maximum demand, a rate half as great for a second hour's use, and all the balance is charged at a low rate and, unfortunately, even with this schedule additional discounts are given for quantity.

The theoretical basis of this group of rates is that the company's investment will be proportional to the consumer's maximum demand, and the high rate charged for first and second hours' use of such a demand is intended to pay fixed charges as well as operating costs and profits, leaving the other hours to carry operating costs and profits only. This method, while apparently fairly based, is almost as unreasonable as the schedules based on quantity solely. The maximum demand of an individual consumer has but little bearing on the company's investment unless this maximum demand coincides with the maximum demand on the system. The maximum demand on all large electric lighting systems occurs between 5 and 6 o'clock in the evening in December and January. The power plant capacity is fixed by the demand at this period; hence, any maxima of consumers which occur before 4 or after 6 o'clock in these months do not add to the power plant cost, and the same is true of maxima occurring during other periods. It is the sum of the demands between 4 and 6 o'clock in this period, whether they are the consumers' average or maximum demands, which determines the company's investment, and if any such basis were to be used the demand of the consumer during this period should be the basis. Even this would be unfair, because of what is known as the diversity factor, and as this is most important in any rate discussion its meaning should be made perfectly clear.

In a group of fifty or a hundred apartments, on one night three or four may have most of their lights lit on account of entertaining guests, half a dozen may be practically dark, and in the rest not one-fifth of the lights will be in use. The next night approximately the same proportion will exist, but the three or four apartments using most of their lights will be different ones. The same thing is true, but to a much smaller degree, in offices, hotels and factories. The busy season of one factory may be the slack season of the other.

It is evident that any schedule based on the maximum demand of each apartment user would be unfair because the maximum demand on the central station is the demand of the group as a whole, not the demand of the individual. This averaging of demand is at the root of the centralization industry, as it is because of this that capacity in central stations is installed only equal to a fraction of the greatest theoretically possible demand.

The diversity factor is the proportion that the greatest demand of a group bears to the sum of the individual greatest demands. In the group of apartments cited the sum of the greatest demands of the individual apartments, if there were a hundred of them, might be 4000 lights, but the actual maximum demand would not be over 800 lights. In a group of stores, if the sum of the individual maximum demands was 4000 lights, the maximum demand of the group would be perhaps 2800 lights. Several most careful investigations have been carried on to determine the diversity factor in each class of users and tables have been published giving the results of such investigations, so that the matter is one of practical knowledge and not speculation.

It becomes evident at once that any schedule of rates based on the individual maximum demand that did not take into account the diversity factor would be to the highest degree unjust and discriminatory, and even if the diversity factor were considered, unless the time of day and period of the year were also factors, the schedule would not be based on cost of service.

It would seem that the only fair basis for a rate would be one predicated on the time during which the energy was used, but this would involve two-rate meters with clock-work, and such a method would not be possible except for consumers of large quantities, where the cost of meters would be insignificant compared to sales. The other alternative would seem to be to have the Public Service Commission fix rates for various classes of consumers, based upon hours of use, diversity factor and cost of metering and billing.

A year's investigation by the installation of a few hundred maximum demand meters would enable any public service commission, through its engineers, to fix the probable periods of maximum demand for different types of consumers, and with these records as a basis differential flat rates could be established which would represent average cost plus average profit for each class.

From the writer's own investigations, he is convinced that the present rates will be found to be entirely wrong, as many of the consumers receiving the lowest rates cost more to supply than those paying the highest prices. This conclusion is based upon a great many load curves collected from buildings of all types during more than fifteen years, supplemented by direct personal knowledge of conditions, and this knowledge also leads to the conclusion that perhaps the greatest beneficiaries of the change in rates would be the companies themselves. At present these companies are supplying current to a number of consumers of large quantities at cost or less than cost, if fixed charges are included, as, of course, they should be.

They are obliged to supply a very large demand during the mid-winter, which lasts only an hour or so during comparatively few days, so a large investment is needed, which is used only a few hours during a year, and this investment is mainly needed to supply the consumers receiving the lowest rates. Under a logical rate system, a much lower rate would be given to consumers of small quantities, and the writer is satisfied—although it is directly contrary to the usual belief—that the small stores' and apartment dwellers' rate would be greatly reduced, as they are now bearing an undue share of the cost and profits of the companies. A lower rate to such consumers would greatly stimulate use, and any loss the companies might sustain through the large consumers starting to manufacture their own electricity would be far more than compensated by the increase in use by the small consumers, and as the loss through the large consumers would be sales at very *low* rates, and the gains would be sales at *high* rates, the probable benefit to the companies is obvious.

*New York, N. Y.* PERCIVAL ROBERT MOSES.

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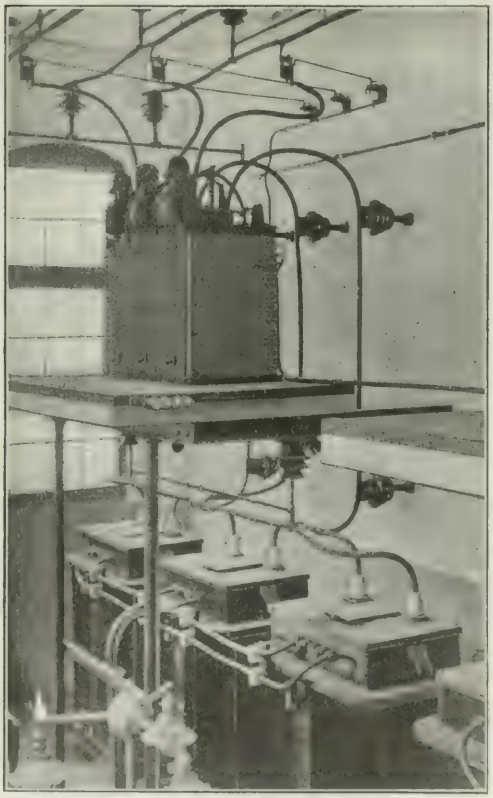
[The general subject of rate variation, as suggested by the opinion of Mr. Brandeis, is discussed in an editorial in this issue. The fundamental fact should be borne in mind that differences in rates, where the conditions of service differ, do not constitute discrimination.—EDS.]

# Field of the Operating Engineer

**A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers**

## Platform Support for Oil Switches

The accompanying illustration shows an effective method of installing solenoid-type oil switches in a New England substation originally designed for 22,000-volt service. On account of an increase in the transmission pressure to 33,000 volts, the rearrangement of wiring in the substation constituted something of a problem when the change was made. All of the available floor space was occupied by two banks of transformers and two rotary converters, with the controlling switchboard. The engineers in charge of the work therefore designed a reinforced-concrete platform above each bank of transformers for the corresponding oil-switch



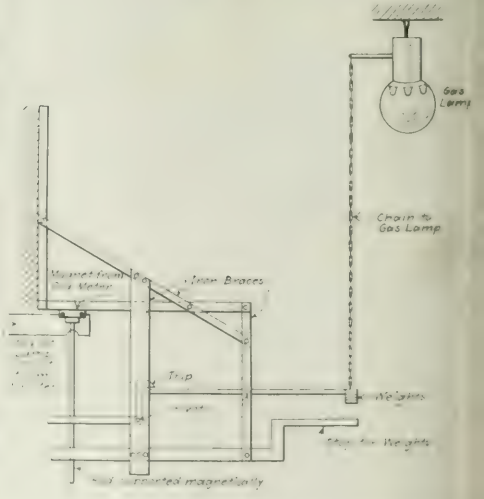
REINFORCED-CONCRETE PLATFORM FOR OIL SWITCHES

installation. These platforms are each 9 ft. long, 8 ft. 6 in. wide, and 7 in. thick from the top to the bottom of the slab, the reinforcing bars being of ⅝-in. stock placed laterally and longitudinally 9 in. apart on centers. Each platform is provided with a curb made of 2.5-in. by 2.5-in. by 0.1875-in. angle-irons, and at the outer edge the slab is carried on a 5-in., 9.75-lb. I-beam supported by 4-in. wrought-iron pipes. Cross I-beams are run from the front of each platform into the wall at the rear, which provides a bearing surface for the beams. The illustrated arrangement of switches enabled the wiring to be brought into the substation overhead with ample clearance for safe operation and straightforward travel from the roof bushings to the transformers. The overload-trip coils in the high-tension leads are located close to the ceiling above the switches, the relays being actuated by horizontal rods run to them, as shown. The circuit-closing contacts are mounted in a bank against the wall and connected with the solenoids of the switches by circuits run in conduit.

## Automatic Control of Emergency Lamp

In central stations where motor-driven exciters are used it is often considered good policy to have at hand some source of auxiliary illumination to be used in case of failure of the exciter set. In the plant of the Marion (Ind.) Light & Heating Company, which is operated in parallel with the Muncie (Ind.) station, an ingenious arrangement has been worked out providing this emergency lighting at low cost. The method used is outlined in the accompanying sketch.

An old meter magnet is mounted on an iron frame and connected to a lamp circuit which is energized from the exciter. When the voltage across this magnet is reduced




AUTOMATIC GAS-LAMP LIGHTER FOR BREAK-DOWN SERVICE

the suspended rod is dropped. The flange of the falling rod strikes the lever end of the trip and releases a weighted bar connected to the gas-lamp chain. The weights attached to this bar exert a pull which is just sufficient to trip the automatic lighter in the gas lamp. A stop for the weights has been provided so that the lamp will not be subjected to unnecessary jerks caused by the falling weights. By suc-

sive trials the weight of the falling rod has been adjusted until the magnet will operate when the exciter potential falls to 100 volts.

The station force claims that on account of the parallel operation of the station the device has proved to be invaluable. When the Muncie station drops a large portion of its load the exciter voltage at Marion is often lowered to a point which calls for attention. In cases of this kind the gas lamps never fail to give the alarm and trouble from this source is obviated.

Previous to the installation of this device the gas bill for one large lamp was about $10 per month, but now the monthly bill has been reduced to the minimum, as it is necessary to keep only the pilot flame alight.

## Reduced Cost of Iron-Pipe Cross-Arm Construction

For several years the Marion (Ind.) Light & Heating Company has been using cross-arms made from iron pipe bought at junk yards and other places were second-hand pipe in fairly good condition was available. A single arm intended for use on straight lines where no dead ends

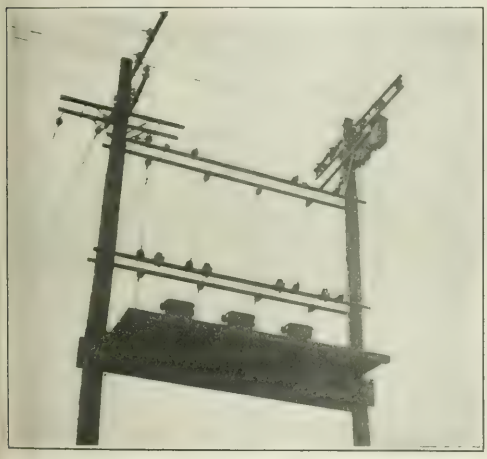


FIG. 1—IRON-PIPE CONSTRUCTION AT TRANSFORMER BANK, EATON, IND.

are to be placed is made of a 5-ft. piece of 2-in. pipe. Holes are bored in the pipe to accommodate a 0.625-in. through bolt at the center and 0.3125-in. carriage bolts for securing 26-in. braces at about 16 in. from the center of the arm. The pins on the single arms are made of cast iron and are held in place by common axle clips bought

COST OF A 5-FT. IRON-PIPE CROSS-ARM

| | |
|---|---|
| Second-hand 2-in. pipe | $0.225 |
| Blacksmith's charge for boring | 0.045 |
| Pins | 0.050 |
| Axle clips | 0.025 |
| Total | $0.345 |

from a local hardware store and formed to fit the 2-in. pipe. The accompanying table shows approximately the cost of a 5-ft. arm.

A type of pin not shown in the illustration has recently been worked up for use with pole-type transformer installations. The base of the pin casting fits over the end of the pipe and is held in position by means of a set screw. In this manner an extra horizontal pin which is very useful in supporting transformer taps is provided at the end of the arm.

Where wires are to be dead-ended use is made of a double-pipe arm, which carries the insulators on bolts between the two pipes as shown in the illustrations. Although these arms cost a trifle more than those made from a single pipe, no braces are needed with them, so that the total



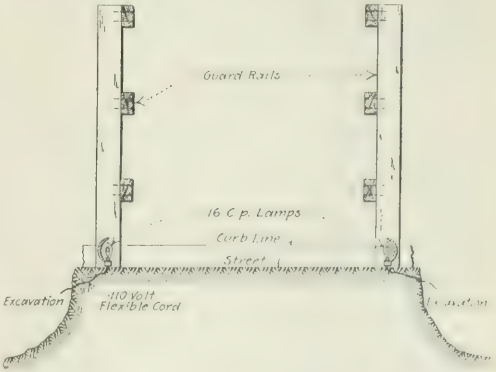
FIG. 2—STANDARD AND DEAD-END IRON-PIPE CROSS-ARMS

difference in price is very slight. Further saving is effected in framing poles to be fitted with iron-pipe cross-arms, for as a rule no gain is sawed in the pole, as is necessary with wooden arms. The through bolts draw the iron arms into the poles far enough so that sawed gains are not needed.

In general it is said that the pipe construction has proved so satisfactory that it is being employed wherever possible. As fast as the old wooden alley racks which formerly carried the Marion company's circuits in the downtown districts begin to show signs of weakness, they are being replaced with racks of iron-pipe construction. Heavier 3-in. pipe is used for this service. More durable and economical type of construction is produced by setting the ends of the 3-in. pipe in the brick walls of the adjoining buildings than by the use of hangers attached to the walls.

## Electric Lamps as Accident Preventers

At a busy corner in New York City the crossing used by pedestrians was for a time partially blocked by a public-utility corporation while making underground repairs, thus narrowing the available path to about 3 ft. With a continual stream of hurrying shoppers crowding through this narrow passage there was danger of heedless persons

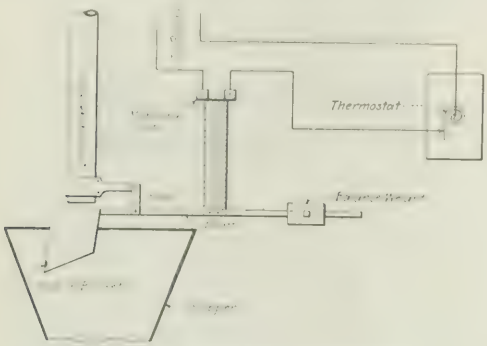



ELECTRIC LAMPS USED TO PREVENT ACCIDENTS

tripping on the curb, which stood about 6 in. above the level of the street. But the foreman of the construction crew foresaw the danger and materially reduced the risk by placing a 16-cp lamp at each side of the walk where it would shed its rays on the curb and yet would be out of the way of traffic. The accompanying sketch shows how the lamp was mounted.

## Water Relay for Use on Transformer Piping

[illegible] of the water-cooled transformers on the system of the Washington Water Power Company, Spokane, Wash., is equipped with a protective device which in case of interruption to the transformer water supply automatically trips out the high-tension oil switch and rings an alarm bell to call the station attendant. The device itself, which is




SCHEME OF WATER-RELAY CONNECTION

known as a "water relay," consists, as shown in the sketch, of a small water bucket and a movable iron weight fastened to opposite ends of a short beam. As long as the water is pouring from the discharge pipe into the small bucket and running over into the hopper beneath, the added weight of the water keeps the contacts at the mercury cups closed. But should the water supply fail the water in the bucket drains out through the hole in the bucket bottom, and the iron weight falls and breaks the contact. By experimenting with the size of the hole in the bucket a fairly accurate time element can be introduced if it is desired.

The thermostat shown in series with the alarm circuit is provided so that if the transformer becomes unduly heated from any cause the alarm will also be given and the oil switch tripped in time to save the transformer. The thermostat is made of a spiral of two dissimilar metals and is hung in the oil above the transformer windings. This device has been found valuable where the flow of water was only partially interrupted, allowing enough water to fall into the bucket to balance the beam.

## New Condensing-Water Tunnels at Racine, Wis.

A new concrete intake and discharge tunnel which will replace an older one of smaller rating is just being completed at the Racine (Wis.) generating station of the Milwaukee Light, Heat & Traction Company. The new tunnel will be 3.5 ft. in diameter and will discharge water by gravity into a well from which it will be pumped through the condensers. Only 5500 kw in generating units is installed in the station at present, but an ultimate rating of 15,000 kw is contemplated, the condenser intake and discharge tunnels being laid out with this in view. The old tunnels which are being replaced by the newer construction were only 20 in. in diameter.

Additions have also been made in the boiler-room equipment, three 500-hp Edge Moor water-tube boilers with Jones stokers having been installed. A Terry-Platt turbine-driven centrifugal boiler-feed pump capable of delivering 200 gal. per minute has also been installed. Three turbine-driven fans are being installed and other changes are being made which will greatly increase the rating and improve the operating conditions of the plant.

## Patching a Broken Switch Panel

[illegible] some repairs a piece of a marble end panel was accidentally [illegible] Can the piece be put back without marring the appearance of the board? B. A. M.

Make a cement of four parts of gypsum and one part of powdered gum arabic mixed to a mortar-like mass with a cold solution of borax. Fasten the broken piece with this mixture and let it stand for a few days before touching it. The borax solution can be colored to match the marble and the joint waxed and polished.

## Sulphur as a Cause of Clinkering

We are having trouble with clinkering and have been advised that this is due to sulphur in the coal we are using. Can one determine in advance, from analysis of its chemical impurities, whether a given fuel will clinker, and does the presence of sulphur invariably indicate tendency to clinker? K. S. M.

There is a general impression that sulphur is the cause of clinkers forming, but this view is now being amended owing to the fact that the trouble mentioned seems to depend more on the method of firing and the rate of combustion than upon the constituents of the ash. In fact, coals containing as much as 5 per cent of sulphur may be burned without any difficulty whatever due to clinkering. Sulphur, alumina, iron, silica, lime, etc., reduce the fusibility of ash, it is true, depending upon the quantities in which they are present, but the chief factor seems to be the frequency with which the fireman slices his fire and works up the ashes into the bed of hot coals. In the latter case the ash will melt and fuse together, forming dense, heavy masses of clinker. But this result may be quite independent of the presence of sulphur in the original coal, for sulphur, being both volatile and combustible at relatively low temperatures, would certainly be driven off and consumed long before the ash stage was reached. The way to avoiding clinkering, therefore, seems to be in proper instruction of the fireman, and we doubt whether one would be justified in relying on a mere chemical analysis.

## Percentage of Unaccounted-for Output

In [illegible] practice what is considered a reasonable percentage [illegible] output, in other words, the difference between the readings of the station watt-hour meters and the sum of the readings of customers' meters? W. E. L.

The unaccounted-for output of central-station systems varies widely and depends upon a number of factors, such as line resistance and conductor drop, efficiency and ratio of transformers connected, character of meters installed, condition of lines, insulation of circuits, trimming of trees in right-of-way, presence of grounds in customers' premises, etc. In one extreme case of which we have record the total of kilowatt-hours consumed by the transformer iron losses during the daylight hours was practically double the consumption of the community by night, but this was a new industrial city which was expected to grow rapidly and had therefore been "over-transformed" with the expectation that it would soon reach up to the liberal rating provided. On the other hand, several other cases have been reported where the sum of the customers' readings actually equaled or even exceeded the registration of the station instruments, but here investigation showed that it was the meters that were acting badly. In the average well-kept alternating-current system the distribution losses or unaccounted-for kilowatt-hours will usually run from 10 to 30 per cent, with 15 per cent as a common figure. This is equivalent to unmetered registration of 85 per cent of the plant output, which may be considered very fair practice. In direct-current distributing systems, however, the losses, owing to drop in conductors, are usually much greater. One large metropolitan company, for example, recently reported unmetered losses aggregating 40 per cent of its total output.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*The "Hand" of an Armature.*—Humphry MacCallum.—The author criticises the way in which the terms "right-handed" and "left-handed" are sometimes applied to armature windings. He recommends the following two definitions for the purpose of distinguishing between those armatures which under similar conditions give opposite directions of rotation: "Right-handed armatures are those in which the positive brushes are opposite the north poles of the field magnet when the direction of rotation is clockwise when viewed from the commutator end. Left-handed armatures are those in which the positive brushes are opposite the north poles of the field magnet when the direction of rotation is counter-clockwise when viewed from the commutator end." An important advantage of this method of classification is that it applies equally well to the series or the parallel armature. The essential difference between the two hands in either case is that in the "right-hand" coupling coil ends or the ends of a "round" cross one another, whereas in the "left-hand" coupling they do not cross, a distinction which gives rise to the following perfectly definite rules: (1) In all lap or parallel-wound drum armatures if the right ends of section cross one another, the winding is "right-handed," but if they do not cross it is "left-handed." (2) In all wave or series-wound drum armatures if the ends of a complete round, consisting of $p/2$ sections, cross one another, the winding is "right-handed" and if they do not cross it is "left-handed."—London *Elec. Review,* Sept. 19, 1913.

*High-Frequency Alternators.*—An illustrated review of recent developments in the use of sustained oscillations in wireless telegraphy and the design and uses of high-frequency alternators. —London *Elec. Review,* Sept. 12, 1913.

*High-Frequency Alternator.*—T. R. Lyle.—A highly mathematical paper read before Section A of the British association, in which the author shows that the theory of the Goldschmidt alternator is a simple case of the more general theory of the alternating-current generator which was published by the author in 1909.—London *Electrician,* Sept. 26, 1913.

*Air Filter.*—An illustrated description of air-filter plants of British make for the purification of the air used for cooling electric generators.—London *Elec. Review,* Sept. 6, 1913.

### Lamps and Lighting

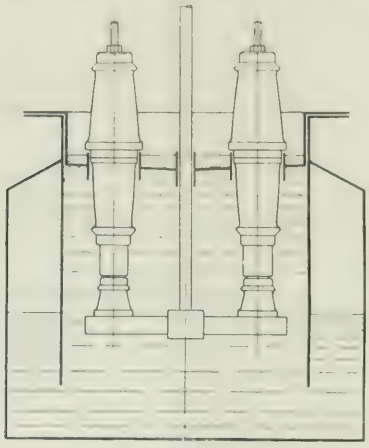
*A New Method of Starting Mercury-Vapor Apparatus.*—J. S. Anderson.—An abstract of a paper read before the British association. Mercury-vapor lamps and rectifiers are started by tilting the lamp or rectifier, either by hand or automatically. This is inconvenient, especially when dealing with lamps used for scientific purposes. For example, in carrying out experiments on the Zeeman effect a mercury-vapor arc lamp is extremely suitable. But difficulty arises from the fact that the lamp must be placed between the poles of an electromagnet, the distance between the poles being usually so small that any tilting apparatus interferes with the proper mounting of the lamp. This difficulty has been overcome by constructing a lamp which may be fixed in position between the poles of an electromagnet, or in any other suitable position, and then started without having to be tilted. This is brought about by the employment of a heating arrangement near one of the electrodes, preferably the negative electrode. The lamp tube is provided with a small vessel near this electrode, the vessel having a re-entrant portion or recess in which a heating element is placed, while the part of the tube immediately above this small vessel and its recess is constricted. The heating element consists of a small coil of platinum wire wound round a suitable support. It may be placed in the recess of the small vessel or removed at will, without interfering with the vacuum of the lamp. This heating coil of wire is connected in series or in shunt, in the latter case being provided with an automatic cut-out. An external resistance is placed in series with the lamp. Before starting, the small vessel is full of mercury, which forms a continuous connection inside the tube between the positive and negative electrodes. When the current is switched on the heating coil becomes incandescent, and the heat given off raises the temperature of the vessel and its contained mercury. Very little heat is required, because the first bubble of mercury vapor formed rises to the constricted portion of the lamp and is there caught, thus breaking the continuity of the mercury inside the lamp and starting the arc. The platinum wire of the heating element can be made of such a thickness, and the external resistance can be so adjusted, that the wire does not emit heat when the lamp is working but becomes incandescent when the lamp is started, the action being quite automatic.—London *Electrician,* Sept. 19, 1913.

### Generation, Transmission and Distribution

*Maximum Loads on Transmission Lines.*—H. B. Dwight.—An article on the problem of the minimum transmission-line capacity which will serve to transmit a given block of power, or, in other words, what the limits are to the loading of a transmission line. Varying-voltage lines and constant-voltage lines are discussed and the following conclusions are reached: For transmission lines the line voltage is limited by the phenomenon of corona. The limit of the load on a line operated without synchronous condensers is variation in voltage. The load limit for a line operated at constant voltage by means of synchronous condensers is much larger than the above limit, and the limiting condition is usually low efficiency. For heavy lines, with large reactance, or where the cost of power for line losses is low, theoretical limit for constant-voltage lines may be approached, which will involve increased cost of synchronous condensers. The charging current is of small commercial importance, even though it may be large in amount, and must be carefully allowed for. In general, it is a help; its main disadvantage is that it increases the voltage rise when load is suddenly disconnected from systems not closely regulated.—*Elec. Journal,* September, 1913.

*Power Transmission and Oil Switches.*—An account of the very long discussion which followed the recent paper by Klingenberg before the German Association of Electrical Engineers on power transmission over extended districts. Leitgebel, Roessler, Klingenberg, Stern, Schwennicke, Goldenberg, Schueler, Kuebler, Georges, Peterson, Meyer, Wunder, Wikander, Weltzel and Seitz participated in the discussion. Roessler emphasized the fact that in

... high transmission systems it is not always best to use one high transmission voltage and one low distribution voltage, for in certain cases economies will result if three voltages are used, including a medium pressure between the high potential for transmission and the low voltage for distribution. In spite of double transformation losses the total cost may be less, but each case must be figured out for itself. Stern spoke of explosions of oil switches. When the arc is formed oil is evaporated and this vapor mixed with air forms an explosive mixture. There can be no such explosion if the mixture of the oil gas with air is prevented. The oil switch cannot be made air-tight since the gas developed by the arc produces a pressure which the construction would not stand. The new oil switch of the Allgemeine Elektricitats Gesellschaft serves to prevent



OIL-SWITCH CONSTRUCTION

mixture of the oil gas with air but retains the air cushion. The oil box has three chambers, the switch being in the central chamber, which is completely filled with oil. The air is above the oil in the two side chambers. There is evidently no possibility of the oil gas mixing with the air. Very small switches of this design have been successfully used to rupture short-circuits of turbines up to 18,000 kva. —*Elek. Zeit.*, Aug. 28, 1913.

### Traction

*British Municipal Tramways Association.*—An account of the recent Sheffield conference of the (British) Municipal Tramways Association. The presidential address by A. R. Fearnley dealt with general conditions of municipal street railways and referred at some length to competition from motor omnibuses. The speaker declared it advisable for railway systems to make experiments with buses. Papers were presented by S. Flint on the advantages and disadvantages of platform fare collection, by W. C. Fenton on the maintenance of paving on street-railway track according to British law, and by J. B. Hamilton on city passenger transportation.—London *Electrician*, Oct. 3, 1913.

*Motor Omnibus.*—An editorial on the field of the motor omnibus with reference to the discussion at the (British) Municipal Tramways Association. In London and its suburbs street-railway companies are suffering heavily from motor-omnibus competition, and provincial companies are beginning to become apprehensive. The present position of railway enterprises in Great Britain is said to be unsatisfactory. Although large street-railway systems can pay satisfactorily, small ones do not often reach this happy position. The extension of lines into districts where the density of the traffic is low is liable to prove unremunerative. Nevertheless, passenger traffic should be provided as far as possible in outlying districts where the traffic is small if such districts are to be developed, and it then becomes a question what method should be adopted. One method is to use the trackless trolley car. This has the advantage that energy for the purpose can be obtained simply by the extension of the overhead system. The other method is to use motor omnibuses as feeders to the railway system. For this reason the motor omnibus should have careful consideration by street-railway managers, quite apart from its claims as a rival. At the Tramway Association conference J. B. Hamilton presented a paper which was antagonistic to the motor omnibus. He claimed that it can be worked only at a loss. On the other hand, E. R. Fearnley in his presidential address admitted that both the motor omnibus and the trackless trolley have certain advantages. There are possibilities of a reduction in the price of gasoline and in the future reduction of the consumption of gasoline per mile. Mr. Fearnley would "even consider the possibility of running motor omnibuses in preference to relaying the track. The Sheffield tramways committee has found it desirable to try the effect of running motor omnibuses in conjunction with its cars and has had ten omnibuses for this purpose on four routes. The vehicles have proved reliable; the traffic they have handled has been very heavy, and there seems to be no doubt that next summer a much larger number of such vehicles will be required to meet the demand."—London *Electrician*, Oct. 3, 1913.

*Mountain Railway Locomotives.* E. Steffhuner and F. Popp.—An English translation of their recent German paper on the design of the locomotives for the Mittenwald Railway. The overhead trolley pressure is 15,000 volts and the frequency is 15 cycles. A single-repulsion motor is used on each locomotive, and has an hourly rating with natural cooling of 800 hp, developing a tractive effort of 7500 kg at the circumference of the wheels at a speed of 30 km (24 miles) per hour.—London *Electrician*, Sept. 26, 1913.

### Installations, Systems and Appliances

*Arcless Interruption of Circuits.*—F. Kraus. The author starts with the Ayrton formula for the electric arc and derives from it the conditions under which no arc is possible. He finds that either one of the following two conditions must be fulfilled: The first is that an arc will be impossible if the voltage is below a certain minimum. The second is that for a given voltage there is a certain minimum resistance for which an arc is impossible. If the circuit is broken with a current less than that corresponding to this critical resistance there will be no arc. The first condition is well known. The second does not seem to have been realized. The author discusses experimental investigations concerning the correctness of this second condition and describes practical applications of the principle.—*Elek. u. Masch.* (Vienna), Aug. 24 and 31, 1913.

### Wires, Wiring and Conduits

*Impregnation of Wooden Poles.*—R. Novotny. An article on the economy of the method of impregnating wooden poles with creosote. The author shows that it is possible to reduce the consumption of creosote oil to a smaller amount than is usually employed, although, of course, there is a limit to this reduction.—*Elek. u. Masch* (Vienna), Sept. 7, 1913.

*High-Tension Insulators.*—A. Martin-Saxton. An article on insulators for use above 5000 volts. The author discusses the principal phenomena observed in insulators, the principles determining their form and size, tests of insulators and mechanical requirements.—*Elek. u. Masch.* (Vienna), Aug. 24, 1913.

*Preserving Wooden Poles.*—R. E. Neale.—An illustrated description of the Powell saccharine process for seasoning and preserving timber.—London *Elec. Review,* Sept. 19, 1913.

*Protection Against Atmospheric Discharges.*—P. Lang.—An article on the protection of lines against atmospheric discharges, with special reference to the use of condensers. Formulas are derived which show that the condensers should be installed near the earth and that their capacity should have a certain volume which must not be too high. The author discusses energy losses and the effect of static charges, and compares the results with examples from practice.—*Elek. u. Masch.* (Vienna), Aug. 24, 1913.

### Electrophysics and Magnetism

*Theory of Contacts Between Bad Conductors.*—W. H. Eccles.—A paper read before Section A of the British Association on the theory of the rectifying action of light contacts (such as are used in detectors for wireless telegraphy). The author offers a broad rule which indicates the direction of the rectifying action. This rule is that when the difference of the specific heats of electricity in the two substances in contact is of the same sign as the difference of the Peltier effects, the negative current is greater than the positive current for numerically equal voltages, and when the difference of the specific heats is zero, or is of opposite sign to the difference of the Peltier effects, the greater current is produced by the positive voltage. In fact, according to this electrothermal theory, the Thomson effects, not the Peltier effects, determine the direction of rectification. The evidence in favor of this rule, together with exceptions from it, is discussed.—London *Electrician,* Oct. 3, 1913.

*Valve Action of Zirconium.*—L. H. Walter.—An article in which the author shows that while zirconium electrodes do not promise, even when available, to be of any great value in connection with valve cells, the fact that zirconium exhibits a pronounced valve effect is of interest, in that it is the first known case of a metal of the fourth periodic group behaving in this manner. In the same way the metal tungsten is the only example of an element of the sixth group showing this phenomenon.—London *Electrician,* Oct. 3, 1913.

### Units, Measurements and Instruments

*Magnetic Tests of Sheet Iron.*—K. Zickler.—If the maximum permeability and the specific electric resistance be known, the author shows how to determine by simple formulas the hysteresis and eddy-current losses and from these the total iron losses in sheet iron. The accuracy obtained is sufficient for technical purposes.—*Elek. u. Masch.* (Vienna), Aug. 31, 1913.

*Resonance in Cable Tests.*—André Leauté.—The author refers to his method of using resonance for producing elevated voltages in high-tension cable tests and shows that it can be applied without danger so long as certain precautions are taken to avoid disturbing the equilibrium of the phase of the network under operation.—London *Electrician,* Oct. 3, 1913.

*Traction Motor Tests.*—In this long illustrated serial on electric-shop testing, tests of direct-current railway motors are taken up.—*Elec. Journal,* September, 1913.

*Use of Iron in Electrical Measuring Instruments.*—M. Dolivo-Dobrowolsky.—An illustrated English translation of the German article abstracted some time ago in the *Elec. Review,* Aug. 8, 1913.

### Telegraphy, Telephony and Signals

*Induction Coils for Telephone Lines.*—L. Cahen.—A mathematical article with reference to the recent paper of Bia Gati on the use of induction coils in shunt for telephone circuits. The author concludes that this system will stand comparison with the Pupin system of induction coils in series only where the distortion of the current does not represent an obstacle to good hearing. This is improbable, but an experimental trial would be interesting.—*La Lumière Elec.,* Sept. 6, 1913.

*High-Speed Telegraph.*—A. Franke.—The first part of an illustrated description of the new high-speed telegraph manufactured by Siemens & Halske.—*Elek. Zeit.,* Sept. 25, 1913.

*Wireless Telegraphy.*—H. Thurn.—An article giving statistical data on coast and ship wireless stations in different countries. The systems employed are listed according to their status on June 15, 1913, special reference being given to Europe, and especially Germany and the German colonies.—*Elek. Zeit.,* Oct. 2, 1913.

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# Book Review

An Elementary Treatise on Calculus. By William S. Franklin, Barry MacNutt and Rollin L. Charles. South Bethlehem, Pa.: Published by the authors. 253 pages, illustrated. Price, $2.

Mathematics is a very large subject and may be regarded from many different standpoints. The pure mathematician very commonly regards mathematics as the logic of quantity. To his mind the logical aspect is dominant. The physicist very commonly regards mathematics as the science which explains the phenomena of the material universe. To his mind the explanatory aspect is dominant. The engineer very commonly regards mathematics as the source of rules for reaching swift and reliable arithmetical conclusions in practical engineering problems. To his mind the arithmetical aspect is dominant. The teaching of branches of mathematics, such as the differential or integral calculus, naturally varies with the type of mind that presents the subject and with the type of mind to which it is presented. There is a tendency for conflict between the teachings of pure mathematicians, physicists and engineers. What seems proper to the purist seems stilted to the physicist and obscure to the engineer. What seems proper to the physicist seems loose to the pure mathematician and indefinite to the engineer. What seems proper to the engineer seems trivially utilitarian to the purist and narrow to the physicist.

In the history of the teaching of advanced mathematics the pure mathematician dictated the policy and dominated the field until within a generation of our time. The time-honored ascendency has recently been bitterly contested. The rigid formalism of the fine old mathematical scholars was held up to scorn by the men who desired to make their mathematics into useful tools for the practical mind. No Calvinist indicted the medieval church more vindictively. On the other hand, the loose reasonings of the practitioner type were gall and wormwood to the carefully trained scholar. Between the extremists of these two groups no quarter was ever given or taken. At the present time more tolerance is displayed. All honest types of mathematics are good, in their own way, for the particular minds to which they are addressed. But it has become clear that engineers should learn their mathematics from applied mathematicians and not from pure mathematicians.

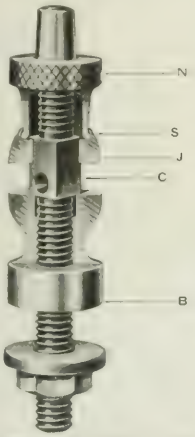
The book under consideration belongs essentially to the physicist-engineer's class. It bases its conceptions on simple physical phenomena and arrives at its conclusions in the most direct and least formal method consistent with practical accuracy. It should, therefore, win favor with students of that class. Perhaps the strongest chapters in the volume are those dealing with wave motion and with vector analysis. These seem to us remarkably good. Those subjects are seldom presented clearly and simply in books on the calculus.

# New Apparatus and Appliances

**An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers**

## Improved Type of Binding Post

A binding post which is said to be adaptable to all classes of wire tips and all kinds of wire, and which, it is declared, will form a better mechanical and electrical connection than the ordinary binding post, is shown in the accompanying illustration. The base of the jaw *B* is held stationary in or near the position shown by the lock-nut below it. The non-rotating jaw *J* fits the square copper stud, and as force is applied at the nut *N* the travel occasioned by the screw thread is transmitted through the swivel *S*, bringing the two jaws of the binding post together. The device is made of brass and is designed to carry a current of 30 amp without excessive heating. Special sizes are also made.



IMPROVED BINDING POST

This "standard connection," as it is called by its manufacturer, the Sloan Engineering Company, of Brooklyn, N. Y., is said to insure reliable connections and to reduce trouble resulting from poor contacts.

## Portable Incandescent-Lamp Holder

A portable incandescent-lamp holder called the "handilight," which can be supported in several different positions, is being manufactured by the Luminous Unit Company, of St. Louis, Mo. The design of the base makes the outfit adaptable to a variety of conditions. Supported as shown in the illustration, it can be used as an ordinary table or reading lamp. With the goose-neck hooked on the top of a mirror it becomes adapted for shaving. The lamp can also be used as a porch fixture by hanging the slotted portion of the support on a nail or screw. By laying the base horizontally on top of a piano the reflector can be adjusted to illuminate the score. Placed on an office desk the lamp forms a convenient form of portable fixture.


PORTABLE FIXTURE ADJUSTABLE TO SEVERAL POSITIONS

## The Largest Mine Locomotives Ever Built

The Carnegie Coal Company has recently installed at the Charleroi (Pa.) Coal Works two of the largest mine locomotives ever built. These locomotives weigh 30 tons apiece and are of the Baldwin-Westinghouse "barsteel" type. It is estimated that each locomotive can haul 100 cars, each loaded with 3 tons of coal, over the grades which will be encountered on the local right-of-way.

Each locomotive consists of two separate units which can be separated and used as 15-ton locomotives if desired. The use of two units in tandem is advantageous in such large machines because the weight is distributed over eight wheels instead of four, and hence the locomotive has


30-TON MINE LOCOMOTIVE

greater tractive power and does less damage to the trac than if the weight were more concentrated.

In the "barsteel" construction the frames are not bui up of plates but are formed of a grid of steel bars of heav cross-section. The side frame of each unit is cast sep rately, giving strong and rigid construction. The ope ings in the frame afford ready access for inspection, oilin replacing brakeshoes, adjusting brake rigging, etc., ar also provide ventilation for the electrical apparatus, so th its all-day efficiency is higher than would be the case the frame totally inclosed it. This type of frame h been in use for many years for large freight locomotiv but has been adapted for mine locomotives only within t last year.

Both air brakes and hand brakes are provided. A auxiliary air reservoir is placed on the trailing unit, t main reservoir and compressor being located on the lea ing unit. The hand brakes are operative on both un when disconnected for independent operation.

The controller for the tandem pair is of the individu magnetic blow-out type which handles all four motors

nce. When the tandem is split the four-motor controller perates the two motors of its unit without change in onnections, while the other unit has its own two-motor ontroller.

## Tabulating Machines for Smaller Central Stations

The Commonwealth Edison Company of Chicago, with nore than 100,000 customers on its books, has for several ears checked its monthly billing sheets by machinery. A ard is punched for each bill and the different cards are hen automatically sorted and tabulated for the amounts nd class of service. This is done primarily as a check gainst the correctness of the bill extensions. Beyond this, owever, it has the very decided value of forming the asis for all statistical analyses which the company makes ith regard to the sale of its service.

The same idea but in a somewhat different form is now eing carried out by the Portland (Ore.) Railway, Light & Power Company on the Pacific Coast and by the Cleveland Ohio) Electric Illuminating Company. Particularly interesting is the use made of the cards for shop accounts, both or labor and material in repair work. The arrangement is uch that the aggregate cost in labor and material during ny given time can be determined automatically and uickly. If, on the other hand, the cost of a particular ind of work is desired, it can be obtained in the same way y running the cards through the machines again after setting the automatic recording device to catch that particular item.

Soon after the management of one company found that t could obtain through the cards answers to all sorts of pecial inquiries, the accounting department was almost wamped with requests for information. This, of course, ad really been needed just as much before the card system as installed, but, realizing that it could not be obtained except at large expense and irritating delay, very few of the eads of departments had had the temerity to ask for it. Many matters had been allowed to go by default in preference to making a demand which was bound to be reflected



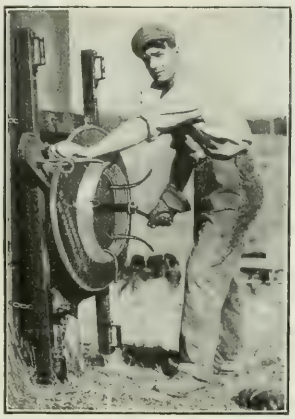
TABULATING MACHINE USED IN OFFICE, CLEVELAND ELECTRIC ILLUMINATING COMPANY

at the end of the next month in the cost sheets of the department.

The illustration shows a complete statistical unit in the office of the Cleveland Electric Illuminating Company. At the left are shown two key punches being operated by two young women, while the gang punch with a quick-set device rests on a table at the right of the picture. The sorter operated by the man standing and the tabulator in front of the man in the chair are the remaining machines in the set. The card files are shown at the left along the wall. All of the machines for the above-mentioned installations of tabulating machines and automatic sorting devices were furnished by the Tabulating Machine Company, New York City.

## Combined Take-Up and Pay-Out Reel

Mathias Klein & Sons, of Chicago, are marketing the Eichoff combined take-up and pay-out wire reel which is said to facilitate greatly the handling of electric-light,



COMBINED TAKE-UP AND PAY-OUT WIRE REEL CHAINED TO BASE OF POLE

telegraph and telephone wire, performing the work of both the separate pay-out and take-up reels, with economy in time and labor. The services of but one man are required to operate the Eichoff reel as compared with several men necessary where separate reels are used. The reel disk proper, instead of being made of wood, is of No. 10 galvanized sheet steel, 34 in. in diameter, with a 1-in. flange turned around the edge. An adjustable wire guide enables the operator to coil up wire without assistance. A brake around the hub can be set to hold the wire at any tension or a stop-pin fixes the reel disk stationary. The arms are adjustable, facilitating easy removal of the wire. The axles are made from 0.875-in. cold-rolled steel with cast-iron hub, and the weight of the reel is about 80 lb. As shown in the illustration, the frame, which is provided with handles, can be clamped to a tree or any convenient post which is strong enough to withstand the strain imposed by the pull of the wire.

## Indirect Lighting of Chicago Bank Interior

A modern tendency in bank illumination is the lighting of counting-house interiors by the indirect system, concealing the light sources in troughs along the top of the bank rails surrounding the tellers' cages, etc. One of the latest installations of this type is that of the Swedish-American Bank at Balmoral and Clark Streets, Chicago. As shown by the movement of the hands of the clock dial in Fig. 1, the photographic plate from which this reproduction was made was exposed only six minutes, no flashlight or other artificial aid having been used.

The entire absence of pendent fixtures preserves perspective in a remarkable manner, and the beautifully lighted

ceiling, from which the room is actually illuminated, gives the interior a high, spacious and dignified appearance. It would be difficult to secure the same effect by suspending visible light sources from the ceiling, for the eye finds it a task to see past a bright light and the ceiling is visually



FIG. 1—INDIRECT ILLUMINATION OF INTERIOR OF SWEDISH-AMERICAN BANK, CHICAGO, ILL.

lowered. The lamps in this installation are kept burning at evening solely for the attention attracted and the advertising value which the lighting affords.

The illumination is accomplished by using two 60-watt lamps with reflectors in each of the eight boxes or troughs along the bank rail over the teller's wickets. Besides this, there are four reflectors containing 150-watt lamps over the vestibule entrance, which is not shown in the photograph. Two skylights in the ceiling admit natural illumination during daylight hours, but behind the panes are mounted eight reflectors containing 100-watt lamps which may be lighted to add to the artificial illumination, producing a beautiful effect. The main banking room is 50 ft. long, 32 ft. wide and 26 ft. high, and the reflectors are contained in the rectangular casings on the bank rail and are 9 ft. above the floor.



FIG. 2—EXTERIOR VIEW OF SWEDISH-AMERICAN BANK, CHICAGO, AT NIGHT

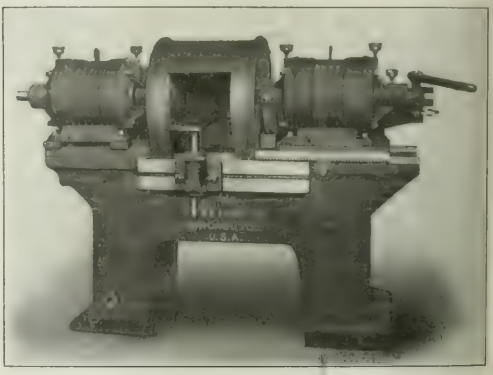
The installation was made by the Pierce Electric Company of Chicago, and the architects were Messrs. Ottenheimer, Stern & Reichert, also of Chicago. The reflector units were furnished by the National X-Ray Reflector Company.

## Motor-Driven Doubled-Spindle Grinder

A new 18-in. disk grinder possessing a number of interesting features has recently been developed by C. H. Besly & Company, Chicago. As shown in the illustration, the machine has two disks for grinding two parallel surfaces simultaneously, each grinding disk being mounted on the shaft of a motor. The right-hand motor and its disk can be moved by means of a gear and rack and can be clamped at any desired distance within a maximum of 10 in. from the other disk. In order to bring the disks in contact with the work the shaft and disk of the right-hand motor can be moved forward about 1 in. by means of the lever. A micrometer stop screw, graduated to 0.001 in., limits this motion so that work can be ground very accurately.

The dust hood telescopes automatically as the distance between the disks is varied. Ten work-rests, varying in size from 0.25 in. to 5.3125 in. in width and suitable for all sizes of work within the rating of the machine, are regularly furnished with the grinder.

The motors are of the Westinghouse steel-frame induc-



DOUBLE SPINDLE DISK GRINDER WITH INDUCTION MOTOR DRIVE AND MICROMETER ADJUSTMENT

tion type with special bearing brackets to carry the unusually large bearings required for grinding service. Each motor is rated at 5 hp.

## Elevated Controllers

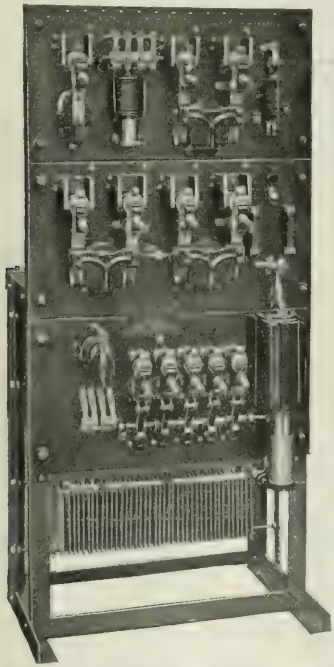
Elevator controllers of the type shown herewith are now being produced in both single-speed and two-speed types. The single-speed types are used with motors having no field control, while the two-speed types are used with motors in which additional speed variation is made possible by shunt-field resistors. In both types a combination of armature-series and shunt-field resistance will slow down the elevator and bring it to a stop if any part of the equipment fails to function properly. The armature shunt resistance is used also for dynamic braking.

The magnetic switches mounted on the slate control panel can easily be taken apart for inspection or for renewal of the contacts. All switch arms have a channel section and the other parts are heavily ribbed where required, so as to eliminate the breakage. All electrical contacts on these panels are of the butt type, carbon to copper and have a wide range of adjustment for taking up wear. Dust and dirt cannot collect on the contacts because of their vertical position.

The main contacts are equipped with magnetic blow-out coils of bar-wound copper. These are mounted on th

back of the control panel, so that the coils cannot be damaged from the arc. All of the wiring is exposed on the back of the panel. A double-pole main-line switch breaks both sides of the line and in connection with the direction switches gives four breaks in the armature circuit. The direction switches are mechanically interlocked to prevent their simultaneous operation, which would cause a short-circuit on the line. These switches will also automatically open on abnormal drop in voltage and stop the equipment.

A double-coil overload movement is arranged to stop the elevator in case of overload and can be automatically reset by throwing the car switch to the off position. This gives a reliable indication as to whether the car is overloaded, and by having the resetting feature in the car switch it is possible to set this overload within the closest



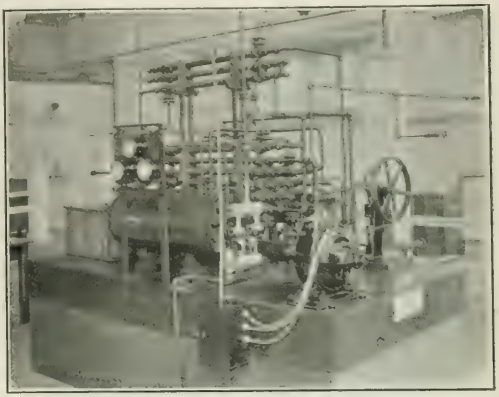
TYPE OF CONTROLLER PANEL WITH NEW SINGLE AND TWO-SPEED ELEVATORS

limits. This device possesses an advantage over the hand-operated circuit-breaker in that the operator is not compelled to go to the switchboard in case a slight overload occurs.

The controllers described above are now being built by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

## Combination Electric Plant and Refrigerating Equipment

A complete miniature exhaust-steam ice plant having a rating of 0.5 ton of refrigation was exhibited in operation the International Refrigeration Exposition in Chicago the Carbondale Machine Company, of Carbondale, Pa., demonstrate the applicability of the absorption-type ice plant to central-station equipment. Live steam was supplied to a small vertical engine direct-connected to a 3.5-kw 110-volt direct-current generator. This electrical unit was furnished by the Engberg Electrical & Mechanical Works, of St. Joseph, Mich. The engine exhaust at 3-lb. pressure was conducted to the steam coils of the ammonia generator of the small absorption-type refrigerating machine.



MODEL EXHAUST-STEAM REFRIGERATING MACHINE

Here the latent heat of the steam was utilized to distil off ammonia gas, and the refrigerant produced was used to operate a frosted sign, and to freeze small cakes of ice. The illustation herewith shows in detail the model refrigerating machine. Electricity from the generator was used in the operation of the small Robbins & Myers motor shown, which drove the ammonia circulating pump used in returning aqua ammonia from the absorber to the ammonia generator.

## Stimulating Electric Pumping at Syracuse, N. Y.

The accompanying illustration shows a window display used by the Syracuse Lighting Company, Syracuse, N. Y., to interest the suburban and country residents in electric




WINDOW DISPLAY TO INTEREST SUBURBAN AND COUNTRY RESIDENTS

pumping. The exhibit consists of an electrically driven triplex pump (shown in the lower-left corner of the picture) discharging into a pressure tank at its side. As the dummy figure pours the water on the flower garden in the foreground the pump is automatically stopped and started;

by means of a pressure relay on the tank. Appropriate posters in the window called attention to the advantages of the electrically driven pump as an aid in times of drought and fire. The pump in the display was made by the Goulds Manufacturing Company, Seneca Falls, N. Y.

## Change in Condensing Turbine Design

In making recent improvements in the design of its small turbine units, the Terry Steam Turbine Company, Hartford, Conn., had two objects in view, namely, to approach the low rates of steam consumption achieved with larger units and to eliminate air leakage into the condenser. The

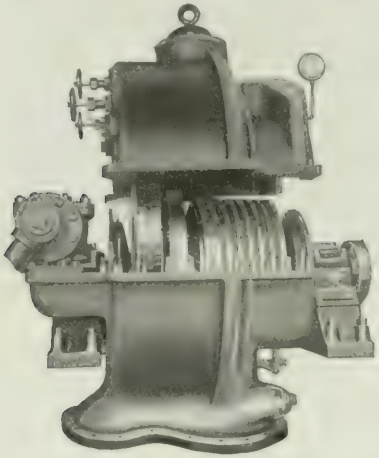
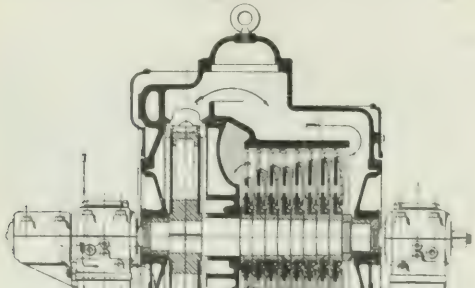


FIG. 1—STEAM TURBINE, WITH CASE REMOVED, EXPOSING ROTATING ELEMENT



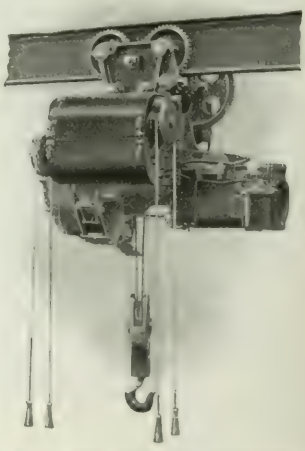
[illegible] THROUGH STEAM TURBINE, SHOWING PATH OF STEAM TO CONDENSER

machine consists essentially of a multi-velocity wheel as the high-pressure element and a low-pressure end made up of several multi-pressure impulse elements. The main feature distinguishing the arrangement of the low-pressure stage from that used in some other types lies in the fact that the low-pressure element is here reversed and receives steam at the end farthest from the high-pressure element, exhausting into the condenser connection at the center of the turbine as shown by the path of the arrows in Fig. 2. The stationary buckets on the low-pressure end are placed on annular rings, from which they may be removed in blocks if necessary.

The only gland exposed to vacuum has been shifted from the end of the casing, as it is in other types of condensing turbines, to the middle, where it is exposed on one side to the action of a vacuum and on the other to steam at just above atmospheric pressure. This reduces the leakage of air through this gland to a minimum. The effectiveness of the gland does not depend upon packing or any of the other devices used to keep out the air. Aside from these changes the turbine has the same characteristics as the former machines made by the company which have been described from time to time in the columns of the *Electrical World*.

## Hoist for Shop, Factory or Warehouse Duty

In a new type of small shop hoist brought out by the Pawling & Harnischfeger Company, Milwaukee, Wis.,



SMALL SHOP HOIST WITH SPUR-GEAR EQUIPMENT AND [illegible] CONTROL

plain spur gears are used throughout, all worm, bevel and planetary gearing having been eliminated as being inefficient. The gears employed are of cast steel and the pinions are of hardened forged steel. The load brake and hoist gears run immersed in oil. The designer has also given much attention to making all parts of the hoist accessible.

Unless otherwise specified, these hoists are equipped with direct-current motors. In sizes above 2 hp they are built with four wound-field poles, cast-steel frames and laminated cores. The armatures are form-wound, and both armature and field coils are impregnated under vacuum to render them impervious to moisture and oil. The motors are built for all standard potentials up to 600 volts. If alternating-current motors are specified, they may be furnished for two-phase or three-phase circuits of pressures ranging from 110 volts to 550 volts. These motors are of the slip-ring type. Drum-type controllers with many speed points are used with both alternating-current and direct-current motors.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Electrical Exports During July, 1913.**—Government figures on the exports of electrical machinery and appliances from the United States during the month of July show the following values for items of largest significance: Batteries, $44,084; generators, motors and transformers, $955,682; fans, $40,217; insulated wire cable, $147,948; interior wiring supplies and fixtures, $68,695; lamps, $69,852; telegraph instruments, $3,402; telephones, $77,969; locomotives, $4,780; miscellaneous, $910,643. The value of the copper and copper manufactures exported during the same period was $11,290,445.

**Ornamental Street-Lighting Business Brisk.**—At least one of the makers of ornamental street-lighting poles is making active preparations for the commercial appearance of the new high-efficiency tungsten lamps in the street-lighting field. This concern expresses the opinion that the municipal lighting situation will ultimately develop into the use of single high-intensity lighting units, in place of the varied line of two, three, four and five-lamp clusters at present largely in demand. This concern is pushing its sales in all sections of the country and claims that it is having trouble in keeping the production up to the demand. Among the cities which have recently placed orders with it for lighting-pole equipment are Holyoke, Mass., with 62 poles; Schenectady, N. Y., with 62; Edmonton, Alta., with 76; Lewiston, Me., with 100, and Brantford, Ont., with 152 poles. All of the above poles are for use with single-arc lamps.

**New Electrically Operated Washer Finding Large Western Sale.**—The new perforated cylinder type of electrically operated washing machine, recently put out by the Conlon Electric Washer Company, of Chicago, is finding its best sale, according to a representative of the company recently interviewed, in Chicago and the West. The apparatus embodies the advantages of compactness, durability and simplicity, having a geared shaft-drive with single lever control. There is provided also a reversing lever control for the wringer attachment. This company is finding, as a number of the cooking appliance concerns also report, that the Western part of the country furnishes a good field for quick sales where the class of apparatus can prove its merit. The extension of power and lighting service is being carried on with great rapidity in that section, and there is less capital tied up in old apparatus. These facts combine to produce a good demand for all sorts of electrical appliances.

**Continuous Dump Stoker Perfected.**—The American Engineering Company, which has been working for some time on a continuous dump Taylor stoker, has finally produced a machine which embodies this feature. A set of the new stokers is in satisfactory operation at the company's plant in Philadelphia, and similar apparatus has been tried out successfully under the boilers of the Detroit Edison Company. The new device makes it possible to remove ashes without admitting excess air to the combustion chamber, allowing the boilers to be operated continuously at large overloads without any interruption for cleaning the fire. An installation of these stokers is being made in the Fifty-ninth Street power house of the Interborough Rapid Transit Company in New York City, where the change from the old-type stokers is being made four boilers at a time, as rapidly as the work can be carried on without interfering with the operation of the station. Several other large orders for this apparatus are pending.

**Reduction in Prices of Electrical Manufactures Expected.**—Speaking recently concerning the probable effect of the new tariff rates on the electrical industry as a whole, a representative of one of the leading manufacturing interests expressed the sentiment that a general reduction of prices on electrical manufactures will soon be noticed, involving either a reduction in the margin of profit of the makers or in the wages of the labor employed, or both. According to this manufacturer, Germany, as the largest maker of electrical goods in Europe, is the most probable competitor of the American manufacturing interests. He claims that the German laborer, getting 60 per cent of the wage of the American, is equally efficient and that this gives the manufacturer of that country an advantage in the matter of selling price of goods. Aggressive competition is not expected to mature at once, since the foreign manufacturers will have to enlarge their production and organize sales forces to handle their goods in this country, but it is predicted that in two or three years the full effects of their presence will be felt in the electrical industry of the United States.

**Santo Vacuum Cleaner Sales Excellent.**—The Santo Electric Appliance Company, of 168 Madison Avenue, New York, agent for the Keller Manufacturing Company, of Philadelphia, in New York and vicinity, claims that at the present time it does no soliciting and has no regular sales force, since the volume of inquiries is large enough to keep its force of demonstrators busy. The Santo vacuum cleaner, handled by this concern, is of the flexible diaphragm type, and it is claimed that it gives a higher and more steady vacuum than can be produced by the centrifugal fan type of cleaner, while the diaphragm of canvas, impregnated with rubber, is said to show little wear after long usage. Sixteen of these cleaners have recently been installed on the *Imperator*, and one has been sold for use in the Engineering Societies Building in New York. A point of interest in connection with this company's work is the fact that it has begun to have a call for repairs and replacements on the machines first sold and has been obliged to install a repair department to care for this demand. In order to stimulate the purchase of the newer and more efficient machines, the company offers an allowance on the older types of Santo cleaners, if it is desired to return the same in part payment for new machines.

**Westinghouse Electric Equipment Sold for Public Utility Purposes.**—Electric railway companies and central stations have been active buyers of generating and substation apparatus from the Westinghouse Electric & Manufacturing Company during the past few weeks. An order has been received from the Pittsburgh Railways Company, Pittsburgh, Pa., for three 500-kw, 600-volt, six-phase, 60-cycle rotary converters with three 550-kva, 22,000-volt, three-phase transformers and one 14-panel switchboard for the control of same. From the United Railways & Electric Company, Baltimore, Md., an order has been taken for a 2000-kw, 600-volt, six-phase, 25-cycle, commutating-pole rotary converter; three 750-kw, 13,200-volt air-blast transformers and switchboard. The Edison Electric Illuminating Company, Boston, Mass., has placed an order for a 750-kw, 575-volt, six-phase, 60-cycle, commutating-pole rotary converter with two 825-kva, 13,200-volt, three-phase air-blast transformer and two blower outfits for same. A sale has been made to the Cleveland, Painesville & Eastern Railway Company, Willoughby, Ohio, of two 500-kw, 600-volt, six-phase, 25-cycle, commutating-pole rotary converters. Other interests which have placed orders with the same company for electrical equipment of various kinds within the last month or two are the Oakland, Antioch & Eastern Railway Company, Oakland, Cal.; Duquesne Light Company, Pittsburgh, Pa.; Milford & Uxbridge Street Railway Company, Milford, Mass.; Greenville, Spartanburg & Anderson Railway Company, Spartanburg, S. C.; Chautauqua Traction Company, Jamestown, N. Y., and S. S. Bullis, Medford, Ore.

**American Asbestos Production in 1912.**—The production of asbestos in the United States during 1912, was 4403 short tons, or a decrease of 3201 short tons from the 1911 figures. Even with this 72 per cent reduction the total for 1912 was the second largest yearly production on record. Most of the asbestos mined in this country comes from Vermont and Georgia, and a little is obtained from Wyoming. The finest quality asbestos is found in the Grand Canyon of the Colorado in Arizona, but this deposit is not commercially accessible. Asbestos, when free from magnetite, is an excellent electric insulator and its field of particular usefulness lies in service where its fire-proof and heat-insulating qualities are also desired, notably, as a covering for electric wire and cable, as a lining for street car controller boxes, and as insulation in various electric heating and cooking appliances.

**Waverley Electrics Sold to Central Stations.**—Six light shaft-driven electric delivery wagons were recently sold to the New York Edison Company by the Waverley Company, which reports that similar cars have enjoyed an increasing popularity in this country and in Canada. Central stations are coming generally to believe that the use of electric vehicles for their delivery and repair work is a paying investment both in the direct economies achieved and in the indirect advertisement for electric service which such use provides. Among the larger central stations which have recently purchased Waverley cars for this service are the Edison Electric Illuminating Company of Boston, the Commonwealth Edison Company of Chicago, the Denver (Col.) Gas & Electric Company, the Louisville (Ky.) Lighting Company, the British Columbia Electric Railway Company, of Vancouver; the Merchants' Heat & Light Company, of Indianapolis, Ind., and the Duquesne Light Company, of Pittsburgh, Pa.

**Electrical Devices on 1914 Models of Gasoline Automobiles.**—Although the season is still young and in a large number of cases the manufacturers have only decided upon the chassis design for their 1914 models, it is interesting to compare figures on electrical accessory equipment so far planned for next year's gasoline automobiles with those for this year's cars. Of the 50 makers, comprising a recent listing for this purpose, 41 of whom had electric starters on their 1913 models, 19 have decided upon the type of electric starter for their 1914 cars. Electric lighting equipment was regularly placed in this year's cars by 42 of these makers, and 16 have so far decided on this equipment for the coming year. Ignition magneto apparatus was installed by 44 of the same manufacturers in 1913, and already 20 of them have fixed on this element in their 1914 designs. Auxiliary battery equipment was supplied by 26 of these makers in 1913, and 12 have signified their choice of similar equipment for 1914. It is of interest to note that of this list of 50 leading manufacturers, 22 equipped their cars electrically in all four of the above items in 1913, while so far 10 have indicated that their 1914 models will be so equipped.

**Industrial Motor Drive Supplied by the General Electric Company.**—The General Electric Company has recently obtained from some of the large steel companies extensive orders for electric power equipment. The biggest single order reported is that of the Republic Iron & Steel Company, of Birmingham, Ala., which concern plans the installation at its mills, at Thomas, Ala., of a 400-kw motor-generator set, a 250-kva synchronous motor, five 150-kva transformers, seven motors ranging from 5 hp to 100 hp, switchboard and accessories, and will place in operation around the yards and buildings four 8-ton electric industrial locomotives. The same company will add to the electric drive equipment at its Youngstown (Ohio) plant thirteen motors, ranging from 10 hp to 350 hp, together with control panels. Other concerns which have recently put in orders for similar equipment are the American Steel & Wire Company, of Cleveland, Ohio; the Forged Steel Wheel Company, of Butler, Pa.; the Bethlehem Steel Company, of South Bethlehem, Pa., and the Otis Steel Company, Cleveland, Ohio. The sale of this class of apparatus is not, however, confined to the steel industry. The Singer Manufacturing Company, of New York, has ordered from the General Electric Company a 5000-kw, 2300-volt Curtis turbo-alternator for installation at its plant in Elizabethport, N. J. The California Portland Cement Company, Los Angeles, Cal., in equipping its mill at Colton, Cal., for electric drive, will install thirteen 75-hp and six 150-h motors with a switchboard and accessories. Sixty-five i duction motors ranging in capacity from 1 hp to 50 hp ha been ordered for electric-drive purposes in the carpet fa tory of S. Sanford & Son at Amsterdam, N. Y. The Ludlo Manufacturing Company, Ludlow, Mass.; American Prin ing Company, Fall River, Mass.; Farr Alpaca Compan Holyoke, Mass.; National Lead Company, New Yor N. Y.; Buda Company, Harvey, Ill.; Pennsylvania Feldsp Company, Rochester, N. Y., and the International Harve ter Company, Chicago, Ill., are among the other concer which have lately decided to install General Electric equi ment in connection with their manufacturing operations.

**Tennessee Hydroelectric Development to Supply Alum num Industry.**—Operation began this week at the Oco No. 2 plant of the Eastern Tennessee Power Compan located on the Ocoee River, near Parksville, Tenn. Th generating station, which was built and equipped by t J. G. White Engineering Corporation, of 43 Exchan Place, New York, has a capacity of 20,000 hp, with pr vision for future extension to 30,000 hp, and the ener generated will be largely used in the manufacturing aluminum, as well as in the lighting and traction service the adjoining towns. The plant is located in the mountai and the water is conducted to it in a flume 4 miles lon feeding into a steel penstock. The operating head 250 ft. and the construction and equipment work, which h covered a period of fifteen months, has cost in the neighbo hood of $2,000,000. A ground area of 125 ft. by 80 ft. occupied by the station, which is of concrete and brick co struction. Two 9375-kw, 6600-volt, three-phase, 60-cyc General Electric generators are installed, driven at 3 r.p.m. by I. P. Morris turbines and having exciters direct connected to the drive shaft. Provision has been made f the installation of a third unit of similar capacity. T other electrical equipment in the station consists of tw three-phase, 60-cycle, 6600/66,000/120,000-volt transforme oil-switching equipment, electrolytic lightning arresters, a a 50-kw motor-generator set for battery charging, static lighting and electric crane operation. All of this apparat was furnished by the General Electric Company. Pne matically operated disconnecting switches are installed, a the station equipment includes a 50-ton electric crane. the present time the station is operating at 66,000 volts order to work with the Ocoee No. 1 plant, but eventual the transmission voltage will be 120,000. It is planned carry energy to Knoxville, Chattanooga and Nashville, a the transmission system so far completed consists of tw wooden-pole lines and one double-circuit steel-tower lin The suspension-type insulators used on this system we supplied by the Ohio Brass Company. The constructio and equipment of this plant was carried on under the supe vision of J. G. Munson.

## NEW YORK METAL MARKET PRICES

| | Oct. 14 Bid. | Oct. 14 Asked. | Oct. 21 Bid. | Oct. 21 Asked. |
|---|---|---|---|---|
| | Selling Prices | | Selling Prices | |
| | £ s. d. | | £ s. d. | |
| | 74 10 | | 74 | |
| | 16 50 | | 16 75 | 16 8 |
| | 17 | to 17 5 | 17 | to 17 5 |
| | 17 10 | to 17 12 6 | 17 5 | to 17 7 6 |
| | 4 5 | | 4 5 | |
| | 40 00 | to 40 50 | 40 00 | to 40 50 |
| | 7 75 | | 7 60 | |
| Spelter, spot | 5.35 | to 5.45 | 5.35 | to 5.4 |
| | 40 15 | to 40 15 | 40 00 | to 40 5 |
| | 20.50 | to 21.00 | 20.00 | to 20.5 |
| Future | 20.00 | to 20.50 | 19.75 | to 20. |

## *OLD METALS

| | |
|---|---|
| Heavy copper and wire | 15 00 |
| | 6 75 |
| | 5 5 |
| | 4 5 |
| | 4 75 |

## *COPPER EXPORTS

Total tons to Oct. 21

*Daily transactions on the New York Metal Exchange.

# Corporate and Financial

**Keystone Telephone Company Declares Initial Dividend.**—The directors of the Keystone Telephone Company of Philadelphia have declared an initial dividend of 3 per cent out of the earnings of the preceding six months. This is to be paid on the preferred stock of the company, on which there are accumulated unpaid dividends of 63 per cent. For the nine months ended Sept. 30 the company's gross earnings were $944,417, while net earnings were $465,112.

**Power Debentures Offered in London.**—An issue of £560,000 of 4½ per cent perpetual debenture stock of the Vancouver Power Company, guaranteed unconditionally, principal and interest, by the British Columbia Electric Railway Company, is offered in London at 88. The issue is made to provide for obligations arising from an increase in the generating capacity of the Vancouver Power Company and also of the Vancouver Island Power Company, a subsidiary.

**Capital Stock of Boston Utility Increased.**—The stockholders of the United Electric Light Company, of Boston, have voted to increase the capital stock of the company from $1,500,000 to $1,750,000 in order to provide funds for extensions of its plant. The new stock is to be issued at 200 in accordance with a decision of the Gas and Electric Light Commissioners on Sept. 5. Payment must be made on half of this stock by Jan. 6 and on the remainder by April 6, and subscriptions must be made prior to Jan. 1, 1914.

**Electric Transmission Company Changes Hands.**—The control of the Electric Transmission Company, of Bristol, Va., organized a year ago by B. L. Dulaney, is said to have been acquired by Samuel Insull, president of the Commonwealth Edison Company, of Chicago. This company was started for the purpose of generating electricity with unmarketable coal from the mines of southwestern Virginia and supplying industries along the Atlantic seaboard, the particular field in view being the manufacturing industries in the Piedmont region. It is reported that Mr. Insull proposes to construct transmission lines to carry the energy to other markets.

**Beaver River Power Company Purchased.**—The Idaho Power & Light Company, organized by L. L. Nunn and associates, has taken over the properties of the Beaver River Power Company, at Bliss, Idaho, and at Beaver, Utah, together with the transmission and distributing lines supplying electricity to Boise and other towns in Idaho and Utah. With this move the 10,000-hp hydroelectric generating station on the Malad River and all the franchises of the old company were acquired. L. L. Nunn, formerly general manager of the Telluride Power Company before its absorption by the Utah Power & Light Company, is now president of the Idaho Power & Light Company.

**Electric Company of America Finances.**—Arrangements have been made whereby stock of the Electric Company of America deposited between Oct. 24 and Nov. 1 with Cassatt & Company, of Philadelphia, may be exchanged for its equivalent at $14 per share in either $100 or $1000 bonds of the American Gas & Electric Company, fractional amounts being made up in negotiable scrip. In case the bonds of $1000 denomination are desired, delivery will be made on stock deposited on or before Dec. 1. Holders of the $100 bonds who wish to exchange them for their equivalent in $1000 bonds may do so by depositing them in multiples of ten with Cassatt & Company between the dates mentioned. A distribution of 35 cents per share is payable on stock of the Electric Company of America on Nov. 1.

**American Water Works & Guarantee Company Protective Committees.**—As announced in the Oct. 11 issue of the *Electrical World*, a protective committee has been formed. This committee, consisting of G. L. Edwards, H. C. Ward, Robert Wardrop, E. F. Shanbacker, Allan Forbes, H. S. Cole, M. B. Moon, J. H. Puelicher, W. A. Durst, A. B. MacCaughey, W. J. Davis and L. L. McClelland, is asking for the deposit of bonds of the Twin Falls-Oakley Land & Water Company, Twin Falls-North Side Land & Water Company, Twin Falls-Salmon River Land & Water Company, and the Sacramento Valley Irrigation Company. The intention is said to be to organize the irrigation properties independently, separating them from the water-works and electric light, power and railway properties, none of which has so far defaulted on payments of coupons or dividends on bonds or preferred stock held by the public. The depositary is the Safe Deposit & Trust Company, of Pittsburgh, Pa. In order to protect the interests of holders of the 5 per cent gold bonds of the California-Idaho Company, which were guaranteed by the American Water Works & Guarantee Company, a protective committee has been formed, composed of A. W. Krech, Paul Staes, W. K. Whigham, W. C. Audenried, Jr., and H. L. Burrage.

**Agawam Power Company Purchased.**—The Amherst Power Company, of Greenfield, Mass., has purchased the Agawam (Mass.) Power Company. A reduction of 20 per cent in local lighting rates, as well as lowered motor-service, is now in effect in Agawam. The Amherst company has begun to supply energy to the Lane quarries in Westfield and is now furnishing electricity to the Ramapogue Ice Company's plant in the West Springfield district. A distribution line has been completed to the local pumping station at Bear Hole reservoir and motors will shortly be installed.

**Annual Report of the Consolidated Gas, Electric Light & Power Company.**—The annual report of the Consolidated Gas, Electric Light & Power Company, of Baltimore, for the fiscal year ended June 30 shows an increase of $649,686 in gross income, or 11.9 per cent, over the figures for last year, and an increase of $329,393 in net earnings, or 11.6 per cent, as compared with the corresponding item for 1912. Sales of electric energy increased 20.4 per cent. During the year 95.8 per cent of the total output of electricity was purchased from the Pennsylvania Water & Power Company, generated at its hydroelectric plant at Holtwood, Pa. Four additional substations were erected by the company, its Westport generating station further enlarged and equipment added to its principal substations. The industrial power department closed a number of large additional contracts for power service, including a single contract with the Maryland Steel Company for 7500 hp. On May 1 the company acquired control of the property and business of the Patapsco Electric & Manufacturing Company, thus adding 1037 electric customers and bringing under its control the only territory in the vicinity of Baltimore at that time not exclusively supplied by it. The plan was tried with some success of offering stock for subscription by the employees of the company on easy payment terms, the result being the disposal of about 1000 shares in lots of from one to twenty-five. Out of the earnings for the year a special reserve fund has been set aside for a new business campaign and extraordinary expenses.

**Annual Meeting of the Boston Edison Company.**—The twenty-eighth annual report of the Edison Electric Illuminating Company of Boston has been issued, covering the fiscal year ended June 30, 1913. At the annual meeting on Oct. 14 President Edgar stated that for the past three months the business of the company has grown at the rate of 10 per cent per annum, or at practically the same rate as for the year ended June 30. The directors were authorized to apply to the Board of Gas & Electric Light Commissioners for authority to issue 22,756 shares of additional capital stock to finance improvements, the price to be announced at the hearing before the board. President Edgar's report points out that the reduction in the retail price for electricity from 11 to 10 cents per kw-hr. in March, 1912, has saved the company's customers about $200,000 per year. During the year an additional turbo unit of 15,000-kva maximum rating has been purchased for installation in the South Boston station in the spring of 1914. With the exception of the year 1910, when various electric properties were purchased by the company, the increase in the connected load has been far greater than in any previous year. The present connected load is more than double that of five years ago, and amounts to 3,502,925 50-watt equivalents. Three new substations are being built by the company and another is contemplated in Dorchester. With the exception of the laboratory and one or two other structures, the new service buildings of the company on Massachusetts Avenue, Boston, are now substantially completed. The company's territory now embraces over 700 sq. miles, and the connected motor load aggregates 93,175 hp, compared with 78,733 hp in 1912.

## Business Notes

**The Philadelphia Storage Battery Company** has moved its office and depot in Chicago to the Moon Building, 2612 and 2614 South Michigan Avenue. Mr. D. C. Arlington is in charge.

**Byron T. Mottinger & Company,** with address at Akron, Ohio, have been formed by Byron T. Mottinger, formerly associated with the Youngstown (Ohio) Armature & Construction Company.

**The American Conduit Manufacturing Company,** of Pittsburgh, Pa., announces the addition to its sales staff of E. H. Sutton, who will act as special representative of the company, with headquarters at Pittsburgh.

**Moloney Electric Company.**—The Moloney Electric Company, St. Louis, Mo., manufacturer of transformers, is being represented in Philadelphia by the Elliott-Lewis Electrical Company, Inc., 138 North Tenth Street.

**The Bentz Richardson Company, Ltd.,** of 114 Phœnix Block, Winnipeg, Man., has recently been organized to introduce and promote the sale of high-class electrical specialties throughout western Canada.

**The Adams-Bagnall Electric Company** has opened a branch office at 1318 Pine Street, St. Louis, Mo., in charge of W. L. Cummiskey. At this office there will be carried a full line of electrical supplies and automobile accessories.

**Sloan, Huddle, Feustal & Freeman,** consulting engineers, of Madison, Wis., announce the formation of their partnership, succeeding the firm of Sloan, Huddle & Company. They announce also the opening of an office in Indianapolis, Ind., in the Hume-Masur Building, with Mr. Huddle in charge.

**Kerry & Chace, Ltd.,** have been incorporated to carry on operations as consulting, constructing and operating engineers with a head office in Toronto. The firm succeeds the consulting engineering firm of Smith, Kerry & Chace, the reorganization having been necessitated owing to the death of Mr. Smith on June 29.

**Robert W. Hunt & Company,** engineers, of Chicago, Ill., announce the re-election of Mr. T. C. Irving, Jr., as vice-president in charge of the Toronto business. Mr. C. C. Whittier has been made treasurer and general manager of Robert W. Hunt & Company, Ltd., with headquarters at 905 McGill Building, Montreal. Mr. R. N. Dickman has become associated with both the American and Canadian companies and is engaged in the examination of gypsum and coal properties in Western Canada.

## New Industrial Companies

**The Northwestern Electric Castings Company,** of Chicago, Ill., has been incorporated with a capital stock of $10,000 by Herschel V. Shepard, Howard W. Lewis and William T. Church.

**The Electrical Specialties Company,** of Newark, N. J., has been incorporated by M. Mazzolia, of Kearney; G. C. Tramer and H. C. Tramer, of Newark. The company is capitalized at $100,000 and proposes to manufacture electrical appliances.

**The Multi-Lux Illuminating Company,** of Cleveland, Ohio, has been incorporated with a capital stock of $25,000 for the purpose of manufacturing electric-light fixtures. The incorporators are: E. M. Smith, H. W. Kackley, H. S. Malm, Ira O. France and W. H. C. Towler.

**The Collins-Wagner Manufacturing Company,** of Brooklyn, N. Y., has been chartered with a capital stock of $15,000 to manufacture electric fixtures and works of art. The incorporators are: Henry M. Kahle, Charles Wagner and Arthur V. Collins, 16 Dunham Place, Brooklyn, N. Y.

**The Auto Electric Equipment Company,** of Buffalo, N. Y., has been incorporated by Edward W. Werick, Charles H. Werick and Fred C. Schoenthal, all of Buffalo, N. Y. The company is capitalized at $15,000 and proposes to manufacture and deal in electric generating machinery and appliances.

## Trade Publications

**Lamp Efficiency.**—The General Electric Company has just issued Bulletin No. A4142, which deals exhaustively with various operating conditions which affect the efficiency and life of incandescent lamps.

**Lighting Fixtures.**—The F. W. Wakefield Brass Company, Vermilion, Ohio, is mailing to dealers a folder relative to its lighting fixtures in which reasons are given for dealers carrying its interchangeable fixtures.

**Flashers.**—A large poster being mailed by the Reynolds Electric Flasher Manufacturing Company, 617 West Jackson Boulevard, Chicago, contains a suggestion to install flashers on electric signs in order to increase their attractiveness.

**Galvanometers.**—The Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, in a leaflet recently issued has announced a reduction in the prices of its small portable galvanometers. In Bulletin 232 the D'Arsonval galvanometer is described and illustrated.

**Pyrometers.**—The Industrial Instrument Company, Foxboro, Mass., has issued Bulletin No. 81, relating to electric pyrometers, fire bars and fittings, high-resistance pyrometers, platinum couples, porcelain and quartz tubes and various methods of application.

**Commutator Grinder.**—The Phillips automatic commutator grinder, a device for truing commutators running in position at normal speed, is described in an eight-page pamphlet recently issued by the Phillips Manufacturing Company, 60 Wall Street, New York.

**Resistance Thermometers.**—A sixteen-page pamphlet on resistance thermometers for long-distance measurement, registration and alarm has recently been issued by the Hanovia Chemical & Manufacturing Company, 233 New Jersey Railroad Avenue, Newark, N. J.

**Receptacles.**—In P. & S. Bulletin No. 760, issued by Pass & Seymour, Inc., Solvay, N. Y., illustrations of a large number of electric signs in various parts of the country are shown, in all of which P. & S. sign receptacles are employed. Various types of sign and outlet boxes are illustrated.

**Hoisting Machinery.**—The Otis Elevator Company, Eleventh Avenue and Twenty-sixth Street, New York, has issued a pamphlet entitled "Automatic Hoisting Machinery Used in Connection with Blast Furnaces," which was distributed at the recent New York convention of the Association of Iron and Steel Electrical Engineers.

**Meters.**—Ampere-hour meters for general service are the subject of Bulletin No. 36 recently issued by the Sangamo Electric Company, Springfield, Ill. The construction features, the uses and the applications of this device are analytically and diagrammatically set forth. A price list is also given. The bulletin is well printed and illustrated.

**Automobile Equipments.**—"Westinghouse Electrical Equipments for Automobiles and Garages" is the title of a small pamphlet (Folder 4223) issued by the Westinghouse Electric & Manufacturing Company. It describes the Westinghouse 6-volt, single-wire starting, lighting and ignition systems. Accessories, including meters, rectifiers, vulcanizers, etc., are also described.

**Telephones.**—The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., is sending out a large folder telling about its national publicity campaign in advertising its telephone system for offices, stores, factories and homes, and offering sales promotion service to telephone companies and contractors. Inclosed within the folder is a booklet of twenty-four pages that describes what its title indicates, "Systems That Save Business Time."

**Soldering Pastes.**—The M. W. Dunton Company, 65 Atlantic Avenue, Providence, R. I., has issued a poster, size 24 in. by 18 in., folded for mailing, which contains a number of illustrated practical "kinks" suggested by use of "Nokorode" soldering paste. Along the sides of the folder are illustrated the containers of the various specialties made by the company, including those of varnished cloth and tapes, soldering pastes, soldering salts, friction tape, sleeving and others.

# Personal Mention

**Mr. T. A. Clifton** has leased and will manage the Devall Bluff (Ark.) Electric Light Company, which was formerly operated by the municipality.

**Mr. H. W. Thompson** has been appointed superintendent of the municipal lighting and power plant at Azusa, Cal., succeeding Mr. Charles Edwards.

**Mr. Homer Rickard** has resigned from the Maryville (Mo.) Electric Light & Power Company to accept the position of manager of the Hamilton (Mo.) Electric Light Company.

**Mr. J. P. Butler,** local manager of the Corning (Cal.) office of the Northern California Power Company, has been transferred to the Chico office as successor to Mr. F. P. Bergen, resigned.

**Mr. A. H. Warren,** who has been manager of the Pensacola (Fla.) Electric Company for the past five years, has been transferred to the Galveston-Houston Electric Company, Galveston, Tex.

**Mr. F. P. Bergen,** local manager for several years of the Chico (Butte County) office of the Northern California Power Company, has resigned to take up broader work in hydroelectric engineering.

**Mr. Charles E. Campbell,** designer and builder of electrical apparatus and president of the Campbell Electric Company, of Lynn, Mass., is the subject of an illustrated sketch in the Lynn *Item* of Oct. 11.

**Mr. W. G. Chace,** of the firm of Kerry & Chace, Ltd., formerly Smith, Kerry & Chace, of Toronto, has been appointed chief engineer of the entire construction of the Greater Winnipeg water system.

**Mr. Charles R. Hosmer** has been elected president of the West Kootenay Power & Light Company, Ltd., of Rossland, B. C., as successor to the late W. M. Doull. The executive offices of the company are located in Montreal, Quebec.

**Mr. T. R. Robinson,** superintendent of the Worcester Suburban Electric Company, of Uxbridge, Mass., has resigned. Mr. Robinson has been connected with the company for the past five years, and during his incumbency the station was entirely rebuilt.

**Mr. Charles C. Marshall,** of Sidney, Ohio, has been appointed by Governor Cox to succeed the late W. L. Dechant as member of the Ohio Public Utilities Commission. Mr. Marshall has been counsel for the commission and is described as a moderate, fair-minded man.

**Mr. F. A. Persons,** for several years superintendent of the Concord, Maynard & Hudson Street Railway Company, of Maynard, Mass., has been promoted to the superintendency of motive power and equipment of the roads controlled by the Massachusetts Consolidated Railways, with headquarters at Greenfield, Mass.

**Mr. G. L. Pearson** has resigned as general manager of the Central New Hampshire Power Company, of Brattleboro, Vt. In view of the recorded intention of the company to act hereafter as a holding company, no one has been appointed to succeed Mr. Pearson and the office of general manager has been abolished.

**Mr. T. J. Hanlon,** who at one time was connected with the Dallas (Tex.) Electric Light & Power Company and at present is superintendent of the street railway department of the Pensacola (Fla.) Electric Company, has been appointed general manager of the company as successor to Mr. A. H. Warren, who has been transferred to Galveston.

**Mr. J. B. McCall,** president of the Philadelphia Electric Company and also of the National Electric Light Association, has accepted membership on the jury of award for the International Exposition of Safety and Sanitation to be held under the auspices of the American Museum of Safety early in December at the Grand Central Palace, New York City.

**Mr. John J. Kates,** formerly commercial agent of the Key West (Fla.) Electric Company, has been appointed commercial agent of the Paducah (Ky.) Light & Power Company, succeeding Mr. H. J. Pettengill, Jr., who has been placed in charge of the commercial department of the Blackstone Valley Gas & Electric Company at Woonsocket, R. I.

**Dr. Irving Langmuir,** to whose research work may be attributed the recent developments in the high-efficiency tungsten lamp, was born in Brooklyn, N. Y., Jan. 31, 1881. His early education was obtained in the public schools of that city, which he attended until June, 1892, at which time his parents went to Paris, and there Dr. Langmuir studied under French teachers for three years. Returning to the United States in the fall of 1895, he entered Chestnut Hill Academy at Philadelphia, and the following year found him in Pratt Institute, Brooklyn. Entering college, Dr. Langmuir took the course in metallurgical engineering at Columbia University and was graduated in 1903 with the degree of metallurgical engineer. While at Columbia University he was interested mainly in chemistry and mathematics. After his graduation Dr. Langmuir went abroad and took up post-graduate work at the University of Göttingen, Germany, carrying on investigations on the kinetics of chemical reaction and on the dissociation of water vapor and carbon dioxide in the laboratory of Prof. Nernst. In January, 1906, the degrees of M.A. and Ph.D. were awarded to him by the University of Göttingen, his major subject having been physical chemistry. Returning to the United States the following month, he became an instructor in chemistry at the Stevens Institute of Technology, where he taught until July, 1909. After leaving Stevens Institute, Dr. Langmuir entered the research laboratory of the General Electric Company at Schenectady, since which time he has been engaged mostly in researches on tungsten lamps and also to some extent in work related to electric heating devices. Some of his work in connection with the tungsten lamp was detailed in a paper before the American Institute of Electrical Engineers on Oct. 10 and published in these columns last week. Dr. Langmuir has, however, been a frequent contributor to national scientific bodies, some of his contributions being as follows: "Thermal Conduction and Convection in Gases at Extremely High Temperatures," before the American Electrochemical Society at Toronto, Can., Sept. 22, 1911; "A Chemically Active Modification of Hydrogen," presented at the Washington meeting of the American Chemical Society in December, 1911; "Chemical Reactions at Very Low Pressures—The Clean-up of Oxygen in a Tungsten Lamp," before the New York Section of the American Chemical Society, Nov. 8, 1912; "Chemical Reactions at Very Low Pressures—The Chemical Clean-up of Nitrogen in a Tungsten Lamp," before the New York Section of the American Chemical Society, Nov. 8, 1912; "Laws of Heat Transmission in Electrical Energy," presented at the mid-winter convention of the American Institute of Electrical Engineers in New York, February, 1913, and "Conduction and Radiation of Heat," presented at the twenty-third general meeting of the American Electrochemical Society, Atlantic City, April 3, 1913.



IRVING LANGMUIR

# Obituary

**Robert B. Borland,** superintendent of cable construction of the New York Telephone Company for the past fifteen years, died in his home at Bayonne, N. J., on Oct. 19. Mr. Borland was a graduate of Stevens Institute and of the School of Mines, Columbia University.

**Charles A. Chapin,** of Chicago, president of the Indiana & Michigan Electric Company, South Bend, Ind., died on Oct. 22. The company of which Mr. Chapin was the head absorbed the Charles A. Chapin Light & Power Company, Buchanan, Mich.; the South Bend (Ind.) Electric Company; the Elkhart (Ind.) Electric Company, and the Berrien Springs (Mich.) Power & Electric Company.

# Construction

## New England

ASHLAND, MASS.—[illegible] light plant, expects to purchase one 75-hp Rodney Hunt turbine within the [illegible]

MILFORD, N. H.—The Selectmen have signed a contract with the Milford Lt. & Pwr. Co. for lighting the streets of the village for a period of ten years. Under the terms of the contract the company is to replace all arc lamps with incandescent lamps at $20 each per year.

NEWPORT, N. H.—The plant and holdings of the Newport El. Lt. Co., of Newport, and the Sunapee El. Lt. Co., of Sunapee, has been purchased by the Central New Hampshire Pwr. Co., of Brattleboro, Vt. It is understood that an additional turbine will be installed in the Newport plant and the Newport system will be connected with the Claremont lines. The price paid for the properties is said to be $180,000.

WINOOSKI, VT.—The Winooski Valley Pwr. Co., a subsidiary of the American Gas Co., of Philadelphia, Pa., is building a hydroelectric power plant at Hubbles Falls, Vt. The plans provide for the development of 10,000 hp, half of which, it is said, has already been contracted for. Morris Stroud, 222 South Third Street, Philadelphia, Pa., is president of the American Gas Co.

BROCKTON, MASS.—The contract for the proposed addition of the power plant of the Edison El. Illg. Co. of Brockton, at East Bridgewater, has been awarded to the Stone & Webster Engineering Corpn., of Boston. The cost is estimated at $350,000. The work will include the erection of an addition to present plant and the installation of two additional boilers, of 600 hp each, to be fitted with automatic stokers, forced-draft fans, air ducts and ash hoppers. The four present boilers are to be similarly equipped; also the installation of a 5000-kw turbo-generator, together with a 100-kw motor-driven exciter, condensing-equipment, switchboard, etc.; coal bunkers, conveyors, traveling weight hoppers, together with crusher.

CHICOPEE, MASS.—The Electric Light Commission expects to extend its lighting system to Fairview, a part of the city heretofore without an incandescent lighting service, within the next two months. Contract for the material has already been placed.

EVERETT, MASS.—Estimates have been submitted to the Board of Trade of the cost of maintaining an ornamental street-lighting system on Broadway from the Boulevard to Glendale Square or from the Boulevard to Sumner Street. The plans provide for the erection of 69 magnetite arc lamps, to cost $8,743 per year if the wires are placed underground, or $6,849 annually if overhead wires are used.

HAVERHILL, MASS.—The State Board of Gas and Electric Light Commissioners have approved the petition of the Haverhill El. Co. to issue additional capital stock to the amount of $278,400.

TORRINGTON, CONN.—The Torrington El. Lt. Co. is contemplating replacing the 32-cp incandescent lamps now in use with 60-cp lamps.

## Middle Atlantic

CLAYVILLE, N. Y.—At a special election held recently the proposition to enter into a contract with the Utica Gas & El. Co. to light the street with electricity for a period of five years, at $825 per year, was carried.

WEEDSPORT, N. Y.—The Village Council has adopted an ordinance directing the village clerk to advertise for bids for construction of a municipal electric-light plant.

WEST HAVERSTRAW, N. Y.—Bids will be received by George Blagden, president of the board of managers of the New York State Hospital for Crippled and Deformed Children, West Haverstraw, N. Y., until Oct. 29, for construction, heating, plumbing and electric work for solaria at the New York State Hospital for Crippled and Deformed Children at West Haverstraw. Bids will be received for each division of the work separately and no combination of bids will be considered. Drawings and specifications may be consulted and blank forms of proposals obtained at the New York State Hospital for Crippled and Deformed Children at West Haverstraw and at the office of Lewis F. Pilcher, state architect, Capitol.

PITTSBURGH, PA.—The Pittsburgh Railways Co. contemplates remodeling the car barn on Fifth Avenue in Oakland as a substation and laboratory of the Duquesne Lt. Co. Equipment will be installed for the distribution of electricity throughout that district of the city. The cost of the work is estimated at $75,000.

LONG BRANCH, N. J.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 23, for construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Long Branch, N. J. Drawings and specifications may be obtained from the above office or from the custodian of site, at Long Branch. O. Wenderoth is supervising architect.

PARKERSBURG, W. VA.—Plans are being prepared by the Parkersburg, Marietta & Interurban Ry. Co. for the installation of an ornamental street-lighting system on Market Street. The plans provide for [illegible]

RALEIGH, W. VA.—The Raleigh Coal & Coke Co. is contemplating the construction of a power house (36 ft. by 36 ft.) and machine shops (40 ft. by 125 ft. and 40 ft. by 60 ft.). The company proposes to equip its plant with motors aggregating 2500 hp.

CHARLOTTESVILLE, VA.—The Redland Pwr. Co., of Charlottesville, has nearly completed the installation of a 3000-hp steam turbine power plant. Through mistake an item was published in the issue of Oct. 4 stating that the Redland Lumber Co. was contemplating the installation of an electric-light plant.

MANASSAS, VA.—N. Wilson Davis, engineer, of Harrisonburg, Va., it is reported, has been engaged by the Town Council to prepare plans and supervise the construction of an electric-light plant, sewer system and water works. Bonds to the amount of $75,000 have been voted for the proposed improvements.

WASHINGTON, D. C.—The contract for construction of lighting, heating and power system for the United States court house in Washington, D. C., has been awarded to W. G. Cornell, of Washington, at $18,930.

WASHINGTON, D. C.—Work, it is expected, will soon begin on the installation of a new street-lighting system on Pennsylvania Avenue between the Treasury Building and the Peace Monument. It is proposed to replace the 78 lamps of 700 cp now in use with 150 lamps of 1500 cp each. The contract for lamp-posts has been awarded to the Union Foundry Co. of Alabama. Plans have been prepared by Walter C. Allen, electrical engineer of the District of Columbia, providing for increased illumination in the area bounded by Pennsylvania Avenue and G Street and Fifteenth and Seventh Streets, Northwest.

## North Central

BELDING, MICH.—The Spencer El. Lt. & Pwr. Co., of Belding, expects to repair within the next year headrace flume and reset waterwheels, flume and race to be of reinforced concrete, also to purchase one waterwheel of 150 hp and one waterwheel governor within the next 12 months. The company hopes to secure the city lighting contract for a term of five years, beginning June 1, 1914. Wire, poles and reflectors for 140 series tungsten lamps of 80 cp for above have been purchased. J. E. Stanton is manager. William G. Fargo is consulting engineer.

COLDWATER, MICH.—The managers of the municipal electric-light plant expect to purchase within the next eight months two water-tube boilers of from 200 hp to 300 hp and also to purchase a carload of poles within the next six months. William H. Friedrich is superintendent.

HIGHLAND PARK, MICH.—Bids will be received at the office of the village clerk, 20 Gerald Avenue, Highland Park, until Nov. 3 for furnishing labor and material for the construction of an ornamental street-lighting system, consisting of 61 standards for five-lamp clusters and 20,0[illegible] ft. of twin conductor, No. 4 cable. Plans and specifications are on file at the office of L. D. Beckley, superintendent of public works, 28 Gerald Avenue.

SAULT STE. MARIE, MICH.—Applications have been made to the International Joint Commission in Ottawa, Ont., by the Michigan & Lake Superior Pwr. Co., of Sault Ste. Marie, Mich., and the Algoma Steel Corpn., of Sault Ste. Marie, Ont., for permission to divert the water at Sault Ste. Marie. The companies propose to build a dam from each side of the international boundary, which will meet in the center.

AKRON, OHIO.—Bids will be received by R. M. Pillmore, director of public service, Akron, Ohio, until Oct. 29 for furnishing and [illegible] pumping machinery and equipment, including one motor-driven [illegible] steam-turbine and motor-driven low-lift centrifugal pumping unit[illegible] 000,000 gal. capacity), one steam-turbine-driven generator unit, [illegible] board transformers, wiring and accessories. Plans and specifications [illegible] be seen at the office of the director or at the office of F. A. Ba[illegible] engineer, 1120 Tremont Building, Boston, Mass.

CALDWELL, OHIO.—Bids will be received by the village clerk [illegible] Caldwell until Nov. 5 for the purchase of $8,000 in bonds, the proceeds of which will be used for extensions and improvements to the municipal electric-light plant and water-works system. Harry A. Smith is village clerk.

[illegible], OHIO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 28 for the construction, complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Cambridge, Ohio. Drawings and specifications may be obtained after Oct. 20 from the above office or from the custodian of site at Cambridge, O. Wenderoth is supervising architect.

FINDLAY, OHIO.—The proposition to issue $57,000 in bonds for the purpose of installing a municipal distribution system for the purpose of distribution of electrical energy for municipal, industrial and domestic uses will be submitted to the voters at the general election to be held Nov. 4.

MAUMEE, OHIO.—The State Utilities Commission has granted the [illegible] & Pwr. Co., of Maumee, authority to issue [illegible] $30,000 first mortgage bonds, which [illegible] The sum to be borrowed must not be less than 80 per cent of the par value of the bonds.

ST. PARIS, OHIO.—The managers of the municipal electric-light plant expect to purchase within the next two months one set of Loco shaking grates and one 6-in. by 4-in. by 6-in. duplex boiler-feed pump. John C. Phelps is superintendent.

FULTON, KY.—We are informed that the Fulton El. Lt. & Pwr. Co. has practically completed the installation of additional equipment in its plant, changing from 133-cycle alternating current and 220-volt direct current to a 60-cycle system, also doubling the output of the plant. The company expects to remodel its power house, making it fireproof. A. D. Brinkerhoff is secretary and treasurer of the National Lt. & Pwr. Co., of St. Louis, which controls the Fulton company.

GRAYSON SPRINGS, KY.—The Grayson Spring Hotel Co. has awarded a contract to the Falls City Construction Co., of Louisville, to design and build a hotel plant, to cost about $400,000. An electric light and power plant will be installed in connection with the hotel.

MOREHEAD, KY.—The managers of the municipal electric-light plant are contemplating the installation of a 50-hp oil engine and discarding the present steam engine and boiler. E. E. Maggard is manager.

OWENTON, KY.—The town of Owenton has granted W. English Arnold a franchise to construct and operate an electric street-lighting system here. Mr. Arnold will install electrical equipment in connection with his flour mill in Owenton.

RICHMOND, KY.—The Dix River Pwr. Co. has recently filed deeds for land along the river to be used in connection with its proposed power plant, to be erected on the river near Richmond. The proposed plant will have sufficient output to furnish energy to many of the larger cities in central Kentucky. L. B. Herrington, of Richmond, is president.

ELWOOD, IND.—The Indiana General Ser. Co., of Elwood, is completing the rebuilding of its steam generating plant at Elwood and the converting of the Alexandria plant into a substation and residence combined. It has also built an outdoor substation at Orestes, supplying energy from its high-tension line in that locality. N. M. Argabrite is manager.

UNION CITY, IND.—The Union City El. Co. expects to purchase within the next two or three months several thousand feet of steel-roped cable for connecting ornamental street lamp standards and from 50 to 75 ornamental boulevard lamp-posts for lighting the main streets of Union City. D. O. Vaughn is manager.

BARRY, ILL.—The Central Illinois Pub. Ser. Co., of Mattoon, expects to erect within the next four months about 35 miles of transmission line from the Illinois River at Valley City to Hull Station, connecting with the transmission lines from the Keokuk power plant at the latter place. W. G. Printy is local superintendent.

BUFFALO, ILL.—The Central Illinois El. Co., of Buffalo, is contemplating the purchase of equipment for 16,500-volt transmission line 7 miles long. George B. Conover is president.

MADISON, WIS.—Plans are being prepared by the City Council and the Capitol Building Commission for the installation of an ornamental lighting system for lighting the Capitol Park and surrounding streets. The plans provide for the erection of 60 ornamental standards in the park. The cost of the system is estimated at about $25,000, of which about $10,000 will be paid by the State.

MELLEN, WIS.—The Mellen Wtr. & Lt. Co. would like to receive information pertaining to oil engines and producer gas engines and also on tungsten street-lighting systems. A. W. Pribnow is president and general manager.

MENOMONEE FALLS, WIS.—The plant and holdings of the Menomonee Falls Lt. & Pwr. Co. have been purchased by J. A. Pratt, of Menomonee Falls, and William C. Leitzke, of Wausau. The new company will be known as the Menomonee Falls El. Lt. & Pwr. Co., and will install a new power plant. It proposes to furnish electricity to surrounding towns and villages as well as in this city.

MILWAUKEE, WIS.—The Wisconsin Railroad Commission has authorized the Wells Pwr. Co., of Milwaukee, to issue $136,000 in capital stock and $35,000 in notes. The company is further authorized to issue $55,000 in 6 per cent notes, to be sold for not less than 75, the proceeds of $190,000 to be used to retire outstanding indebtedness and $5,000 to be used for extensions and improvements to its plant and property.

REMIDJI, MINN.—Within the next 30 days the Warfield El. Co., of Bemidji, expects to purchase one carload of poles. A. A. Warfield is secretary.

DULUTH, MINN.—The contract for construction of the new dam at Thomson for the Great Northern Pwr. Co., of Duluth, has been awarded. It is understood that contracts for the installation of an additional motor unit at Thomson will soon be awarded. The cost of the proposed improvements is estimated at $300,000. The company is also contemplating extensions to its power system on the Mesaba and Cuyana ranges, for which preliminary surveys have been made. J. B. Crane, of Duluth, is contract agent.

FERGUS FALLS, MINN.—The City Council has voted to install an ornamental street-lighting system, to cost about $4,500.

McKINLEY, MINN.—The Village Council has entered into a contract with the St. Louis Pwr. Co. for electricity to operate the municipal electric light system.

WALKER, MINN.—Bids will be received by the State Board of Control, State Capitol Building, St. Paul, until Nov. 5 for construction and completion of service building, plumbing, wing, power plant, laundry, recreation building and children's pavilion at the State Sanatorium, Walker, Minn., including general contract work, heating and ventilating, plumbing and electrical work, in accordance with plans and specifications furnished by C. H. Johnston, architect, 715 Capitol Bank Building, St. Paul. Bids will be received collectively and separately. Copies of plans and specifications may be seen at the Builders' Exchanges in St. Paul and Minneapolis, at the office of the superintendent at the institution at Walker, and at the office of the State Board of Control, State Capitol Building, St. Paul. Extra copies of plans and specifications may be obtained on application to the architect on payment of cost of duplication of same.

WINONA, MINN.—Bids will be received by the State Board of Control, State Capitol Building, St. Paul, until Nov. 5 for the construction and completion of the model school building at the State Normal School, Winona, including the general contract work, heating and ventilating, plumbing and electrical work, in accordance with plans and specifications furnished by C. H. Johnston, architect, 715 Capitol Bank Building, St. Paul, Minn. Bids will be received collectively and separately. Copies of plans and specifications may be seen at the Builders' Exchanges in St. Paul and Minneapolis, and at the office of the president of the State Board of Control, State Capitol Building, St. Paul. Extra copies may be obtained on application to the architect upon payment of the cost of duplication.

AMES, IA.—The Electric Light and Water Department expects to erect within the next six months a 500-kw Curtis turbine and Westinghouse Le Blanc condenser in the municipal electric light plant, and to purchase generating panel with instruments and switches. Charles E. Warsaw is manager.

DES MOINES, IA.—The Des Moines El. Co. is contemplating the installation of a central heating plant to serve the downtown district. The cost of the plant is estimated at $250,000.

EDGEWOOD, IA.—Bonds to the amount of $12,000 have been voted for the installation of a municipal electric-light plant.

GLIDDEN, IA.—At an election held recently the proposition to issue $10,000 in bonds for extensions to the municipal electric-light plant was carried.

SUMNER, IA.—The Sumner El. Lt. Co. expects to purchase within the next four months one 20-hp or 25-hp oil engine. C. V. Stewart is superintendent.

CAINESVILLE, MO.—The Missouri El. Gas & Wtr. Co., of Cainesville, expects to purchase within the next 30 days 20,000 ft. of No. 4 insulated copper wire (new code). L. J. Beauregard is superintendent.

GILLIAM, MO.—The Gilliam El. Lt. & Pwr. Co. would like to exchange a 50-hp Weber gas producer outfit for a 20-hp oil engine. W. R. Burton is president.

FARGO, N. D.—Bids will be received by A. R. Watkins, city auditor, Fargo, until Oct. 29 for furnishing material and erecting an ornamental street-lighting system, extending on Eighth Street from First Avenue to Front Street; on Front Street from Eighth to Tenth Street, and on Broadway from Fourth to Fifth Avenue North, in accordance with plans and specifications now on file in the office of the city auditor.

BLAIR, NEB.—At an election held recently the proposition to issue bonds for an electric-light plant and extensions to water-works system was carried.

GRETNA, NEB.—The town of Gretna has granted the McKinley interests a franchise to furnish electrical service here for a period of 50 years. Electricity for operating the system will be transmitted from Papillon. Springfield, Ralston, Richfield and Louisville will be supplied from the same circuit.

HOOPER, NEB.—H. G. Meyer, receiver for the local electric-light plant, expects to make some repairs to the distribution system and to purchase about 200 lamps within the next three months.

WICHITA, KAN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 3 for the removal of the present elevator and the installation complete of an electric passenger elevator in the United States court house and post office at Wichita, in accordance with plans and specifications, copies of which may be obtained at the above office. O. Wenderoth is supervising architect.

WILSON, KAN.—The Wilson El. Lt. Co. expects to purchase within the next 30 days material for an ornamental street-lighting system, consisting of ornamental poles and a series of street-lighting regulators.

## Southern States

HIGH SPRINGS, N. C.—The installation of a hydroelectric power plant on the French Broad River is contemplated by James E. Rector, of Asheville, N. C., and associates. The promoters are prepared to correspond with contractors and manufacturers relative to construction of dam, hydraulic equipment, electrical machinery, etc.

WILSON, N. C.—Bids will be received by the Board of Public Works until Nov. 4 for water-tube boilers, two 500-kw engine or

[illegible] bidding forms will be mailed upon application to Gilbert C. White, [illegible] Public Works, Wilson, N. C. D. S. Boykin is chairman.

CHARLESTON, S. C.—The Isle of Palms Development Co., it is reported, is contemplating the installation of an electric cable under Cooper River from the foot of Charlotte Street to carhouse at Mount Pleasant for the purpose of furnishing electricity to Mount Pleasant, Sullivan's Island and Isle of Palms. The proposed cable will be about 6000 ft. long and will cost about $66,000.

AUGUSTA, GA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 3 for the construction, complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office and court house at Augusta, Ga. Drawings and specifications may be obtained from the above office or from the custodian of site at Augusta. O. Wenderoth is supervising architect.

BRUNSWICK, GA.—The installation of an ornamental street-lighting system on Newcastle Street is under consideration. The Board of Trade is interested in the project.

CORNELIA, GA.—The Wofford Shoals Lt. & Pwr. Co., of Cornelia, expects to erect within the next six months an auxiliary plant in the town of Cornelia, and to purchase equipment for same, consisting of a 100-kw, three-phase, 60-cycle, 2300-volt generator, a kerosene-oil engine (four-cylinder type preferred), with kerosene-oil producer equipment, switchboard equipment necessary for paralleling above generator with water-power plant of same rating. J. A. Wells is secretary and treasurer.

ATLANTIC BEACH, FLA.—Preparations, it is reported, are being made by the Atlantic Beach Corpn. for the installation of a street-lighting system, covering about 3 miles of streets. Ornamental street lamps are to be erected along the boardwalk and streets as they are opened. E. R. Brackett is president of the corporation.

DE LAND, FLA.—The De Land El. Lt., Pwr. & Ice Co. expects to purchase two car loads of 40-ft., 50-ft. and 60-ft. (6-in. top) cedar poles. E. L. Hon is manager.

MAYO, FLA.—The proposition to issue $15,000 in bonds for the installation of a municipal electric-light plant will be submitted to the voters.

PULASKI, TENN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 29 for construction, including mechanical equipment, interior lighting fixtures and approaches, of United States post office at Pulaski, Tenn. Drawings and specifications may be obtained at the above office or from the custodian of site at Pulaski. O. Wenderoth is supervising architect.

BREWTON, ALA.—The managers of the municipal electric-light plant expect to make extensive improvements to the municipal electric-light plant and water-works system and to purchase new equipment for power house, including a 150-kw generator set and two pumps having a rating of 1000 gal. per minute within the next three months. J. S. Bannon is superintendent.

COLUMBIA, ALA.—The Columbia Pwr. Co. expects to install an additional water wheel (175 hp); also tungsten street-lighting system for the city of Columbia. C. P. Townsend, Jr., is proprietor.

BOONEVILLE, MISS.—The Booneville Wtr. Wks. Co. expects to erect within six months a series street-lighting system; also to purchase a 50-kw or 60-kw, three-phase, 60-cycle generator, 200 meters and some transformers.

MURFREESBORO, ARK.—J. Bickley and associates, it is reported, have been granted a franchise to install and operate an electric-light and power plant in Murfreesboro.

CROWLEY, LA.—The city of Crowley expects to purchase within the next three months a 180-hp oil-burning engine for the municipal electric-light plant.

NEW ORLEANS, LA.—Plans, it is reported, are being prepared by Leon C. Weiss, of New Orleans, for the construction of a power house, etc., for the Kenner-New Orleans Interurban Railway Co.

WELSH, LA.—Bids will be received by the Mayor of the town of Welsh until Nov. 3 for furnishing materials and equipment and construction of proposed new municipal electric-light plant, consisting of engines, generators, switchboard, street series regulators, poles, cross-arms, wire, arresters, street hoods, transformers, etc. Bids will be considered as a whole or on individual items. Plans and specifications may be obtained upon application to Anderson Offutt, consulting engineer, 439 Carondolet Street, New Orleans, La.

BOKHOMA, OKLA.—The Wilson Lumber Co. is planning to install a steam power plant in Bokhoma. The equipment, with the exception of engines and boilers, has not yet been decided upon.

MARIETTA, OKLA.—Bids will be received by the city clerk, Marietta, until Nov. 3 for extensions to the municipal water-works and sewer systems and electric-light plant as follows: For construction of approximately 10,000 ft. of 4-in. cast-iron water pipe, 10 hydrants and six valves; approximately 11,000 ft. of 6-in., 8-in. and 10-in. vitrified sewer pipe in place; 18 manholes, 12 flush tanks, seven lamp-holes and brick power house 40 ft. by 92 ft. The city will also purchase direct a 100,000-gal. tower and tank, 125 ft. high; one 225-hp, four-valve engine (200 r.p.m.); one 150-kva generator with exciter (200 r.p.m.); one standard switchboard panel, miscellaneous electrical instruments; one deep-well pump having a capacity of 100 gal. per minute, and a 15-hp motor; one 300-h feed-water heater and one boiler-feed pump. Plans and specification may be procured at the office of the Benham Engineering Co., consulting engineer, 435-437 American National Bank Building, Oklahoma City, Okla. Bonds to the amount of $35,000 have been issued for th above work.

NORMAN, OKLA.—Contract has been awarded by the Universit of Oklahoma for the erection of a central power plant, consisting o building (65 ft. by 73 ft.), concrete smokestack 100 ft. high, to b built 25 ft. higher if necessary; 12-in. steam pipes in concrete tun nels covered by concrete sidewalks; 2000 ft. of tunneling and thre boilers, to the Holmboe Construction Co., at $41,640.

VALLIANT, OKLA.—Plans are being considered, it is reported, t organize a stock company for the purpose of establishing and maintainin an electric-light plant in Valliant.

COLORADO, TEX.—The Texas Pwr. & Lt. Co., of Dallas, has pur chased the plant and holdings of the Colorado El. Lt. & Pwr. Co.

CUERO, TEX.—The City Council has granted the Cuero Lt. & Pwr Co. a new franchise for a period of 50 years. The company is contem plating the construction of a new dam and power house several miles be low the present dam; also a large steam power plant in the city for us in case of high water. The installation of a new street-lighting system i also under consideration.

PORT ARTHUR, TEX.—The Men's Civic League, it is reported, ha adopted definite plans for the installation of an ornamental street-lightin system on Proctor Street.

## Pacific States

PUYALLUP, WASH.—The City Council has authorized the light com mittee of the Council to engage an electrical engineer to prepare estimate of the cost of erecting an electrical distribution system in Puyallup Propositions for furnishing electricity for operating the proposed syste have been submitted by the managers of the Tacoma municipal electric light plant and the Stone & Webster Corpn.

SEATTLE, WASH.—Bids will be received by the Port Commissio 843 Central Building, Seattle, Wash., until Oct. 29 for the installation o light and power wiring systems for what is known as the central wate front improvement of the port of Seattle. Plans and specifications are o file in the office of the Port Commission. C. E. Remsberg is secretary.

SEATTLE, WASH.—Bids will be received by the Port Commission, 84 Central Building, Seattle, Wash., until Oct. 29 for the installation of lighting system for the east waterway improvement of the port of Seattl Plans and specifications are on file in the office of the Port Commissio C. E. Remsberg is secretary.

SPOKANE, WASH.—The Nixon-Kimmel Co., of Spokane, expect to erect within the next two months a 11,000-volt, 60-cycle transmi sion line between Umatilla and Echo, Ore., a distance of 20 mile George Nixon is president.

TACOMA, WASH.—The City Council has recently appropriate $12,000 from the light fund for the erection of an auxiliary transmi sion line between the Nisqually municipal power plant and the city sub station. Work on the erection of the proposed line will soon be started

ALBANY, ORE.—Bids will be received at the office of the supervisin architect, Treasury Department, Washington, D. C., until Nov. 26 fo construction complete, including mechanical equipment, interior lightin fixtures and approaches, of the United States post office at Albany, Ore Drawings and specifications may be obtained from the above office o from the custodian of site at Albany. O. Wenderoth is supervisin architect.

CARLTON, ORE.—The City Council has granted the Yamhill El. Co of Newberg, a franchise to construct an electric-light system in Carlto for a period of 25 years. Work will begin at once on the erection of transmission line from the hydroelectric plant in Newberg. A 24-hou service will be established.

EUGENE, ORE.—The installation of an ornamental street-lightin system on Olive Street has been authorized by the City Council. Bid for material and installation of same will soon be asked.

KLAMATH FALLS, ORE.—The Pringle Falls El. Pwr. & Wtr. Co., o Klamath Falls, contemplates the construction of a large power plant, t be located 6 miles west of here. A small power plant and lumber mil will be erected at once and will be operated while the large power station is being built. M. C. Donahue, of Klamath Falls, is president.

WHEELER, ORE.—The City Council has granted a franchise to the Wheeler Lumber Co. to install and operate an electric-lighting system i Wheeler. Work will begin at once on the installation of a distributin system.

AZUSA, CAL.—The managers of the municipal electric-light plan expect to rebuild the entire system within the next six months to comply with the state law, provided the proposed bond issue is sanctioned at th forthcoming election. H. W. Thompson is superintendent.

BIGGS, CAL.—The Oro El. Corpn., of Oroville, has been grante permission to furnish electricity to the California Rice Milling Co. in th city of Biggs.

LOS ANGELES, CAL.—A water power permit has been issued by the Department of Agriculture at Washington, granting rights to the Pacific Lt. & Pwr. Co., of Los Angeles, to operate power plants in the Sierra national forest. The company will transmit electrical energy at 150,000 volts to Los Angeles, a distance of 240 miles. This permit allows 12 years for construction. The present plans provide for the construction of four power houses, two reservoirs and 25 miles of cement line tunnels. Part of the energy developed will be used for pumping water for irrigation purposes in the upper San Joaquin Valley. Energy will be transmitted over a double steel tower line on aluminum cable.

LOS ANGELES, CAL.—The contract for general construction of a 12-story hotel building (brick and steel construction), to be erected at the corner of Fifth and Main Streets, has been awarded to the F. O. Engstrom Co., Fifth and Seaton Streets, Los Angeles, for Hart Brothers, at $350,000. The Machinery & Electrical Co., 351 North Main Street, Los Angeles, was awarded the contract for power plant, including furnishing and installing boilers, stacks and connections, engines, generators and switchboards, hot-water heater, heating and ventilation, foundations, supports and all appliances and apparatus for engine nd boiler equipment, at $74,935. Parkinson & Bergstrom, Security Building, Los Angeles, are architects.

SUTTER CREEK, CAL.—The State Railroad Commission has granted the Amador El. Lt. & Pwr. Co., of Sutter Creek, permission to issue $12,000 in bonds and 3000 shares of capital stock.

BOISE, IDAHO.—Preliminary steps have been taken by the City Council toward the construction of a municipal electric-light plant and water-works system. The city engineer has been instructed to secure data on a gravity water system and the Mayor has been authorized by the Council to take up with the federal government the proposition of acquiring power from the Arrow Rock River to generate electricity for lighting purposes.

SAFFORD, ARIZ.—The Gila Valley El., Gas & Wtr. Co. is reported to have been awarded a contract to construct an electric-light plant in Safford.

GLENDIVE, MONT.—The Glendive Ht., Lt. & Pwr. Co. expects to purchase 50 luminous-arc lamps with necessary equipment for ornamental street-lighting system. Frank C. Hughes is manager.

HELENA, MONT.—The Standard Engineering Co., Colma Building, Seattle, Wash., has applied to the City Council for a franchise to operate an electric light and power plant in Helena.

CONEJOS, COL.—The Conejos Co-operative Roller Mills & Mfg. Co. expects to purchase within the next four months one overshot waterwheel to operate under a 22-ft. head (48 second ft. of water). John Crawford is electrician.

PITKIN, COL.—The Brant Independent Mining Co., of Pitkin, is contemplating the installation of a hydroelectric power plant to furnish electrical energy for operating its mine and also to the towns of Pitkin and Ohio City. The proposed plant will be erected on Quarts Creek, where a dam and a flume is now being built to carry the water to the power plant. The present plans provide for the development of 600 hp.

## Canada

VANCOUVER, B. C.—The Dominion government has instructed H. A. Gasham, marine surveyor, to take soundings in Nodalles, Okis and Cardero channels, separating Valdez and Thurlo Island and the mainland, preceding the laying of 115 miles of telephone lines.

NEEPAWA, MAN.—The by-law authorizing an expenditure of $18,000 for extensions to the municipal electric-light system was passed recently.

TRANSCONA, MAN.—Tenders will be received by P. E. Ryan, secretary of the Commissioners of the Transcontinental Railway, at the office of the Transcontinental Railway, Ottawa, Ont., until Nov. 4 for furnishing and installing electric wiring systems required in connection with the equipment of the Transcontinental Railway car shops at Transcona, Man., about 6 miles east of Winnipeg. Plans may be seen and forms of tenders and specifications obtained at the office of W. J. Press, mechanical engineer, Ottawa, Ont., and at the office of H. H. Pinch, assistant engineer, Transcona.

FERGUS, ONT.—The Hydro-Electric Power Commission is planning to furnish energy to the towns of Fergus and Elora, the transmission line to be extended from Guelph. The cost of installing the local system in each town is estimated at $10,000.

HAMILTON, ONT.—The Hamilton By-Product Coke Ovens, Ltd., recently incorporated with a capital stock of $1,000,000, will erect a plant for manufacturing coke for smelting, foundry, industrial and domestic uses. The plant will be equipped for electrical operation and will use between 700 hp and 1000 hp per day. P. V. Burns, of the Ontario Pipe Line Co., and John G. Gauld, of Nesbit, are interested in the project.

NIAGARA FALLS, ONT.—The Ontario Pwr. Co., it is reported, is contemplating utilizing the waters of Chippewa Creek for generating electrical energy, if the project on foot to install a lock in the creek below Lyon's Creek in connection with canal system materializes.

OWEN SOUND, ONT.—The Council will soon close a contract with the Hydro-Electric Power Commission of Ontario for the development of Eugenia Falls on Beaver River. It is estimated that the falls can supply 1400 hp without storage and 4000 hp with storage facilities. The requirement of Owen Sound at the present time would not exceed 800 hp, for which a rate of $31 per hp has been quoted by the commission.

PORT HOPE, ONT.—Plans have been prepared by the Port Hope El. Lt. & Pwr. Co. for the installation of an electric street-lighting system in Port Hope, to cost about $13,000. The plans provide for the installation of 355 tungsten lamps of 60 cp, erection of 34 concrete posts and the remainder wooden poles. The contract for installation of the system has been awarded to the Midland Construction Co. of Toronto.

ST. CATHARINES, ONT.—A by-law authorizing an expenditure of $116,000 for the construction of a substation and distribution system for electricity to be supplied by the Hydro-Electric Power Commission of Ontario will be submitted to the ratepayers on Oct. 30.

TORONTO, ONT.—Plans have been submitted to the city engineer by the Toronto El. Lt. Co. for removing its overhead lines and placing its wires in underground conduits in the area between Wellesley Street and the waterfront bounded by Sherborne Street and Spadina Avenue. The cost of the work is estimated at about $2,000,000.

WINDSOR, ONT.—The Sandwich, Windsor & Amherstburg Ry. Co., of Windsor, has recently placed orders for additional switchboard equipment and for 50 meters. James Anderson is general manager.

CHARLOTTETOWN, P. E. I.—The City Council has passed a resolution offering to purchase the plant of the Charlottetown Lt. & Pwr. Co., to be owned and operated by the municipality. The price suggested is $96,000.

HULL, QUE.—The Hull El. Co. expects to erect within the next two months two 800-kva transformers and to purchase four closed single-end trailer cars within the next three months. Gordon Gale is general superintendent.

ST. JEROME, QUE.—Contracts for material and construction of the municipal electric-light plant have been awarded and the work is nearing completion. The equipment of the plant will consist of two 270-hp twin horizontal, open-flume-type Allis-Chalmers-Bullock waterwheels (277 r.p.m. under a 20-ft. head); Bell Switzerland oil-pressure-type waterwheel governors; two 150-kw, 60-cycle, 6600-volt Allis-Chalmers-Bullock generators; two switchboards, Weston instruments, Condit three-pole, single-throw oil switches, three 100-kva, single-phase, 6600-2200-volt Allis-Chalmers-Bullock transformers. The Canadian Allis-Chalmers Co. has the contract for the entire electrical equipment. S. D. Sweetnam, of Montreal, Que., is consulting engineer. E. M. Marchand is secretary and treasurer of town of St. Jerome.

## Miscellaneous

SANTIAGO, CUBA.—The Cia Electrica de Alumbrado y Traccion de Santiago expects to erect within the next 18 months a substation with an output of 600 kva, to be equipped with one synchronous motor-generator set to furnish energy for transmission at 2300 volts, three-phase, to 600-volt direct-current for tramway; also to purchase within the next 18 months automatic stokers for nine Babcock & Wilcox boilers, one new open feed-water heater with meter; also flow meters for nine boilers; also material for 12 miles of 2300-volt, three-phase transmission line, equal amount of 0000 trolley wire and feeder cables. Within the next 24 months the company expects to purchase one additional 1000-kw, 2300-volt turbo-generator and one 500-kw synchronous motor-generator set, switchboard equipment, including turbine panel, motor-generator panels and additional alternating-current and direct-current feeder panels to be added to the present switchboard. M. B. Puente is general manager.

HILO, HAWAII.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 15, 1914, for construction complete, including mechanical equipment and approaches, of United States post office, custom house and court house at Hilo, Hawaii. Drawings and specifications may be obtained at the above office, at the office of Henry D. Whitfield, architect, 160 Fifth Avenue, New York, N. Y., or from the custodian of the site at Hilo, Hawaii. O. Wenderoth is supervising architect.

# New Incorporations

MOORES, N. Y.—The Mooers El. Lt. Co. has been incorporated with a capital stock of $5,000 by H. W. Knapp, Minnie L. Knapp and T. E. Filmore, all of Mooers.

COSHOCTON, OHIO.—The Ohio Service Co. has been incorporated by Frank E. Pomerene, Robert G. Thompson, K. K. Garrett, H. S. Lebarger and L. A. Smith. The company is capitalized at $30,000 and proposes to generate and distribute electricity.

STRANG, OKLA.—The Grand River Pwr. & El. Co. has been incorporated with a capital stock of $5,000 by H. C. Holderman, E. L. Stegall and Maude A. Holderman. Post office address is Lynch.

WHITE SULPHUR SPRINGS, W. VA.—The Allegheny Pwr. Co. has been chartered with a capital stock of $25,000. The incorporators are: A. E. Huddleston, Edward M. Haynes and others.

SALABERRY, QUE., CAN.—The Valley Field Wtr. Pwr. Co. has been incorporated with a capital stock of $1,000,000.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED OCT. 14, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,075,362. ELECTROLYTIC CELL; C. W. Marsh, Greenwich, Conn. App. filed April 10, 1911. Diaphragm type intended for decomposition of chlorides of sodium and potassium.

1,075,363. ELECTROLYTIC CELL; C. W. Marsh, Greenwich, Conn. App. filed Jan. 15, 1912. Diaphragm type for electrolysis of alkali-metal chlorides.

1,075,364. ELECTROLYTIC CELL; C. W. Marsh, Greenwich, Conn. App. filed Jan. 15, 1912. Has pervious cathode and diaphragm flexed to provide recesses communicating with the anode compartment.

1,075,365. ELECTRIC LAMP ATTACHMENT; W. P. McNeel, San Antonio, Tex. App. filed April 23, 1912. Lamp-dimming switch attachment.

1,075,402. VAPOR-ELECTRIC DEVICE; F. P. Coffin, Schenectady, N. Y. App. filed Jan. 25, 1913. Rectifier with cathode chamber insulated from the main arc chamber.

1,075,404. IMPEDANCE DEVICE FOR USE WITH CURRENT RECTIFIERS; F. Conrad, Swissvale, and Y. Sakai, East Pittsburgh, Pa. App. filed Jan. 10, 1912. By which rectifier may be caused automatically to charge widely varying numbers of cells of storage battery.

1,075,421. ELECTRIC SIGNALING SYSTEM; R. M. Hopkins, New York, N. Y. App. filed Jan. 27, 1913. Current of minimum strength normally maintained in the signal circuit is increased sufficiently to operate the signal instrument.

1,075,423. TELEPHONE HAND SET; R. R. Ireland and A. F. F. Gilson, East Orange, N. J., and Closter, N. J. App. filed April 1, 1913. Supporting member with the transmitter properly positioned at one end and the receiver at the other end, and with the switch mechanism housed intermediate to the ends.

1,075,430. TELEPHONE EXCHANGE SYSTEM; F. R. McBerty, New Rochelle, N. Y. App. filed July 23, 1910. Automatic selectors whereby various kinds of lines, such as ordinary and private branch exchange lines, may be interconnected.

1,075,436. ELECTRIC HEATER; W. O. Peale, Pittsburgh, Pa. App. filed March 13, 1911. "Batch heaters" for candy making; plurality of heater units one above the other, with a reflector for each unit.

1,075,441. ELECTROMAGNETIC RETAINING DEVICE; G. Rekers, Rochester, N. Y. App. filed March 31, 1911. Overcomes liability of retaining device becoming "locked" in retaining position when the energizing current ceases.

1,075,445. CONTROLLER FOR ELECTRIC MOTORS; H. A. Steen, Pittsburgh, Pa. App. filed Jan. 3, 1910. Contact arm moved rapidly from one point to the next, and at same time a time element is introduced whereby motor is gradually accelerated.

1,075,452. DYNAMO-ELECTRIC MACHINE; H. Weichsel and S. T. Webster, St. Louis, Mo. App. filed June 15, 1912. For starting gas engine from a storage battery and serving as generator when motor is running.

1,075,462. SYSTEM OF TRAIN CONTROL; J. L. Crouse, Pittsburgh, Pa. App. filed Dec. 21, 1910. Controls the two locomotives on a train concurrently through the releasing of the air brakes on the forward engine.

1,075,463. LAMP SOCKET; J. Darby, Summit, N. J. App. filed March 12, 1910. Pull socket with special pawl and ratchet-operating mechanism.

1,075,470. RAILWAY-MOTOR VENTILATION; J. D. Forrer, Pittsburgh, Pa. App. filed Sept. 12, 1910. Introduces the cooling air through the gear case.

1,075,472. ELECTRICALLY HEATED STOVE UNIT; W. S. Hadaway, Jr., East Orange, N. J. App. filed June 28, 1909. Lids of different heating capacity which may be applied to the same stove base.

1,075,473. ELECTRIC SOLDERING IRON; W. S. Hadaway, Jr., East Orange, N. J. App. filed April 10, 1911. Incased tubular heater which fits snugly into tapered receiving member.

1,075,475. INCANDESCENT LAMP; R. H. Henderson, East Orange, N. J. App. filed Feb. 3, 1911. Provides a guard for the hook which supports the filament and after applying the filament removes the guard.

1,075,479. GALVANIC CELL; M. L. Kaplan, Brooklyn, N. Y. App. filed May 20, 1913. Contains sesquihydrated manganese peroxide as a depolarizing agent.

1,075,484. ARC-LAMP ELECTRODE; G. M. Little, Pittsburgh, Pa. App. filed Jan. 5, 1907. Contains iron oxide and potassium silicate.

1,075,485. TELEPHONE PAY STATION; G. A. Long, Hartford, Conn. App. filed Feb. 19, 1912. Prevents operation of signal until toll for the message has been paid.

1,075,497. ELECTRIC SOLDERING IRON; E. E. Rose, Pittsburgh, Pa. App. filed April 10, 1911. Tapered soldering tip frictionally held in tapered sleeve within the heater unit.

1,075,502. COMMUTATOR FOR DYNAMO-ELECTRIC MACHINES; T. S. Scott, Pittsburgh, Pa. App. filed Dec. 14, 1908. Clamping rings for the commutator segments consisting of convolutions of steel wire.

1,075,503. TELEGRAPH TRANSMITTER; C. E. Scribner, Jericho, Vt. App. filed Sept. 8, 1911. Printing telegraph transmitter for system with two main-line conductors and ground return.

1,075,504. TELEGRAPH TRANSMITTER; C. E. Scribner, Jericho, Vt. App. filed Nov. 28, 1911. Transmitter capable of sending plurality of characteristic impulses, with a controlling relay for each characteristic impulse.

1,075,517. ELECTRICAL HEATER ELEMENT AND METHOD OF MAKING THE SAME; H. B. Taylor, Wilkinsburg, Pa. App. filed Oct. 13, 1909. Threads insulated conductor through metal tube and then subjects assembled parts to high pressure.

1,075,539. CASING FOR INCANDESCENT ELECTRIC-LAMP SOCKETS; C. H. Bissell, Syracuse, N. Y. App. filed Feb. 18, 1911. Multiple lock between shell and cap.

1,075,542. TRAIN ANNUNCIATOR; S. C. Bryant, Chicago, Ill. App. filed, March 3, 1911. To notify operator in a signal tower of the approach of a train.

1,075,556. BATTERY; W. H. Fenoughty, Belleville, Ill. App. May 12, 1913. Casing with springs which make the proper connections by the simple insertion of the cells into the casing.

1,075,563. METAL FILAMENTS; C. A. Hansen, Schenectady, N. App. filed July 9, 1906. Squirtable mixture consisting of an of tungsten, starch, glycerine and glucose.

1,075,570. ELECTROLYTIC CELL; A. H. Hooker, Niagara Falls, N. App. filed Feb. 26, 1912. High-amperage cell for the electrolysis alkali-chloride solutions.

1,075,573. TRANSFORMER BUSHING AND TERMINAL; S. E. Johannesen, Pittsfield, Mass. App. filed Feb. 6, 1912. Terminal board having a bushing adapted to project through the wall of a transformer casing.

1,075,579. MOTOR STARTER; C. D. Knight, Schenectady, N. App. filed Nov. 12, 1908. Resistance in secondary circuit automatically reinserted in the secondary circuit upon opening of primary circuit; primary circuit cannot be closed until all sistance is inserted in the secondary circuit.

1,075,609. ELECTROLYTIC CELL; G. W. Stone, Niagara Falls, N. App. filed March 6, 1911. Anode chamber with non-pervious facing; separable cathode chambers.

1,075,612. MEANS FOR FASTENING ELECTRIC LAMP SOCK W. C. Tregoning, Cleveland, Ohio. App. filed June 5, 1911. M yoke engages enlargement on socket base to clamp same to

1,075,613. SOCKET AND TERMINAL CONNECTION FOR TRIC LAMPS; W. C. Tregoning, Cleveland, Ohio. App. filed 5, 1911. Special T-shaped terminal.

1,075,614. IMAGE-TRANSMITTING TELEGRAPH; L. Vienna, Austria-Hungary. App filed June 27, 1910. Making breaking of the circuit alternately actuates the reproducing and means which produce relative movement between the rec surface and reproducing means.

1,075,615. VAPOR-ELECTRIC DEVICE; E. Weintraub, Lynn, App. filed April 3, 1911. Has means to prevent the arc being in the space between the inner and outer envelopes.

1,075,634. PROCESS FOR THE PRODUCTION OF REFRACT ELECTRICALLY CONDUCTING MOLDED BODIES Berlin, Germany. App. filed June 25, 1912. Heats m bon and silicon in atmosphere of carbon nonoxide to obtai heats same in the presence of carbon to reduce the SiO

1,075,660. ELECTROLYTIC CELL; C. W. Marsh, Green App. filed April 18, 1913. Has plurality of superpose chambers provided with opposite lateral openings for r electrodes.

1,075,683. ELECTRIC-MOTOR DRIVE; C. C. Batchelder, Schene N. Y. App. filed June 23, 1909. Parts of paper-making machine are driven at the different requisite speeds by motors with frequency changers connected between the several and alternating-current buses.

1,075,717. WHEEL STRUCTURE; R. MacRae, Chicago, Ill. App Feb. 26, 1912. Driving motor is carried within the wheel.

1,075,713. ELECTRODE; J. L. R. Hayden, Schenectady, N. Y. filed May 12, 1912. Contains cerium titano-fluoride and titano-fluoride.

1,075,733. PRESSURE-OPERATING DEVICE; A. Simon, Milwa Wis. App. filed Nov. 4, 1909. Upon occurrence of abnormal ditions, the pressure device automatically operates the rheos insert sufficient resistance to protect the motor.

1,075,749. CIRCUIT-BREAKER; C. C. Badeau, Bethlehem, Pa filed Aug. 11, 1908. Protecting switch in which one of the terminals, the magnet coil and a switch member are formed flexible strip of metal.

1,075,768. ARC-LAMP ELECTRODES; F. R. Crane, Jr., Chicag App. filed March 31, 1913. Composed of comminuted carbon ash, cast-iron filings, metallic magnesium and a clay binder.

1,075,775. WAX MELTING AND SEALING DEVICE; M. Fe and G. H. Jackson, La Rochelle, France. App. filed Nov. 1, Special arrangement of heat-conducting bodies.

1,075,786. APPARATUS FOR PRODUCING AND UTILIZING M MOVEMENTS IN WEAK CURRENT TECHNICS. J. A Copenhagen, Denmark. App. filed April 11, 1911. Press coil suspended from a resilient bar secured in axis of the p electromagnet with a strong current.

1,075,799. CONTROLLING CAM; C. M. Walker, Pueblo, Col. filed Feb. 26, 1912. For centering the pivotal arm of the without the use of springs.

1,075,873. APPARATUS FOR BLEACHING AND FOR PRET BLEACHING, DEODORIZING AND DISINFECTING TIONS; O. Summer, St. Margaret's-on-Thames, England. A April 22, 1913. Tapered chamber within tank; electrode in and one in the tapered chamber.

1,075,882. INDICATOR AND POWER DEVICE THEREFOR; and M. E. Walters, Los Angeles, Cal. App. filed Aug Hidden electromagnet rotates a visible indicator.

1,075,897. ELECTRODE; R. N. Chamberlain and S. J. Hall, and Hinsdale, Ill. App. filed Dec. 6, 1912. Of hollow const

1,075,953. ELECTRIC LAMP SWITCH; J. A. M. Traus, Netherlands. App. filed Jan. 24, 1911. Liquid contact maker op by a cam.

1,075,955. DOOR-LOCK SWITCH; G. Wright, Schenectady, and Ball, New York, N. Y. App. filed Feb. 19, 1908. Lights turn when door is locked from the outside.

1,075,978. DENTAL WATER FILTER AND HEATER; C. Joer and A. E. Joerin, Detroit, Mich. App. filed May 8, 1913. H of water under control of user.

1,075,986. ELECTRIC SWITCH; J. F. McElroy, Albany, N. Y. filed Sept. 16, 1909. For controlling an electric heater in the of electric railway cars.

1,075,987. AUTOMATIC CONTACTING DEVICE; F. McM Union City, Ind. App. filed May 22, 1911. For charging batteries when dynamo has reached predetermined speed; fo on autos, etc.

# Electrical World

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**Security for Short Loans**

The effect of a "general memorandum" issued by the Board of Public Utility Commissioners of New Jersey in regard to the practice of corporations in pledging bonds as collateral security for short-time loans appears to be that if bonds are legally usable as collateral security in this way, such use constitutes a formal "issue" under the statute and requires an authorization by the board. A borrower does not usually contemplate the possibility that his collateral may so depreciate in value as to endanger the lending bank's margin of security. Similarly he does not feel that the bank may call his loan at a time of depression when other sources of money are closed to him or when a forced sale of his collateral may yield too little to meet his debt. However, in such contingencies, remote as they look to public utility corporations, bonds deposited as collateral security for short-term loans might reach eventually the public market, where their "issue" under formal authorization by the regulating commission would be assumed. No company, of course, would want to have any question raised in regard to the legality of issue of its securities, and naturally no bank would want to have any doubt cast upon the subject, so that the issue raised by the New Jersey commission is important, not only in that State but in other sections of the country as well. The necessity for short-time loans may arise suddenly, as in the event of a catastrophe, and the machinery of the commission should not be allowed to hamper companies in the effort to secure funds to provide service. This possible difficulty could be overcome if all companies could secure sanction in advance for the issue of bonds and could then hold them in the treasury awaiting the emergency or need. Such a plan, however, has a flaw because regulating commissions exercising authority under the broad laws to which we are now accustomed cannot well approve securities until they know the purposes for which the proceeds are to be used. An alternative plan is for the companies to try to prevail on the banks to take their short-time notes without collateral security.

**Industrial Research**

About a decade ago the great advantage to be derived from bringing the scientist directly to the manufacturer's workshop, provided this could be done in the proper spirit, became evident, and the institution now well known as the industrial research laboratory has gradually become firmly established. There are those who still maintain, and no doubt correctly, that the world's greatest discoveries came from independent investigators working alone, often amid great hardship, driven on by the fire of their own enthusiasm and complete absorption in one idea. Be that as it may, the industrial laboratory has now to its credit some remarkable achievements, which would do honor to any university investigator. It is also worth noting that these achievements are due in great measure to that broad directorship over research work which, while not imposing irksome restrictions, guides it toward useful ends. The production of the drawn-wire tungsten filament and the nitrogen-filled tungsten lamp, recently described by Dr. Irving Langmuir before the American Institute of Electrical Engineers and by Mr. L. A. Hawkins before the New York Electrical Society, are two noteworthy achievements to the credit of the research department of an electrical manufacturing company. While such spectacular results bring great credit to industrial research in general and to this department in particular, it seems to be a fact nevertheless that such departments represent an excellent investment even when measured by the value of their day-to-day services of a minor character rendered to a great industrial organization. The competition of industrial laboratories is acting with a healthy stimulative effect on university laboratories in which alone was formerly conducted all scientific research work, although the two are in many respects non-competitive, at least in the sense that the objectives are usually dissimilar. Announcements of university bequests to be devoted to research are made with more frequency than formerly, and the ultimate consumer may well congratulate himself upon the distinguished efforts that are being made in his behalf.

**Utilization of Low Hydraulic Head**

The account in this issue of the hydro-electric development on the Auglaize River is worthy of comment by reason of the rather difficult conditions of the hydraulic development. The utilization of a low head in a flat country is always troublesome. In this particular case the plant is in the flood region of Ohio and the dam and headworks were actually washed away in the great floods of last spring after the plant had been running for a few months. The present dam raises the water sufficiently to produce a head of 26 ft., which is fairly high for that part of the country. The flowage of the stream will be increased by some of the government works now nearing completion, and conditions are expected to be such as to enable some 40 per cent of the station equipment to be utilized at all times, while for most of the year the 5000-kw equipment can be fully utilized. In the power house of this plant use has been made of vertical turbines, as is frequently advantageous in low-head working. The arrangement of these units is somewhat unusual in that the weight of the rotating part is carried not by a step bearing but by a bearing hung at the top, there

being merely guide bearings below. In some respects the arrangement is advantageous on account of the great ease with which the bearings can be inspected and cared for. They are lubricated by oil under pressure and cooled by water. From the general standpoint of economy it is rather striking to find in a country of cheap coal a low-head plant like this in successful operation. We may be reasonably sure that from the strictly commercial standpoint the plant promises success in spite of the low head, the variable flow and the competition of cheap fuel. The fact is that a hydraulic plant economically installed and operated for profit can at the present time actually hold its own under conditions which a few years ago would have been deemed prohibitive.

## Electric Traction and Safety

Theorize as one may about the more remote causes lying back of the numerous recent railway disasters, it still remains unpleasantly plain that the true causes have not been removed effectively. The latest addition to the list of wrecks is alleged to have been due to a broken rail, a conclusion doubtless correct so far as it goes. When one pauses, however, to inquire into the things that lie behind broken rails, dangerous switches and rear-end collisions some facts appear which are often not taken into consideration. It is well known that there has been a tendency to use rails too hard to resist shocks adequately—rails deliberately hardened to increase the wearing properties to a point utterly condemned under oath by one of the great railmakers giving testimony after a disaster. Bad switches have had their share of responsibility, switches good enough for moderate speeds but unsuitable for the traffic to which they were subjected, and there has been, too, a wholesale disregard of signals so far as fact and fancy in the evidence have been disentangled. Dead engineers tell no tales, and in some instances it never will be known just what really did happen, but there are certain features which we believe are worth attention from the standpoint of the electrical engineer.

With an electric locomotive which has practically all its weight on the drivers and the minimum of reciprocating parts, we believe it is a well-demonstrated fact that the maximum tractive power is secured with the minimum of pounding and bending of the rails. A very heavy electric locomotive is as bad as any other in the matter of mere weight, but for equal drawbar pull it has the advantage in strains imposed upon the track. In other words, in drawing a given train at given speed a well-designed electric locomotive should increase the factor of safety in the rail and decrease the chance of breakage either from direct fault of the rail or from fault of the underlying roadbed. The power of acceleration in an electric locomotive, due to the very large torque instantly available, makes it easier to run slowly at hazardous spots without losing time than is true with the steam locomotives. This feeling does not insure in itself safe operation, but it makes safe operation easier. Electric operation lends itself very readily to an absolute block system in which no train can find motive power within an occupied section. Safety systems of this kind can be put into service on any electrified system when the necessity for them is made evident, as it has been in the last few months. These facts furnish good reasons for the more general use of electric traction on trunk lines. Sufficient carelessness, neglect and mental obtuseness can make any system of motive power dangerous, yet, on the other hand, the fewer adverse conditions there are to contend with the less the danger is likely to be.

A matter which deserves to be investigated is the adequacy for present-day operation of block-signal systems installed some years ago. As trains have become heavier and speeds have been increased the braking distance within which the train can be certainly stopped has correspondingly increased. There is less leeway in case of running by a signal than there used to be, and hence the degree of caution once adequate is no longer sufficient. This fact of itself points to the need of a system of traction which readily permits the automatic holding up of a train which runs by a signal whether the engineer sees the signal or not. Even if the engineer is reasonably watchful, he may not always catch promptly the signal set against him, and if, as sometimes happens, he relies upon the fireman to look for signals, the latter from exposure to the glare of the furnace may be quite unable to see them in time. It may be practicable to apply an automatic stop system to steam locomotives; some engineers believe it can be done. It is, however, perfectly well known that an automatic stop system acting to cut off the supply of energy can be successfully used in the case of an electric train. The plainest considerations of caution point to the advantages of electric traction, and it is to be hoped that the terrific lesson of the year 1913 will not be wasted.

## Testing Shunt Instrument Transformers

The introduction of instrument transformers has been of great aid to electrical testing, but it has also brought about a need for the careful testing of such transformers themselves, since otherwise large errors might creep in through defects in their calibration. An instrument transformer possesses both a ratio and a phase angle. In some cases only the ratio needs to be measured and taken into account, but in other cases the effect of phase distortion accompanying the use of the instrument may be considerable. The testing of instrument transformers calls for a relatively higher degree of precision than ordinary ammeter or voltmeter tests, so that they are frequently dismounted and sent to special laboratories for test. Not only is this an inconvenience, but it is often important that such transformers should be tested locally in place, with their own leads and accessories.

In the article on page 898 Mr. H. B. Brooks describes a simple and ingenious method of testing any new instrument transformer against a standard transformer of the same type when a source of polyphase currents, and particularly of two-phase currents, is available, as is ordinarily the case, and when a suitable alternating-current wattmeter is at hand. The method depends essentially on measuring small differences in opposed alternating secondary voltages and theoretically calls for a voltmeter of very low range

but not too low resistance, to measure these residuals. The ordinary voltmeter is well known to be of little use at very low range, but by separately exciting the voltmeter—that is, by using a wattmeter of suitable range with a steady current in the series coils—it becomes converted into a low-range voltmeter for detecting fractions of a volt. The method is so simple and so easily applied that it deserves to be made widely known.

## Railroad Coach Lighting

The extensive and carefully conducted tests on day-coach lighting made during the past summer under the auspices of the committee on illumination of the Association of Railway Electrical Engineers and reported at that association's recent convention confirm previous results of tests on the lighting of various interiors and afford a striking commentary on the inefficiency of certain very common methods of steam railway car lighting as compared to the efficiency of other methods which are better in appearance and more comfortable to the passengers. With test results reduced to an equal basis of 66.6 lumens per running foot of car, there was a difference between the systems tested ranging from 2.42 ft.-candles for the most efficient translucent reflector equipment down to 1.03 ft.-candles for the least efficient of the lamp equipments tested.

It is gratifying to know that the bare lamp which obtrudes itself so atrociously in the vision of passengers on many cars is next to the bottom of the list in efficiency. Since it is both inefficient and uncomfortable, railway managements can no longer have excuse for continuing its existence. The standard square diffusing shade regularly used in sleeping cars also makes a very poor showing with only 1.35 ft.-candles. This equipment has always afforded a striking example of lack of attention to illuminating engineering with consequent loss of money to the operating company and a loss of illumination for the use of the passengers in such cars. Clear prismatic reflectors head the list at 2.42 ft.-candles, with heavy density opal reflectors a close second at 2.14 ft.-candles. The latter, on account of their ease of cleaning when of proper design, should find extensive use in railway car lighting. As might be expected, the highest efficiency was always obtained with bowl-shaped reflectors open at the bottom. All attempts to close the bottom of such reflectors with diffusing bowls have been unsatisfactory on account of the decided loss of efficiency.

The tests show that there is no practical difference in the measured illumination obtained with the center-deck and side-deck systems of lighting. In the center-deck system the lamps are placed in a single line along the center of the car. In the side-deck system one row of lamps is placed over each row of seats. However, the center-deck system has important advantages in lower cost of lamp renewals and cleaning and the use of larger and more efficient lamps. To avoid bad shadow effects it is found that lamps must be spaced opposite every two pairs of seats with either system where direct lighting is employed. With indirect or semi-indirect lighting, which, of course, is applicable to only the center-deck system, the spacing can be every three seats. It is interesting to note that both these latter systems in the tests gave higher efficiency than did the bare lamp. Thus, the most comfortable system for the eye under these specific conditions consumes less electricity than the most uncomfortable system. With such authoritative results before them, American railway managements can no longer have an excuse for the continuance of the inefficient lighting arrangements that have been too common in the past. The facts of the matter are that details of car-lighting fixtures in the past have too frequently been determined in an offhand way with the minimum of consideration by some official of a railroad who is unaware of the great differences in comfort and efficiency with the different lamp and reflector equipments available. It is a condition similar to that formerly existing in other fields of illumination. Fortunately, adequate excuse for the continuation of such conditions is rapidly vanishing.

## Short-Circuited Turns in Radio-Telegraph Circuits

The mathematical solution stating the reaction of overhanging turns of inductances in radio-frequency circuits which Mr. Louis Cohen describes on page 899 of this issue is interesting in that it affords a theoretical and conciliatory confirmation of some qualitative experimental observations which have at times appeared in contradiction. It has often been noted that the action of short-circuiting portions of coils carrying high-frequency energy would reduce the current flow for constancy of other conditions. This has generally been blamed upon a direct $I^2R$ loss in the short-circuited turns, though a number of radio engineers seem to have recognized the presence of a marked reduction in current due to a detuning effect caused by reduction of effective inductance on account of reaction of current in the closed secondary. The author in effect covers both these points by considering the current present after short-circuiting the secondary, and again after retuning the system "as a whole." While his results have not been quantitatively confirmed by other investigators, and although he quotes none of his own experiments in this direction, the general deductions from his theory seem to agree with practice.

A point not considered is the change brought about by the introduction of a natural period, in either the main coil or its short-circuited portion, approximating the period of excitation. The reactions in the several possible cases offer a pretty problem, since the self-resonant frequencies must change with every alteration of self-induction or mutual induction in or between the several parts of the coils considered. Phenomena which at first blush appear very curious, but which a little consideration usually explains satisfactorily, often occur in measuring large inductances at very high frequencies, owing to the similar natural frequencies of the coils under observation. If a complete analysis of these cases were presented, it is conceivable that the conclusion therefrom would be useful in the design of coils for actual radio-signaling.

# The News of the Week

**Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.**

## November Meeting, A. I. E. E.

A meeting of the American Institute of Electrical Engineers will be held in the Engineering Societies Building, New York, Nov. 14, at 8:15 p. m. The general subject of the meeting will be "Electrical Equipment of Gasoline Automobiles." Three papers will be presented as follows: "Dynamo Electric Lighting for Motor Cars," by Mr. Alfred E. Waller, Bronxville, N. Y.; "Advantages of Clutch Type Generators and of Separate Starting and Lighting Units for Motor Cars," by Mr. Alexander Churchward, New York, and "Electrical Equipment of Gasoline Automobiles," by Mr. Frank Conrad, Pittsburgh. The members of the Society of Automobile Engineers have been invited to participate in the meeting.

## Society for Electrical Development

The campaign committee of the Society for Electrical Development, of which Mr. W. E. Robertson, of Buffalo, N. Y., is chairman, has enlisted the services of the salesmen employed by a large number of its members. These men, with the consent and co-operation of their companies, will devote the greater part of their time during November, which will be known as "pioneer month," to securing members for the society. It is estimated that the efforts of about 1500 men will be in this way put forth in behalf of the society during November. The total amount of funds pledged to the society's work is approaching $150,000, and it is believed that through this effort the $200,000 required will be available in December. The society now has members in every state in the Union except Maine, Delaware and North Dakota. The total membership at present approximates 700. This number doubtless will be considerably increased as the result of the special campaign now in progress. The society has issued in pamphlet form the address on "Electrical Co-operation" read by Mr. James H. Collins before the Jovian Congress at New York City on Oct. 16. Mr. Collins, whose articles on business problems are familiar to readers of the *Saturday Evening Post*, has stated the advantages of membership in the society in a broad and convincing manner. A brief abstract of his address appeared on page 829 of our issue dated Oct. 25.

## Utah Power & Light Case Still Undecided

No decision has yet been rendered by the United States Circuit Court of Appeals in the appeal from the decision of Judge J. A. Marshall of the United States District Court of Utah, in a test case charging the Utah Power & Light Company, of Salt Lake City, with trespass in constructing a flume and reservoir in the Cache National Forest in Utah. The company constructed a flume and reservoir on government land which in 1902 was withdrawn from entry. The company relies upon the act of Congress enacted in 1886 granting right-of-way over government lands and further contends that the State's right of eminent domain over public lands is superior to the federal government's interest as a proprietor. The government holds that the act of 1886 has been virtually repealed and that the Department of Agriculture is authorized to withdraw land from entr and forbid its use for water-power purposes. The Unite States District Court dismissed the bill of complaint agains the company by the government, and the decision of th United States Circuit Court of Appeals at Denver, Col., i awaited with interest as the issue involves the rights of th national and of the state government over public lands and fees estimated at from $1,000,000 to $2,000,000 durin the next ten years are contingent upon the outcome. Ver many similar instances in mountain and Pacific Coas states are awaiting determination.

## National Conservation Congress to Meet at Washington

The fifth National Conservation Congress will be hel at Washington, D. C., Nov. 18, 19 and 20. In the notice sent out it is intimated that in the next few months th fight for the protection of the country's forests and wate ways will command the attention of the nation. Dire reference is made to the prospect of a series of fights state legislatures, which crystallizes the suspicion that th question of state rights is to play an important part in th coming combat. The officials of the Conservation Congre are concerned over activities in the West in the interest state ownership and control of the national forests an waterways. So great is the clamor in some circles that it understood that the conservation interests realize the im portance of definite steps to prevent the states from wres ing the control of these resources from the federal gover ment.

## Electricity Used by Government to Build Hu Irrigation Project in Montana

The Sun River Valley in Montana is now entering up an era of electrical development which is to hasten t completion of one of the government's huge irrigati projects.

Seventy miles of transmission line have been built, e tending from the Rainbow Falls hydroelectric plant of Great Falls Power Company on the Missouri River weste through the entire length of the valley to the base of mountains where the principal diversion dam is now u construction across Sun River. The electrical ene transmitted at a voltage of 110,000, is stepped down at thi transformer stations, from which it will be distributed the principal features of the work. It is now being used the Sun River diversion dam, operating pumps and air c pressors, concrete mixers and derricks and in lighting construction camp and the site of the work. The gov ment is constructing a distribution transmission line a the Pishkun Reservoir and the Sun River Slope cana distance of 44 miles.

The contract for the excavation of the main canals laterals has been awarded and the contracting compan having special shovels and drag-line scrapers designed constructed for the work. All power machinery on work will be actuated by electricity, including the air c pressors on the tunnel work. It is believed that a c

iderable reduction of cost and time will be accomplished.

The power company is bound by the contract to extend he present trunk transmission line 30 miles when required y the United States at right angles entirely across the roject. This will make available at the outset electrical nergy for each of the towns now on the project and the onsiderable number of new towns already projected along he three new lines of railway which are being constructed cross the project, giving them cheap energy for manufacuring and allied uses. The Sun River project involves ome of the largest features of construction work yet ndertaken by the Reclamation Service.

## Standardized Plugs and Receptacles

The committee on wiring of existing buildings of the Commercial Section of the National Electric Light Assocition, of which Mr. R. S. Hale, of Boston, is chairman, s soliciting engineering, manufacturing, insurance and ommercial opinions on the feasibility of standardizing lugs and receptacles. Should standardization be desirable, he committee would like to know how many sizes should e standardized, what should be the limits of demarkation etween the different sizes, what steps should be taken to nake the standardization effective, and the best methods o follow in eliminating non-standard plugs and receptacles rom all future wiring work.

## New York Edison School Term Opens

With eighteen special speakers secured for the term, mong them many well known educators and "specialists," ll arrangements have been completed for the 1913-14 ourses of the Commercial School of the New York Edison Company at the Edison Auditorium, which began on Oct. 7. Dr. Hugo Munsterberg, the Harvard psychologist, the Rev. John Haynes Holmes and Dr. C. P. Steinmetz appear n the list, as do also the names of Mr. Walter Dill Scott, irector of psychology at Northwestern University; Dr. ames J. Walsh, Mr. John H. Patterson, of Dayton; Dr. Henry C. Metcalf, Mr. E. St. Elmo Lewis, Dr. Lee Galloway, Dr. Woods Hutchinson, Dr. Luther Halsey Gulick, Messrs. T. C. Martin, C. A. S. Howlett, S. Roland Hall, H. . Holmes, E. J. Mehren and A. L. Pelton. Seven different ourses have been arranged this year by Mr. F. C. Henderchott, director of the school. Each course touches a different phase of work of a public service corporation, and ach is composed of a series of from six to nine lectures ith examinations. Four courses are arranged for first-ar students and three for second-year students. All employees of the commercial department must attend the hool.

## Meetings of the Philadelphia Section, I. E. S.

On the evening of Oct. 17 the Philadelphia Section of the Illuminating Engineering Society held a joint meeting vith the Photographic Society of Philadelphia at the Engiers' Club, following a dinner for the members and guests. A paper by Mr. F. M. Steadman, entitled "A Simple Unit Method for Measuring the Intrinsic Actinicity of Flames and Surfaces for the Practice of Photography," was presented by Prof. A. W. Goodspeed, following which Mr. William J. Serrell presented a report of the recent Pittsburgh convention. A bank of lamps used by photographers in taking pictures under artificial light was exhibited and was described by Mr. Calvert. The photographic lenses on exhibition were described by Mr. George H. Hulse.

The following program has been arranged by the society for the coming season:

On Nov. 30 there will be a joint meeting with ophthalmologists of Philadelphia at the College of Physicians and Surgeons. Dr. Edward A. Shumway will present a paper on "Some Effects of Artificial Light Upon the Eye." Dr. George S. Crampton will discuss "The Effect of Mercury-Arc Lamps Upon the Eye," and Prof. Arthur J. Rowland will discourse on "The Lighting of a Private Library."

On Dec. 8 a joint meeting with the Philadelphia Section of the American Institute of Electrical Engineers will be held at which the following papers will be presented: "Brightness Measurements Versus Illumination Measurements," by Dr. Herbert E. Ives; "Railway Car Lighting," by Mr. George H. Hulse, and "The Mercury Quartz-Tube Lamp," by Mr. Buckman.

On Jan. 6 Prof. C. E. Ferree will address the society on the "Deficiencies of the Method of Flicker for the Photometry of Lights of Different Colors."

On Feb. 7 a meeting will be held under the auspices of the Drexel Institute, and President C. O. Bond, of the Illuminating Engineering Society, will speak on "Light and How to Use It."

On Feb. 18, when a joint meeting will be held with the Franklin Institute, Dr. Herbert E. Ives will present a paper on "Artificial Daylight."

On March 20 Mr. F. D. Bartlett will present a paper on "Lighting and Signaling Systems of Subways," and Prof. James Barnes will discuss "The Sun—the Master Lamp."

On April 9 at a joint meeting with the Franklin Institute Past-president Preston S. Millar will address the meeting on "Recent Developments in the Art of Illumination."

On April 18 two papers will be presented: "The Structure of the Normal Eye and Its Ability to Protect Itself Against Ordinary Light," by Dr. Wendell Reber, and "Glassware for Illumination and Other Purposes," by Mr. James Gillinder.

The season's work will close with a mass meeting of all the engineering societies of Philadelphia and vicinity, to be held on May 15. Arrangements are being made for a special program in which is included an address by Dr. Charles P. Steinmetz on "The Relation of Engineers to the Progress of Civilization."

## Census Records of the Electrical Industry in 1909

Statistics on the electrical industry in the United States for 1909 have been given out by the Census Bureau. The figures cover only strictly electrical products and do not include the manufactures of wood or iron poles, glass or porcelain insulators, bare iron or copper wire, or any electro-chemical or electro-metallurgical products. There were engaged in the manufacture of electrical machinery apparatus and supplies in the United States in 1909 a total of 1009 establishments, employing altogether 105,600 persons, of whom 102,950 were wage earners.

The total capital invested in the industry as restricted above was $267,844,432 and the value of the products for that year totaled $221,308,563. The industry is largely centralized in the States of New York, Pennsylvania, New Jersey Massachusetts, Illinois and Ohio, ranking in the order named. Of the states named, New Jersey made the greatest gain over figures for the year 1904, and Michigan, while ranking low in total number of persons employed and in value of products, showed the largest gain of any state over the figures for the last census. More than two-thirds of the total number of concerns engaged in the manufacture of electrical products in 1909 were incorporated and the value of the product turned out by the corporately owned part of the industry was 96.7 per cent of the total for that year.

There were 13,882 direct-current and 2309 alternating-current generators built in 1909, with an aggregate value of

$13,081,048 and an average rating of 84 kw. Transformers numbering 76,729 and valued at $8,801,019 were manufactured. The production of switchboards was valued at $5,971,804. A total horse-power of 2,733,418 and a value of $32,087,482 were represented in the 504,030 motors turned out during 1909.

Of the total number of motors given in the report, 388,854, with an aggregate rating of 4,817,140 hp, were installed in manufacturing establishments, showing the growth of electric drive in that single year. The number of primary batteries manufactured in 1909 was 34,333,531, valued at $5,312,595. Arc lamps to the number of 123,985 and with a total value of $1,706,959 were produced, the decrease in figures from 1899 representing the inroads of the incandescent lamp for street-lighting work. The production of incandescent lamps showed a valuation of $15,714,089 and a total number of 66,776,997, of which about one-fifth represented tungsten lamps. The insulated wire and cable manufactures in 1909 constituted the largest single item in the electrical manufacturing industry. The total value of the insulated wire and cable made in the United States during 1909 was $51,624,731, of which $40,250,572 was the value of the product of concerns in the industry proper and the remainder was made by companies engaged primarily in wire drawing or other industries. Only a small number of the producers of insulated wire and cable drew the wire which they insulated.

## "Electrical Day" at Dallas, Tex.

Friday, Oct. 31, was designated as "Electrical Day" at the Texas State Fair being held at Dallas, and it was made the occasion for an elaborate Jovian celebration and parade. Special provisions were made to register all visiting electrical men and to provide them with badges and tickets to the fair. The feature of the day, it was announced, would be the electrical parade held in the evening. The first of the three divisions was scheduled to contain twenty handsomely decorated floats furnished by the electrical firms of Dallas. For the second division between twenty and thirty decorated automobiles were entered, while behind them came the employees of electrical organizations, more or less in uniform, and carrying insignia, transparencies, etc. To heighten the effect of the illumination features carried in the parade, Manager E. T. Moore of the Dallas Electric Light & Power Company arranged to have the ornamental tungsten lighting extinguished for the time being along the line of march. All of the electrical houses in the city showed much enthusiasm over this feature of Dallas "Electrical Day," and neither time nor money was spared to make the occasion a huge success and one that would not soon be forgotten by the participants.

## Fast Long-Distance Run by Electric Automobile

Another fast run was credited to a Bailey electric roadster last week, when a car operated by Col. E. W. M. Bailey, of S. R. Bailey & Company, Boston, made the trip from Boston to New York at an average running speed of practically 22 miles per hour. The trip from Boston to Worcester, 41.3 miles, was completed in one hour and fifty-nine minutes. After stopping in Worcester an hour for lunch, during which time the car was on charge, the run was continued to Springfield, the distance of 53.6 miles being covered in two hours and thirty minutes. After a two-hour charge at Springfield, the car finished the 66.1-mile run to New Haven in two hours and forty-eight minutes, ending the day's run of 161 miles. The average speed for the day was greater than that which most gasoline cars would have made under the same conditions. On the second day Colonel Bailey covered the 78.4 miles between New Haven and New York in three hours and fifty-one minutes on a single battery charge. The total distance of 239.4 miles was negotiated in eleven hours and eight minutes actual running time. The car was equipped with an Edison battery.

## Sea Trials of the "Jupiter"

As we go to press a report is received that the electrically propelled collier *Jupiter*, described in our issue of Aug. 3, 1912, has made a successful forty-eight-hour trial at sea off Santa Barbara, Cal. Unofficially it is stated that the vessel maintained an average speed of 14.78 knots per hour or more than three-quarters of a knot above her designed speed. The *Jupiter*, it will be remembered, is a 20,000-ton ship equipped with twin propellers directly connected to three-phase induction motors, supplied with energy by turbo-generator.

Three colliers of similar displacement, the *Cyclops*, the *Neptune* and the *Jupiter*, were equipped respectively with reciprocating engines, geared turbines and electric propulsion in order to secure comparative tests on vessels of sea going ability.

## Railway Electrical Engineers at Chicago

The opening sessions of the sixth annual convention of the Association of Railway Electrical Engineers, which met in Chicago Oct. 21 to 24 inclusive, were reported in last week's issue of the *Electrical World*. An account of the later sessions follows.

### Methods of Battery Charging

Wednesday's meeting was opened by Mr. J. R. Sloan, of the Pennsylvania Railroad, who read the report of the committee on methods of charging storage batteries. The report was an extensive one and discussed the advantages and disadvantages of several methods of charging batteries with straight-storage, head-end and axle-generator train lighting systems. For the first-named system the committee recommended placing a fixed resistance in series with the battery and maintaining a constant potential across both battery and resistance during charging. An ampere-hour meter can be used to open a circuit-breaker when the charge is completed. A similar method of charging was also recommended with the head-end system. For axle-generator systems two schemes rank about equal in merit, according to the committee's report. The underlying principle in both methods is to supply constant current to the battery until the latter attains a definite voltage, after which the generator pressure is maintained constant. Curves were presented showing the performance of batteries when charged according to the recommended straight-storage method.

*Discussion*

In the discussion which followed Messrs. W. H. Kelly of Philadelphia, Pa., and L. L. Newman, of Pittsburg, Pa., reported that the method of straight-storage charge recommended by the committee is proving satisfactory in cases under their personal supervision. Considerable discussion ensued on the merits and disadvantages of series and multiple charging. Mr. J. L. Minick, Altoona, Pa., said that it is inherently wrong to charge the batteries of several cars in series, as each set of cells will usually be in a different condition of discharge. Mr. J. R. Sloan described a wiring lay-out used by the Pennsylvania Railroad for charging its batteries, by means of which the cells can be connected in multiple or in series. Mr. L. L. Newman stated that a multiple lay-out is cheaper than one of the series type, since the switchboard, resistance and generator equipment are all simpler. Mr. J. H. Davis, Baltimore, Md., said that series wiring is warranted only where the charging yards are laid out in a long line rather than in a mass. Other speakers expressed belief that series charging

be employed to advantage if cars are grouped according to the condition of their batteries. The remainder of the discussion related to the design of ballast resistors used to limit charging current.

### Standards and Specifications

Mr. E. W. Jansen, of the Illinois Central Railroad, next read the report of the committee on standards, which contained specifications for axle-generator axles, generator suspensions, battery boxes, axle pulleys, electric connectors, etc. The report of a sub-committee on lamp specifications was included. This section enumerated, as new developments in lamp manufacture which will change present methods of inspection and test, the coming use of "vaccum getters," the elimination of seasoning of tungsten filaments, and the introduction of an inert gas under pressure into the bulbs.

Mr. B. F. Fisher, of the Westinghouse Lamp Company, said that lamp specifications should be modified to allow for developments in lamp manufacture. Owing to the present tendency toward shortening the period of seasoning tungsten filaments, the lamps will, when first purchased, show a higher candle-power than normal, but after being burned a few hours this candle-power is reduced. The period of seasoning has been shortened in order that the lamps may be packed and shipped like carbon-filament lamps without danger of filament breakage. This practice has also reduced the price of lamps.

### Lamp Testing

A paper entitled "The Problems of Incandescent Lamp Testing," prepared jointly by Messrs. Preston S. Millar and L. J. Lewinsohn, was read by Mr. Millar and gave a detailed account of lamp-testing procedure. Methods which are present practice were analyzed and their advantages and disadvantages were brought out. The authors declared that proper tests tend toward economical operation. Charts were shown indicating that tungsten lamps comply with purchasers' specifications much better now than heretofore, so that it is no longer so necessary to inspect sample lots. It is difficult to obtain reliable deductions from forced tests when lamps are burned above normal efficiency. Because of the non-uniformity of tungsten lamps, a large number of samples should always be selected for test. In 1911 the average life of a tungsten lamp was 750 hours and the power consumption 1.13 watts per candle; now the average life is 2500 hours and the consumption about 1 watt per candle.

Mr. W. H. Rolinson, of the Westinghouse Lamp Company, expressed belief that too much stress has been laid on defects in the appearance of lamp filaments, for few of these faults really affect the lamps' performance. If perfect lamp filaments are demanded, Mr. Rolinson added, the development of an inexpensive lamp product will be hindered. While agreeing with Mr. Millar regarding the lack of uniformity in smaller tungsten lamps, the speaker said that the rating of larger units can be predetermined with considerable accuracy. He emphasized the need of employing qualified lamp testers if the results of tests are to be depended on.

Some discussion followed on the derivation of life correction factors which are used in estimating the normal life of lamps from forced tests. Mr. Fisher said that the Westinghouse Lamp Company uses the initial watts per candle as a basis for determining life correction factors. Mr. Miller added that the Electrical Testing Laboratories are conducting tests to discover whether these factors can be properly be based on the average watts per candle.

### Wires and Cables

Mr. W. A. Del Mar, of the New York Central & Hudson River Railroad, chairman of the committee on wire specifications, followed with the report of that committee, which covers wires and cables for pressures up to 15,000 volts. Paragraphs on the chemical analysis of rubber, potential test requirements, explanation of terminology used and order forms for wires and cables were included in the report.

Mr. R. H. Rice, Chicago, told of the work of the American Electric Railway Association in compiling similar specifications.

The report of the committee on installation of wiring for electric lamps and motors in railway buildings was read by Mr. Joseph A. Andreucetti, of the Chicago & Northwestern Railroad. This report supplements that of last year and includes specifications for the electrical equipment of movable railroad bridges. It goes into detail regarding conduit, outlet, pull and junction boxes, conduit supports, cabinets and panel boards.

A general discussion ensued in which it was intimated that too many details which cannot always be predetermined were included in the report. Mr. A. S. Schulman, Chicago, suggested that the committee be instructed to confer with committees from the National Electrical Contractors' Association and the National Electric Light Association.

### Outside Construction

Mr. W. H. Keirn read the report of the committee on outside construction and yard lighting. Concrete poles were proposed under certain conditions where the track lay-out is a permanent installation. Where tracks are re-located frequently wooden poles are recommended. Methods of preserving wooden poles, installing cross-arms, insulators and pins, tying wires, etc., were also discussed. The committee does not favor the painting of cross-arms, but it does recommend brush treatment where the arm joins the gain. Warning to the public, and especially to linemen, of the proximity of high-tension lines by labeling poles "Danger" was also recommended. The use of high-tension overhead distribution lines on yard circuits was discouraged and secondary distribution recommended. Methods of clamping wires to insulators were described. Underground systems for yards were encouraged, owing to the assurance of continuity of service, elimination of danger, low cost in up-keep and non-interference from changes in track lay-out. Topics of construction of manholes and underground systems, together with a discussion of the advantages and disadvantages of different types of lamps for yard lighting, concluded the report.

### Data and Information

Mr. C. R. Gilman, of the Chicago, Milwaukee & St. Paul Railroad, chairman of the committee on data and information and the question box, next read his report. The data supplied reveal the tendency among railroads to replace arc lamps with large tungsten units. This is a step toward increasing the efficiency and decreasing installation and maintenance expenses. For the twenty-two roads reporting, the total rating in alternating-current shop motors exceeds that of direct-current motors by 8877 hp. The increasing use of alternating-current motors is ascribed to their lower first cost, greater reliability, lower maintenance expense and greater flexibility. On the same roads there has been an increase in the number of electrically lighted cars and a corresponding decrease in those lighted by oil. One ball-bearing company reports 2500 generators now in use.

### Illumination of Cars

The relative merits of various reflecting and diffusing media with different spacings of units were discussed in the report of the committee on illumination, of which Mr. Lewis S. Billau is chairman. The experiments from which the committee derived its conclusions were conducted in passenger coaches furnished by the Lake Shore & Michigan Southern Railway. Center-deck and side-deck systems were investigated with a view to obtaining adequate illumi-

nation, pleasing effects, good efficiency and satisfactory distribution of light. Center-deck lighting was found to compare favorably with side-deck illumination. For direct lighting, units should not be spaced more than 6 ft. apart. The color of head-linings has no appreciable effect on the useful illumination produced by direct units. The illumination values obtained show the desirability of using lamps of higher lumen output.

Mr. Arthur J. Sweet, Milwaukee, Wis., who had charge of the tests, described the methods of conducting them. Head-linings should have a light color, he believes, in order to reduce the contrast with the lamps. Fifteen-watt lamps have been found inadequate for proper illumination, and Mr. Sweet believes 600-lumen lamps would be more satisfactory. He advises rating lamps in lumens rather than in watts.

Mr. J. L. Minick, of Altoona, Pa., believed that indirect lighting of railway cars would not be universally used until more efficient lamps or other sources of electrical energy were developed. As a rough estimate he said that semi-indirect lighting requires double the energy taken by a direct system and therefore demands facilities for increased battery capacity.

Mr. P. S. Millar pointed out a fallacy in many eye-fatigue experiments made with glare. He said that increased intensity cannot compensate for lack of diffusion in producing satisfactory illumination.

In judging car lighting from the artistic viewpoint, Mr. Sweet reported that the majority of officials on railroads are in favor of light-density opal reflectors. Inclosing reflectors and diffusing bowls having a satin finish were considered next in popularity.

Mr. J. R. Cravath, Chicago. Ill., favored center-deck lighting as involving less specular reflection. He spoke of the inefficiency of Pullman lighting and said that under present conditions direct lighting is the only practical system for car illumination. To assist in preventing eye strain, reflectors can, however, be used which completely cover the lamps.

### Self-Propelled Units

A paper on "Gas-Electric Cars" was abstracted by Mr. L. C. Joseph, Jr., Schenectady, N. Y. The gas-engine rating should be about 20 per cent larger than the generator rating to allow for overloads, and the set should be operated at a definite speed. Some tabulated data given indicated what can be expected of different types of these self-propelled cars. Figures were also quoted on the cost of operation of gas-electric cars. The paper included a description of essential driving and control parts, with an account of motor performance.

Mr. J. E. Hilton, of the Frisco system, presented some convincing data on the economic operation of gas-electric cars made by the General Electric Company. An average cost of 18.5 cents per car-mile was given for operating and maintaining this railroad's seven cars over a period of six months. Some of these cars pulled trailers, climbed 2 per cent grades and traversed as much as 100,000 miles in six months.

Detailed information on the construction of the electric tractor used for pulling freight cars by the Pennsylvania Railroad was given by Mr. T. V. Buckwalter, Altoona, Pa. This tractor is equipped with an eighty-cell Edison battery, operates in either direction, and develops 24,000-lb. drawbar pull with an 85-volt, 900-r.p.m. motor. All four wheels exert tractive effort.

Mr. George W. Cravens, Chicago, chairman of the committee on shop practice, submitted his report in which electric arc-welding operations, individual motor drive and automatic control were discussed. The committee advocated the use of automatic control on machinery where practicable and favored standardizing the power supply. Discussion of this report related mainly to details of shop practice.

A standing committee consisting of three members was established which will compile specifications and information on standard practice to be published in loose-leaf form.

### Election of Officers

At the executive session which concluded the convention, the majority expressed themselves in favor of holding the 1915 semi-annual meeting at San Francisco, but no action can be taken until the next annual meeting, which will be held at Atlantic City coincidently with the Master Car Builders' convention. The semi-annual meeting for 1914 will be held at Chicago.

Officers for the ensuing year were elected as follows: President, Mr. C. R. Gilman, Milwaukee, Wis.; first vice-president, Mr. H. C. Meloy, Cleveland, Ohio; second vice-president, Mr. E. W. Jansen, Chicago, Ill.; secretary-treasurer, Mr. Joseph A. Andreucetti, Chicago, Ill. Messrs. J. J. Hack, San Bernardino, Cal., and N. E. Lemmon, Chicago, Ill., were chosen as new members of the executive committee.

Mr. C. R. Gilman, president-elect of the Association of Railway Electrical Engineers, is a charter member of the association and one of its most active supporters. He is also a member of the Illuminating Engineering Society.



PRESIDENT-ELECT C. R. GILMAN

Mr. Gilman was first to advocate the change from 110 volts to 60 volts for train lighting and was also instrumental in bringing about many changes in fixtures. He began his career as a machinest in the East, serving time first as an apprentice and later as a full-fledged machinist. In 1889 Mr. Gilman went to Milwaukee, where he was shortly appointed assistant to the mechanical engineer of the Chicago, Milwaukee & St. Paul Railroad. Later he became interested in train lighting and devised a system for head-end operation. Mr. Gilman is still in the employ of the same road, now holding the title of chief electrician.

A number of entertainment features were provided during the convention for the women present. On Friday evening the annual banquet was served, at which over 400 members and guests were present. Messrs. D. J. Cartwright, Phillipsburg, N. J.; Bion J. Arnold, Chicago, and F. W. Walker, Chicago, made addresses. Mr. Arnold spoke on the education of the engineer and Mr. Walker referred to the important part which electrical engineers are playing in the improvement of railroad service.

The exhibition of train-lighting equipment shown in connection with the Railway Electrical Engineers' convention was much superior in both variety and extent to the displays made by the manufacturers in preceding years. Two large halls in the Hotel LaSalle were occupied by the exhibits, about forty manufacturers being represented.

## Chicago Convention of Electric Vehicle Association

The fourth annual convention of the Electric Vehicle Association of America was held in the Hotel LaSalle, Chicago, on Oct. 27 and 28. Headquarters were established on the nineteenth floor of the hotel and the meetings were held on this floor. The rooms of the manufacturers and dealers were on the eighteenth floor and there were a number of exhibits. The attendance numbered 351, and the convention was snappy and energetic, characteristic of an aggressive and alert industry.

### President Williams' Address

President Arthur Williams, of New York, called the opening session to order promptly and read his annual address. Pointing out the remarkable development of the association, he said that it had grown from twenty-nine to 428 members in three years. The membership includes thirty-four manufacturers of electric vehicles and sixty-one central-station companies. There are sections in New England and Chicago and local associations in New York and Philadelphia, while a movement is under way to establish a local section on the Pacific Coast, probably in San Francisco. Eventually the membership ought to include every central-station company in the United States and possibly every user of an electric vehicle. There are now thirty-seven manufacturers of "electrics" as against twenty a year ago. It is estimated that there are 37,000 electric vehicles in the United States. Mr. Williams gave other interesting statistics and commented at some length on the advancement and prospects of the electric vehicle. In relation to electrically operated fire apparatus, for instance, he pointed out that there is no delay in starting, as is often the case with gasoline-operated fire engines. This saving of time is of great importance. Mr. Williams referred to the operation of storage-battery street cars in New York City and said that these cars are a good advertisement of the heavy duty of which the electric storage battery is capable.

One important suggestion which the president made was that street congestion in large cities be relieved by the substitution of night trucking for day trucking. This change would mean an enormous increase in economic efficiency. The speaker alluded to the very great possibilities of such business and to the income electric-service companies might receive from it. In the larger cities alone if all trucking were done electrically at 2 cents per kw-hr. the annual income would be about $400,000,000. Mr. Williams also pointed out that if motor vehicles became the rule large farm areas now devoted to raising food for animals would be released and utilized for the raising of food for the human race. The president urged the standardization of starting connections and complimented the advertising committee upon the very gratifying results achieved by its campaign. He alluded to the importance of the garage problem and said that an important work of the future would be the preparation of guide-books for all parts of the United States showing the locations of electric-charging and repair stations for vehicles. The address contained a number of important and interesting points, not all of which are mentioned in this brief summary. It was referred to a committee consisting of Messrs. Hayden Eames, of Cleveland; E. E. Witherby, of Chicago, and W. P. Kennedy, of New York.

### Tendency of Legislation

Mr. E. W. Curtis, Jr., of New York, reported for the legislative committee in the absence of Chairman P. D. Wagoner. The committee commented that during the last year an epidemic of more or less radical legislation seems to have broken out in various sections of the country, its general trend being to penalize automobiles unduly by taxation or limitations of various kinds. The committee urged uniform state legislation in relation to automobiles. The outlook, according to the report, is that future legislation will increase the rate of taxation for automobiles in general and will limit the weight of trucks used for business purposes.

### Operating Costs and Standard Forms for Cost Keeping

The committee on operating records reported through Chairman W. P. Kennedy, of New York. It presented a table made up to show the general average operating costs of electric vehicles of various sizes and also submitted a standard form for keeping the costs of operation of electric trucks. Mr. Kennedy exhibited a memorandum book designed for vehicle owners in which total cost figures may be entered. In estimating the cost of electrical energy in the table given no kilowatt-hour rate was mentioned, since conditions differ so greatly in different localities. However, Mr. Kennedy informed the association that the rate used was 4 cents per kw-hr. The cost of energy is only about 10 per cent of the total operating cost, so that the kilowatt-hour rate is not of the preponderating importance which it is often thought to be.

There was considerable discussion on this important report. Messrs. F. N. Carle of New York, Charles H. Marsh of Washington, J. A. Hunnewell of Lowell, E. S. Mansfield of Boston, W. H. Conant of Washington, Day Baker of Boston, C. F. Smith of Boston, George H. Jones of Chicago, J. S. Codman of Boston, S. G. Thompson of Newark, N. J., and others took part.

### Insurance of Electric Vehicles

Mr. Day Baker, chairman of the committee on insurance, reported that during the year the committee had been successful in securing a 10 per cent differential rate on liability insurance in favor of electric vehicles as compared with other forms of motor cars. This rate has been almost universally adopted. Also, the committee has obtained from the New England Casualty Company a further consideration equivalent to practically a 20 per cent differential from the standard rates for gasoline-driven automobiles and trucks. President Williams and Mr. Converse D. Marsh, of New York, commented on the advertising and other values of this insurance differential in favor of the electric vehicle.

### Electric-Vehicle Educational Work

Mr. Charles Blizard, of Philadelphia, in the absence of Chairman W. G. Pancoast, read the report of the committee on the establishment of courses of instruction. The work in the West Technical High School of Cleveland was described.

In the discussion Mr. E. M. Jackson, of Denver, told of the educational work in relation to electric vehicles undertaken by the Denver Gas & Electric Light Company. This subject, he said, is very important, and he suggested that a course of battery and vehicle instruction be conducted by the Electric Vehicle Association. Mr. E. E. Witherby, of Chicago, added that the association might undertake a correspondence school of this description intended for the practical benefit of young men engaged in the business. Mr. E. W. Curtis, Jr., of New York, said that the General Vehicle Company had established a school of that sort on its own initiative. Mr. Day Baker reported that some of the technical schools in Boston were taking up the subject. Mr. H. E. Niesz, of Chicago, described briefly the investigation undertaken by the Chicago Section, of which he is chairman.

### Prevailing Rates and Facilities for Charging

Mr. John F. Gilchrist, of Chicago, as chairman of the committee, read the report on rates and charging stations. The report was based on data received from 128 electric-service companies, in answer to the committee's questions. The average rates reported in ninety-one of the largest cities of the country were 3.007 cents per kw-hr. for energy furnished to public garages and 5.338 cents for private garages. The committee described the battery-service sys-

tem, originated by the Hartford Electric Light Company, and expressed itself as genuinely interested to know what the final results of this plan would be. On this system the company buys, maintains, charges and installs in customers' trucks all batteries necessary for continuous operation. The customer is relieved from all care of batteries. The committee presented a large amount of data in the form of tables and curves.

Messrs. Harvey Robinson of New York City, L. L. Edgar of Boston, Homer E. Niesz of Chicago and Day Baker of Boston, in a short report on "What the Sections Are Doing," told of the work of the local electrical vehicle associations in their respective districts.

### Co-operation of Manufacturers and Central Stations

Mr. E. L. Callahan, of H. M. Byllesby & Company, Chicago, summed up the advantages to be realized from promotion of the use of electric vehicles, as viewed by both the electric-vehicle manufacturer and the electric-service company. From the standpoint of the electric-vehicle manufacturer, said Mr. Callahan, the principal objects to be attained through co-operation are greater satisfaction among vehicle users, reduction of their operating difficulties, increased sales and advice concerning prospective purchasers. Through the co-operative effort the central station hopes to gain increased revenue from the sale of energy, use of off-peak energy, the advertising which is the result of the use of the vehicle, and the industrial and social progress of the community. The author declared that the rates of most progressive central stations are already quite fair for charging service. As the result of a recent study of rates in a city of 325,000 inhabitants, the vehicle-charging rate was set at 3.8 cents per kw-hr. for the first 1000 kw-hr., with a sliding scale reduction thereafter. Investigation has shown that the cost of charging electric vehicles is seldom even 10 per cent of the total cost of operation. Comparing electric irons and electric trucks as central-station revenue producers, Mr. Callahan declared that while the sale of a flatiron increases the company's annual gross revenue by about three times the price of the iron, the electric vehicle increases the revenue only about 6 per cent of its cost. The flatiron produces a revenue equal to its original selling price in about four and a half months, while the average electric truck requires approximately seventeen years and a pleasure vehicle twenty-five years to show the same return.

*Discussion*

A lively discussion ensued in which Messrs. C. D. Marsh, of New York City, and S. G. Thompson, of Newark, N. J., declared that central stations should share a large part of the expense of selling electric vehicles, as the revenue obtained from the vehicles is about 300 per cent of the cost of getting the business. Mr. Baker referred to a "Handbook of Electric Vehicles" which was written by Mr. F. W. Smith, of New York, and contains valuable information and data. Mr. H. H. Rice, of Indianapolis, pointed out that manufacturers should explain the possibilities of profit in the sale of electric vehicles to central stations if the latter's co-operation is desired. He added that the electric vehicle owes its greatest drawback to neglect in the garage rather than to its treatment on the streets.

### Traffic Problems

An interesting paper on "Traffic Problems and the Automobile" was abstracted by the author, Dr. E. E. Pratt, manager of the Industrial Bureau of the Merchants' Association of New York. The speaker referred to legislation which has been enacted in New York against speeding and affecting street wear. The McAneny ordinance of New York was discussed and commended. This ordinance bases vehicle fees on the weight per inch of tire width, the weight per wheel, and on the width of car when this exceeds 6 ft. 6 in.

### The Garage Problem

Opening Tuesday morning's session, Mr. E. S. Mansfield, Boston, presented the report of the garage committee, whose purpose is to investigate garage conditions and to attempt the arrangement of general local rates for the charging and care of electric vehicles throughout the country. The committee suggested that some provision be made whereby public garages can obtain repair parts for electric vehicles at a discount. The committee also reported the receipt of 100 official garage signs which will be distributed among garages qualifying for recognition. Reports from local garage committees were included in the general report.

Discount for repair parts furnished to public garages was the subject of the discussion which followed. Mr. C. K. Chapin, Memphis, Tenn., said that the Memphis Consolidated Gas & Electric Company has been operating a public garage without any agency agreement regarding discount on repair parts and at times has therefore been forced to do work at a loss. Nevertheless, there has been an increase of about 300 per cent in the number of passenger vehicles and about 700 per cent in the number of commercial cars in that city. Mr. Chapin believes that manufacturers should give public garages a discount on repair parts so as not to discourage the sale of electric vehicles, and added that agents in his locality would be glad to have the burden of repairs carried by the central station.

### Electric Vehicles in Department-Store Service

Features of the garage equipment and vehicle installation of Gimbel Brothers' New York department store were described in Mr. David F. Tobias' paper on "The Electric Vehicle in Department-Store Service." An interesting practice of this store is the custom of rebuilding its vehicles each year instead of merely overhauling them. By maintaining a stock room in which repair parts are kept the time has been greatly reduced during which vehicles have to be "shopped" for repairs. Mr. Charles A. Duerr, manager of the garages of Gimbel Brothers, who contributed information for this paper, said that the Gimbel vehicles have operated at very small additional expense with snow on the ground, although gasoline cars have not done as well. Merchandise is transferred from the main store to the distributing stations at night with a considerable saving in time. Three years' experience with electric vehicles has demonstrated to Gimbel Brothers that such vehicles are a success.

A discussion followed in which Mr. C. F. Smith, Boston, quoted data showing that electric vehicles require, on the average, only one "tow-in" per 8500 miles of service with an average haul of 1.3 miles, while gasoline vehicles require one tow-in per 3000 miles of service with an average haul of 8 miles.

### Care of Vehicle Batteries

Extracts from a report on vehicle batteries made to another association were read by Mr. S. C. Harris, of New York. Several electric-service companies have reported that there is no apparent reason why negative plates should not be used a second time, provided they have been properly cared for and are not too thin. But they should not be so used unless in such good condition that they will not limit the life of the second set of positives. The boosting of vehicle batteries should be resorted to more frequently, especially in winter.

### Report on Publicity and Advertising

In his report Mr. F. W. Smith, chairman of the committee on publicity and advertising, declared that a campaign of such general educational character as the present one is not expected to produce many direct inquiries. There have been received, however, approximately 2000 communications as the result of this advertising. These inquiries were about evenly distributed between commercial and passenger cars, and they came literally from every corner

of the globe. In the spring work of 1913-1914 campaign it was early evident that the activities of the Society for Electrical Development would to some extent interfere with the collection of funds for the campaign of the Electric Vehicle Association. But, said Mr. Smith, with a few exceptions all of the larger central stations have renewed their subscriptions to the fund. At the time the committee report was written the total subscribers to the fund numbered 107, an increase of five over last year. There are eighty-two central stations contributing, an addition of one over last year. The battery and other accessory manufacturers number ten, or two more than last year, and the vehicle manufacturers fifteen, as against thirteen last year. There are, however, five within this class who have not subscribed to the second-year fund, making seven new names added to the list of vehicle manufacturers. The share contributed by each of the three classes stands as follows: Central-station companies, 54 per cent; battery and accessory manufacturers, 31 per cent; vehicle manufacturers, 15 per cent.

The second advertising campaign of the Electric Vehicle Association of America involves an expenditure of $33,422.28, and will be carried on through five advertising mediums, namely, general magazines, fashion and social magazines, central-station papers, automobile trade journals, and a fifth group contemplating the use of three special papers.

### Aid for Purchasers of Trucks

Called on by President Williams, Mr. Hayden Eames, of Cleveland, Ohio, declared that the work of trucking might be done in the future by public-service delivery corporations. Mr. Eames then set forth briefly a plan originating in the fertile brain of Arthur Williams relating to the organization of an equipment trust to assist business men and corporations in the purchase of electric trucks. Manufacturers are often reluctant to take money from their businesses to improve their transportation facilities. The electric-vehicle equipment trust would advance the money, securing itself by liens on the equipment. A traffic-engineering bureau of the trust would see that the purchases were utilized to best advantage by the users. A similar plan is used with success in the purchase of railroad equipment, and Mr. Williams does not see why it would not work out in relation to electric commercial vehicles.

Other papers presented and discussed at the convention were: "The Merchant, the Central Station and the Electric Vehicle," by Mr. F. Nelson Carle; "Charging of Storage Batteries in Unattended Garages," by Mr. Maxwell Berry; "Electric-Vehicle Salesmanship," by Messrs. G. H. Kelly and E. J. Bartlett; "Recent Developments in Lead Batteries," by Mr. Bruce Ford; "Tires for Commercial Electric Vehicles," by Mr. F. E. Whitney, and "Organization," by Mr. Ralph Temple. Abstracts of these will appear in a later issue.

### Election of Officers

President Williams had appointed as the nominating committee, Messrs. George H. Jones, of Chicago; E. W. Curtis, Jr., of New York; R. L. Lloyd, of Philadelphia; E. S. Mansfield, of Boston, and Charles Blizard, of Philadelphia.

On the report of the tellers the following officers were declared to be elected unanimously: President, Mr. Frank W. Smith, New York, United Electric Light & Power Company; vice-president, Mr. John F. Gilchrist, Chicago, Commonwealth Edison Company; secretary, Mr. Harvey Robinson, New York, New York Edison Company; treasurer, Mr. Day Baker, Boston, General Vehicle Company; incoming directors, Messrs. Arthur Williams, New York, New York Edison Company; W. P. Kennedy, New York; W. G. Bee, Orange, N. J., Edison Storage Battery Company; Clare N. Stannard, Denver, Denver Gas & Electric Light Company.

On taking office, President Smith spoke feelingly of the work of Past-presidents Blood and Williams. The thanks of the association were extended to President Williams by a rising vote. Just before adjournment, Vice-president Gilchrist was called upon for a few remarks. He paid a cordial tribute to the work of the vehicle manufacturer and said he thought that in the relation of manufacturers and central stations the latter had rather the better of the bargain. However, he hoped that a way could be found to make service wagons for central-station companies at lower first cost.

Mr. Frank W. Smith, who has just been elected president of the Electric Vehicle Association of America, is vice-president of the United Electric Light & Power Company of New York City, with which he has been continuously identified for a period of thirty-three years, having started as an office boy with its predecessor, the United States Illuminating Company in 1880. Mr. Smith was born in Alden, N. Y., June 22, 1867, and has been well schooled in the electric lighting business, especially in the administrative end. Starting at the bottom round, he has climbed from office boy to general clerk, to paymaster, to assistant auditor, to assistant secretary, then to secretary and finally to vice-president. Upon him has devolved the



PRESIDENT-ELECT F. W. SMITH

active management of the affairs of the United Electric Light & Power Company for a number of years. He is also a director of the company as well as of the Brush Electric Illuminating Company of New York. He has worked assiduously as chairman of the publicity and advertising committee of the Electric Vehicle Association of America in collecting funds for that work, and the success which has attended the society's campaign is due in large measure to his efforts. Mr. Smith belongs to the Engineers' Club, the Friars' Club, the American Institute of Electrical Engineers, the New York Electrical Society, the Municipal Art Society, the American Museum of Safety and the National Electric Light Association.

### Entertainment and Registration

The convention was well planned by a large convention committee, of which Mr. H. E. Niesz was chairman, Mr. G. H. Atkins vice-chairman and Mr. W. J. McDowell secretary. Mr. L. E. Wagner was chairman of the sub-committee on entertainment. The total registration was 351, greater by 100 than last year. Philadelphia, through Mr. R. L. Lloyd, of the Philadelphia Electric Company, invited the association to hold its next year's convention in the City of Brotherly Love.

## Chicago Electrolysis Ordinance May Be Modified

By a vote of twelve to four the local transportation committee of the Chicago City Council, after an animated all-day session on Oct. 25, approved a modification of the existing electrolysis ordinance to which the local traction companies have been so resolutely opposed. The ordinance, which was adopted by the City Council on July 15, 1912, provided that there shall be no drop in voltage between any two points on the electric-railway grounded return exceeding a maximum of 12 volts. Further, between any two points on the return 1000 ft. apart within a mile of the City Hall the drop shall not exceed the limit of 1 volt, and between any two points on the return 700 ft. apart outside of this mile limit the drop shall not exceed 1 volt. The maximum allowable drop before the passage of the 1912 ordinance was 25 volts between any two points within the city limits.

During the present merger negotiations the Board of Supervising Engineers, Chicago Traction, was asked to make a report on this subject. It reported that so far as it knew there is no place where the conditions imposed upon the companies using grounded return circuits are so severe as those imposed upon the Chicago electric-railway companies by the 1912 ordinance.

The National Bureau of Standards at Washington has also had an expert in Chicago recently to advise on the subject. As a result of the investigations by the representatives of the United States government, the city of Chicago and the Board of Supervising Engineers it was agreed that the necessary first cost for the initial investment required of the companies to comply with the 1912 ordinance would be $4,984,424, provided the ordinance was interpreted upon an average maximum load for a fifteen-minute period. Mr. Palmer, the city electrician, however, said that the net cost would be about $3,000,000, taking into consideration only the cost of apparatus not useful to the companies otherwise than for correction of electrolysis.

As a result of this situation the Board of Supervising Engineers, at the request of the Council, suggested a compromise plan which has recently been approved by a subcommittee of the local transportation committee of the Council. This plan, drawn up by Mr. Bion J. Arnold, chairman of the board, is substantially as follows:

The city is to be divided into three zones, and all uninsulated electric return circuits are to be so arranged that the sustained maximum difference of potential between any two points on any uninsulated portion of the circuit shall not exceed 10 volts in the inner or congested zone, 15 volts in the middle zone and 20 volts in the outer zone. The Board of Supervising Engineers is to have the power, however, to prescribe limits from time to time, notwithstanding the exact figures mentioned in the plan. This is to provide for the potential gradient. It also has the power to increase the allowable drop in the outer zone to 25 volts at such points as it may deem advisable for the extension of track in outlying districts of the city where the underground utilities are not fully developed. Within the period of two years the provisions of the ordinance must have been complied with by the companies throughout their entire railway systems. This is to be accomplished by the expenditure of not less than $1,000,000 as directed by the Board of Supervising Engineers, if, in its judgment, this expenditure is considered necessary. The companies shall expend further such additional amounts upon return circuits and other electrical apparatus as the Board of Supervising Engineers may from time to time prescribe in order to prevent damage from electrolysis.

The ordinance as passed by the committee must be passed by the City Council and approved by the Mayor to become law. If that is done, it would seem to be likely that similar action will be taken in the case of the elevated-railway companies and the Chicago Tunnel Company.

## Regulations for New Jersey Utilities

At a hearing before the Board of Public Utility Commissioners of New Jersey in Trenton on Oct. 21 rules and regulations for electrical supply utilities and for all utilities owning or using poles and wires were adopted. Some changes have been made since the first copy of the rules was issued.

The third rule, as revised, will provide that construction work shall be in accordance with good standard practice, rather than in accordance with the recommended practice of associations. Each utility owning poles supporting wires on public highways is required on or before Jan. 1, 1915, to stencil each pole with identifying marks or numbers. Each pole, post, tower or other structure used for the support or attachment of wires, guys or lamps must be inspected by the utility with sufficient frequency to determine in each case the necessity for replacement or repairs.

The fluctuation in voltage on lighting circuits shall not vary between sunset and 11 p. m. for a period exceeding five minutes more than 3 per cent above or below the standard voltage, although causes beyond the control of the utility shall not constitute a violation.

Each utility supplying electrical energy for incandescent illumination shall inspect in a general way the incandescent lamps of each consumer to whom free renewals are supplied at least once every two years and render consumers reasonable assistance in securing incandescent lamps best adapted to the service rendered.

Each utility shall furnish to any prospective customer on request a statement of the kind or kinds of service available. Where unusual conditions prevail information shall be given as to the conditions under which efficient and satisfactory service may be secured.

Whenever any transformers, high-tension insulators or other appliances are removed from the system for any reason they must be inspected before being reinstalled.

A utility may refuse to connect with any customer's wiring when it is not in accordance with the provisions of the National Electrical Code, when the certificate of the underwriters or the local inspection bureau has not been issued, or when the wiring is defective under the rules of the utility. The rules contained in the 1913 edition of the National Electrical Code regarding grounding of secondaries are adopted for all new construction.

Utilities shall furnish customers supplied with energy on a measured basis with electric meters and such service appliances as are customarily furnished. Any utility now furnishing service through meters owned by customers must arrange to take them over by Jan. 1, 1914, and thereafter own and maintain all service meters. Detailed directions for the testing of watt-hour meters are given.

An electric meter may be considered correct when it does not show, in comparison with standards approved by the commission, an error greater than 4 per cent on the light load or heavy load. The normal load shall be considered as the following percentage of full connected load: (a) Residence and apartment lighting, 25 per cent; (b) elevator service, 40 per cent; (c) factories (individual drive), churches and offices, 45 per cent; (d) factories (shaft drive), theaters, clubs, entrances, hallways and general store lighting, 60 per cent; (e) saloons, restaurants, pumps, air compressors, ice machines and moving-picture theaters, 70 per cent; (f) sign and window lighting and blowers, 100 per cent.

Each utility supplying electricity shall equip itself with a rotating standard test meter of suitable range. It shall provide a house or switchboard type meter, or meters of suitable capacity to be used only for checking the rotating standards. This check should be made at least every week when the standard is in service. Utilities supplying direct current or having already other test apparatus, or small utilities having less than 100 meters, may apply to the commission for a modification of this rule.

A complete record is to be kept of all periodic tests and tests on old meters brought in. Each utility having more than 500 meters shall report monthly. Utilities having less than 500 meters shall report quarterly.

## Public Service Commission News

### Indiana Commission

The Valparaiso Lighting Company has filed with the Public Service Commission of Indiana a complaint against the city of Valparaiso and the Citizens' Mutual Light, Heat & Power Company of that city. The latter company is inoperative now but threatens to begin operations as soon as the City Council allows a franchise.

The case will test the section of the Indiana law which provides that the commission must issue a certificate of convenience and necessity before a competing utility plant may be installed. The complaint declares that notwithstanding the provisions of the commission act and notwithstanding there has not been secured from the commission a declaration that public convenience and necessity require a second public utility in Valparaiso, the city, through its Mayor and Common Council, has claimed the right to grant to the Citizens' Mutual Light, Heat & Power Company a franchise, and has in like manner claimed the right to enter into a contract with the Citizens' company for street lighting for a period of ten years.

The petitioner points out that it has been ready at all times to supply any or all electric energy needed either for private or municipal consumption.

The Public Service Commission has been asked to make physical valuations of electrical and other utility properties at Terre Haute and Vincennes.

### Missouri Commission

The Public Service Commission of Missouri has issued an order prescribing the form and governing the filing and publication of schedules of rates of electrical corporations and municipalities. The order provided that schedules should be filed not later than Oct. 15 showing rates for every kind of service in force on April 15, 1913, together with supplements covering changes authorized by the commission, if any, since that date.

The order states that full compliance will be expected from officials of corporations and municipalities in each instance. The commission defines the flat rate, the uniform meter rate, the demand rate, the two-charge rate, the three-charge rate, the block rate, the step rate and the consumer's output rate. It says that these methods of charge may be combined with various wholesale discounts, minimum guarantees, etc., but the fact that they are listed does not necessarily imply that they are in accord with the public service commission law, or that any or all of them have been or will be sanctioned by the commission.

A provision in a schedule that certain things may or may not be done according as the manager or some other official may direct is objectionable and will subject the schedule, when tendered for filing, to rejection.

### Massachusetts Commission

The Supreme Judicial Court has received an appeal signed by ex-Governor Morgan G. Bulkeley of Connecticut and others against the recent order of the Public Service Commission approving the issue of convertible debenture bonds by the New York, New Haven & Hartford Railroad to the amount of $67,552,000. One of the principal reasons for the appeal is that the company has a present indebtedness of $202,844,450, and it is contended that, since as a guarantor for obligations it is liable for the further sum of $79,648,900, the allowance by the commission of the issue is illegal. The appeal is taken to the court under Section 27, Chapter 784, Acts of 1913, by which the commission was established.

# Current News Notes

Wireless Between America and Asia.—The first commercial message handled by wireless between America and Asia was transmitted Oct. 27 from the United States Army Signal Corps station at Nome, Alaska, to the Russian government station at Anadyr, Siberia.

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Municipal Purchasing and Testing Department for Ontario.—The Municipal Electric Association has approved the organization of a purchasing and testing department to be controlled by the Hydro-Electric Power Commission of Ontario for the purpose of supplying the various municipalities with necessary equipment at minimum rates.

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Durham, N. C., to Erect Large Electric Sign.—The Commercial Club of Durham, N. C., is hunting for a slogan or a short sentence to be displayed on a large electric sign which it proposes to erect in order to advertise the city. A prize of $50 in gold is offered for the slogan, the contest closing Nov. 5. Durham has a population of 27,000 and is a great tobacco center.

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Grounding Secondaries in Winnipeg.—Public Utilities Commissioner Robson is making an investigation of the merits and demerits of the grounded secondary system of distribution, and has requested the Winnipeg Electric Railway Company and also the light and power department of the city of Winnipeg to show cause why they should not be compelled to adopt a grounded secondary system.

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Missouri Utilities.—According to the Public Service Commission of Missouri, there are 109 municipally owned plants in that State furnishing water, gas, electricity and heat. The total number of companies engaged in the manufacture and distribution of gas, electricity, water and heat is 312. None furnishes all these commodities, but a number furnish two or more. The commission will soon begin the collection of information touching the rates of service furnished by these plants.

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Floating Power House at Jeffersonville, Ind.—The city officials of Jeffersonville, Ind., recently witnessed the test of a small installation of hydroelectric machinery carried on a barge moored in the Ohio River near that point. The floating power plant consisted of an endless chain of paddle-wheels which when lowered into the water was propelled by the current of the stream and drove a small generating unit. The apparatus used was of inconsiderable size and developed only a few horse-power. Experienced men who have studied the river in that vicinity for years are still skeptical, declaring that in certain seasons the current is insufficient to drive the paddle-wheels.

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Electric Spanker in West Virginia Schools.—Two schools of Huntington, W. Va., where the discipline has always been gaged by the strength of the instructor's arm, have been transformed by means of an electric spanker into institutions of learning with the best average deportment of all the schools in that city, according to Superintendent M. Foulke. A day or so after the school season began a carpenter and an electrician appeared at one of the schools and began the installation of a spanker in a small anteroom. The device delivers about five short sharp blows a second and worked so well in one school that it was installed in another. According to Superintendent Foulke, since the "persuaders" have been installed and their characteristics have become known, not one unruly pupil can be found in either school.

Machinery for Dredging Toronto Harbor to Be Operated Electrically.—All machinery to be used in deepening the Toronto Harbor will be operated by electricity. The Canadian Stewart Company, which has contracted to do the work for some $10,000,000, has asked the Toronto Electric Light Company, Ltd., and the Toronto Hydro-Electric System to quote prices for the supply of from 7000 hp to 8000 hp. On account of its simplicity, the contractors propose to substitute electricity for steam in the operation of dredges, pumps and other machinery. Work will commence next spring and three large dredges will be used. The smallest dredge will require 1250 hp and the work will extend over five years. The Toronto Hydro-Electric System obtained the contract for supplying the energy.

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Analyses of Coals.—Bulletin 22 of the Bureau of Mines, entitled "Analyses of Coals in the United States," is a valuable contribution to the literature on coal. It contains descriptions of mine and field samples collected during a period of six years and has been compiled by Mr. N. W. Lord, with chapters by Messrs. J. A. Holmes, director of the Bureau of Mines; F. M. Stanton, A. C. Fieldner and Samuel Sanford. The volume contains information regarding the character of the coal, the impurities in the beds sampled and the nature of the roof and the floor of the beds, and gives supplementary details with reference to the output of the mine, the method of mining and preparing the coal and the chief uses to which the coal is put that may be of assistance to government engineers or purchasing agents and others in preparing specifications and awarding contracts for fuel. With about a thousand pages of reading matter, arranged geographically according to counties and cities, a bibliography, a list of Bureau of Mines publications on fuel technology and a most complete index that gives the names of places at or near which the samples described were collected, this comprehensive work will be found of much value to all interested in the subject. It has been issued by the Department of the Interior, Bureau of Mines, Washington, D. C.

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## SOCIETY MEETINGS

Meeting of the Industrial Electrical Engineering Society of Detroit.—At the meeting of the Industrial Electrical Engineering Society of Detroit at the Adcraft Club on Oct. 24, Mr. W. J. Fitzgerald, of the Detroit Edison Company, read a paper on "Electric Motors."

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Meeting of Radio Engineers.—At a meeting of the Institute of Radio Engineers which will be held on the evening of Nov. 5 at Fayerweather Hall, Columbia University, New York, Dr. Lee De Forest will speak on "The Audion-Detector and Amplifier." Anyone interested in the subject is invited to attend.

* * *

New York Electrical Society.—Mr. L. A. Hawkins, of the research laboratory of the General Electric Company, delivered a lecture on "The Place of America in Scientific Research Work" before the New York Electrical Society on Oct. 23. The high-efficiency nitrogen-filled tungsten filament lamp was described and shown in use.

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Meeting of Boston Edison Company Section, N. E. L. A.—The Boston Edison Company Section of the National Electric Light Association held its annual meeting on Oct. 21, the following officers being elected for 1913-14: President, Mr. J. W. Cowles; vice-presidents, Messrs. C. H. Crockett and C. E. Greenwood; secretary, Mr. J. J. Buckley; treasurer, Mr. C. H. Miles. Messrs. W. H. Cole and C. S. Hadaway were added to the executive committee. A paper by Mr. D. B. Rushmore, of the General Electric Company, was read describing the use of electricity in the construction of the Panama Canal and plans for its application in the permanent service of the great waterway. Mr. T. E. Pevard then gave a talk upon the new load-dispatching facilities of the Boston Edison system, which are to be completed within about two months.

* * *

Dinner of the Duquesne Light Company's Section, N. E. L. A.—The monthly dinner of the Duquesne Light Company's Section of the National Electric Light Association was held at the Colonial Annex Hotel, Pittsburgh, last week, more than 300 members attending. Mr. Henry W. Pennywitt, chief of the local weather bureau, explained the equipment and workings of the bureau, and motion pictures were shown of the last annual dinner of the section, held at Homestead Park last summer.

* * *

Electric Club of Chicago.—At a well-attended meeting of the Electric Club of Chicago on Oct. 23 Messrs. C. W. Forbrich, F. W. Harvey and F. P. Vose were appointed a committee to see if it be practicable to devise some modest death-benefit association as an auxiliary to the club. Mr. W. J. McDowell, secretary of the Chicago Section of the Electric Vehicle Association, invited the club to attend the Chicago convention of that association. Mr. D. J. Cartwright, of Phillipsburg, N. J., president of the Association of Railway Electrical Engineers, was present as the guest of the club and made a few remarks. The remainder of the meeting was devoted to home-talent entertainment. There were violin and flute solos by Messrs. W. S. Taussig and George C. Keech respectively and humorous speeches by Messrs. James H. Delany and Perry R. Boole.

* * *

Meeting of New York Companies' Section, N. E. L. A.—The first fall meeting of the New York Companies' Section of the National Electric Light Association was held at the Edison Auditorium Oct. 20. Mr. Joseph B. McCall, president of the N. E. L. A. and of the Philadelphia Electric Company, was present, and after a short address on association affairs conferred the Doherty Gold Medal upon Mr. T. F. Bludworth, of the New York Edison Company. This medal was awarded for the best paper presented before a company section during the year 1912 and was won on a paper entitled "Adaptability to Service." Mr. H. M. Edwards, chairman of the section, then introduced Mr. W. W. Freeman, recently appointed executive officer of the street railway, gas and electric light interests in Cincinnati, who told in an intensely interesting manner some of his experiences while on a recent trip through Mexico.

* * *

New Jupiter and Mercury Greeted with Enthusiasm.—The weekly luncheon of the St. Louis League of Electrical Interests, Jovian Chapter, on Oct. 22 was turned into a home-coming celebration in honor of the New Jupiter, Mr. W. N. Matthews, and the re-elected Mercury, Mr. Ell C. Bennett, both of St. Louis. The meeting was held in the City Club of St. Louis and 165 members attended. Messrs. Matthews and Bennett, who were elected to their positions in the Jovian Order in New York on Oct. 15, had a very cordial reception. Speeches were made by Messrs. Arthur H. Halloran, of San Francisco, managing editor of the *Journal of Electricity, Power and Gas*; A. C. Einstein, vice-president of the Union Electric Light & Power Company; H. J. Pettingill, president of the Southwestern Telegraph & Telephone Company; W. A. Layman, president of the Wagner Electric Manufacturing Company; Frank D. Beardslee, Union Electric Light & Power Company; Frank Adam, Mr. Matthews and others. The attendance was the largest recorded in the history of the league.

# Hydroelectric Station on the Auglaize River

**Low-head development in the flat lands of the Maumee River Valley in Ohio—Features of the generating and switching equipment**

THE engineering possibilities of low-head hydraulic developments in an almost level country have again been demonstrated in the flat valley of the Maumee River in western Ohio by the construction on the Auglaize River, one of the Maumee's main tributaries, of the first hydroelectric station of the Auglaize Power Company. The city of Defiance, Ohio, 4 miles down stream, is the nearest railroad station to the development and was the point to which all of the material used in the erection of the plant had to be shipped. This lack of railroad facilities made the problem of transporting material no simple one, and some of the heavier pieces of machinery were hauled to the site of the station by means of a traction engine hitched to heavy wide-tired wagons.

### State of the Development

The present Auglaize development was begun in 1911 and was completed in 1912. Supplementing the station about to be described three more hydroelectric plants and one steam auxiliary station are now being planned. At the site of the power house and dam, as well as for many miles upstream, the river banks rise abruptly to an approximate height of 30 ft., affording an excellent natural basin for impounding water in the periods of maximum river flow.

About five months after the present station had been placed in operation the memorable floods of March, 1913, swept down upon the dam and headworks. At the period of greatest flow water 12 ft. deep was rushing over the spillway, while the difference in head caused by the 22-ft. dam in the river's path was but 2 ft. With this tremendous stream flow the water ran over the top of the river bank at the end of the dam farthest from the station, washing away the earth which backed up the retaining wall. This light concrete wall held for several hours, but when finally the supporting earth had been removed it crumbled before the torrent and gave the water a path around the end of the dam. The break did not noticeably affect the level of the river at Defiance, although with the news of the failure consternation spread among the city's inhabitants. The loss of both the impounded water and the natural stream flow during the time taken for repairs was, however, the cause of a considerable period of enforced idleness at the station.

The break has since been repaired and a cut is being

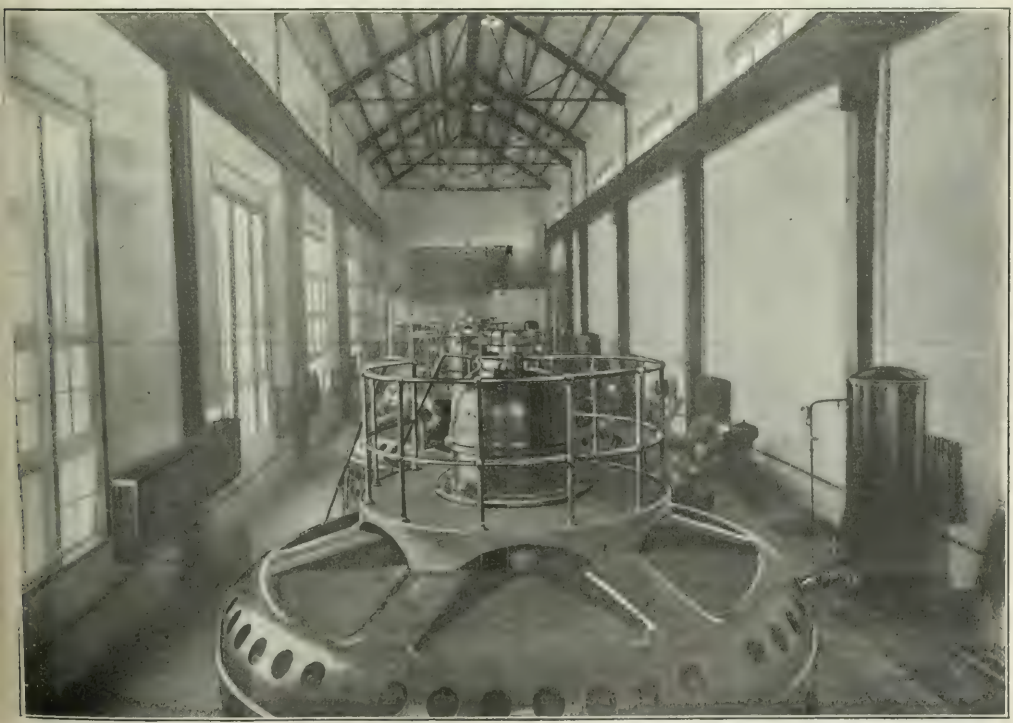


FIG. 1—MAIN GENERATOR ROOM, AUGLAIZE POWER COMPANY, LOOKING TOWARD SWITCHBOARD

dredged from the large government reservoir near St. Mary's, Ohio, which will add a flow of 700 cu. ft. per second to the stream. It is said that with this concession added to the natural stream flow sufficient water will be available to operate two of the station units at all times. Hope is also expressed that in the near future contracts

A floating boom has been placed at a sharp angle from the outboard corner of the power house to the bank of the river to deflect large floating masses of débris and ice to the Tainter-gate openings. Iron screens at each wheel intake are depended upon for intercepting the smaller river trash. As will be seen from the plan of the generating

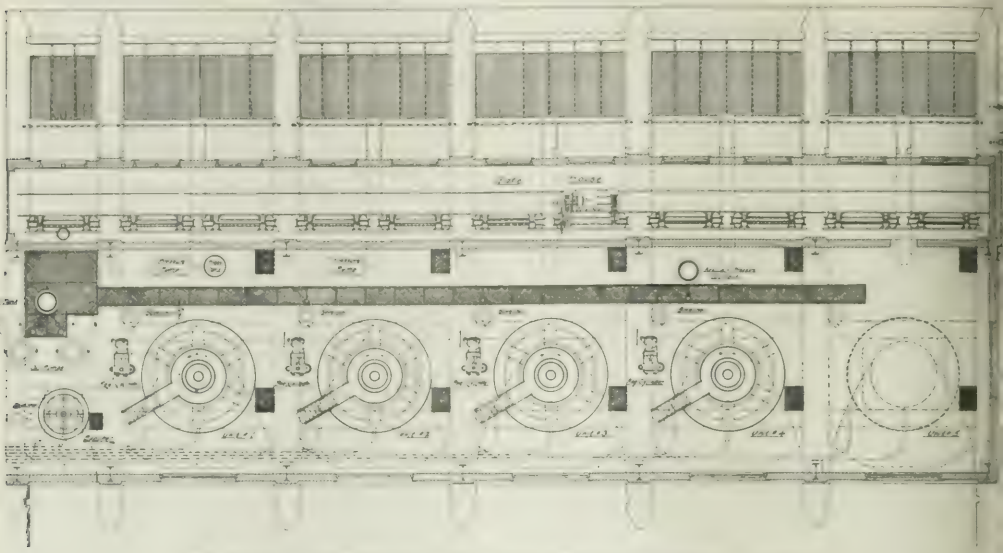


FIG. 2—PLAN OF GENERATING ROOM, AUGLAIZE POWER COMPANY, PLANT NO. 1

will be consummated which will allow secondary power from the remainder of the station to be delivered over a transmission line to Toledo during a portion of the year.

### Dam and Headworks

The dam, which was built by the Ambursen Hydraulic Company, is made up of twenty-five 15-ft. bays, with a total length of 375 ft. Three Tainter gates, each 30 ft. wide, and the main generating room of the power house, 145 ft. long, are also built across the bed of the stream and form part of the dam. At this point the river is 610 ft. wide, and under normal conditions the dam furnishes an effective head of 26 ft.

room of the station (Fig. 2) the gates are hoisted from a 10-ft. gatehouse running the full length of the station on the upstream side. The hoisting mechanism, also shown in Fig. 2, is driven by a 4.5-hp motor taking energy from one of several outlets in the wall along the track. There are in all eleven gates—two for each generator and one for the



FIG. 3—TURBO-EXCITER AND MOTOR-DRIVEN OIL PUMPS



FIG. 4—OIL SWITCHES IN HIGH-TENSION BUS ROOM

exciter unit. The gate hoist is able to raise a single ga in about fifteen minutes.

### Generating Equipment

The generating equipment of the station consists of t Allis-Chalmers 1000-kva, 2300-volt, 25-cycle, three-pha Y-connected, revolving-field alternators spaced in a sin

down the middle of the plant at a distance of 23.5 ft. ween centers. The vertical turbine wheels, which run a speed of 94 r.p.m., measure 9 ft. in diameter, and each equipped with twenty buckets. All wheels are of the gle-runner type and the weight of the rotating element carried by a hung bearing shown at the top of the ma-

tion motors and are capable of producing 125 kw and 75 kw respectively. All of the exciters are wired so that they may be switched to a common bus from which energy is distributed to the field windings of the alternators. A 40-ton crane built by the Northern Engineering Works, Detroit, Mich., serves all portions of the generating room.



5—POWER HOUSE, DAM AND TAINTER GATES, UPSTREAM SIDE



FIG. 9—WATER FLOWING AROUND THE END OF DAM AFTER THE FLOOD

nes. Three guide bearings spaced along the vertical ft keep the rotating parts in alignment. Both the main rings and the guide bearings are water-cooled. With water level at the spillway crest a 22-ft. head is obnable at the wheels.

The turbine bearings are oiled from the floor of the sta- by an automatic pump which supplies hard oil at pres- es varying from 2000 lb. to 300 lb. per sq. in. A pres- e relay in the oil system controls the automatic starter the motor-driven oil pump. The turbine governors are supplied with oil at 160 lb. pressure from a central oil- ssure system. The two 25-cycle, 220-volt, 40-hp motors ring this apparatus are automatically started and stopped the pressure variations of the system. Two motor- en pumps supply water at a pressure of 40 lb. to the

Two low-pressure steam boilers heat the station in winter and also furnish steam for heating and other purposes in the homes of the station operators which have been built on the river bank about 100 yd. from the power house. In case of the entire disablement of the water-driven equipment, steam may be taken from these boilers to drive a small horizontal engine belted to a direct-current generator, rated at 172 amp at 125 volts.

For stepping up the voltage as the energy leaves the station destined for Maumee five three-phase, 1000-kva, 2300/34,600-volt, 25-cycle, composite-type transformers have been installed. These water-cooled units were furnished by the General Electric Company and have both their primary and secondary windings connected in delta. The transmission line to Defiance is supplied through three



FIGS. 6, 7 AND 8—TRANSMISSION-LINE A-FRAME AND STRAIN TOWERS IN PROCESS OF ERECTION

rmformers and generator bearings and for other gen- ral purposes.

The exciter equipment is divided into three units, one of which is a 125-kw, 125-volt machine driven by a ver- ica waterwheel of the same type as the large units. This exciter is used only when the water supply is plentiful. The ther two units are driven by 25-cycle, 2300-volt induc-

single-phase, 2300/6600-volt, 400-kva Allis-Chalmers transformers which are also connected with windings in delta. The local alternating-current supply required by the station lighting and auxiliaries and by the lighting in the operators' houses is furnished through three single-phase, 125-kw, 2300/220/110-volt, delta-to-delta transformers. Each of the main banks of transformers feeding the line

to Maumee is protected on the transmission-line side by aluminum-cell lightning arresters designed for use on circuits operating at 60,000 volts. On the Defiance line 13,000-volt arresters of the same type are used.

### Switchboard and Switching Equipment

In the combination panelboard and benchboard located



Fig. 10—Switchboard gallery

on an elevated gallery at the south end of the generating room is centered the control of the entire station. Small synchronizing motors on the governor stands are controlled from the benchboard so that any machine may be started, brought up to speed and with the aid of remote-controlled switches may be placed on the busbars by a single operator on the switchboard gallery. All remote-control switches are of the solenoid type. By proper switching from the benchboard it is possible to obtain any combination of machines or transformers desired by the operator. Of the eleven panels which go to make up the board, three are exciter panels, three are meter panels, three switching and relay panels, one carries the Tirrill regulator, and one serves for switching the local load. The exciter panels carry the remote-control starters, field-rheostat handles and



Fig. 11—Composite transformer

instruments. The rheostat resistors are mounted back of the board. The three meter panels are fitted with one alternating-current voltmeter, an ammeter, a wattmeter and a direct-current field ammeter for each waterwheel unit. The main ammeter and voltmeter are arranged so that they may be switched to read respectively current in any phase and voltage between any two legs of the line. On th panels are also provided ammeters for measuring outgo current. At the middle and above the board an electr static ground detector is supported on an iron standa Both synchroscope and synchronizing lamps are used paralleling the machines on the buses. The output of ea generator is measured and recorded by five recording wa meters, these instruments being placed on the rear of t switchboard.

The extensive switching facilities provided at this s tion allow any piece of the apparatus or any portion of t wiring to be cut out of the circuit. The most spectacu switching installation in the station is found in the roo above the transformers, where six sets of 70,000-volt, thr phase remote-control oil switches are located. One ba of these big machine switches is provided for each alt nator and an additional set connects the high-tension b with the Maumee transmission line. In connection w the latter set of switches three high-tension ammeters installed in the outgoing lines and time-limit rela equipped with auxiliary tripping devices protect the s tion equipment from short-circuit and high-potential sur on the line. Disconnecting switches with safety latches placed between the oil switches and the high-tension b

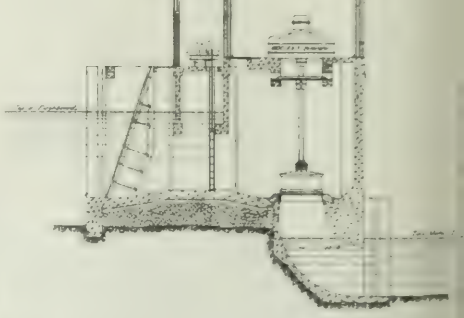


Fig. 12—Section through power house

Two additional groups of disconnecting switches have installed to enable the operator to open the circuit betw the transformers and the low-tension bus and to allow 2300-volt leads to be disconnected from the machine s Thus any phase of any circuit may be cut dead in particular place by proper manipulation of disconnec switches.

### Transmission Lines

The two transmission lines extending from the st of the Auglaize Power Company transmit energy t towns of Maumee and Defiance, Ohio. The line to M mee is 53 miles long and is operated at 34,600 volts the one to Defiance is 4 miles long and is operat 6600 volts. Steel towers of the A-frame type are us both lines. Illustrations herewith show two of the A-f towers and also the strain tower at the station in pr of erection.

Mr. Harden T. Crawford, New York City, is pre of the Auglaize Power Company and Mr. W. P. W Toledo, Ohio, is manager. The general scheme of de ment was planned by Mr. R. R. Livingston, cons engineer, New York City.

# The Waterside Turbine Station at Louisville, Ky.—II

**Electrical equipment and switching apparatus for 6600-volt and 2200-volt circuits—Special calibrating panels on switchboard—Use of colored wire, labeling and designation of phases—Plant work-order system**

THE preceding article of the above title, which appeared in the *Electrical World* of Oct. 25, described the general features of the prime-mover uipment in the Waterside station of the Louisville (Ky.) as & Electric Company, including a reference to the nusual condenser-pit arrangement by which, to accomodate the 45-ft. rise and fall of the Ohio River at this oint, the condensers are installed nearly 50 ft. below the rbine-room floor. Details were also given of the angement of steam headers by which the use of traps is voided.

The following paragraphs relate particularly to the elecical apparatus in the plant, special attention being given the auxiliary and switching equipment, and to improved perating features devised locally.

### UXILIARY ELECTRICAL EQUIPMENT AND SWITCHBOARD

In addition to the main generating units, the turbine room ontains two General Electric rotary converters rated at oo kw each, one 500-kw Westinghouse synchronous motorenerator set, one General Electric turbine-driven 125-volt xciter and one motor-driven exciter, and a 5.5-kw General lectric 220-volt motor-generator which supplies energy r the operating storage battery.

The synchronous motor-generator set operates on 6600-lt three-phase energy and supplies electricity at 600 volts r commercial-motor load. The field excitation of the nchronous motor is adjusted to give 70 per cent leading wer-factor, to aid in correcting the inherent lagging wer-factor of the system. This set is started by a comnsator and oil switch located below the floor but is conlled from the switchboard. A 8.5-kw, 125-volt exciter is ounted on one end of the shaft of the machine.

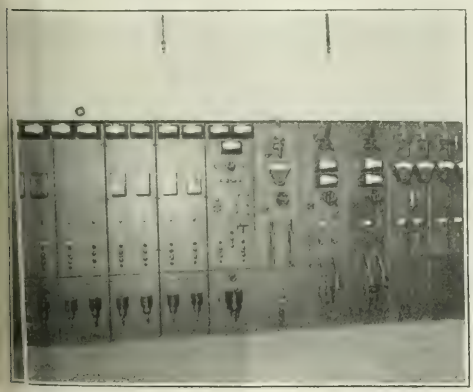


FIG. 7—DISTRIBUTION SWITCHBOARD, CONCRETE WALL ABOVE PANELS CONCEALING CONDUIT

The two 200-kw, 600-volt rotary converters also furnish dir-current motor service. Each of these machines is pro ded with a compensator, a field break-up switch and 220-390-volt transformers so that they may be started up om the alternating-current side.

At the north end of the turbine room is the operating engineer's office. Here complaints and work-order blanks are filed by a card-index system and station log sheets are inspected to ascertain where savings can be instituted. Tabulations of cost of labor and material on repair jobs make it a simple matter for the operating engineer to estimate the cost of similar jobs in the future. Every possible

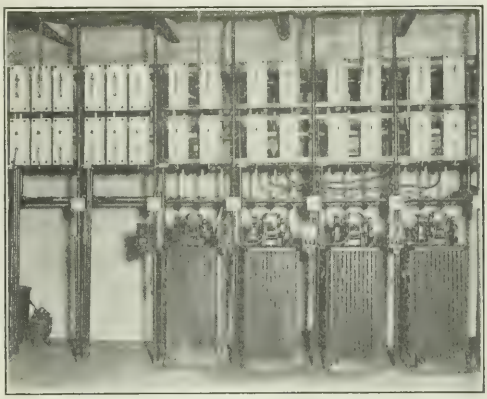


FIG. 8—SINGLE-PHASE REGULATORS ON 2200-VOLT LIGHTING CIRCUITS

effort is made to give the men about the plant an understanding of the operation of the apparatus and the reasons for the various readings and measurements taken and reported.

The "switchboard room," or space occupied by the benchboard and vertical switchboard, which are on the engine-room floor level, is 18 ft. wide and extends the entire length of the station. One end of this space is utilized for the feeder regulators and air-blast transformers. The benchboard is divided into six panels—two for the 2000-kw and 4000-kw turbo-generators, three for the 500-kw vertical turbo-generators in the adjoining old station, and one for the two exciter units. Supported on pedestals above the benchboard are six meter panels, on which, in addition to the usual instruments, there are mounted three-blade, double-throw, broken-back knife switches, normally held in the upper position by a spring. When it is desired to read on the wattmeter the wattless component of the energy being supplied by the generators, the corresponding switch is thrown down.

Placed on a swinging bracket at one end of the benchboard are six voltmeters, a synchroscope and a frequency meter. Another large synchroscope is placed on the wall where it can be seen from any part of the turbine room.

On each of the benchboard panels is a signal device connecting with a similar signal on the pedestal beside the corresponding generator. The generator field switches are interlocked with the synchronizing plug receptacles and the remote-control switches so that the field switches cannot be opened while the main switch is closed, nor can the main switch be closed unless the synchronizing plug is inserted. Telephonic communication can also be obtained with different parts of the station and with the electrical

engineer's office. One master clock over the exciter panel operates all of the printometer devices in the station.

### Special Calibrating Panels

All of the instruments on the benchboard, as well as those on the distributing panels, can be calibrated without removing them from the panels by connecting a portable testing set of terminals onto a special calibrating panel on the back of each instrument panel. On this panel are terminals which connect with potential terminals of the instruments on the respective panels. These are normally connected to

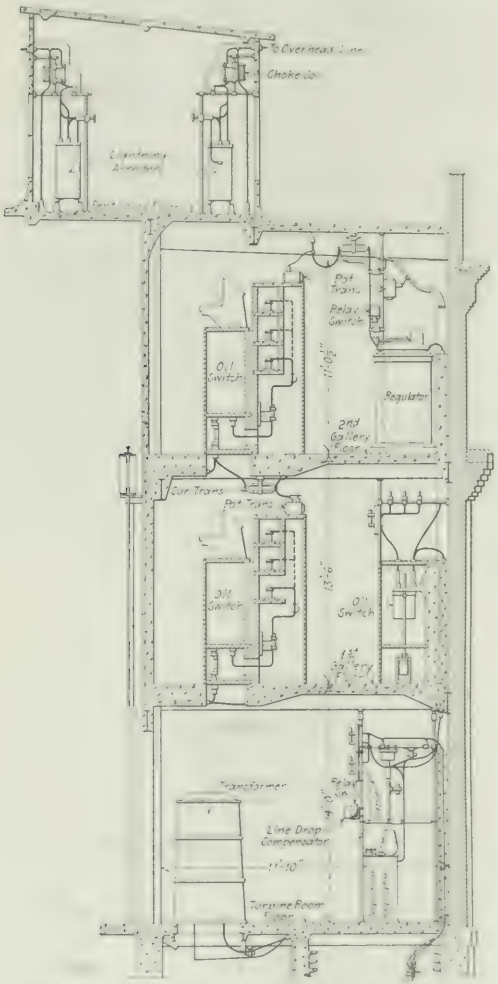



FIG. 9—OIL-SWITCH GALLERIES OVER SWITCH ROOM

potential transformer terminals (also on the panel) by copper bridges. In its upper position, a four-blade, double-throw, broken-back knife switch connects the current terminals of the instruments to the current transformers, and when in its reverse position short-circuits and grounds the transformers. The operating circuit of the overload relay is connected through the fourth pole of this switch, so that a gap can be made on the circuit when the instruments are being tested to prevent the accidental opening of circuit-breakers.

When testing instruments, the potential terminals are disconnected from the potential transformers and connected by flexible cord and clips to the portable set. The broken back switch is placed in the lower position, and current clip from the portable set are inserted in the upper clips of th switch. These clips are of different design so that ther is no danger of mistake in connecting the portable set to th calibrating panel.

The vertical switchboard controls the underground an overhead feeder circuits. The construction of this board the arrangement of the building to accommodate it and th utilization of colored wires to facilitate tracing circuits ar among the main features of this portion of the switch board room.

Colored wire is used throughout the station to facilitat tracing instrument circuits in case any instrument become inoperative. Oil-switch control wiring has its individua color to distinguish it from the wires running to indicatin and recording instruments. Potential and current wires similarly, have designating colors, and different phas wires have the same color scheme throughout the system The busbars are arranged in a definite order so that th phases can be distinguished by their position without refer ring to a chart. Where the buses are arranged horizon tally the phases read A B C from east to west or fron north to south, as the case may be. When placed verticall they read from the top down. All the buses in the switch board room both low-tension and high-tension (excep

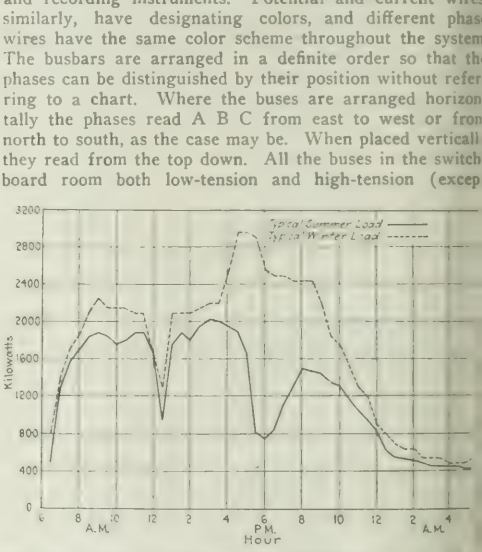



FIG. 10—TYPICAL SUMMER AND WINTER LOADS, IO WATERSIDE STATION

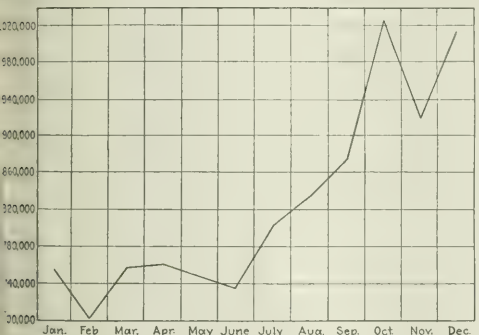
6600 volts) are covered, not to prevent flashovers, but protect against short-circuit due to some tool falling ac them. Next to the bus is a layer of fiber bent to con to the shape of the bus, and surrounding this is a layer empire cloth. Two exciter buses are installed for em ency. The turbine-driven exciter is used only rarely, motor-driven set being operated ordinarily.

The 2300/4600-volt alternators at present supply 2 volt energy to three 1500-kw sets of Westingh 2300/6900-volt step-up transformers, the low-tension l of which are sectionalized in order that the generators transformers may be grouped into independent systen desirable. Two of the transformers are of the three-ph air-cooled type, while the other set consists of three sin phase, delta-connected, oil-cooled transformers having combined rating of 1500 kw.

As the generating equipment is increased and the ne sity of a more extensive high-tension district becomes perative, the connection of generators and transformer the 2200-volt and 6600-volt buses will be reversed. In other words, the generators will be connected to su 4600-volt energy to compensators which will step the sure up to 6900 volts. Energy at this voltage will the be supplied direct to the nominal 6600-volt buses, and he transformers which are now being used as step-up its

will be used to step down to 2300 volts for the nominal 2200-volt bus. This change will be made provided, of course, that the extent of the high-tension district warrants it. The entire station has been laid out with this reversal of conditions in view.

Each main generator switch is grouped with the 2200-volt switch of a step-up transformer and with a number of 2200-volt feeder-line switches, which can thus be supplied with energy by the particular generator without assistance from an outside source. With this arrangement it is possible to sectionalize the bus and operate each generator independently of the others. Above each compartment containing a 2200-volt distributing oil switch is a marble panel on which are mounted two single-blade, double-throw knife switches used to connect the single-phase feeders to different phases where it is necessary to balance the load on the three-phase system. The sectionalizing switches for the 2200-volt bus are mounted horizontally and have special locks to prevent their being opened by gravity or current surges. Two "dogs" close over and grip the blade automatically when the switch is closed. The 6600-volt oil switches are actuated by motors, while the 2200-volt switches are operated by solenoids. The 6600-volt buses consist of flat copper bars supported on vertical porcelain insulators, connections being made with copper




G. 11—KILOWATT-HOURS GENERATED BY MONTHS, 1912

bing. Duplicate buses are employed to permit flexibility operation.

### Feeder Regulators

Located on the second gallery are six voltage regulators, ur of which, rated at 150 amp each, are used on the 2200-lt system for supplying energy to combined motor and hting loads. Regulation is applied in the one lighting ase only. Two three-phase, 100-amp regulators adjust e voltage of the 6600-volt motor circuits. Lightning pro-tion is provided by General Electric electrolytic light-ng arresters. Each feeder regulator is provided with a tential transformer and a plug receptacle which connects th a recording voltmeter in the switchboard room, by ans of which any circuit on which there is a complaint voltage variation can be investigated without setting up cial apparatus for the purpose.

Eight single-phase, 150-amp lighting regulators for the 10-volt lighting circuit are installed on the main floor the station at the north end of the switchboard room. Supplementing the station lighting from the alternating-rrent mains, in case of plant shut-down, emergency vice is automatically supplied by a no-voltage release tch which connects the station service system to the rage-battery bus, used normally to furnish current for witch operation and signals.

eeder circuits are conducted to their destinations as verhead lines and through underground conduits. The verhead circuits are carried up to the penthouse above the second gallery, in which the multi-gap and electrolytic lightning arrester equipment is installed.

Two subways are provided for the underground circuits leaving the generating station, although only one of these tunnels is being used at present. The cables are brought down from the oil switches or regulators in fiber ducts to a concrete cable rack in the basement. At each end of

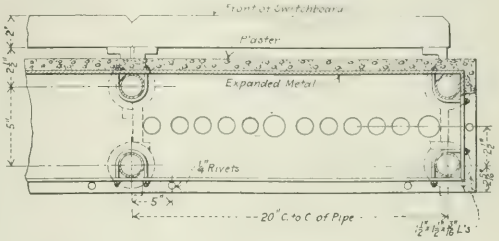



FIG. 12—PUNCHED PLATE USED AS TERMINAL PLATE FOR CABLES APPROACHING SWITCHBOARD FROM ABOVE

the rack is a manhole which communicates with one of the subways previously mentioned. On the cable-rack pot-heads, as well as on the switchboards, feeder regulators and other apparatus the circuits are numbered, each 2300-volt and 6600-volt line having the prefix figure "2" or "6" added respectively to the number of the circuit to indicate the potential of the circuit.

Each of the electrolytic lightning arresters is connected to a relay in such a manner that when there is a discharge to ground an annunciator drop is released in the switchboard room and a bell continues to ring until the drop is restored to its normal position. In this way there is brought to the attention of the operator any disturbance which is too insignificant to damage machinery but which may lead to future trouble. Similar alarms are provided for the overload relays which light incandescent lamps. The turbine room is served by a 40-ton double-hoist alternating-current crane.

Sargent & Lundy, engineers, Chicago, designed and supervised the construction of the Waterside station.

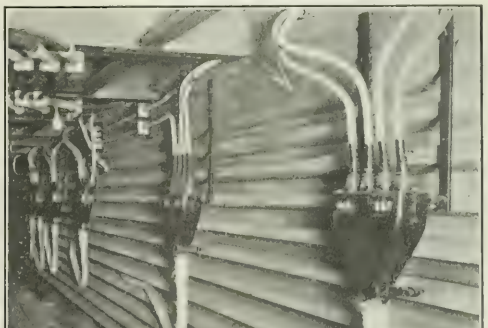


FIG. 13—CONCRETE CABLE RACKS IN BASEMENT LEADING TO SUBWAYS

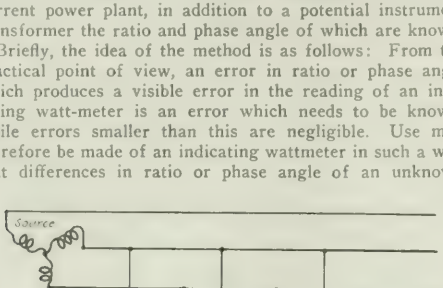
The officers of the Louisville Gas & Electric Company are as follows: President, General George H. Harries; vice-president, Mr. Donald McDonald; superintendent of electrical department, Mr. G. Wilbur Hubley; treasurer, Mr. T. B. Wilson; secretary, Mr. Thomas W. Kennedy; consulting engineer, Mr. L. S. Streng.

## Testing Shunt Instrument Transformers[1]

By H. B. Brooks

The ratio and phase angle of an instrument transformer may be accurately determined by laboratory methods. The commercial importance of such transformers has stimulated the development of accurate methods in recent years.[2] In many cases, however, it is not practicable to dismount transformers and send them to a laboratory, and a method is wanted which, while giving all needed accuracy, can be carried out at the point of installation, using commercial instruments and the ordinary supply voltage. Such a method of testing potential instrument transformers will now be described. No claim for originality of principle is made, as the only novel feature is the use of facilities which are available in any properly equipped alternating-current power plant, in addition to a potential instrument transformer the ratio and phase angle of which are known.

Briefly, the idea of the method is as follows: From the practical point of view, an error in ratio or phase angle which produces a visible error in the reading of an indicating watt-meter is an error which needs to be known, while errors smaller than this are negligible. Use may therefore be made of an indicating wattmeter in such a way that differences in ratio or phase angle of an unknown




CONNECTION FOR TESTING STANDARD AND UNKNOWN TRANSFORMERS

transformer and a standard transformer have the best possible opportunity to produce a deflection. By properly choosing conditions, this deflection may be readily made to give the numerical values of the quantities which are desired.

The primary windings of the standard transformer and the transformer to be tested are connected to the same supply system, as shown in the accompanying illustration. The secondary windings are connected in series so that their voltages are opposed. The secondary voltages will be nearly equal and will rise and fall in unison as the line voltage varies. The thing to be measured is the difference between the two secondary voltages, which difference in general would be only a few volts. As the lower end of the scale of an alternating-current voltmeter is practically useless, this small voltage cannot be measured satisfactorily with even a low-range voltmeter. However, a 5-amp indicating wattmeter may be used as a voltmeter by separately exciting its series coil.[3] This may be done by passing 5 amp through the coil to a lamp load. This exciting current must not be drawn from either of the two transformers whose ratios are to be compared, but must come from the secondary of any other available transformer connected to the same phase as the transformers under comparison. The current through the series coil of the wattmeter should be kept at approximately 5 amp, but this current needs to be measured with only moderate accuracy. The shunt circuit of the wattmeter may now be used as a voltmeter to measure the small difference in the secondary voltages of the two transformers under comparison. For example, if the wattmeter is made for 5 amp, 150 volts, 750 watts, and has a 150-division scale, then one division is 5 watts and will be given by 5 amp in the series coil and 1 volt on the shunt circuit; hence the difference between the two secondary voltages, in volts, will be shown by the number of divisions deflection of the wattmeter. Since the ratio of good potential instrument transformers changes very little with ordinary fluctuations of line voltage, the difference of the secondary voltages will be practically constant. As the wattmeter reading is steady and can be taken to one-tenth of a division, the ratio of one transformer in terms of the other can be read to 1 in 1000. If the wattmeter has a 75-volt range, this may be used and the reading will be doubled; that is, one volt difference between voltages will be given two divisions deflection. It is obvious that with a wattmeter having a still lower voltage range, say 30 volts,[4] the difference between the secondary voltages could be still more accurately read.

The question as to which transformer has the greater ratio may be easily answered from the fact that increasing the non-inductive load on the secondary always lowers the secondary voltage and thus increases the ratio of transformation. If the reading of the wattmeter is up scale when there is no load on the secondary of the transformer under test, and if this reading increases as successive lamps are connected to the secondary of the transformer under test, the voltage of this transformer at no load is lower than that of the standard transformer. Similarly, if the deflection is below zero with no load and the addition of load brings the deflection up through zero to a reading on the scale, the voltage of the transformer under test at no load is higher than that of the standard transformer. In this case the potential leads should be reversed at the start to bring the readings on the scale; they will decrease as the load is gradually applied and pass through zero, when the leads may be replaced in the original position.

It is obvious that the above method is a suitable one for determining the regulation of "power" transformers, by using one transformer of a bank on no load as the standard transformer and determining the drop of voltage of another transformer as the load on it is increased. The method is similar in principle to the one described by Drysdale,[5] but differs in important details. In his method the shunt circuit of the wattmeter is connected to the secondary of the standard transformer, and the series coil of the wattmeter, with some added resistance, is used as a low-range voltmeter to measure the difference of the secondary voltages. The method described in the present article inverts these uses of the two coils, the series coil being the one which is separately excited and the shunt circuit being used as the low-range voltmeter. This has the advantage of drawing a very much smaller current from the transformers under comparison and thus avoiding what might be an appreciable error in the case of small transformers.

If the preceding test for ratio is made with the primaries connected to one phase of a two-phase circuit, a determination of the difference of the phase angles of the two transformers may then be made by connecting the wattmeter series coil and 5-amp lamp load to the other phase. Before doing this, the ratios of the transformers should be ma

[1] Being a condensation of an article in the *Bulletin* of the Bureau of Standards. Read and [illegible] Bulletin of the Bureau of Standards, Vol. 6, page 1; 1909; Reprint No. 116. Agnew and Fitch, *Electrical World*, Vol. 54, page [illegible] Reprint No. 150. E. Orlich, *Elektrotechnische Zeitschrift*, Vol. 30, pages 435 and 466; 1909. L. T. Robinson, *Trans.* Am. Inst. Elec. Eng., Vol. 28, page 1005; 1909. F. A. Laws, *Electrical World*, Vol. 55, page 223; 1910. Sharp and Crawford, *Trans.* Am. Inst. Elec. Eng., Vol. 29, page 1517; 1910. Agnew and Silsbee, *Trans.* Am. Inst. Elec. Eng., Vol. 31, page 1267; 1912.

[2] [illegible] described by Drysdale, London, *Electrician*, Vol. 57, page 783; 1906.

[3] With this range, at 60 cycles, no error due to mutual inductance enters [illegible] types of portable wattmeter. It is not advisable, in general, to reduce the range below 30 volts.

[4] London *Electrician*, Vol. 65, page 644; 1910.

al by loading the secondary of one or the other with ps or other non-inductive load.[6] The current taken by load should be determined. If it must be applied to standard transformer in order to make the ratios equal, value of phase angle of the standard transformer cor- onding to the given load may be taken from a curve ted from the certified values.[7] The small voltage shown the wattmeter with its series coil on the second phase measure of the difference of the phase angles of the transformers with the given secondary loads. For mple, suppose that the wattmeter constants are those viously referred to and the 150-volt shunt circuit is in so that one division deflection is given by 1 volt ap- d to the potential circuit. Suppose the deflection is division when the 5-amp current in the series coil is vn from the second phase of the two-phase circuit le the primaries of the two potential instrument trans- ners are on the first phase. The 0.3 volt divided by the ndary voltage (say 110) of the transformer under equals 0.0027. This number is the sine of the small le by which the phase angles of the two transformers er. By reference to a table of natural sines,[8] the angle ound to be nine minutes. Hence 0.1 division of the tmeter corresponds to three minutes. By using the 75- range of the wattmeter 0.1 division will correspond to and one-half minutes.

remains to determine which of the two secondary volt- s is leading the other. To test this point, advantage be taken of the fact that increasing a non-inductive l connected to the secondary of a potential instrument sformer tends to make the reversed secondary voltage behind the primary voltage. With the connections e for phase-angle test as just described, and the watt- r reading 0.3 division up the scale, connect one or more ndescent lamps to the secondary terminals of the trans- ier under test, without disturbing any of the former ections. If the deflection of the wattmeter is increased, ading-up scale denotes that the secondary voltage of transformer under test lags behind that of the stand- transformer. If the application of the lamp load to transformer under test sends the wattmeter reading below 0.3 division, a reading-up scale denotes that econdary voltage of the transformer under test leads lof the standard transformer.

a two-phase circuit is not available, three-phase to hase arrangement of transformers may be used. If is not convenient, the test for phase angle may be made citing the wattmeter series coil from another phase three-phase circuit. In this case, however, the watt- reading must be multiplied by 1.16 (the reciprocal 866) in order to get the deflection which would be e if test were made on a two-phase line. The calcula- ns then made as before. The phase-angle test may so e made with the series coil connected to the third nas as a check. If the deflections are slightly different om hose obtained when phase two is used, the mean of e o values may be taken.

In he illustration no connected load is shown on the co ary of the transformer whose ratio and phase angle e t be determined. However, any desired load may be nn ted to it and the comparison made in the same way. he ad is simply connected to the secondary terminals ithc t disturbing any of the other connections.

To st the accuracy of the foregoing method, two 5500- 0-11 volt potential instrument transformers were com- ared t three secondary loads. The test was then repeated, using an accurate laboratory method. The values for ratio by the two methods agreed to within 0.02, 0.05 and 0.08 per cent for the three loads, which were respectively light load, rated load and twice rated load. The values of phase angle by the two methods agreed to within less than half a minute. The wattmeter used was arranged with a 30-volt potential range especially for the test.

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## Effect of a Short-Circuited Secondary on an Oscillating Circuit

By Louis Cohen

In a recent discussion at a meeting of the Institute of Radio Engineers* a question arose regarding the effect of short-circuiting the overhanging turns of an inductance coil in an oscillating circuit, as indicated in the illustration on the next page.

Some maintained that the short-circuiting of the overhanging turns produces large damping in the oscillating circuit, while others declared that their experience with such an arrangement had not shown any bad effects. It would appear that there exists some misunderstanding about the problem, and it will perhaps be of some interest to indicate briefly the mathematical solution of the problem, and to show that both views may be justifiable. It is all a question of the relative magnitudes of $L_1$ and $L_2$ and the mutual inductance between the coils $L_1$ and $L_2$.

Mathematically the problem is the same as that of the oscillation transformer. To simplify the discussion, assume a sine emf (undamped) acting on the oscillating circuit; we have then the well-known transformer differential equations for the two circuits, which are as follows:

$$\left.\begin{aligned} L_1\frac{dI_1}{dt} + R_1 I_1 + \frac{1}{C_1}\int I_1 dt + M\frac{dI_2}{dt} &= E\varepsilon^{i\omega t} \\ L_2\frac{dI_2}{dt} + R_2 I_2 + M\frac{dI_1}{dt} &= 0 \end{aligned}\right\} \quad (1)$$

Solving these two equations, we get for the absolute values of the currents in the two circuits:

$$\left.\begin{aligned} I_1 &= \frac{E\sqrt{L_2^2\omega^2 + R_2^2}}{\sqrt{\left\{(M^2 - L_1L_2)\omega^2 + \frac{L_2}{C_1} + R_1R_2\right\}^2 + \omega^2\left\{L_2R_1 + L_1R_2 - \frac{R_2}{C_1\omega^2}\right\}^2}} \\ I_2 &= \frac{EM\omega}{\sqrt{\left\{(M^2 - L_1L_2)\omega^2 + \frac{L_2}{C_1} + R_1R_2\right\}^2 + \omega^2\left\{L_2R_1 + L_1R_2 - \frac{R_2}{C_1\omega^2}\right\}^2}} \end{aligned}\right\} \quad (2)$$

The circuit may be tuned in two ways: it can be tuned without any regard to the secondary circuit, or the system as a whole can be tuned including the secondary circuit.

In the first case $L_1\omega - \frac{1}{C_1\omega} = 0$, and the expression for $I_1$ in equations (2) reduces to

$$I_1 = \frac{E\sqrt{L_2^2\omega^2 + R_2^2}}{\sqrt{(R_1R_2 + M^2\omega^2)^2 + R_1^2L_2^2\omega^2}} \quad (3)$$

In the second case, tuning the system as a whole,

$$(M^2 - L_1L_2)\omega^2 + \frac{L_2}{C_1} = 0$$

or

$$\omega^2 = \frac{1}{L_1C_1(1 - K^2)}, \left(K^2 = \frac{M^2}{L_1L_2}\right) \quad (4)$$

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[6] The writer is indebted to Dr. P. G. Agnew and Mr. F. B. Silsbee for ... ar other helpful suggestions.

[7] Such interpolation is easily made, since the ratio and phase angle ...rves potential instrument transformers are sensibly straight lines.

[8] If a ble of natural sines is not available, the angle (in minutes) may ...e obtained by multiplying the quotient of the two voltages by 3438; thus, ...27 ...es 3438 equals 9+. This assumes that the sine of a small angle ...equa ... the angle expressed in radians. For the small phase angles of ...erum ... transformers this assumption introduces no appreciable error.

* *Proceedings* of the Institute of Radio Engineers, Vol. I, Part 2, pages 32, 33.

and the expression for $I_1$ in equation (2) (neglecting $R_1R_2$) becomes

$$I_1 = \frac{E\sqrt{L_2^2\omega^2 + R_2^2}}{\omega\left(L_2R_1 + L_1R_2 - \frac{R_2}{C_1\omega_2}\right)}$$

$$= \frac{E\sqrt{L_2^2\omega^2 + R_2^2}}{\omega\,(R_1L_2 + R_2L_1K^2)} \qquad (5)$$

If the overhanging coil were entirely removed and the oscillating circuit tuned to its natural period, we would have

$$I_1' = \frac{E}{R_1} \qquad (6)$$

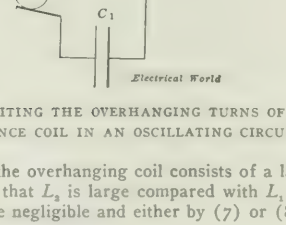
Comparing equations (3), (5) and (6), it is seen that by tuning the primary circuit alone, the presence of the short-circuited overhanging coil (or closed secondary) reduces the current in the primary circuit in the ratio,

$$y_1 = \frac{I_1}{I_1'} = \sqrt{\frac{R_1^2}{R_1^2 + \frac{2R_1R_2M^2\omega^2 - M^4\omega^4}{L_2^2\omega^2 + R_2^2}}} \qquad (7)$$

Tuning the system as a whole, the effect of the closed secondary is to reduce the current in the primary in the ratio,

$$y_2 = \frac{I_1}{I_1'} = \frac{R_1\sqrt{L_2^2\omega^2 + R_2^2}}{\omega\,(R_1L_2 + R_2L_1K^2)} \qquad (8)$$

An examination of equations (7) and (8) will show what effect the closed secondary may have under different conditions. If the overhanging coil consists of a large number of turns, so that $L_2$ is large compared with $L_1$ and $M_1$, the effect will be negligible and either by (7) or (8) $y = 1$ approximately.




SHORT-CIRCUITING THE OVERHANGING TURNS OF AN INDUCTANCE COIL IN AN OSCILLATING CIRCUIT

The greater the value of $L_2$ the closer the approximation. If, on the other hand, the overhanging coil consists of only a few turns, so that $L_2$ is small compared with $L_1$ or $M_1$, the effect may be very serious, and in some extreme cases the current in the oscillating circuit may be reduced to almost zero because of the closed secondary.

One or two illustrations will perhaps make it clearer.

Assume the case of a coil of 100 turns, length 10 cm, radius 5 cm, with ninety turns overhanging,†

$L_1 = 0.02$ mh., $L_2 = 0.59$ mh., $M = 0.024$ mh.

Assume $R_1 = 10$ ohms (including radiation resistance of antenna, if the coil is part of an antenna circuit).

$R_2 = 3$ ohms, $\omega = 10^6$.

For these constants we have by (7),

$$y = \frac{10}{\sqrt{100 + \frac{34,560 - 332,000}{348,000}}} = \frac{10}{\sqrt{101}} = 1 \text{ approximately}$$

By (8)

$$y_2 = \frac{10 \times 590}{10 \times 590 + 3} = 1 \text{ approximately.}$$

Short-circuiting the secondary has practically no effect the current in the primary in this case. Suppose, howev that only thirty turns are overhanging. Then,

$L_1 = 0.42$ mh., $L_2 = 0.12$ mh., $M = 0.056$ mh.

Assume $R_1 = 10$ ohms, $R_2 = 1$ ohm, $\omega = 10^6$.

For these constants, by (7),

$$y_1 = \frac{10}{\sqrt{100 + \frac{11,090,000}{14,400}}} = \frac{10}{\sqrt{100 + 770}} = 0.34.$$

The current in the primary circuit is reduced to 34 p cent of the value that it would have if the secondary c cuit were entirely absent.

If the system is tuned as a whole, including the s ondary, we have by (8)

$$y_2 = \frac{10 \times 120}{1200 + 26.4} = 0.98.$$

For this case, tuning the system as a whole, the curre in the primary will not be affected materially by the pr ence of the secondary.

Consider now an extreme case, the overhanging c consisting of a single turn.

$L_1 = 0.68$ mh., $L_2 = 0.0003$ mh., $M = 0.006$ mh.

Assume $R_1 = 10$ ohms, $R_2 = 0.05$ ohms, $\omega = 10^6$.

By (7) $y_1 = 0.09$.

By (8) $y_2 = 0.33$.

For this case even by tuning the system as a whole t current in the oscillating circuit is reduced to one-third normal value.

It is evident, therefore, that the effect produced by sho circuiting the overhanging coil depends altogether on relative magnitudes of $L_1$, $L_2$ and $M$.

Experiments made some three years ago by the writ gave results which were in general in agreement with above. It was suggested at that time that a single-turn s ondary placed within the inductance coil so as to get maximum mutual inductance and rotating it back and fo through 90 deg. would produce sufficient variation in c rent to serve as a means for sending signals in a wire station in place of the key generally employed.

†For formulas to calculate the inductances, see paper on "Formulas and Tables for the Calculation of Mutual and Self Inductance," by E. B. Rosa and Louis Cohen, *Bulletin* Bureau of Standards, Vol. 5.

## Sand-Blast Action of Desert Winds on Wires

By Arthur Palme

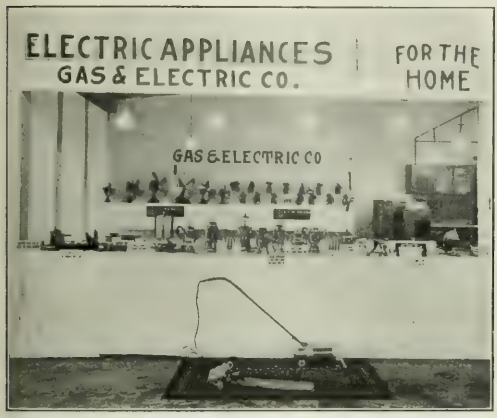
Overhead electric wires of any kind erected in Egyp the vicinity of the African deserts suffer severely from attacks of the fine sand blown about by the winds. E ing from Cairo to the Pyramids of Gizeh is an e trolley line which is used chiefly by tourists. The t of huge palm trees serve as trolley poles to suppor overhead conductor, and the contrast between the m hurrying motor cars and the peaceful centuries-old of the Pharaohs holds the interest of many a contemp traveler. At one side of the trolley conductor on shaped insulators are run the feeders, which like the ley wire are of bright, hard-drawn copper. After wires had been installed it was soon found that th variably broke and fell within six to seven month cross-section being much reduced at the point of fra Investigation showed that the desert winds which s across the right-of-way whip sand particles agains wires, causing a filing action which cuts away the c much like an artificial sand blast. The glass globes o lamps installed along the road have exhibited the me destructive action. A similar effect is observed wit incandescent units used to light the way to the Sp These strings of lamps, besides having to be mov frequent intervals to accommodate the varying level shifting sands, are rapidly eaten away by the etching of the desert winds. Thus far no remedy has been d ered for this destruction except frequent renewals.

# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## A Prize-Winning Central-Station Exhibit

At the Tri-State Fair held at La Crosse, Wis., during September, the exhibit of the La Crosse Gas & Electric Company won first prize. The display occupied two booths, one of which was devoted to electric appliances as shown in the accompanying illustration. A feature of the exhibit




PRIZE-WINNING DISPLAY BOOTH AT LA CROSSE, WIS.

which contributed to its success was the fact that everything shown was in actual use. Bread, cake and pies were baked and given away, along with boiled eggs, tea and coffee and other good things to eat and drink.

The apparatus exhibited included heating devices, irons and fans, vacuum cleaners, glassware, etc. The exhibit was in charge of Messrs. Frank H. Evans and Phillip Linker.

## Line Extensions Into Sparsely Settled Territory

Inconsistency is sometimes revealed in the policies followed by some central stations in the making of line extensions into territory where the immediate returns do not seem commensurate with the necessary outlay, declared Mr. F. S. Nicholson, vice-president and general manager of the Sayre (Pa.) Electric Company, in addressing the recent New York convention of the Atlantic Gas & Electric Company.

A given electric-lighting company will cheerfully spend thousands of dollars for its equipment, power plant and initial distribution system, although having practically no assurance that sufficient business will ever be secured to cover the cost of operation. But after the first investment has been made and the plant is in operation, the policy is changed, and in the matter of small extensions the management often refuses to consider making any outlay of money without a positive guarantee against loss. It is, of course, history that many of the customers served by an electric-light plant must of necessity be served at a loss. The small consumers are of doubtful value and if analyzed separately would probably show a net loss at the end of the year. But when taken and combined as a whole with other customers, declared Mr. Nicholson, they tend to swell the net earnings rather than diminish them. For this reason, insisted the speaker, an earnest effort should always be made to care for any of these residents that apply, regardless of the fact that for the time being they must be taken at an apparent loss to the operating company. It will be only a matter of twelve to eighteen months until practically all of the extensions thus made will be returning a profit to the company.

## Salem (Mass.) Central Station Discards Horses

The Salem Electric Lighting Company, of Salem, Mass., has discontinued the use of its entire horse-drawn equipment, and its transportation work from now on will be done entirely by motor vehicles. The company has a fleet of eight automobiles, six of which are electric machines, ranging in size from a runabout to a 2000-lb. truck. The gasoline machines are used only for long-distance work. Mr. S. Fred Smith, local manager of the company, which is one of the Tenney properties, believes that this is one of the first instances in New England, if not in the East, where a central station has made "a clean sweep" of its horse-drawn vehicles and gone over entirely to motor equipment.

## Electric Trucks in Industrial Plants

In a paper before the ninety-fifth semi-annual meeting of the National Association of Cotton Manufacturers at Atlantic City, N. J., recently, Mr. Day Baker, New England manager for the General Vehicle Company, pointed out that in a one-story garage, not over 25 ft. by 65 ft. in dimensions, may be housed a complete equipment of five electric trucks, which will displace and perform the work of nine or ten horse-drawn trucks and eighteen to forty horses, depending on the size of the trucks required and the methods of operation. Many special applications of electric trucks can be made to advantage. For example, an electric winch was recently installed on one of the yard trucks of a Lowell textile plant. With this winch freight cars are switched in a shed where steam locomotives and gasoline trucks are prohibited. The winch is also used in loading heavy cases and in shifting cars around the loading platform.

Rapid advance is being made in industrial-truck applications for indoor service. An installation of twenty-five of these is in service on the New York pier of the Fall River Line steamers. The trucks are capable of ascending a 20 per cent grade, and they operate in extremely confined and congested quarters. The operators drive the trucks at three times walking speed, and each carries from two to three times the weight portable on a hand truck. A fleet of ten such trucks is also in use at a print works in Lawrence, Mass., hauling rolls of print cloth from the storehouse to the printing machines and transporting dye tubs between the color room and the machines. One of these trucks in a plant near Montreal is equipped with a hand winch for warping on coils of wire, and one now building is designed to carry fire extinguishers and other

protective apparatus for mill service. In a representative mill an industrial truck carrying two men delivers six full beams of cloth and returns with six empties in eleven minutes, the beams weighing 1902 lb. Fifty-five minutes was formerly required for this work. By the introduction of industrial trucks savings in labor running sometimes as high as 70 per cent are being secured, and the original cost of the truck is soon cared for from the labor appropriation.

## A Fan Display on a Moving Truck

The Los Angeles Motor-Truck Club recently held a commercial-vehicle parade, and the Southern California Edison Company was called on for the loan of a number of trucks for use in the procession. Seeing in the opportunity thus afforded a chance of "boosting" the electrical industry, the Edison company hurriedly equipped a truck with a number of large 110-volt direct-current fans, mostly of the oscillating type. The fans were connected to the truck battery,



MOVING FAN DISPLAY ON TRUCK

which consisted of sixty-five Edison cells giving an emf of approximately 80 volts, and they ran well at this low voltage. Colored streamers helped to enliven the appearance of the display, which attracted much attention.

At another time the same idea could be worked out more elaborately. Only three hours were available for installing the fans in the case illustrated so that the display necessarily had to be made simple.

## Garage Rates for Customers' Electric Vehicles

In an Eastern city of 80,000 population the central-station company now operates a garage for the convenience of its electric-vehicle patrons. Most of these users charge their batteries on their own premises but bring the cars in to the company's garage occasionally for flushing, overcharging and general battery attention. The pleasure cars average consumptions of 100 kw-hr. per month, returning a central-station income of about $5 per month.

MONTHLY RATES FOR GARAGING CUSTOMERS' ELECTRIC VEHICLES

| | |
|---|---|
| 7[illegible]-lb. vehicle | $35.00 |
| 1,[illegible]-lb. vehicle | 35.00 |
| 2,[illegible]-lb. vehicle | 37.50 |
| 4,000-lb. vehicle | 45.00 |
| 7,000-lb. vehicle | 55.00 |
| 10,000-lb. vehicle | 60.00 |
| Storage space without care | 17.00 |

The accompanying table shows the schedule of monthly rates charged by the company garage for stabling customers' cars, charging batteries, cleaning and adjusting. These rates do not include renewals or extensive repairs. For a single charge of a pleasure vehicle the rate is $1. For charging, calling for and delivering the rate is $1.25 and for washing $1 extra.

## Electric Appliances for Farmers' Wives

The North Dakota Federation of Women's Clubs believes that the women on the farm are entitled to the same advantages as are possessed by the women of the city. By the introduction of labor-saving devices, such as electric flatirons, electric washing machines, electric cream separators and the like, it feels that a decided step will be taken toward making farm life more attractive to the farmer's wife and daughter. The ladies do not appear to be quite sure where the electricity is coming from, but at any rate they are interested in the subject, as shown by the fact that a rural betterment department has been established by the federation to familiarize farmers' wives with these modern improvements. It is said that President Minnie J. Neilson, of Grand Forks, N. D., is enthusiastic over this phase of the federation's work.

## Rental of Electric Household Conveniences

A woman in South Bend, Ind., writes to the household department of a Chicago daily newspaper to say that her neighbors expressed so much admiration for her electric flatiron that she conceived the idea of renting it to them. The rate fixed for the use of the iron is 10 cents an hour. This enterprising housewife is also the proud possessor of an electric vacuum cleaner. This she rents out also, charging for its use 15 cents an hour. Thus the neighbors have paid the businesslike owner of these devices enough to reimburse her for the first cost and also supply her with some extra pin money. This plan would seem to be all right from the electric-service company's point of view, but probably is not exactly to the liking of the manufacturers of these devices.

## Activity in Indianapolis

Work is well under way for extensive additions to the Mill Street generating station of the Indianapolis Light & Heat Company. The present station is a modern, well-built turbine plant with four vertical Curtis units having a total maximum rating of about 15,000 kw. The addition will house a General Electric horizontal turbo-generator of 12,500 kva, with boilers and accessories. Space will be provided for two additional 15,000-kva units. The big new unit now ordered will be ready for service, it is planned, by July 1, 1914. In the completed station all the generators will be in one room about 250 ft. long, but there will be two distinct boiler rooms.

The Indianapolis company is also installing a large new storage battery, made by the Electric Storage Battery Company, in Substation C, on East Wabash Street. The old battery in the North Meridian Street substation is to be rebuilt. When these improvements are completed there will be a battery reserve on the system capable of supplying 18,000 amp for one hour.

Increasing business makes these plant additions necessary. Indianapolis has two large electric-service companies, the Merchants' Heat & Light Company being the other one. Until recently there were three, but the People's Light & Heat Company has been absorbed by the Merchants' company, unless the action of the Public Service Commission is set aside by the courts. Both the existing companies operate district-heating plants. Indianapolis is wide awake electrically, however, and, despite competition, the Indianapolis Light & Heat Company reports that its kilowatt-hour output has exceeded that of last year every month by from 16 to 20 per cent. It has about 29,000 customers in a city of 233,000 people. It does the city electric street lighting, maintaining about 2300 arc lamps for this purpose. It is an energetic, home-owned company, with progressive policies. Mr. C. C. Perry, its president, has

directed its affairs since 1888. Few electric-service properties in this country have been in charge of the same man for twenty-five years. Mr. Thomas A. Wynne is vice-president and engineer of the company.

The younger company, the Merchants' Heat & Light Company, has been in existence about eleven years. Mr. E. L. McKee is president and Mr. E. Darrow is general manager. It also reports a flourishing and increasing business. It is said to have the largest district-heating system in the world. The district supplied is about 3 miles long and 2 miles wide, and to it is furnished low-pressure exhaust steam from two stations. The station of the former People's company at Sixteenth and Alabama Streets will be shut down electrically, but hot water for heating will be supplied from it, the water being heated by exhaust steam from the Merchants' company's present stations. The Merchants' company, in its electrical department, makes a special effort to obtain the business of large consumers. "We are the company," it says, "that lights the big stores and theaters." Its principal generating station is at West Washington Street and the White River. Mr. Darrow recently announced plans to install an additional 10,000-kw turbo-alternator unit and 4000 hp in water-tube boilers in this station, although it had been previously proposed to build a new plant in the Massachusetts Avenue section.

## Central-Station Refrigeration

A neatly printed and attractively illustrated pamphlet entitled "Electric Refrigeration" just issued by the Commonwealth Edison Company of Chicago gives some examples of modern ice and refrigeration plants operated from central-station service. Brief descriptions are given of nine artificial ice factories in Chicago using electrical energy from the central station. The remainder of the book is devoted to electric refrigeration as exemplified in dairies, butcher shops, florists' establishments, storage warehouses, groceries and restaurants; also, water-cooling by electrically driven compressors. The booklet is interesting in affording an idea of the extent to which central-station energy is used in ice-making and refrigeration in one city. It also should be valuable in furthering the extension of electric service for these purposes.

## Opening a "White Way" at Mount Vernon, N. Y.

On the evening of Oct. 9 the "white way" lighting installed on Fourth Avenue, Mount Vernon, N. Y., by the Westchester Lighting Company, was officially opened by the mayor of the city. The installation comprises forty four-lamp clusters carried on ornamental iron posts located at 150-ft. intervals. Each post is equipped with four 100-watt multiple tungsten lamps inclosed in 12-in. Alba globes.

The new installation replaces seven 1200-cp arc lamps, each of which consumed 1777 kw-hr. per annum. It is estimated that each tungsten cluster will consume 1000 kw-hr. per annum. Three of the lamps in each cluster will burn from sundown to midnight and are to be paid for by the merchants. The fourth lamp will burn on the regular all-night lighting schedule and is to be paid for by the city.

Preparations for an elaborate celebration had been made by the Westchester Lighting Company, opening at 7 o'clock with an illumination of the company's office building outlined with electric lamps. In addition a powerful searchlight was played over the city from the cupola of the building.

The parade, which began at 8 o'clock, was led by a steam calliope, followed by automobiles containing the officials of the company and citizens. The president of the company rode on horseback. Behind the automobiles came the trucks and wagons of the company from adjoining districts. About 100 vehicles were in line, all gayly decorated. The trucks carried striking signs, a good sample of which is seen in the accompanying picture of the truck from Tarrytown.

The automobiles and floats were followed by the male employees of the company marching four abreast led by a military band. In all there were about 1000 marchers




ELECTRICALLY LIGHTED TRUCK IN PARADE AT MOUNT VERNON, N. Y.

in line, carrying transparencies and company pennants. The rear of the parade was brought up by the company's emergency car, in which was seated a boy dressed as a "buttons" in a white suit. For buttons down the front of his coat he wore a row of small electric lamps which flashed during the progress of the parade.

Many merchants took advantage of the opportunity to do some very creditable advertising, following in the wake of the parade with their decorated wagons.

## Commercial Methods at Boston

At the recent convention of Edison illuminating companies a paper by Mr. Leavitt L. Edgar recounted one year's activity by the Boston Edison company in promoting the use of energy-consuming devices and the result. The Boston 1912 Electric Show was run at a cost of over $200,000, and although showing a deficit was more than successful from an educational viewpoint. More than 350,000 persons paid admission during the four weeks of the show, which was devoted to varied applications of electricity to domestic and commercial uses. The country-wide attention that the company has brought to the electric vehicle is well known. During the electric-vehicle campaign the company authorized the expenditure of $7,500 by the Massachusetts Institute of Technology to enable it to carry on investigations of various sorts to determine the cost of operating electric vehicles under all kinds of conditions. The recently announced department of investigation inaugurated with an endowment of $100,000 at the college mentioned is admittedly a direct result of the researches carried on by it for the Edison company.

Perhaps the most unusual method of attracting the attention of the public has been the "Farm of Edison Light and Power," a portable equipment containing practically every farming implement and appliance that is made to operate by an electric motor. The "House of Edison Light," built by the company to educate the housekeeper in the use of electricity in the home and moved from place to place in the company's territory, is also another well-known feature of the company's merchandising scheme. During the last year the company entered seriously upon a campaign to promote the use of devices by giving lectures

before gatherings of different kinds. The lecture bureau is supplemented by a corps of demonstrators, and the "May breakfasts" given by suburban churches, as noted at the time in these columns, were in charge of the lecture division. During July the appliance department inaugurated a plan for selling electric ranges on an instalment plan of ten monthly payments of $8, plus the cost of wiring, which is installed by a contractor at a flat price of $33. This campaign is now under way. Last spring another flatiron campaign was started with 3-lb. and 6-lb irons on thirty days' trial. At the end of the time the iron, if kept, was billed at $4.50. These flatiron campaigns have always been successful and the company intends to continue them next year. In addition to the many lines of activity mentioned, the Boston Edison company maintains stores where complete stocks of the latest electrical appliances may be had. The appliance department, which operates three shops, gives free demonstrations at the homes of customers. The company also maintains signs throughout Boston and its suburbs advertising electric service. In addition, it has established thirty-six pay stations for the convenience of customers in paying bills.

## An Electric-Vehicle Display Window

In connection with a recent electric-vehicle campaign, Mr. Robert W. Hoy, commercial manager of the Harrisburgh (Pa.) Light & Power Company, arranged a window exhibit which attracted a great deal of attention. Around the edge of the display space was built an oval track with a 3-in. groove, while in the center of this raceway was a miniature model of Market Street, the principal business thoroughfare of Harrisburg, carefully laid out from Market Square to Fourth Street, a distance of two blocks. Lines were drawn representing street-car tracks just as they are located on these streets and heavy threads fastened to a percolator at one end and a toaster stove at the other represented trolley wires. Two street cars were shown in operation with their trolley poles making contact with the threads, while in the spaces at the sides vehicles of all descriptions, horse-driven, gasoline and electric trucks, were arrayed in lifelike arrangement. The electric wagons were distinguished by signs on the sides, "Electric Service." Traffic policemen were stationed at three points along the street. One of the principal attractions of the display by night was the miniature ornamental lighting installation, reproducing with fidelity the arc standards recently erected along the curbs of the principal streets in the business section of Harrisburg.



ELECTRIC-VEHICLE WINDOW DISPLAY AT HARRISBURG, PA.

Racing around in the groove circumscribing the window were three celluloid balls, red, white and blue, which were driven by the wind from three 12-in. fans placed at the corners of the track. One ball represented electric vehicles, one the gasoline cars, and the third horse-driven wagons, and there was one point in the oval where it was possible for these balls to pass each other. The white ball, for some unexplained reason, passed the other two very frequently and was therefore named the "electric wagon." In the center of the window a large placard called the attention of the public to the many advantages to be gained by using electric vehicles.

## Information for Customers

Much useful information is contained in the new "Customers' Information Book" of the Minneapolis General Electric Company. This is a pamphlet of thirty-two pages bound in a neat paper cover. A copy of it has been mailed to every customer of the company, and one is handed to each new applicant for service. Its purpose is to give customers information that will be useful in the satisfactory employment of electric service.

The company states its purpose thus: "Our desire is to earn the right to reasonable compensation in exchange for a service necessary to Minneapolis and its people, and to earn the wage fairly by honest service pleasantly and cheerfully rendered." This is certainly well put. Customers are told how to obtain service, what the sales department is for, how to adjust service troubles, how to read meters and check bills, and the basis of rates. The customers and the general public are invited to visit the office of the company, one part of which has been fitted up as a customers' lobby with public writing tables, telephones, stationery and comfortable furniture for those wishing to transact business or meet friends.

Prominence is given to the statement that the general manager endeavors to receive personally all who wish to see him. In relation to pulmotors it is announced that a completely equipped machine will be sent at once by automobile in response to all emergency calls, without regard to the cause of the injury to the patient. Another statement of interest is that during warm weather the company will, upon a doctor's certificate, give free electric fan service to invalids unable to pay for it. This offer of course, applies only to localities where the company's service is available. In relation to "grief" the company says: "Every complaint lodged with the company is a favor, because we desire our service to be as nearly perfect as ingenuity and unremitting attention can make it. Each service trouble call is followed up by a return post card asking whether the trouble has been remedied satisfactorily. The company does not do wiring, and says that so long as the contractors and supply houses of Minneapolis render efficient service at reasonable prices, as at present, it will continue to co-operate with them in all practicable ways.

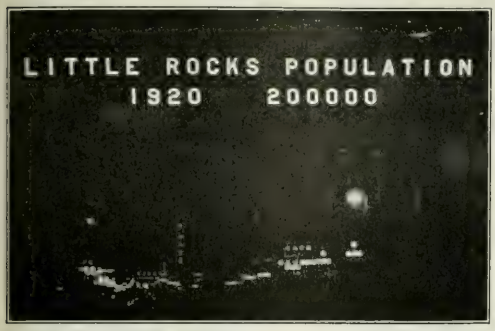
Rate schedules are given fully and an attempt is made to explain the basis of rates. The residential rate is 10 cents per kw-hr. for the first 3 kw-hr. per room per month and a secondary rate of 6 cents per kw-hr. is made for all additional energy, both subject to a discount of 5 per cent for prompt payment. The minimum bill is fixed at $1 per month. It is noteworthy that in the whole pamphlet the words "rule" and "regulation" are not used except in one instance, where it is stated that every employee is provided with a book of "Safety Rules" and is instructed in first aid to the injured.

H. M. Byllesby & Company control the Minneapolis General Electric Company, and the book was prepared under the direction of Mr. W. H. Hodge, manager of the publicity department of the Byllesby organization. It is the intention ultimately to supply each Byllesby property with a similar book, printed locally, as in the case of the Minneapolis pamphlet.

# Illumination and Wiring

## Little Rock's Slogan Sign

To the city of Little Rock, Ark., the Little Rock Railway & Electric Company has donated the double-reading electric sign illustrated herewith. The cost of its operation will be defrayed by the local merchants, who have undertaken a subscription collection among the business houses of the main thoroughfares. The slogan sign contains 654 10-watt lamps and is illuminated on both sides. It is mounted on a steel framework between 35-ft. poles. Since the erection of the display a number of merchants have adopted its slogan in their newspaper advertising.

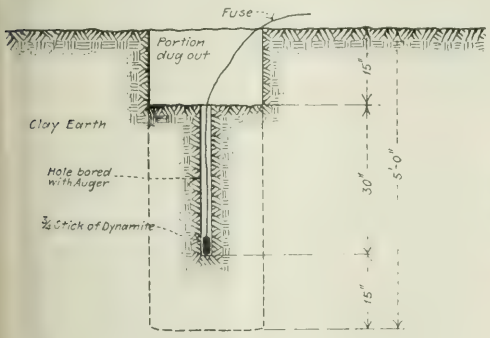



ELECTRIC-LIGHT SLOGAN AT LITTLE ROCK, ARK.

## Blasting Holes for Wooden Poles with Dynamite

Nearly every central-station manager north of the Mason and Dixon line has had the unpleasant experience of paying prices ranging upward from $1 apiece for pole holes which had to be dug in frozen ground. The accompanying illustration shows the scheme which was used by the Marion Light & Heating Company, of Marion, Ind., for digging holes when the ground was frozen to a depth of more than 24 in.

The hole was first topped and the earth removed to a depth of from 12 in. to 15 in., care being taken that the top of the hole was in conformity with the size of the finished hole desired. A long-handled auger was then used to bore a hole slightly larger in diameter than a stick of dynamite to a depth of about 27 in. or 30 in. The charge, when placed in this small hole and tamped in and ignited, blew a neat round excavation as large in diameter as the portion which had been dug out at the top. With three-quarters of a stick of dynamite at the depth specified in the illustration, a hole 5 ft. deep was secured in the clay ground at an average saving of 15 to 20 per cent over the cost of manual digging.

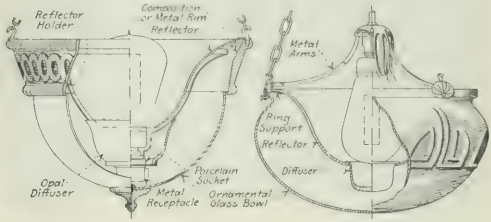



BLASTING POLE HOLES WITH DYNAMITE

## Types and Uses of Semi-Indirect Lighting Units

By LEONARD V. JAMES

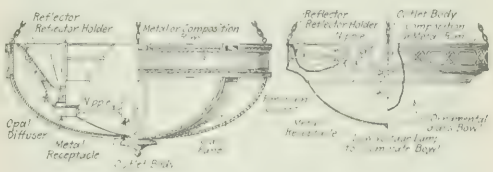
The tendency in modern lighting installations is undoubtedly toward diffused illumination, together with an effort to add to the appearance of the room by the use of proper fixtures. Direct lighting from unshaded sources and indirect lighting with all of the light-flux reflected to the working plane from a diffusing surface are the extremes. Approaching the direct lighting there is the type of unit in which the light source is shielded by shades ranging from nearly clear glassware to translucent bowls and finally to opaque mirrored reflectors, all of these having a more or less directive effect. The so-called semi-indirect system is really a special case of the modified direct, since most of the useful light-flux passes through the translucent bowl.




FIGS. 1 AND 2—LAMPS AND REFLECTORS IN VERTICAL POSITION

The combination of the direct and indirect lighting furnished by the luminous-bowl units is effective and pleasing and meets the public demand for indirect lighting together with an apparent light source. In a paper read before the Illuminating Engineering Society in June, 1912, Mr. Thomas W. Rolph discusses the results of a series of tests, suggesting that the illumination of the ceiling with indirect lighting is from 10 to 15 per cent as intense as that of a direct-lighting fixture producing the same effect in the room. These results seem to have been verified by the manufacturers of the luminous-bowl fixtures under discussion, as the light-flux used in securing the desired effect appears in all cases to be almost exactly 10 per cent.

There are two arrangements of the interior equipment used in the fixtures in question. As a rule the reflectors and lamps are in a vertical position, as shown in Figs. 1, 2 and 3. The reflectors used are one-piece silvered-glass opaque reflectors. The light-flux which illuminates the outside bowl passes through and is directed by an opal diffuser, located so that it interferes but little with the




FIGS. 3 AND 4—LAMPS AND REFLECTORS IN VERTICAL POSITION AND LAMPS AND REFLECTORS IN HORIZONTAL POSITION

normal reflection required for general illumination. Fig. 4 shows the arrangement used when shallow bowl fixtures are employed, it being necessary here to install the lamps and reflectors in a horizontal position. The small lamp which lights the bowl is suspended at the center of the equipment and usually consumes about 10 per cent of the total wattage



FIG. 5—REPRESENTATIVE DESIGN OF FIXTURE IN BEDROOM

of the fixture. Note that in all cases the equipment is suspended from the edge of the fixture.

Representative designs of single and multi-unit luminous-bowl fixtures in characteristic installations are shown in Figs. 5 and 6. It is apparent that a very artistic effect can be secured by properly choosing the patterns and colors employed, the color of the bowl being determined either by that of the glass or that of the illuminating bulb. In each case the installations were photographed by the light of the luminous-bowl fixtures alone. Although long time exposures were necessary, it should be noticed that no halation about the bowls is apparent. The light is soft and diffused, but the manner in which the detail is brought out shows that there is plenty of illumination.

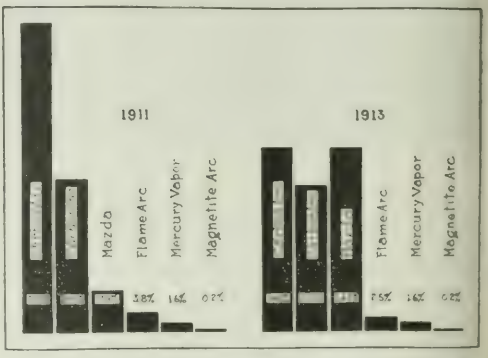


FIG. 6—REPRESENTATIVE DESIGN OF FIXTURE IN DINING-ROOM

Cleaning is accomplished in the single-unit fixture by releasing the chain at one of the suspension points. In the multi-unit fixture the reflectors are readily accessible in their normal positions except where horizontal as in the case of the shallow-bowl equipment, where they may be released by a spring catch and tilted into an accessible position. These reflectors have a fire-glazed inner surface so that dust may easily be removed with a damp cloth. Should it be necessary to clean the bowl, it can either be released by set-screws or the entire interior equipment can be lifted clear of the bowl.

## Incandescent Lamps in Steel-Mill Service

In the progress report on illumination in steel mills presented before the recent convention of the Association of Iron and Steel Electrical Engineers, New York, data from thirty plants of the sixty-one now in the association were shown in tables and charts. The accompanying illustration is a reproduction of one of the most striking diagrams, and shows the recent revolution in lighting methods. While considerable diversity exists among the various plants in the proportions of different types of units employed, the changes in the past two years are marked and the trend is already apparent toward the elimination of all carbon-arc




LIGHTING EQUIPMENT OF STEEL MILLS

lamps and the substitution of tungsten lamps in their stead. There has also been a slight reduction in the number of carbon incandescent lamps used, but the big difference results from the adoption of the tungsten units to take the place of the obsolete carbon-arc lamps. The fact that carbon-filament incandescent lamps are not going out of service more rapidly is perhaps due to the lack of sufficiently high intensities of illumination, since experience has shown that with a proper system of general lighting carbon drop lamps may be done away with and more satisfactory results secured with no increase in total energy consumption.

## Recent Telephone Patents

It has been felt by Mr. H. S. Brewington, of Baltimore, Md., that no register for telephone messages would be satisfactory to all concerned unless visible to the subscriber and at the same time operated only under the joint control of the subscriber and the exchange operator. Mr. Brewington has provided a register accordingly, the register being mounted at the telephone station with the dials in view When it is time to register the operator effects the count with the assistance of the subscriber.

Granular carbon is used in considerable quantity in the manufacture of transmitters, and for the best results i should be of uniform texture. It is with a view of producin better carbon that Mr. J. C. Lee, of Brookline, Mass., ha invented an electric oven for treating the granules. Th carbon particles are required to pass through a contracte throat, at either end of which an electric terminal is placed The baking is effected by electrical energy.

# Letter to the Editors

## Some Phase-Transforming Systems

*To the Editors of the Electrical World:*

Sirs:—Referring to the letter from Mr. Rudolph W. Van Norden in your issue dated Oct. 18, 1913, attention should be called to the fact that in 1892 Prof. R. Eron disclosed the three-phase to two-phase method referred to by Mr. Van Norden by the use of two single-phase units as shown in Fig. 1. Long prior to obtaining a patent on the single-unit three-phase to two-phase transformation, I had in my possession a book of notes and sketches in which is given the method, dating back to 1892, which was used in Italy during that period, the notes showing a *one-unit*, three-phase to two-phase method of accomplishing the same results. This book, which I still have, contains many kinds of unusual polyphase systems and wiring schemes.

The patent in question covered not only the means but the method adopted with the one-unit transformation, and not the three-unit method of three-phase to two-phase transformation referred to by Mr. Van Norden. Application was made for a patent on the one-unit method of three-phase to two-phase transformation only after the writer had been repeatedly advised to do so by friends with whom he had discussed the subject, and after the advantages of the method over all other methods, from the viewpoint of lowest first cost of manufacture and ability

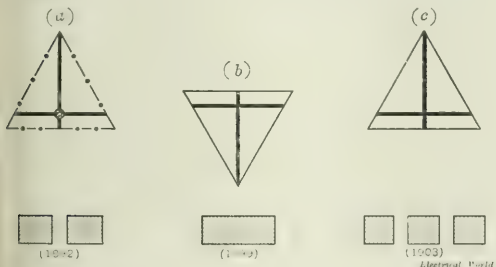



FIG. 1—THREE-PHASE TO TWO-PHASE TRANSFORMATION, SHOWING METHODS USED AND EARLIEST KNOWN DATES

to maintain balanced phase-currents, had been established in practical operation.

In Fig. 1, *a* shows the use of two single-phase units for the three-phase to two-phase transformation, dating back to 1892; *b* shows the use of one three-phase unit for the three-phase to two-phase transformation, dating back to 1899, and *c* shows the use of three single-phase units for the three-phase to two-phase transformation employed by Mr. Van Norden in 1903.

Having become familiar with the original notes given in Professor Eron's book, the present writer devoted considerable study to the internal characteristics of the one-unit method of three-phase to two-phase transformation before the year 1900, but did not consider a patent worth while until certain circumstances arose in the year 1906. In writing the letter on this subject printed in the issue of the *Electrical World* for Sept. 27 it was the writer's intention to mention two other systems covering all the previously mentioned systems of three-phase to two-phase transformation. It will, of course, be understood that Fig. 1 of the earlier letter will cover all of the systems noted with the exception of Fig. 1*a* and that Figs. 2*a*, 2*b* and 2*c* cannot be made to cover any three-phase to two-phase system other than their own—that is, *a* cannot be substituted for *b* or *c*, *b* for *a* or *c*, or *c* for *a* or *b*, a special tap being required for *a*.

For reliability of operation the two systems presented herein (Fig. 2 and Fig. 3) for the transformation of three-phase to two-phase currents require three single-phase transformers, though two single-phase transformers will suffice. In the case of Fig. 3 two transformers will deliver the same phase-angle results as would the three single-phase transformers.

In both Fig. 2 and Fig. 3 one-half of the winding of each unit is connected differently from the ordinary delta.

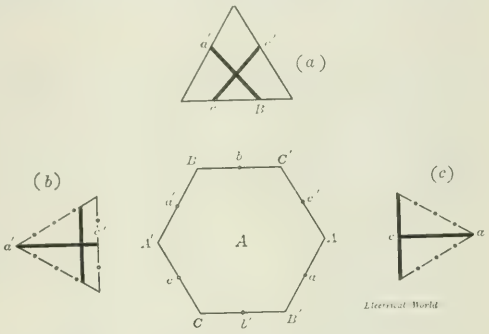



FIG. 2—COMPOSITE METHODS OF OBTAINING THREE-PHASE TO TWO-PHASE TRANSFORMATIONS

In Fig. 2, *A* shows the three-unit method, the other systems being shown at *a*, *b* and *c*, which are self-explanatory. Fig. 3 shows a method in which are two of the three units, half of the respective windings being divided. One of these units can be omitted from the system if need be and three-phase to two-phase operation continued, as at *A′ A″*.

It is clear from Fig. 2 and Fig. 3 that all of the systems described in the issue of Sept. 27 are covered by the two methods shown here, and that it is possible to operate them as indicated. Hence, no matter what may be the detailed make-up of each of the methods shown in the issue of Sept. 27, one or the other or both of these methods (depending on the requirement and the system for the one or the other of the two methods) may be substituted for any or all of them, yet the methods themselves (in their make-up) are quite unlike any of those noted previously.

In so far as concerns the recording of notes and sketches of the methods shown in Fig. 2 and Fig. 3, I have in the past sent from abroad to transformer manufacturers in the United States notes taken from my notebook. However, this is the first time these methods, with a particular view to three-phase to two-phase application, have been published. Other methods and means have been experimented

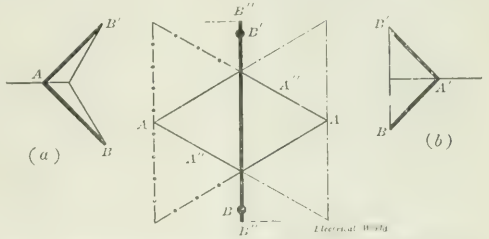



FIG. 3—COMPOSITE METHODS OF OBTAINING THREE-PHASE TO TWO-PHASE TRANSFORMATIONS

with, but those of Fig. 2 and Fig. 3 are the best of the ones dispensing with transformer winding taps other than the common center or 50 per cent tap. In one unit of Fig. 3, *B′*, *B″*, the taps used constitute those of the three-phase to two-phase relations of Fig. 4*b*, shown in the letter in the issue dated Sept. 27.

*New York, N. Y.* William T. Taylor.

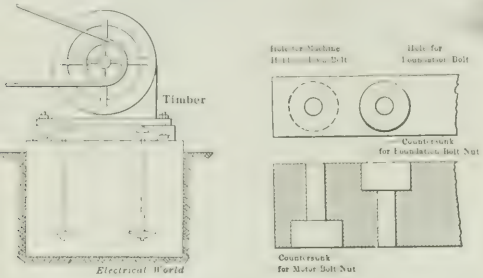
# Field of the Operating Engineer

**A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers**

## Insulating and Grounding Motors and Generators. I

By Terrell Croft

The National Electrical Code specifies that motors and generators operating at pressures in excess of 550 volts must have their base frames permanently and effectively grounded. Motors and generators operating at pressures of 550 volts or less should, so the code specifies, be insu-




FIGS. 1 AND 2—MOTOR INSULATED ON A PARALLEL TIMBER BASE AND ARRANGEMENT OF BOLT HOLES IN INSULATING TIMBERS

lated from the ground wherever feasible, but where the insulation of the frame is impracticable permission may be secured from the local inspection department to omit the frame insulation. However, where such insulation is omitted the frame must be thoroughly grounded.

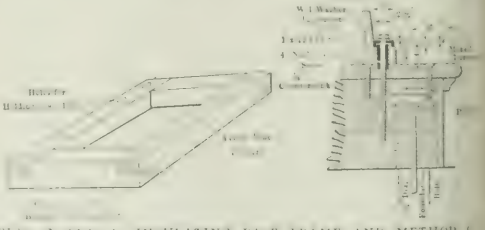
Insulating the frame of a high-voltage machine from the ground introduces a dangerous life hazard, because there may be a leak between the winding and the frame and the attendant touching such a frame can be severely shocked, or possibly killed. Where the voltage is low—below possibly 550—this element of life hazard is not of great moment. It is therefore evident that the frames of all high-voltage machines should be thoroughly grounded, and it is also very likely true that it would be well to ground the frames of all low-voltage machines to protect the attendants from shock.

There is another good reason why it is preferable from the operator's standpoint to ground the frames of all electrical machinery. Consider the case of a frame of a machine insulated from the ground: If a leak occurred in this machine between one of the windings and the frame, the operator would not, in the ordinary course of operation, be advised of its presence, and another ground might occur in the same machine between the winding and the frame, which would make a short-circuit and possibly burn out the machine and produce a fire. If, however, the frame of the machine were thoroughly grounded, a leak between the frame and the winding would make itself known through an indication on the station ground detector, and then it could be readily corrected before another ground could occur and make serious trouble.

The intention of the code rule appears to be that if a frame is insulated it must be thoroughly insulated, and if grounded, thoroughly grounded. If a frame were, however, but imperfectly insulated, sufficient current might, under certain conditions, flow through the high-resistance path constituted by the imperfect insulation and cause a fire. Although the code does not so specify, it is probable that it is always best to ground effectively electrical machinery frames wherever possible, but where effective grounding is not feasible the frame should be thoroughly insulated for the reason just indicated.

It does not appear to be general practice among Underwriters' inspectors rigidly to enforce the code requirement for thorough insulation. Some inspectors appear to pay but little attention to the rule where the pressure is below 550 volts. Where the pressure is in excess of 550 volts, however, thorough grounding is generally insisted upon. Inasmuch as the majority of modern electrical generators are directly connected to their prime movers and are thereby thoroughly grounded through the piping systems serving the prime movers, it is not often that a large generator is not well grounded. Belted motors are frequently insulated owing to being supported on timbers of either a wooden floor or a ceiling. Large motors are usually mounted on a concrete foundation or on the frame of some machine, and in such cases should be thoroughly grounded. Frequently small motors are mounted on the frames of machine tools, and in some cases on small concrete foundations, and hence are not thoroughly insulated, nor can they be said to be thoroughly grounded. In such applications the inspectors appear to ignore the ruling requiring effective insulation or grounding and pass such machines by without comment.

The most common method of insulating generators and motors is by supporting them on wooden timbers. The wooden-base frames used for this purpose should be thoroughly filled and varnished. Almost any sort of wood will do. Where a wooden floor or ceiling is depended on for insulation it should be thoroughly filled and varnished to prevent the entrance of moisture, although it is not often that such precautions are taken in actual practice. A typical installation of a belted unit insulated on timbers is shown in Fig. 1. The timbers are held to the concrete foundation with long foundation bolts, and additional bolts secure the machine frame, or the slide rails, to the timbers.



FIGS. 3 AND 4—INSULATING BASE FRAME AND METHOD OF INSULATING SLIDE RAIL

It is essential that the foundation bolts and the bolts that fasten the machine be well insulated from each other. Fig. 2 shows the arrangement of the bolt holes in the ends of timbers like those shown in Fig. 1, indicating that a sufficient section of wood must be provided between the two holes to obtain adequate insulation. This section in no case should be less than 1 in., and a greater separation

preferable. As indicated in Fig. 2, it is necessary to countersink the holes for all of the bolts so that the bolt head or the nut, as the case may be, rests well below the surface of the timber. If such holes are not countersunk, the metal of the bolt may come in contact with either the foundation top or the machine frame and defeat the purpose for which the insulating timber is employed.

Another type of insulating base frame that is frequently used, which consists of four sticks held together at their ends by "half-and-half" joints, is shown in Fig. 3. Although base frames of this form are more popular than those like that indicated in Fig. 1, they are not as desirable because dirt and oil are apt to accumulate in the box-like cavity formed by the four timbers. It is often very difficult to remove such débris. With the arrangement of Fig. 1, however, the dirt can be pushed out from the machine frame at either end, and the floor or foundation under the machine can be kept clean with little difficulty. If dirt is allowed to accumulate, it may defeat the purpose for which the timbers were placed, because the timbers may become impregnated with it, which will reduce their insulating qualities.

The insulating frame that was installed under a large low-voltage belted alternator is shown in Fig. 5. For this application an extremely heavy timber frame was required because of the size of the machine, which was almost 11 ft. long. After the 10-in. by 10-in. sticks composing the sills for the frame were in place and held down with the foundation bolts, a double floor of 2-in. by 2-in. wood planks was nailed to the sills, and on this floor the generator was supported, the slide rails for it being held down

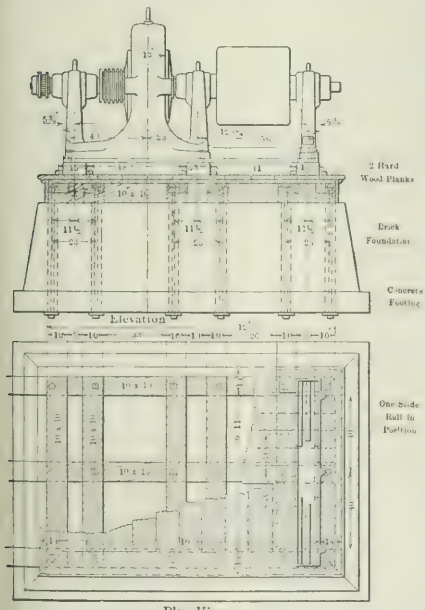



FIG. 5—INSULATING BASE FOR A LOW-VOLTAGE GENERATOR

with lag screws turning through the floor and down into the sills.

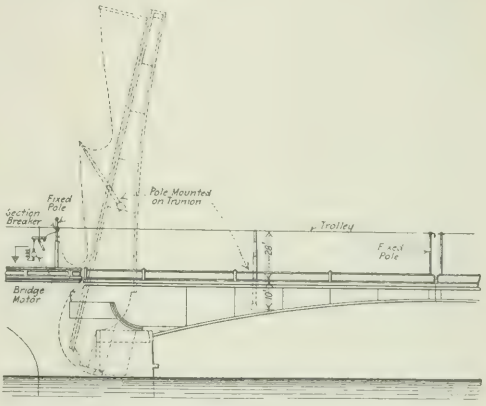
There are often cases where Underwriters' inspectors have insisted that the lag screws holding the slide rails of the machine to the wooden-base frame be thoroughly insulated from the slide rails. The arrangement that has been used in such cases is shown in Fig. 4. The insulating washers and bushings were turned from fiber. The wrought-iron washer should always be placed on top of the fiber washer, as suggested in the picture, to prevent the head of the lag screw from digging into the fiber. In the installation illustrated the countersunk holes in which the nuts on the ends of the foundation bolts turn were filled with pitch to insure further protection.

Various other ways of insulating motors and generators as well as effective methods of grounding the frames of electrical machines will be described in a subsequent issue.

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## Trolley-Wire Slack Take-Up for Lift Bridge

A novel arrangement for taking up slack in the trolley wire when the bascule span is raised is in successful use on the new Cherry Street bridge at Toledo, Ohio. In the design of this structure no towers or overhead construction




ARRANGEMENT FOR TAKING UP TROLLEY-WIRE SLACK FOR LIFT BRIDGE

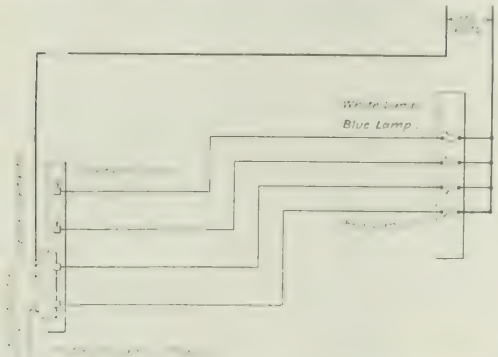
was permitted, so that the usual trolley retractor equipment had to be abandoned. The problem of drawing up slack in the wire was, however, successfully met by providing pivoted trolley poles at the center of each span, each of these poles having its lower end loaded with a weight sufficient to hold it in a vertical position regardless of the angle at which the bridge-leaf stands. In this way the slack accumulated ahead and behind the pivoted pole is divided equally on both sides, keeping the wire always clear of the rail.

As shown in the sketch, the weighted center poles are carried on heavy trunnions, which permit the member to maintain its upright position independent of the bridge position. These poles stand 28 ft. above the roadway, and the weighted portion extends 10 ft. below the trunnion mounting. For the bridge section, No. 4/0 flexible hard-drawn stranded wire is used as the trolley conductor. This bridge section is separated from the main line by an insulating breaker, and receives its energy through one position of a double-throw switch, the other side of which supplies the bridge motor. To operate the bridge, therefore, this switch must first be thrown, thus automatically disconnecting the trolley wire before the lift motor can be started or the bridge moved.

The Cherry Street bridge has been in continuous operation since early spring, being lifted fifteen or twenty times a day, and according to Mr. W. E. Richards, superintendent of the electrical department of the Toledo Railways & Light Company, which made the installation, it has developed absolutely no faults whatever in this long period of practical use.

## Boiler-Room Damper Signal

For obvious reasons, stokers have trouble in seeing the position of the damper after looking at the blazing fire, and in order to offset this difficulty Mr. William F. Thompson, engineer of the station of the Marion (Ind.) Light & Heating Company, has installed in the boiler roof of the plant




SCHEME FOR SHOWING DAMPER POSITION BY MEANS OF LAMPS

an arrangement such as is shown in the accompanying sketch.

Attached to the top of the piston of the automatic damper regulator is a copper contactor which is connected to one side of a 110-volt circuit. To the other leg of the circuit are connected four lamps, and as the piston of the automatic damper regulator moves up and down the lamps are lighted and extinguished. The two red lamps at the bottom are lighted when the damper is nearly closed. As the half-open position is approached the blue lamp is lighted, and at full damper opening the white lamp is switched into the circuit. The return of the piston to the closed damper position extinguishes the upper lamps.

As the damper-regulator piston follows the variations of the steam pressure the lamps also give an indication as to the condition of the fires to one who is familiar with the operation of the plant.

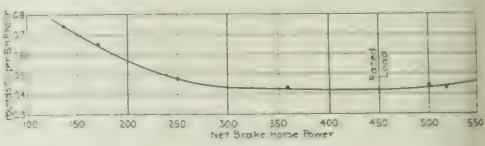
## Fuel Consumption of 450-hp Diesel-Type Engine

In the accompanying table and curve there are presented results of tests recently made on a 450-hp Atlas-

RESULTS OF TEST OF 450-HP DIESEL-TYPE ENGINE

| | HOURS EACH TEST | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2 | 4 | 6 | 2 | 4 | 1 | 1 |
| Approximate per cent of rating | 25 | 50 | 100 | 75 | 100 | 110 | 115 |
| Net load on brake | 131 | 260 | 245 | 381 | 444 | 488 | 521 |
| Total oil per hour, lb. | 97 | 110 | 121 | 184 | 199 | 218 | 229 |
| Oil per brake horsepower, lb. | .741 | .423 | .49 | .433 | .427 | .44 | .44 |
| Oil per indicated horsepower, lb. | .11 | .334 | .30 | .300 | .318 | .332 | .34 |
| Mean effective pressure for each cylinder, lb. per sq. in.: | | | | | | | |
| Cylinder 1 | 40 | 48 | 88 | 72 | 84 | 93 | 96 |
| Cylinder 2 | 41 | 47 | 86 | 75 | 87 | 91 | 97.5 |
| Cylinder 3 | 40 | 45 | 88 | 73 | 90 | 95 | 97 |
| Average mean effective pressure, lb. | 40.3 | 46.7 | 86.3 | 72.7 | 87 | 93 | 96.8 |
| Indicated hp. | 291 | 329 | 403 | 518 | 618 | 676 | 682.4 |
| Mechanical efficiency, per cent. | 45 | 50 | 67.5 | 68.3 | 74.6 | 76 | 77 |
| Friction and compressor losses | 160 | 164 | 136 | 163 | 174 | 188 | 187.4 |
| Revolutions per minute | 184 | 184 | 182 | 181.5 | 180 | 179 | 179 |
| Gal. oil per B.H.P. hour | 9.63 | 9.1 | 6.72 | 5.93 | 5.85 | 6.03 | 6.00 |
| Net thermal efficiency, per cent. | 18.9 | 19.9 | 27.1 | 30.7 | 31.1 | 30.2 | 30.2 |

Diesel engine purchased by Messrs. L. L. & P. N. Nunn, of Provo, Utah. Seven different runs are recorded of one to four hours' duration at various loads. The results show that the fuel efficiency reached a maximum at full-load rating when the consumption per brake-hp-hour reached 0.427 lb. of oil. The fuel used weighed 7.29 lb. per gallon, and on the Baumé scale showed a specific gravity of 30 deg. It had a fuel value of 19,150 lb.-Fahr. heat units per pound. In addition to pointing out the sustained high efficiency of the engine over a wide range around full-load rating, the results also show the overload possibilities of this internal-combustion unit. The test was made in the




FUEL-CONSUMPTION CURVE OF 450-HP DIESEL ENGINE

shops of the builder, the Lyons-Atlas Company, Indianapolis, Ind. At full load the mechanical efficiency of the engine was about 75 per cent, and its net thermal efficiency reached 31.1 per cent.

## Operation of Surge Indicator

Please describe the surge indicator or transmission lines and explain the principle of its operation. G. O. A.

Indication and record of the occurrence of surges in transmission systems can be obtained by means of so-called "surge indicators" tapped onto the phase wires of the line affected. This surge indicator consists of an adjustable horn-gap which is connected in series with a resistor formed of a long tube filled with water and having one end grounded. The gaps are set for values in excess of the normal line pressure, so that in case of a voltage surge the increased potential will break down the gap and discharge to ground through the high resistance. A circular chart prepared with chemicals to render it fireproof, is revolved by clockwork between the points of the spark-gap so that the passage of any spark discharge burns a hole in the paper, thereby recording the exact time at which the surge has taken place.

## The Gas-Ignition Hazard of Incandescent Lamps

Are there any cases on record where the accidental breaking of globes of incandescent lamps has ignited explosive mixtures of gas. If so, how serious is this hazard? L. S. B.

The ignition of mine gases by incandescent lamps was the subject of an elaborate investigation recently carried out by Messrs. H. H. Clark and L. C. Ilsley and reported by them to the United States Bureau of Mines. They found that if through such cause as breaking of the tip or globe an explosive mixture of gas can reach the filament, without breaking the latter or producing partial combustion within the globe, ignition is sure to occur. Certain standard lamps which do not usually ignite mixtures when smashed will do so if the broken pieces of the filament cause a short-circuit when the globe is smashed. The authors believe, however that the matter of ignition is a function of filament diameter, the larger filaments producing ignition in the majority of cases. Instances have been observed with miniature lamps where the filament continued burning intact several seconds after ignition had taken place, showing conclusively that ignition was not due to the arc or spark following fracture of the filament. When a glowing incandescent globe is smashed, the inrushing gases first cool and then break the filament. Ignition takes place, it is believed during the cooling period, but before the filament has been broken.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*Reluctivity of Silicon Steel.*—J. D. Ball.—An article illustrated by numerous diagrams. The curves usually drawn to represent the magnetic properties of a material are of such a nature that they are not easily determined throughout from the observed data, do not show simple mathematical relationship, do not detect small errors or show reliability of test, do not permit of satisfactory extrapolation, and cause considerable difficulty in determining from them the magnetizing force for high inductions. This article deals with the reluctivity, or reciprocal of the permeability, which over a wide range is a linear function of the magnetizing force, a fact often neglected. Accordingly, curves may be drawn which are most satisfactory from all standpoints and from which costs may be derived. Sample curves, tables and equations for silicon steels are given, including the average values obtained for 2.5 per cent and 3.5 per cent silicon content, these materials being widely employed at present.—*Gen. Elec. Review,* October, 1913.

*A 20,000-kva Turbo-Generator.*—This is an illustrated description of a turbo-generator rated at 20,000 kva in operation in the Chorzow power plant of the Upper Silesian Electricity Works, with brief data on the condenser equipment.—*Elek. Zeit.,* Oct. 2, 1913.

*Power-Factor Limitations of Rotary Converters.*—J. L. McK. Yardley.—An article, illustrated by diagrams, which emphasizes the importance of the variation in the currents flowing in the different parts of the armature winding of a rotary converter. Curves are given which explain why it is that careless or indifferent operation of converters without reference to power-factor conditions has sometimes resulted in "roasting" out armature coils. The importance of the tap coil is emphasized. The author also points out the desirability of adjusting a rotary converter to give 100 per cent power-factor at full load rather than half load. He further commends the present practice of securing the desired compounding by using moderate amounts of both series field and reactance rather than by using a greater amount of series field and a smaller amount of reactance. These two points are of particular importance in connection with rotary converters carrying heavy momentary overloads of 100 or 200 per cent, where the effect of the wattless component introduced by the series-field ampere-turns upon the tap-coil temperature must be seriously considered.—*Elec. Journal,* September, 1913.

### Lamps and Lighting

*Metallic-Filament Lamp Prices in Great Britain.*—Notes on a general reduction in the price of all types of metallic-filament lamps in Great Britain at the end of September. The decision appears to be the outcome of the deliberations of the Tungsten Lamp Association. "No surprise need be expressed at the currency of rumors as to the coincidence of this announcement with that regarding the early introduction of a half-watt lamp. The statements made in the various advertisements to the effect that improvements in manufacture and the increasing public demand have merited the lowering of the prices of the lamps are not taken seriously in all parts of the trade. The assumption seems to be that there are changes in design and construction pending, but before these can be generally effected the stocks of the present types of metal lamp must be gradually cleared. What may be looked for afterward the wiseacres do not tell us, but no doubt, they say, this step is the first toward a practical half-watt lamp."—London *Electrician,* Sept. 26, 1913.

*Electric Arc as Standard of Light.*—J. F. Forrest.—His complete British association paper, with numerous illustrations, which has already been abstracted in the *Electrical World.*—London *Electrician,* Sept. 26, 1913.

*Half-Frosted Lamps in Reflectors.*—W. T. MacCall.—An illustrated account of experiments made on the effect of frosting on lamps used with reflectors. Half-frosting reduces the light by about 10 per cent but considerably increases the vertical candle-power. The light absorbed by the reflectors was calculated from the results of the tests. For the opal shade this absorption is 16 per cent for the clear bulb and 17 per cent for the half-frosted one. For the holophane reflector the amount is 13 per cent in both cases.—London *Electrician,* Oct. 3, 1913.

*Ductile Tungsten.*—A note on a recent British patent (No. 13,282, 1912) of P. Schwarzkopf and S. Burgstaller. The object of the invention is to produce a mass of tungsten, molybdenum, etc., with uniformly small crystals, suitable for drawing into wires for metal-filament lamps. The process consists in the reduction of the oxides of the metals by carbon after they have been consolidated by pressure in molds. These oxides should be in the form of a fine-grain powder, each particle of which contains a lower proportion of oxygen than the lowest oxide of the particular metal. Sintering and reduction are both effected at the same time by the use of an adjustable current of hydrogen. The rate of removal of the oxygen, in order to regulate the size of the crystals produced, is effected by the addition of an adjustable quantity of an indifferent gas so that the partial pressure of the oxygen is regulated. At the same time the rate of flow of the reducing gas and the rate of travel of the pressed material, as well as the temperature itself, may all be regulated. Furthermore, a metal or compound which is not decomposed at the temperature to which the finished body is to be submitted may be added to the pressed material. The action of the added metal (uranium is suggested) is to lower the vapor pressure without substantially lowering the melting point of the main metal.—London *Elec. Eng'ing,* Oct. 9, 1913.

*Graphitized Carbon Filaments.*—A note on a recent British patent (No. 27,433, 1912) of the British Thomson-Houston Company and the American General Electric Company. Raw-carbon filaments are impregnated with a boron solution (1 per cent solution of sodium borate), then carbonized, and finally graphitized.—London *Elec. Eng'ing,* Oct. 2, 1913.

*Electric-Arc Versus Gas Lighting.*—An account of results of comparative tests with electric-arc lamps and high-pressure gas units in a section of the city of Strassburg, Germany. Two classes of open-type flame-arc lamp with superposed flame carbons were operated on a 50-cycle, single-phase circuit, in competition with high-pressure and low-pressure inverted-mantle gas lamps. The results of the tests show that with the usual prices for gas and electricity the arc lamp is much cheaper than the gas lamp and, moreover, gives a much more uniform illumination. As a re-

sult of the tests the city authorities have decided in favor of electric lighting.—London *Elec. Review*, Oct. 10, 1913.

*Public-Square Illumination.*—A. Kastalski.—An illustrated description of the arc-lamp installation of the Plaza in front of the new union railroad station at Leipzig, Germany. There are sixty 12-amp direct-current flame-arc lamps connected in series groups of four lamps each to the 220-volt system. The poles also serve as the suspension wires of the trolley lines. Directly in front of the station artistic reinforced concrete poles are used. The switching apparatus is placed in underground chambers.—*Elek. Zeit.*, Oct. 9, 1913.

### Generation, Transmission and Distribution

*Steam Turbine.*—An illustrated description of the Ljungstrom radial-flow steam turbine.—London *Elec. Review*, Oct. 10, 1913.

*Grounded-Star Versus Isolated-Delta Systems, Viewed from Experience in the Southwest.*—C. W. Rice and S. Thomson.—The substance of this paper is to the effect that for extended networks of low power concentration the advantages, from the standpoint of continuity of service are virtually all in favor of the dead-grounded neutral. Grounding the neutral relieves the system from dangerous potentials to earth resulting from grounds on the line, and as a rule such systems are not subject to the damaging effects of the high-frequency disturbances that accompany an arcing ground on an isolated system. Furthermore, a fault is more readily located on a grounded system, while both systems admit of operating the transformers in open delta, or the equivalent, in cases of emergency.—*Gen. Elec. Review*, October, 1913.

*Corona Losses.*—Weidig and Jaensch.—English translations in abstract of their recent German paper and report on corona phenomena and corona losses in transmission lines.—London *Electrician*, Oct. 10, 1913.

### Traction

*Limitations of the Capacity of Rapid-Transit Railways in Cities.*—Brugsch and Briske.—The authors discuss in detail the limitations of the possibilities of electric roads in cities with trains running in rapid succession in opposite directions, where the line is without side branches but is protected by automatic block signals. The intervals required for starting and stopping trains are given, and in conclusion the authors present the accompanying table, which shows the maximum capacity of electric railways in cities with the lengths of trains varying from 60 m to 150 m (from 197 ft. to 492 ft.).—*Elek. Kraftbetr. u. Bahnen*, Sept. 24, 1913.

DATA ON ELECTRIC RAILWAYS IN CITIES

| | Length of Trains | | | |
|---|---|---|---|---|
| | 60 Meters | 90 Meters | 120 Meters | 150 Meters |
| Intervals between trains, seconds | 49 | 55 | 60 | 65 |
| Trains per hour in either direction | 73 | 65 | 60 | 55 |
| Passengers per hour in either direction | 29,000 | 39,000 | 48,000 | 55,000 |

*Direct-Current Traction at 1200 Volts.*—H. J. Mulder.—The author gives an account of the troubles experienced in the early operation of a 1200-volt direct-current railway line. One of the first surprises met with was the fact that no commercial switching apparatus for 1200-volt direct current was available and that 1000-volt apparatus, while satisfactory up to 1050 volts or 1100 volts, failed completely at 1200 volts. It was, therefore, necessary to use commercial switching apparatus intended for high-tension alternating-current work. The difference between the behavior of such apparatus on direct current and alternating current is pointed out. Another and greater difficulty was in the choice of proper insulating materials. Great emphasis is laid on porcelain insulation. Marble is not satisfactory. Problems of line insulation are also discussed. It is finally stated that in practice the operation at 1200 volts has been found to be no more dangerous than at the usual low voltages, so that the use of pressures of 1000 to 1200 volts within cities is quite possible.—*Elek. Zeit.*, Oct. 9, 1913.

*Split-Phase Locomotive.*—E. F. W. Alexanderson.—A concise illustrated discussion of the subject with reference to motor design, early tests, theory of phase converter, compensation for power-factor, and features of control.—*Gen. Elec. Review*, October, 1913.

### Units, Measurements and Instruments

*Speed Meter.*—An illustrated description of a speed meter made by the Siemens & Halske company for automobiles. A rotating magnetic field exerts on a movable armature a torque which corresponds to the speed of rotation of the field. As shown in Fig. 1, a permanent magnet



FIG. 1—SPEED METER FOR AUTOMOBILES

made in the form of a ring with a narrow air-gap, is surrounded by an iron frame. In the narrow space between the frame and the magnet is an armature of conducting material also in the form of a ring. The magnet is driven by gearing from the axle of the automobile. The rotating magnetic field tends to rotate the armature in the same direction, but as there is provided the counteracting force of a torsion spring the armature can revolve only through a certain angle which depends on the speed of rotation of the magnet. The angle of deflection of the armature is then indicated by the needle on the dial. The application of the same principle to a speedmeter for locomotives is also described.—*Mitteil., Siemens & Halske*, September 1913.

*Errors in Magnetic Tests Due to Elastic Strain.*—Campbell and H. C. Booth.—An abstract of a (British) Physical Society paper. In the course of magnetic tests on sheet material considerable errors are sometimes introduced by even slight bending of the sheets or strips. In a careful investigation of this matter by the authors two methods were used. In method A a single length of strip which was flat in the unstrained condition was bent into ring form, care being taken to avoid permanent set as much as possible. The slightly overlapping ends were securely clamped, and the ring was evenly wound with secondary and primary coils. These windings were of thin wire arranged close to the strip so as to keep the ring as flexible as possible. While in this condition of temporary stra

he ring was tested for permeability and hysteresis by the ballistic method. The greater part of the temporary strain was then annulled by changing the circular form into a square shape by sharp bends at four places. The windings were not removed for this alteration. The ballistic tests were then repeated. The changes observed were considerable. In method B two strips of the material, with

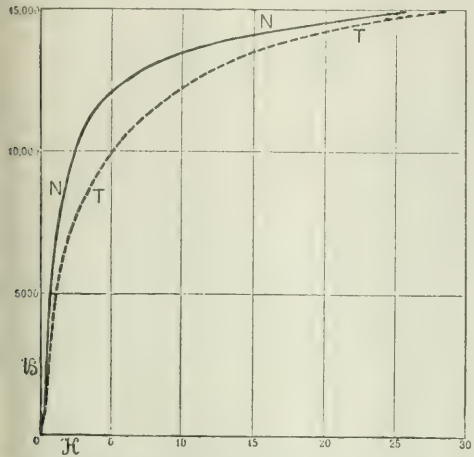



FIG. 2—CURVES SHOWING PERMEABILITY OF SILICON IRON, RING METHOD

suitable uniform windings, were clamped flatwise at the ends of two solid yokes, forming with them a long rectangular magnetic circuit. This circuit could be tested with the strips flat or bent to any desired amount. Permanent set at various curvatures could be applied, and the strips could

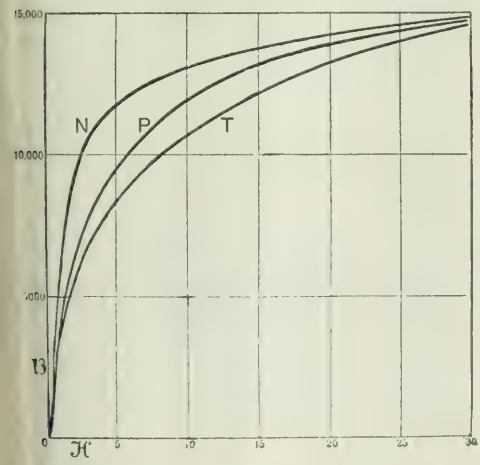



FIG. 3—CURVES SHOWING PERMEABILITY OF SILICON IRON, YOKE METHOD

be restored to their original flat form after any of the bending processes. The results for permeability of silicon iron are shown in Figs. 2 and 3, the former giving results for the ring method and the latter for the yoke method. The curves are marked in each case as follows: *N*, no strain; *T*, temporary strain; *P*, equal permanent strain. The first illustration refers to the ring method, and the second to the yoke method. In the latter method, after the effects of temporary strain had been tested, the strips were allowed to unbend back to the straight condition. When re-tested they gave practically the same results, both for permeability and hysteresis, as in the original unstrained condition. This interesting fact is not indicated in the diagram. It will be seen from that figure that the temporary strain has considerably greater effect on the permeability and the hysteresis than the equal permanent strain has. This is an example in which the effects were somewhat pronounced.—London *Electrician*, Sept. 26, 1913.

*Electric Measuring Machines.*—P. E. SHAW.—An illustrated abstract of a paper read before the (British) Institution of Mechanical Engineers in which the author describes the construction and use of an improved model of a special type of measuring machine for proving standard gages. The original model was made in 1905 and has been in use in the National Physical Laboratory since 1909. The new model is quite similar, but embodies various improvements in its construction and in the electrical methods used to indicate the contact of the micrometer device with the gage being measured. The accuracy of measurement is as high as 0.2 micron. The machine is applicable to all regular metallic or non-metallic solid bodies, whether cylindrical, spherical or parallel-faced.—London *Electrician*, Oct. 10, 1913.

### Installations, Systems and Appliances

*Lightning Arresters.*—An illustrated description of a new form of aluminum lightning arrester. The air-gap has been eliminated by making the aluminum cell in the form of a chain of aluminum links, thus forming a series of aluminum couples which reduces the potential across any pair to 1 volt or 2 volts and avoids heating of the electrolyte. The aluminum chain, immersed in glycerine, is threaded spirally through a central insulating pillar, round which is an outer insulator wound with a choke coil of stranded copper cable which is inserted in the line circuit.—London *Electrician*, Oct. 10, 1913.

*Switching Operations.*—W. W. LEWIS.—An article illustrated by diagrams of switching operations on low- and-high-tension systems with special reference to the safest methods. Wiring diagrams accompanied with numerous oscillographic records cover each of the general classes of switching that occur in practice and enable the fundamental principles thus established to be applied to the more complicated cases of switching. As little switching as possible should be done under tension. When such switching under tension is necessary it should preferably be done on the low side, both when starting up and when shutting down.—*Gen. Elec. Review*, October, 1913.

### Electrophysics and Magnetism

*Magnetism.*—S. B. MCLAREN.—An abstract of a paper read before Section A of the British association outlining a basis for a new theory of magnetism.—London *Electrician*, Oct. 10, 1913.

### Telegraphy, Telephony and Signals

*German Telegraph Experiment Station.*—K. STRECKER.—The first part of a fully illustrated article on the organization and scope of the German telegraph experiment station. The object is research work on telegraphy, telephony, wireless telegraphy, construction of overhead lines and cable lines, interaction between power transmission lines and telegraph and telephone lines, etc. The author describes the office building and its equipment.—*Elek. Zeit.*, Oct. 9, 1913.

*High-Frequency Generator for Wireless Work.*—RICARDO MORETTI.—A note on a new high-frequency generator which is a modification of the Duddell singing arc, but is distinguished from the latter and from Poulsen's generator by the fact that continuous wave trains are not

obtained from Moretti's apparatus. The direct-current arc is operated in series with a suitable ballast resistance, and is shunted by a capacity and inductance as shown in Fig. 4. The positive electrode of the arc is hollow and is traversed by a continuous stream of water (or other cooling liquid). The water cools the electrode, and on entering the arc it is dissociated by the combined effect of heat and electrolysis and an extremely rapid series of explosions occurs in the arc, thus setting up energy surges, the frequency of which is said to be about 100 kilo-cycles per second. These discharges in the arc circuit set up oscillations in the circuit $KL$ of frequency $F = 1/T = \frac{1}{2}\pi\sqrt{LK}$. The frequency of the arc discharges is generally considerably lower than the natural frequency of the oscillating shunt circuit $KL$, so that damped wave trains are obtained—more or less closely following one another according to the frequency

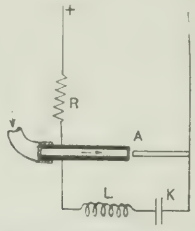



FIG. 4—DIAGRAM OF CONNECTIONS OF HIGH-FREQUENCY GENERATOR FOR WIRELESS WORK

of the arc discharge. Hydrogen inclosure of the arc is not required. Using this generator, a hydraulic microphone and the usual arrangement of aerial, Moretti claims to have achieved satisfactory wireless telephonic communication from Centocelle (Rome) to Tripoli.—*L'Elettricista;* abstracted in London *Elec. Review*, Sept. 26, 1913.

*High-Speed Telegraph.*—A. Franke.—The conclusion of the illustrated description of the new high-speed telegraph system of the Siemens-Halske company, which is now used on five lines of the German telephone system radiating from Berlin.—*Elek. Zeit.*, Oct. 9, 1913.

*Sine-Wave Transmission in the Submarine Telegraph Cable.*—H. W. Malcolm.—The first part of a mathematical article illustrated by diagrams. In the sine-wave transmitter an elementary signal is formed by a single semi-period of a sinusoidal emf, instead of by the positive or negative battery contact which is at present employed in cable telegraphy. Before the importance of this change can be understood, a study is necessary of the theory underlying the transient effects which accompany the introduction or removal of periodic electromotive forces in cables. A single semi-oscillation may be regarded as being made up of two prolonged trains of oscillations, the second displaced and superposed on the first. A formula is obtained whereby the transient current produced by the sudden introduction of a periodic emf can be readily calculated, and it is shown that, although the periodic effects predominate at the sending end, the phenomena at the receiving end are almost entirely transient in nature. A general theorem is deduced regarding the signals produced by any symmetrical emf, from which it appears that they are independent of the shape of the sending emf and dependent only on its mean value. That being so, it is permissible to choose—without regard to the receiving end—the emf which produces least shock at the sending end, and in this respect the alternator is superior to the battery.—London *Electrician*, Oct. 10, 1913.

### Miscellaneous

*Resinous Insulators.*—A note of two recent British patents (No. 23,776, 1912, and No. 24,059, 1912) of the British Thomson-Houston Company and the American General Electric Company. An insulator which can be molded is produced by bringing into contact with a liquid solvent an infusible reaction product of phthalic anhydride and a polyhydric alcohol. In another process camphoric acid is heated with a polyhydric alcohol like glycerol.—London *Elec. Eng'ing*, Oct. 2, 1913.

## Book Reviews

Handbuch der Elektrizität und des Magnetismus. In fünf Bänden. Edited by Prof. Dr. L. Graetz. (A compilation.) Vol. IV. Paper, 270 pages, 178 illus. Leipzig: Johann Ambrosius Barth. Price, 10 marks

This is Volume IV of the series forming a five-volume textbook on electricity and magnetism, from the standpoint of the physicist rather than of the engineer. This volume deals with magnetism and electromagnetism. The work is thorough and scholarly. It is divided into three sections dealing respectively with magnetism generally, the theory of magnetic induction, and magnetic measurements. The volume lacks an index of subject matter, which it must be hoped will be supplied with the complete series. A full consideration is offered of the apparatus for measuring the earth's local magnetic field.

Bau Grosser Elektrizitätswerke. By G. Klingenberg 180 illus., 7 tables. Berlin: Julius Springer. Price 12 marks.

An engineering descriptive treatise on the construction of large electric central stations, especially from the standpoint of the steam engineering constructor. The book is divided into six main sections, dealing with the following topics: Outlines of central-station construction, costs of electric energy transportation, economics of central power stations, basis for charges, the stations of the Victoria Falls & Transvaal Power Company. The book is well illustrated with diagrams and drawings taken from existing central stations. It is clearly written, from the economic standpoint, and contains much information of interest to the constructing engineer.

Examples in Applied Electricity. By C. G. Lamb. London: Cambridge University Press. New York: G. P. Putnam's Sons. 62 pages. Price, 75 cents.

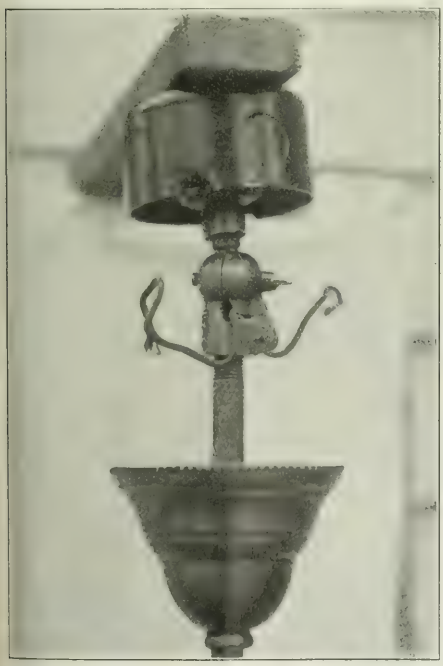
A collection of test questions covering the theory and applications of electricity, intended mainly for the use of instructors. These questions cover nearly the whole field of electrical engineering, with the exception of polyphase currents. Special subjects such as telephony, wireless telegraphy, electrochemistry, ore reduction, etc., are not included. A thorough grounding in the elementary theory of magnetism and electricity is required of the student who would solve these problems. The collection, which includes dynamo-electric machinery, alternating currents and energy transmission, has been compiled mainly from test papers set to students in the Engineering Laboratory, Cambridge, England. The answers are printed together at the end of the booklet, but, except for occasional very brief indications as to intermediate steps, the method of working out the problems is not stated. The results are given to the accuracy of a 10-in. slide rule—a commendable feature. How great an extent a compilation of definite test questions is available for use without modification by any but the originator it is not very easy to determine, but, as containing suggestions to teachers of electrical engineering not only in preparing test questions of their own but also in shaping or improving their courses, this particular publication should be of considerable value.

# New Apparatus and Appliances

**An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers**

## Device for Hanging Lighting Fixtures

The Electro Development Company, New York City, has just placed on the market a useful device to aid wiremen in hanging lighting fixtures properly. This "hang straight," as it is called, consists of a ball-and-socket joint tapped at the lower end to receive the threaded end of the pipe on the lighting fixture. In installing the fixture with this device the wireman fastens the base to the ceiling, or, as shown below, installs the outlet box and places the insulating joint in position. The lower half of the "hang straight" is then put on the pipe and the socket part fitted to the ball. Placing the threaded pin through the center of the ball allows the fixture to hang freely and to reach a vertical position under the action of gravity. With the fixture in this position the wireman has but to tighten the wing nut and place the canopy over the completed job. An adjustable tripod with a set screw in each leg is attached to the device when it is to be used for wall-bracket work.

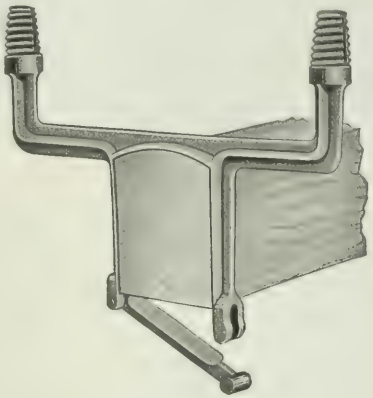


DEVICE FOR HANGING LIGHTING FIXTURE STRAIGHT

Turning these set screws aligns the fixture. To the wireman who knows the difficulty of aligning fixtures the practicability of this device is at once apparent. All edges where the wires might come in contact with the brass are carefully smoothed to avoid abrasion. The device has met with the approval of the National Board of Fire Underwriters.

## Boltless Bracket

The accompanying illustration shows a new type of boltless bracket or arm clamp pin manufactured by the Line Material Company, South Milwaukee, Wis. The bracket is made of galvanized malleable iron and has a pivoted arm fitted with knob which, when driven home with a small hammer, springs over a slight ridge on the stationary arm of the bracket.



GALVANIZED MALLEABLE IRON BOLTLESS BRACKET

This method of fastening the clamp makes installation easy and rapid and eliminates the trouble resulting from loss of nuts and rusting at the bolt threads. The manufacturers claim that the use of this type of clamp bracket will add many years of life to an old or split pole-arm besides insuring long life to new arms since no holes need be drilled reducing their cross-section. The pins are split at the top and are provided with felt insertion so that they allow of some variance in the internal insulator threads.

## Display Scheme with Colored Lamps

In physics the fact is well known that a surface of a given color can be illuminated only by light of the same color, and that under any light not containing its own color such a surface will appear dark or black. A rather novel application of this principle was made by the National Quality Lamp Works of the General Electric Company in its recent exhibit at the New York Electrical Show. In this display a series of placards rising from a dark background were illuminated by light reflected from colored lamps placed in front and at the sides of the cards. A flasher connected to the lamp circuits alternately switched on the lamps of different colors, and as the light fell upon the colored placards portions of the pictures seemed to disappear owing to the neutralizing effect of the colored light that was employed. The effects which were obtained in this manner attracted not a little attention from those attending the show, the exhibit being of a nature to arouse general interest and curiosity.

## Telephone Call System

Telephonic apparatus designed to enhance the value of telephone service in large commercial establishments by quickly locating individuals not within hearing distance of their telephones has recently been brought out by the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. The "call a-phone system," as it is



"CALL-A-PHONE" WITH FIRE-ALARM ATTACHMENT

known, includes a signal-transmitting device mounted within reach of the branch exchange operator and a system of bells placed in the various parts of the plant. These bells are rung simultaneously under the controlling action of the sending device.

The energy which is required to provide for the operation of the system is drawn from the telephone storage batteries, or in the case of isolated systems from a bank of dry cells having a potential of but 20 volts, thus keeping the system at all times within the rules established by the National Board of Fire Underwriters for low-voltage signal systems.

The sending device shown in the illustration consists of a neatly designed and finished cabinet, measuring 15 in. by 11 in. by 9 in., and containing all of the apparatus required for the projection of the current impulses used in forming the code signals. Twelve distinctive code signals can be transmitted with this particular sending device. The interlocking push-button key switches for these impulses will be seen in the center of the front panel, together with the pilot lamp and master key. A directory plate is associated with the selecting keys for the insertion of the name of the party responding to each code signal.

The loud-ringing gongs distributed throughout the plant operate in parallel on a two-wire circuit consisting of ordinary interior-type twisted-pair telephone wire. Any reasonable number of bells may be connected to one circuit, but fifteen is recommended as a limit. For offices small bells or buzzers may be substituted for the gongs at the option of the telephone users.

In addition to the code signaling features of the equipment the system is equipped with a fire alarm. For this purpose leads from the usual type of "break the glass" fire-alarm boxes installed in various parts of the plant are terminated upon the visual signals shown in the lower portion of the first panel of the sending device. When an alarm is turned in from any of the fire-alarm boxes the corresponding visual signal is displayed to indicate the location of the fire and a general alarm is automatically sounded by the sending device. A fire-alarm switch is also included in the equipment of the sending station for convenience in sending alarms for fires which are reported by telephone.

## Constant-Voltage Axle-Lighting Equipment

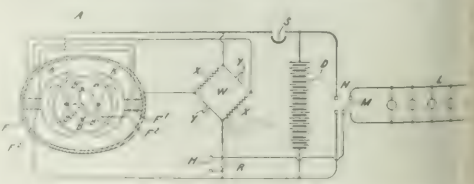
At the convention of the Association of Railway Electrical Engineers which came to an end in Chicago on Oct. 24 the Electric Storage Battery Company, of Philadelphia, exhibited for the first time its new constant-voltage axle-lighting equipment. It is something of a departure for this company to manufacture complete axle-lighting equipments, and considerable interest was taken in the apparatus. The system, which has been tried out successfully on the Santa Fé Railroad, is illustrated diagrammatically herewith. Its feature is the use of a constant-voltage rather than a constant-current value for charging the storage battery.

The dynamo *A* is of the so-called Rosenberg type, described by Dr. E. Rosenberg on page 918 of our issue dated Nov. 10, 1906. It is so arranged that the armature can be rotated in either direction without change in the polarity generated. The machine has been redesigned under the direction of Mr. J. Lester Woodbridge, chief engineer of the Electric Storage Battery Company, who has developed the entire device to its present state.

Current in the primary field winding *F* produces a small primary field flux represented by the arrow *P*, which induces an emf between the short-circuited brushes $B^1$ and a flow of current through the short-circuited connection *C*. This current, flowing through the armature winding, produces, by armature reaction, the secondary or principle field flux, which does not pass through the frame of the machine but is confined to the heavy pole-shoes and the armature, as shown by the arrows *K*. This principal flux produces an emf at the principal brushes $B^2$, which are connected to the external circuit, a series-field winding *F* in this circuit serving to balance the armature reaction due to load.

In the primary field winding $F^2$ there is connected a Wheatstone bridge as indicated. Other junction points are connected to the positive and negative terminals of the machine. This bridge is designed to give the constant voltage characteristics. It includes fixed resistances *X* and iron-wire ballasts *Y*. The latter, on account of their high temperature coefficient, are said to give a practically constant-current characteristic under operating conditions. This combination of circuits produces a field excitation continually diminishing with increase of speed. An automatic switch *S* connects the dynamo to the battery when the machine voltage is slightly above that of the battery, and opens when the output of the dynamo drops to zero. The knife switch *N* connects the lamp circuit to the battery.

The machine voltage is fixed at a point slightly above the floating voltage of the cells. Should it ever be found necessary to give the battery a high-voltage charge, this may be done during a daylight run by means of the fixed



CONSTANT-VOLTAGE AXLE-LIGHTING EQUIPMENT

resistance *R*, normally short-circuited by the switch *N* and also by the clip *M* on the main lamp switch. When both of these switches are open the voltage of the dynamo is raised by an amount determined by the value of the resistance *R*. Whenever the lamps are to be lighted the closing of the switch *N* short-circuits the resistance, reducing the potential to normal and eliminating the pos

bility of excessive voltage at the lamps. It is declared that this system adjusts automatically the output of the dynamo to the requirements of the service and gives the slight amount of overcharge required to keep it in good condition. The equipment is provided with a switchboard containing the automatic switch, ampere-hour meters for the battery and dynamo circuits, fuses, etc. There is also a control panel containing the Wheatstone-bridge field control. No lamp regulator is required in the operation of this system.

In an address on the subject of this new equipment, given in Chicago Oct. 21 during the convention mentioned, Mr. Woodbridge remarked that this axle-lighting system has been developed by his company primarily from the storage-battery point of view, rather than from the dynamo point of view. He said that two new principles have been introduced: First, the dynamo controls the voltage on the circuit and therefore controls the voltage maintained at the battery terminals, instead of the battery controlling the voltage of the dynamo. Second, the dynamo is designed for constant voltage rather than constant current. This constant voltage is adjusted slightly above the normal floating point of the battery at a value just sufficient to keep the battery always practically "full." The charging voltage adopted is about 2.25 volts per cell. This has been considered low, but Mr. Woodbridge declared that actual tests have shown it to be sufficient not only to keep the battery charged but to recharge it after a complete or partial discharge.

The equipment includes sixteen cells of battery with Manchester plates. A potential of between 35 volts and 36 volts is maintained across the battery terminals when the dynamo is in operation and is sufficient for satisfactory operation. Mr. Woodbridge said that as long as the changes in voltage are gradual a considerable range in the intensity of illumination may be permitted in car lighting without producing unsatisfactory results. He thought a variation of from 35 volts down to 32 volts would not be objectionable, provided the fluctuations are not rapid. Lamps rated for 32-volt circuits have been used so far with this equipment, but if the cost of lamp renewals should be considered high on account of over-voltage, there is said to be no reason why 34-volt lamps should not be substituted. Mr. Woodbridge spoke of the fact that an equipment of this sort has been in use over 160,000 car-miles within a year on the Santa Fé without light failure or delay, or any charging of the battery except that given by the axle-driven dynamo en route.

## Electric Signaling Apparatus for Construction Work

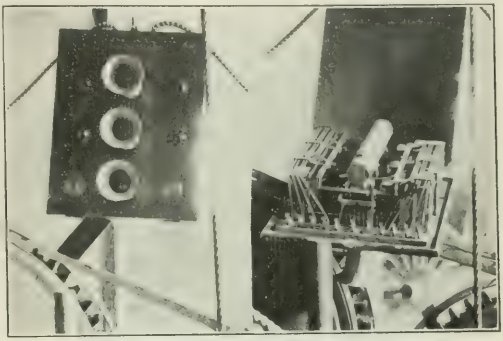
The electric signaling apparatus recently tried out on the new Municipal Building in New York City has several features of interest and is without doubt a step toward better signaling for construction hoists. In this signal system a



FIG. 1—KEYBOARD ATTACHED TO SIGNALMAN'S BELT

conducting cable containing several insulated copper wires run from the engineer's station to the signal man. The man who gives the signal wears a belt to which one end of the conducting cable is attached, and this belt carries a number of buttons, which are marked so that there need be no mistake. The arrangement of the push-buttons will be evident from Fig. 1, which shows the entire keyboard attached to the signal man's belt. The signals provide for raising or lowering the load at high or low speed, for swinging the boom to the right or left, and for stopping each motion almost instantly. In constructing high buildings operators may be placed at several points to watch the travel of the hoist and signal the engineer.

At the hoisting engine the signals are given to the engineer by colored lamps operated simultaneously with electric siren horns. Fig. 2 shows the signal box at the engineer's station, when it is closed, and Fig. 3 shows an interior view of the same box.



FIGS. 2 AND 3—OUTSIDE AND INTERIOR VIEWS OF SIGNAL BOX AT ENGINEER'S STATION

One of the most important features of this apparatus is the recording device by means of which every signal given is recorded upon a paper strip, which may be in the chief engineer's office. Every movement of the hoisting cable and of the boom is also recorded. In the event of an accident through the misunderstanding of signals or from any other cause, it is thus easy to fix the responsibility. To guard against accidents due to the interruption of signals by the breakage of the armored conducting cable, a safely circuit is provided consisting of a continuous wire running through the entire length of the cable. If by any accident the conducting cable should be damaged sufficiently to break the wires, the cessation of the current in this safety circuit immediately causes an alarm bell to ring at the engineer's station.

Mining, subway tunneling, bridge building and the like are cited as other applications for this apparatus by its manufacturer, the Y. & G. Electric Fuse & Engineering Company, Bayonne, N. J.

## Electric Range for Hotel Service

At the New York Electrical Show an electric grill and tea room was run in connection with the New York Edison Company's exhibit, the food served being cooked wholly with electrical devices, which comprised a hotel-type range, a grill of the same pattern and two ovens. To serve the large number of people who patronized the grill room it was necessary that the range be operated at its full capacity from 9 o'clock in the morning until 10 o'clock at night, and it proved to be quite indispensable. On several occasions 75-lb. roasts were cooked. As told by the chef at the electric grill the average day's work for the range consisted of roasting 30 lb. of beef, baking half a bag of potatoes, broiling about 250 chops and 200 young chickens, and keeping soups and other foods warm. During each day approximately 600 patrons were served from this electric kitchen.

The range, illustrated herewith, is provided with two

roasting ovens and a top cooking surface comprising eight rectangular hot plates. The ovens are of liberal size, being 18 in. wide, 16 in. high and 28 in. deep. They have double walls and are insulated with navy "firefelt" placed between the walls to prevent the escape of heat. The compartments are ventilated by means of flues which communicate with an opening in the top of the range. Each oven is provided with



ELECTRIC RANGE FOR USE IN HOTELS

two calorite heating units of the two-heat type, one being located at the top and the other at the bottom, thus giving a range of four heats for each oven with power consumptions for the respective heats amounting to 1.6, 2.4, 3.2 and 4.8 kw.

The eight rectangular hot plates are all of the same size, 9 25 in. wide by 12 in. deep, and the heating unit of each is designed for but one heat. The power consumption of each of the four front units is 1600 watts as they are designed to develop a high temperature for rapid work, while that of the back four is 800 watts, rendering them suitable for slow boiling.

The main circuit is closed through a double-pole circuit-breaker, and in addition the circuits to the individual heating units are protected by fuses and controlled by knife switches. Switches, fuses and circuit-breakers are mounted on a slate panel located at the top of the range and inclosed in a sheet-metal compartment provided with a roll-top door. The heating unit which each switch controls is indicated by a name-plate placed directly above the latter's handle, so that to ascertain what units are in operation one has only to roll up the door and glance at the switches. An aperture at the bottom of the compartment insures circulation of air over the panel devices. Conductors are brazed to the calorite heating units, so that there are no connections that are likely to work loose from alternate heating and cooling. These conductors are carried through conduit to the connection blocks and there connected to the terminals of the respective power circuits.

The framework of the range is substantial, being constructed of angle-irons firmly bolted together. The range front and the door frames are of heavy steel plate, while the hot-plates and end frames of the panel-box are iron castings. The walls of the oven are of sheet metal. All sheet-metal parts are of blued steel, while the other parts are finished in marine or dull black. The heating units are replaceable and the design is such that the hot plates can be raised up to permit cleaning the catch pan located below them.

The over-all dimensions of the range are: Width, 44 in., depth, 38 in., and height, 68 in. It is manufactured by the General Electric Company, Schenectady, N. Y.

## Electric Fountain Without Water Connections

In the booth of the United Electric Light & Power Company there was displayed at the New York Electrical Show which was lately held an electric "rainbow" fountain" which has attracted considerable attention. The fountain is self-contained, requiring no water connections and no electrical connections, as sufficient energy can be taken from the ordinary lamp socket for its operation. Five gallons of water kept in circulation by a small motor-driven pump is forced through a glass bowl, and the numerous streams, breaking into a vaporized spray, are drained into a tank below to be used again. The base of the fountain is octagonal in form and the eight panels are surmounted with cut flowers and growing plants. An automatic projector in the base of the fountain periodically changes the color of the glass bowl from which the water flows, and these color changes when caught up by the falling drops produce striking color effects.

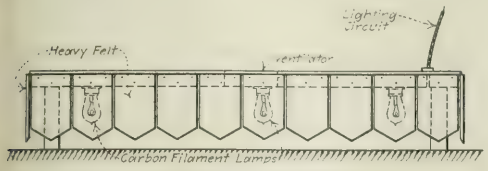


ELECTRIC-FOUNTAIN EXHIBIT AT NEW YORK ELECTRICAL SHOW

This fountain was built by the Feature Advertising Company, 209 Pacific Street, Brooklyn, N. Y. It was equipped at the show with a set of specially designed "temple" bells for musical effects. The bells, which were operated automatically with piano accompaniment, were installed by the Yerkes Sound Effects Company, whose headquarters are in New York City.

## Electrically Heated Chick Hovers

The Standard Electric Incubator Company, New York City, which is marketing an electrically heated chick hover, claims to have solved successfully the problem of keeping small chicks alive after they have been hatched. The scheme of the hover manufactured by this company is indicated by the accompanying illustration. Its construction is




ELECTRICAL CHICK HOVER

simple. A square platform of light pine boards is mounted on four wooden legs. The edges of the pine platform are draped with heavy felt which has been slit at intervals to admit the chicks. The size of the platform and the number of carbon-filament lamps in the hover are determined by the number of chicks which are to be taken care of. It is stated that at least one lamp should be installed for each thirty chicks, and ample room should be provided so that there will be no crowding. Many heat sources are provided instead of a large one with the same radiating ability in order to minimize the tendency prevalent in newly hatched chicks to crowd about the heat source, thereby injuring the weaker members of the brood. Ventilation is accomplished by natural draft entering under the edges of the felt and escaping at the opening shown in the center of the platform.

## Projector Lamp with Uniform Candle-Power Distribution

A 32-cp metal-filament lamp of the standard shape projects only about 5.1 cp downward in the direction of the lamp axis, the bulk of the light being given off laterally. As the majority of chandeliers and other receptacles are arranged so that the lamps operate with their tips hanging downward, this irregularity in distribution, as shown in Fig. 2, often limits the useful light obtainable from the lamp. The objection can, of course, be remedied to some extent by the use of suitable reflectors, but it must be remembered that losses are certain to occur with every reflection.

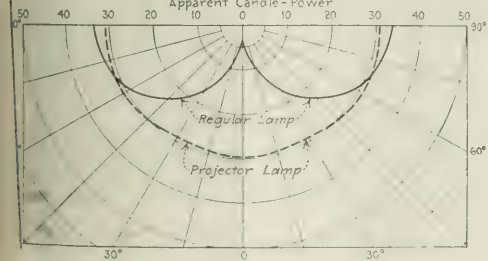



FIG. 1—MEAN VERTICAL DISTRIBUTION CURVES

The Philips Metall Gluhlampenfabrik A.G., Eindhoven, Holland, has taken up the construction of a type of lamp in which the filaments are so arranged that the candle-power is almost uniform in all directions. The filaments of this projector lamp do not run parallel with the filament support but lie stretched in a conical surface. Fig. 2 shows an end and side view of such a 32-cp projector lamp and its curve of light distribution is shown in Fig. 1. A comparison with the distribution curve of the standard metal-filament lamp in the same illustration will show that the effective downward illumination of the new lamp is nearly four times that of the ordinary unit, and that the candle-

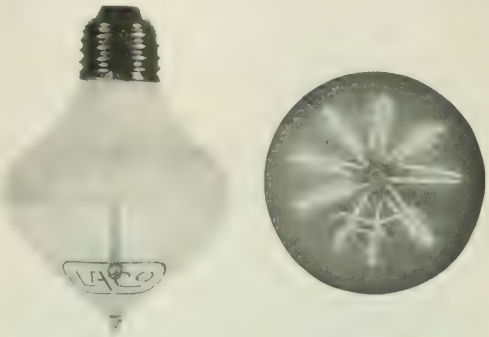


FIG. 2—32-CP PROJECTOR LAMP

power in a given direction remains the same whether the lamp is burned in a vertical, a horizontal or an inclined position.

## Exhibits at Chicago Electric-Vehicle Convention

Makers of electric vehicles, storage batteries, motors, charging appliances, axles, tires, measuring instruments, automobile electric incandescent lamps and other accessories were represented at the Chicago convention of the Electric Vehicle Association. The manufacturers had rooms on the eighteenth floor of the Hotel LaSalle, and no heavy machinery or complete vehicles were shown. The vehicle manufacturers maintaining headquarters were the Baker Motor Vehicle Company, Cleveland; Chicago Electric Motor Car Company, Chicago; General Motors Truck Company, Pontiac, Mich.; General Vehicle Company, Long Island City, N. Y., and Walker Vehicle Company, Chicago. The last-named company exhibited its rear-axle driving unit, with a wheel casing removed to show the gears.

Five makes of storage battery were shown by the Edison Storage Battery Company, Orange, N. J.; Electric Storage Battery Company, Philadelphia; Gould Storage Battery Company, New York; K. W. Battery Company, Chicago, and Philadelphia Storage Battery Company, Philadelphia. All of them showed plates for vehicle-battery use. The Electric Storage Battery Company had a starting battery on display and the Gould company showed some interesting large plates of a type used in the submarine torpedo boats of American and foreign navies. The K. W. Battery Company, of Chicago, is a newcomer. It is the United States representative of Gottfried Hagen, Koelner Akkumulatoren Werke, Cologne, Germany, said to possess the oldest storage-battery factory in existence, the factory being under the technical direction of Dr. E. Sieg.

The General Electric Company, of Schenectady, exhibited a mercury-arc rectifier and various electric automobile lamps. The Electric Products Company, of Cleveland, demonstrated charging appliances for storage batteries, including the Wotton automatic rectifier.

The Fort Dearborn Manufacturing Company, of Chicago, had a new device that excited some attention in the shape of the Benson self-adjusting Hindley worm-gear axle.

Literature on the subject of small motors was distributed

by the Westinghouse Electric & Manufacturing Company. Tires and other products were exhibited or talked about by the Firestone Tire & Rubber Company, Akron, Ohio; Goodyear Tire & Rubber Company, Akron, Ohio; F. E. Sparks, Chicago, and United States Tire Company, New York.

Ampere-hour meters and garage-type watthour meters were shown by the Sangamo Electric Company, Springfield, Ill. The Commonwealth Edison Company distributed central-station literature and the *Electrical World* displayed samples of electric-vehicle data.

## Electric-Lighted Shadow Portrait

The accompanying illustration shows an electrically lighted "shadow portrait" of Hon. W. J. Bryan, Secretary of State, which was exhibited at the recent National Conservation Exposition at Knoxville, Tenn., where Mr. Bryan was a guest of honor. The features of the face are formed



ELECTRIC-LIGHTED SHADOW PORTRAIT OF SECRETARY OF STATE BRYAN

by the usual channeling of the lower reflecting surface. Opal color-caps are used on the tips of the lamps, the density being so chosen that the caps, viewed by transmitted light, are of the same intensity as the reflecting surface at the bottom of the channels. Owing to this lack of contrast, the lighting units themselves are rendered practically invisible, while the features and lineaments stand out in distinct and lifelike fashion. Color can be chosen to make the display resemble the tints of real life, and any portrait or picture can be reproduced with artistic effect. This novelty in electric-sign advertising is being introduced by the Greenwood Advertising Company, of Knoxville, Tenn., and Los Angeles, Cal.

When Mr. Bryan visited Knoxville and was shown this electrically lighted portrait he appeared greatly pleased with the likeness and commended the lifelike appearance of the picture. Following his exhibition of interest, the Greenwood company presented the display to him.

## Metallized Graphite for Bearings and Collector Brushes

A new metallized-graphite product suitable for self-lubricating bushings, for collector brushes on dynamo-electric machinery, for packing rings in steam turbines and for many other uses where a self-lubricating metal is desired is being put on the market by the Graphite Metallizing Corporation, Yonkers, N. Y. The basic element of "graphalloy," as it is called, is pure graphite, and to this constituent by a process of impregnation is added a molten metal to give the completed product solidity that it may be machined to the desired form and have the requisite strength and durability. The process of impregnation of the graphite with the metal is accomplished by the use of air pressures of high values, such as have hitherto been considered commercially impracticable.

Graphalloy has a high compressive strength and can be accurately machined, threaded or tapped with no more difficulties than are met with in working brass. For machining a speed about 25 per cent in excess of that used for brass is to be recommended. Some of the most important mechanical properties are given in the accompanying table.

MECHANICAL PROPERTIES OF GRAPHALLOY

| | |
|---|---|
| Weight of solid graphite electrodes per cubic inch (in pounds) | 0.057 |
| Weight of graphalloy impregnated with babbitt (in pounds) | 0.145 |
| Increase in weight due to impregnation (in per cent) | 150 |
| Specific gravity of graphalloy | 0.4 |
| Percentage of metal in graphalloy (by weight) | 60 |
| Percentage of metal in graphalloy (by volume) | 25 |
| Compressive strength of graphalloy (in pounds per square inch) | 14,000 |
| Modulus of rupture | 12,500 |

The lubricating qualities of this product are said to be practically those of graphite. It has been found that bearings made of this material will run somewhat hotter than similar bearings lubricated with oil, but this result is accounted for by the fact that graphalloy is a relatively poor conductor of heat. However, it is said that in no case will a temperature of less than 400 deg. Fahr. injure the graphalloy of the bearing or cause it to seize the shaft. This product is not advocated for all classes of service, but the manufacturers claim that on light-duty machines operating at high speeds excellent results can be obtained.

For use on circuit-breakers and other electrical contactor graphalloy is made from pure graphite and copper o

DATA ON METALLIZED BRUSHES

| Pressure, Lb. per Sq. In. | Current, Amp. | Current Density, Amp. per Sq. In. | Contact Drop, Volts |
|---|---|---|---|
| 1.0 | 12 | 48 | 0.090 |
| 1.0 | 25 | 100 | 0.177 |
| 1.75 | 12 | 48 | 0.053 |
| 1.75 | 25 | 100 | 0.066 |
| 2.5 | 12 | 48 | 0.045 |
| 2.5 | 25 | 100 | 0.052 |

brass as the service demands. Experiments have shown that for controller and circuit-breaker contacts which are being continually subjected to the action of an electric arc the best combination is graphite impregnated with brass, the theory being that the zinc in the brass vaporizes under the action of the arc and tends to disrupt it. It has been found that with this combination of materials less trouble is experienced from pitting. In cases where the lowest possible specific resistance is needed pure copper is used instead of brass. Graphalloy contacts are said to be entirely free from "freezing" troubles.

Tests made by the New York Testing Laboratories sh

that graphalloy slip-ring brushes have a specific resistance of 20.77 microhms per cu. in. When these figures are compared with the specific resistance of a cubic inch of carbon, which is 1240 microhms, and of graphite, which has a specific resistance of 320 microhms per cu. in., it will be seen that the combination product presents a large advantage in conductivity.

The electrical characteristic of a metallized brush is an all-important item as it enters into the efficiency of the machine and the operating temperature of the slip-ring or commutator to which the brush is applied.

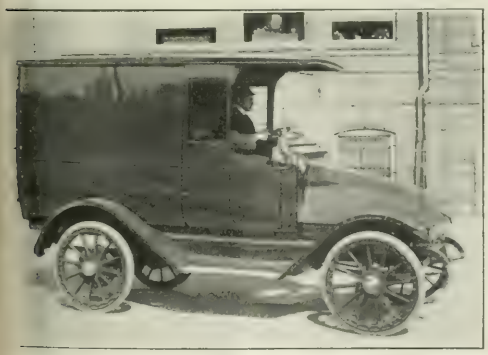
Herewith is given a table of the various contact drops in voltage at a speed of 2500 ft. per minute and at various pressures used in commercial brush holders.

From this table will be noted that the average contact drop is 0.07 volt, and upon comparing this with like tests on other types of brushes the manufacturers claim that it will be found much lower. The current-carrying capacity of graphalloy has been found to be approximately 200 amp per sq. in. However, the maximum allowable current density varies largely with the class of service and also with the limiting temperature of the brush.

## Light Shaft-Driven Electric Commercial Vehicle

The new 1914 model 1000-lb. wagon of the General Vehicle Company, Long Island City, N. Y., has been designed to give a speed of 12 or 15 miles per hour and a mileage of from 45 to 65 miles per charge, depending upon battery equipment. The wheelbase of the truck has been increased from approximately 86 in. to 108 in. and the battery has been taken from under the frame and placed under the hood. Notwithstanding the increased wheelbase, the turning radius is about the same as was that of the shorter wagon and the inside lading space of the two is approximately equal.

The wagon is driven by a single motor through a double universal-joint shaft and worm drive in the rear axle. All wiring, including bell and lamp circuits, is installed in rigid metal conduit. The safety devices on the car are quite complete. Application of either brake immediately dis-

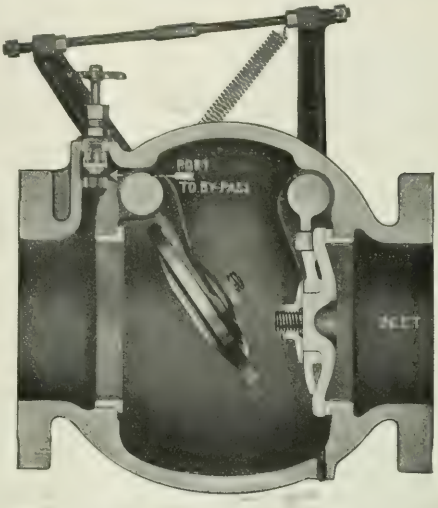


1-4 MODEL SHAFT-DRIVEN ELECTRIC COMMERCIAL VEHICLE

connects the battery from the motor. The emergency brake cannot be locked except when the running switch is in either the neutral or the charging positions and cannot be released until the switch is thrown into the running position. The running switch can be thrown into the running position only when the controller is on the neutral point. These devices increase the safety of the driver and the public and allow the vehicle to be left standing alone without undue danger of accident from accidental or mischievous interference.

## Emergency Cut-Out Valve

At the recent convention of the National Association of Stationary Engineers, Springfield, Mass., the Crane Company, Chicago, Ill., showed for the first time a new automatic, double-acting, non-return and emergency cut-out valve for boiler and header protection. This valve is made with a ferro-steel body and hard metal seats and disks, and



AUTOMATIC, DOUBLE-ACTING, NON-RETURN AND EMERGENCY CUT-OUT VALVE

is adapted for operation on steam pressures up to 250 lb. at a maximum temperature of 500 deg. Fahr. The valve may be arranged for electrical remote control and may be used for the protection of long lines of branch piping. The turnbuckle connecting the outside levers provides a ready adjustment for different operating conditions, the levers themselves giving a visible indication of the position of the clappers on the inside. External adjustments may be made with the valve in operation.

## Suction Sweeper with Large Air Displacement

The Duntley Products Company, Erie, Pa., has recently developed an electric suction sweeper capable of displacing 127 cu. ft. of air per minute. The exhaust of the device is made several times as large as the intake aperture, so that the fan does not have to work against high back pressure. The fan itself, which is 4.5. in. in diameter, is driven by a small motor which operates on either direct current or alternating current of a frequency of 60 cycles or less. The speed of the motor is 8000 r.p.m. The length of the machine exclusive of the handle is but 1 ft. and its height is 8.25 in. The nozzle is 10 in. long and 1.25 in wide inside. The entire equipment weighs about 15 lb. A feature of the cleaner is the method provided for removing the dirt bag. By unhooking this sack from the sweeper handle and pressing a clasp on the exhaust drum the bag can be lifted from its position without being touched.



ELECTRIC SUCTION SWEEPER

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Growing Use of Electricity in China.**—A recent report states that there are at present thirty-four electric-light plants in China and that the number is increasing gradually. In Shanghai it is reported that the increasing use of electricity for industrial purposes is attracting attention, a number of mills and factories there being supplied with electricity. It is stated that many of the leading American manufacturers have representatives in the field who are working to open up a demand for electrical apparatus.

**Large Order Placed for Multiple Conductor Cable.**—The city of Salem, Mass., has placed a large contract with the Simplex Wire & Cable Company, Boston, for multiple-conductor cables for a new fire-alarm system. Most of these cables are lead-covered for underground use and contain all the way from two to eighteen conductors, both in pairs and laid straight. In order to secure as permanent an installation as possible a 30 per cent rubber compound was specified for insulating the conductors. Charles H. Ashby is city electrical engineer.

**Large Interest Shown in Electric Appliances.**—In connection with the recent district fair of Northern Illinois, held at Streeter, Ill., it is stated by A. L. Roome, Illinois sales manager for the Hurley Machine Company, maker of electric washing machines, that there were probably over 70,000 visitors at the fair and that great interest was shown, especially by farmers, in the various electrical appliances on exhibit. He thinks that manufacturers of these lines and central stations may expect a big business during the coming year throughout this section.

**Chicago Demand for Lighting Glassware Observed.**—The H. Northwood Company, of Wheeling, W. Va., is enjoying, according to a recent sttaement of one of its representatives, an unusually brisk business in Chicago. This company, which has only comparatively recently entered the lighting field, is confining its attention to one line, the "Luna" ware, which is made up in various shapes and designs for direct and semi-direct illumination. The company's product is sold almost exclusively for commercial application ,and some export business is done to England.

**Condensing Equipment Installed by Utility Companies.**—The Cleveland (Ohio) Electric Illuminating Company has recently purchased from the Alberger Pump & Condenser Company, of 140 Cedar Street, New York, four 14,000-kw condensing units, consisting of turbine-driven condensation pumps, combined with Corliss engine-driven vacuum and circulating pumps. Apparatus of the same make has been installed by the Aurora, Elgin & Chicago Railway Company in its generating station at Batavia, Ill. This outfit consists of a 7500-kw three-impeller, turbine-driven circulating pump. a turbine-driven "Hydroflo" vacuum pump and a motor-driven condensation pump.

**Boilers Purchased for Large Steel Plant.**—The Otis Steel Company, of Cleveland, Ohio, has recently purchased from the Babcock & Wilcox Company, 85 Liberty Street, New York, boiler equipment of 3528 hp capacity with superheaters. Among the electrical concerns which have lately obtained boiler equipment from the same company are the Edison Storage Battery Company, Silver Lake, N. J., 900 hp; the National Quality Lamp Division of the General Electric Company, Cleveland, Ohio, 1024 hp, and the Toledo Bowling Green & Southern Traction Company, Findlay, Ohio, 1016 hp. The total of eleven large sales reported since the end of September amounts to 15,290 hp.

**Electrical Equipment in the New Bradstreet Building.**—In the new twelve-story Bradstreet Building in New York the generating equipment consists of General Electric steam-driven, direct current, three-wire units, two of 150-kw and one of 50-kw rating. The boilers were supplied by L. R. Merritt & Company, of 95 Liberty Street, New York. The building is wired with a panel on each floor divided into lamp and motor sections and arrangements are made for metering each class of service. On four floors of the building the wiring is arranged for printing-press drive and a number of Crocker-Wheeler motors have been installed for this service on one floor. The electrical contracting on the building was done by L. K. Comstock & Company, of 30 Church Street, New York.

**Electric Sign Manufacturers' Association Organized.**—Announcement has just been made of the organization of the National Association of Electric Sign Manufacturers, membership in which is composed of two classes, the first including manufacturers of electric signs and electrically illuminated advertising displays, and the second embracing makers of electric sign materials and accessories. The formation of such an association has been discussed for some time and its objects are, in brief, to combat hostile legislation in the form of unfair restrictions and taxes, to provide a means for co-operative booming of the sign business, to protect sign manufacturers from dishonest agents, to produce and maintain a standard of material, workmanship and design, and to combat the evil of design piracy In the latter field its efforts will be similar to the work of the Registration League of Philadelphia. The secretary of the association is Mr. Lloyd E. Brown, 315-321 South Warren Street, Syracuse, N. Y.

**Officers of Railway Electric Supply Manufacturers' Association.**—Officers of the Railway Electric Supply Manufacturers' Association have been elected as follows: President C. W. Bender, Cleveland, National Electric Lamp Association; senior vice-president, W. F. Bauer, Chicago, United States Light & Heating Company; junior vice-president, H. G. Thompson, New York, Edison Storage Battery Company; secretary, Jesse Scribner, Chicago, General Electric Company; treasurer, Edward Wray, Chicago, *Railway Electrical Engineer;* executive committee, George H. Porter Western Electric Company; B. L. Winchell, Jr., Kerite Insulated Wire & Cable Company; J. M. Lorenz, Central Electric Company; W. E. Ballantine, Willard Storage Battery Company; A. C. Moore, Safety Car Heating & Lighting Company; J. T. Dickinson, Gould Coupler Company; H. E. Watson, Benjamin Electric Manufacturing Company; G. H. Atkin, Electric Storage Battery Company; F. F. Skeel Crouse-Hinds Company. This association is auxiliary to the Association of Railway Electrical Engineers.

**Constant-Voltage Axle-Lighting System Described.**—Constant-voltage axle-lighting systems are something new, and it is also a departure for the Electric Storage Battery Company to manufacture complete car-lighting equipment Therefore considerable interest was taken in the informal dinner given on the evening of Oct. 21 in the Hotel LaSalle, Chicago, at which time the new equipment was described. This dinner was held during the convention of the Association of Railway Electrical Engineers, and about fifty railroad men were present. G. H. Atkin, manager of the Chicago office of the Electric Storage Battery Company presided, and the principal address was made by J. Lester Woodbridge, of Philadelphia, chief engineer of the company, who has developed the device. Considerable discussion followed Mr. Woodbridge's talk, the questions relating principally to possible sulphating of the batteries and the electrical characteristics of the constant-voltage Rosenberg dynamo which is used. One fact mentioned was that the machine will not run as a motor, although it will run either way as a dynamo without change of polarity. The Atchison, Topeka & Santa Fé Railway Company has had one of these axle-lighting sets in practically continuous

operation since November, 1912, with very satisfactory results, having covered in the neighborhood of 160,000 miles with a minimum of attention, no repairs and no failure or delay in the lighting service. This set gave such satisfaction that in April, 1913, an order was placed with the manufacturers by the railway company for sixty-two similar equipments. Several of the railway electrical engineers expressed cordial appreciation of the original work of the company in bringing out the device, and a vote of thanks was carried unanimously.

**Incandescent Lamp Laboratories Established.**—The H. J. Jaeger Research Laboratories, Incorporated, have been organized for the purpose of pushing the manufacture of tungsten lamps among the independent lamp makers. It is planned to do extensive research and development work on a co-operative basis, which will allow of carrying on large tests and experiments for the benefit of contributing companies that could not afford to undertake such tests unassisted. The laboratories will aim to keep both the design of the lamps and that of the lamp-making machinery up to date and will try to effect a standardization of material and workmanship in the manufacture of tungsten lamps by the companies allied with them. In addition to the technical services above outlined, the laboratories will endeavor to supply information on the commercial end of the lamp business, provide patent protection, and keep in close touch with the European situation through connections in England, France, Germany and Austria. Herman J. Jaeger is president of the concern and Guy V. Williams is its secretary. The main office is at 116 Broad Street, New York, and the laboratories are located at 68 Hudson Street, Hoboken, N. J.

**English Progress Along Electrical Lines.**—According to a representative of one of the leading English electrical houses, interviewed during the past week, steady progress is being made in that country along electrical lines. At present there is a wide variation in voltages and frequencies which greatly retards the growth of the electrical industry along some lines, but this condition is being remedied in the design of new supply systems. Because of the early advances of the gas industry in that country, and also through the fact that there is hardly any building activity (such building work as there is being confined largely to the erection of new structures on old sites), the lighting end of the industry, which is generally the pioneer for other business, is greatly handicapped. However, all new residences, factories and business buildings are wired for electric service. Other influences which have tended to retard progress are the fact that the industry in England has not been concentrated into the hands of a few large interests, which could influence it readily toward uniform standards of design and correspondingly increased production efficiency, and also the fact that apparatus has been built for long service and low depreication rate and has been in many cases too valuable to scrap when improvements have appeared possible.

### NEW YORK METAL MARKET PRICES

| | Oct. 21 Bid. | Oct. 21 Asked. | Oct. 28 Bid. | Oct. 28 Asked. |
|---|---|---|---|---|
| Copper: | | | | |
| Standard, spot* | ..... | ..... | 15.87½ | ..... |
| | Selling Prices | | Selling Prices | |
| | £ s d | | £ s d | |
| London, standard, spot* | 74 17 6 | | 74 15 0 | |
| Prime Lake | 16.75 | to 16.87½ | 16.87½ | to 17.00 |
| Electrolytic | 16.50 | to 16.70 | 16.62½ | to 16.75 |
| Casting | 16.37½ | to 16.50 | 16.35 | to 16.45 |
| Copper wire base | 17.50 | to 17.62½ | 17.50 | to 17.75 |
| Lead | | 4.35 | | 4.35 |
| Nickel | 40.00 | to 45.00 | 40.00 | to 45.00 |
| Sheet zinc, f.o.b. smelter | | 7.50 | | 7.50 |
| Spelter, spot | 5.35 | to 5.45 | 5.40 | to 5.45 |
| Tin, spot | 40.00 | to 40.20 | 39.75 | to 40.00 |
| Aluminum: | | | | |
| Prompt delivery | 20.00 | to 20.50 | 19.75 | to 20.00 |
| Future | 19.75 | to 20.25 | 19.75 | to 20.00 |

### *OLD METALS

| | | |
|---|---|---|
| Heavy copper and wire | 15.00 | 15.00 |
| Brass, heavy | 9.75 | 9.75 |
| Brass, light | 8.50 | 8.50 |
| Lead, heavy | 4.20 | 4.20 |
| Zinc, scrap | 4.37½ | 4.37½ |

### *COPPER EXPORTS

| | |
|---|---|
| Total tons to Oct. 28 | 26,388 |

*From daily transactions on the New York Metal Exchange.

## Corporate and Financial

**Pacific Telephone & Telegraph Bond Issue Authorized.**—During the past week the California Railroad Commission has authorized the issue by the Pacific Telephone & Telegraph Company of $3,000,000 in bonds, the proceeds of which will be used in part to retire the $850,000 of underlying bonds of the Sunset Telephone & Telegraph Company, and the balance for additions and improvements to the company's properties.

**Standard Gas & Electric Notes Offered.**—Through H. M. Byllesby & Company and the Continental & Commercial Trust & Savings Company, of Chicago, an offering is being made of $950,000 Standard Gas & Electric Company collateral trust 6 per cent notes, the unsold portion of the $3,000,000 issue authorized last June. For the year ended Aug. 31, 1913, earnings of the company applicable to interest on these notes amounted to $1,390,993.

**Swiss Bankers Visit Public Utility Properties.**—During the past month a tour of inspection was made by Messrs. Aubert and Lombard, representing banking interests in Geneva, Switzerland, the trip embracing some of the larger public utility properties in the North and South, as well as on the Pacific Coast. They are reported to have been particularly impressed by the possibilities of electric pumping for irrigation service, of which there is a considerable amount in the West.

**Massachusetts Utility Plans Stock Increase.**—A special meeting of the stockholders of the Electric Light & Power Company of Abingdon and Rockland has been called for Nov. 7 in order to secure approval for an increase of 472 shares in the capital stock of the company. It is planned to sell these shares to the present stockholders at a price to be approved by the Gas & Electric Light Commission on the basis of one share of new stock to each four shares of old stock held. This issue is being planned for the purpose of securing funds for the retirement of the floating debt of the company.

**Eighth Annual Report of Ferranti, Ltd.**—At the eighth annual meeting of the stockholders of Ferranti, Ltd., in London, on Oct. 24, the directors' report for the fiscal year ended June 30 was presented. The gross earnings for the year equaled £59,599 and the net earnings £9996. The depreciation reserve account was increased by £10,000 and £22,000 was added to the general reserve account. During the year £4,000 of the first mortgage debentures have been redeemed and the loan on second mortgage debentures has been reduced. The balance of the prior lien debentures have been redeemed by the issue of £34,200 of 6 per cent five-year notes.

**Colorado Power Company Initial Dividend.**—An initial dividend at the rate of 7 per cent per annum has been declared upon the preferred stock of the Colorado Power Company. This company was organized early in the year to take over the properties of the Central Colorado Power Company and the Leadville Light & Power Company. It operates hydroelectric generating plants at Shoshone and Boulder, with a present capacity of about 40,000 hp and an equal reserve capacity for future development. The two stations are connected by a transmission line and electricity is supplied to Leadville, Boulder, Georgetown, Denver and other cities in the vicinity.

**Bond Interest and the Income Tax.**—The Commonwealth Edison Company of Chicago is one of several companies announcing that they will continue to pay interest in full to owners of their bonds after Nov. 1, notwithstanding the new federal law providing for an income tax. The Commonwealth Edison Company will itself make good any deductions required by the income tax law. The Milwaukee Gas Light Company, a subsidiary of the American Light & Traction Company, is another of the corporations affected by the clause in this law which provides for the collection of the tax on bond interest at the source, and since the interest on its $8,000,000 of 4 per cent bonds is payable without deduction of any tax, the company will pay the tax for the six-month period just ended. The common-stock dividend of the American Light & Traction Company was paid on Oct. 31 instead of Nov. 1, owing to uncertainty as

to gross or net the tax deduction clause would apply to dividends as well as bond interest. It has since been ascertained that it does not so apply and the future dividends will be paid on the regular dates.

**Pacific Coast Utility to Increase Preferred Stock.**—A special meeting of stockholders of the Puget Sound Traction, Light & Power Company has been called for Nov. 3 to authorize an increase of $2,686,200 in the preferred stock. There is outstanding at the present time $12,045,600 of preferred stock, including $1,106,800 of non-interest-bearing preferred receipts, exchangeable for preferred stock. It is proposed to open the new issue to subscription by present stockholders at par on the basis of one share to every eleven shares of either common or preferred stock now held. This will provide for the maturity of $7,500,000 two-year 5 per cent notes on Feb. 1, 1914, and for extensions and improvements.

**Sale of Common Stock of the American Cities Company.**—In the Sept. 6 issue of the *Electrical World* note was made of the plan by which the control of the American Cities Company was to be purchased by the United Gas & Electric Corporation. Announcement is now made by Bertron, Griscom & Company that over 70 per cent of the stock of the former company has been deposited in accordance with the terms of the offer made by the latter concern and that the time limit on this offer has been extended to Nov. 10 in order to allow other holders of American Cities stock to take advantage of these terms. The depositary is the Pennsylvania Company for Insurance on Lives and Granting Annuities, of Philadelphia, Pa.

**Change in Stocks of Massachusetts Lighting Companies.**—Stockholders of the Massachusetts Lighting Companies have voted to authorize the trustees to issue 50,000 shares of cumulative preferred stock at $100 and 50,000 shares of common stock without par value, to be exchanged for the present outstanding stock on the basis of one share of new preferred and one of new common for each share of the old stock. Authority was also given for the issue of 30,000 shares of preferred and 30,000 shares of common stock, in addition to the above, at any time and under any conditions desired. The trustees expect to pay on Jan. 15 quarterly dividends of $1.50 per share on the preferred and 25 cents per share on the common stock. The present stock is to be deposited with the Old Colony Trust Company, of Boston, Mass.

**General Electric Company Activities.**—At the present time the "large order" business of the General Electric Company is reported to be somewhat decreased in volume from the figures of the past summer, a loss which is said to be in a good measure offset by an increase in the demand for small equipment and supplies. The company is doing business at the rate of about $2,000,000 per week now, according to reports, without any indications of an immediate decrease, and it is understood that there is enough business on hand to keep its plants in operation for the next six months. Unofficial estimates of the company's earnings for the fiscal year ending Dec. 31 have been placed as high as $120,000,000, and it is the general impression that they will be well above $100,000,000. It is expected that the surplus available for dividends during the present year will reach a higher figure than ever before in the company's history.

**Pennsylvania Water & Power Company Extending Facilities.**—The capacity of the Holtwood (Pa.) plant of the Pennsylvania Water & Power Company was recently brought up to 92,000 hp by the installation of a seventh generating unit of 16,000-hp rating. This leaves room in the power house for the future installation of three more similar units and it is reported that at the present rate of the company's growth another unit will be required early in 1914. The Consolidated Gas, Electric Light & Power Company, of Baltimore, secured from this company during its last fiscal year over 95 per cent of its electric energy supply for Baltimore, Md., and vicinity, and other purchasers of electric energy from the Pennsylvania company are the United Railways & Power Company of Baltimore and the Edison Electric Company, of Lancaster, Pa. It is reported that negotiations are in progress at the present time to supply electricity to the utility companies in Harrisburg and in York, Pa.

## Business Notes

**J. W. Bache & Company,** of 50 Church Street, New York, have been organized to handle the products of the Morris Iron & Steel Company, of Frederick, Md., in the Eastern States, as well as the entire export business of the same firm.

**H. F. Bowser,** formerly manager of the New York office of the Tungstolier Works of the General Electric Company, has opened an office at 489 Fifth Avenue, New York, as lighting specialist and purchasing agent for lighting equipment.

**E. I. Van Doren** has recently opened an office at 343 River Street, Troy, N. Y., as manufacturer's agent for the Wagner Electric Manufacturing Company, handling a general line of electrical supplies and specializing in industrial lighting and power work.

**The Alberger Pump & Condenser Company,** of 140 Cedar Street, New York, announces the appointment of F. E. Getts, formerly with the Chicago office of the General Electric Company, as district sales manager of its Chicago office. The change was made on Oct. 20.

**The U. S. Light & Heating Company,** of 30 Church Street, New York, has removed its New England sales office from 84 State Street to 25 Irving Street, Boston, Mass. This change brings the sales office and service station under one roof and is expected to produce closer co-operation between the two departments.

**The George Cutter Company,** of South Bend, Ind., manufacturer of electric lighting fixtures and distributing apparatus, has opened Eastern offices at 258 Broadway, New York City. F. X. Cleary is in charge, making these his headquarters for the territory covered by the New England, Middle Atlantic and Southern Atlantic States.

**The Splitdorf Electrical Company** is making important changes in the organization of its branch houses in Detroit and Chicago. The Splitdorf Electrical Company of Detroit has been incorporated with C. E. Brelsford as president and W. J. Murray as secretary. R. S. Preble is president and E. A. Kelley secretary of the Splitdorf Electrical Company of Chicago, also recently incorporated.

## New Industrial Companies

**The Lighting Corporation,** of New York, N. Y., has been incorporated with a capital stock of $10,000 by Emory S. Lewis, William L. Glenn and William B. Walsh, 1120 East Seventh Street, Brooklyn, N. Y.

**The Empire Transformer Company,** of Chicago, Ill., has been incorporated by Irwin J. Mendels, Frank D. Hearn and Edward A. Christoph. The company is capitalized at $10,000 and proposes to manufacture and deal in electrical goods.

**The Bastian-Morley Company,** of South Bend, Ind., has been incorporated by James P. Morley, J. P. Hayes and J. Morley. The company is capitalized at $100,000 and proposes to manufacture gas, gasoline and electrical machines devices and appliances.

**The Schutte Electric Company** has filed articles of incorporation at Harrisburg, Pa., for the purpose of dealing in electrical apparatus and supplies. The incorporators are: George L. Kopp, Jacob C. Platz, Herman Schutte, T. R. Evans and Louis N. Shuman.

**The Ak-Ray Corporation,** of New York, N. Y., has been chartered with a capital stock of $100,000 by Sergius P. Grace, Joseph T. Roffy and Sarah K. Singer, all of 17 Battery Place, New York, N. Y. The company proposes to manufacture and deal in lamps, lenses, electrical and gas fixtures.

**The Neuland Electrical Company,** of New York, N. Y., has been granted a charter with a capital stock of $100,000 for the purpose of carrying on research work in electric and other sciences. The incorporators are: H. S. Goul, A. W. Britton and J. M. Sullivan, 37 Wall Street, New York, N. Y.

## Trade Publications

**Transformers.**—Bulletin No. A4144 of the General Electric Company refers to Type H, Form K subway transformers.

**Motors.**—"Some Installations of Watson Motors" is the title of a thirty-two-page illustrated booklet being sent out by the Mechanical Appliance Company, Milwaukee, Wis.

**Indirect Lighting Fixtures.**—Catalog C of the National X-Ray Reflector Company, Chicago, Ill., contains illustrations and brief descriptions of the entire line of "Eye Comfort" fixtures for indirect lighting.

**Magnetos.**—The Bosch Magneto Company, Forty-sixth Street and Broadway, New York, has published an eight-page illustrated pamphlet setting forth a method for adapting the Bosch magneto to Ford cars.

**Batteries and Flashlights.**—The American Carbon & Battery Company, East St. Louis, Ill., has issued Catalog No. 100. Within its twelve pages are illustrated and briefly described tubular miners' and coat flash-lamps, bag-type dry batteries, dry cells and other appliances.

**Gas Engines.**—An illustrated eight-page bulletin—No. 1—issued by the Mesta Machine Company, Pittsburgh, Pa., tells about its gas engines for all classes of service, in sizes from 350 hp upward. The design, characteristics and special features of this apparatus are clearly set forth.

**Seamless Insulation.**—The Hazard Manufacturing Company, of Wilkes-Barre, Pa., distributed a booklet at the recent Nashville convention of the Railway Signal Association in which it described its method of applying seamless insulation to wires. The seamless process has been questioned, but the Hazard company claims that this result is attributable to careless methods of manufacture and not to any inherent defect in the process.

**Belt Dressing.**—In a ten-page pamphlet recently issued by the Cling-Surface Company, 1032 Niagara Street, Buffalo, N. Y., under the title "Comparative Tests of Belts With and Without Cling-Surface," Mr. Robert Thurston Kent gives a report of a test made to determine the relative pulling power of treated and untreated belts at different arcs of contact on the pulley and at varying tensions on the belts. A number of curves illustrate the text.

**Fuses.**—Schweitzer & Conrad, 1770 Wilson Avenue, Chicago, have issued Bulletin No. 1, devoted to high-potential fuses. These fuses are of the indoor and weatherproof types, with mountings for all conditions of installations at electromotive forces up to 110,000 volts. Illustrations of a number of 33,000-volt transformer installations with S. & C. fuses are shown. These devices are fully described and illustrated, and a price list of various types is given.

**Household Appliances.**—The Hotpoint Electric Heating Company, Ontario, Cal., is sending out a broadside which contains a fac-simile of its double-page advertisement in a weekly publication of general circulation. It contains the suggestion to "shop early" and to give the "ideal gift"—a "Hotpoint" electric appliance—for a Christmas remembrance. The poster is intended for dealers, who are urged to make a display of Hotpoint devices in their windows.

**New "Baby" Stimulator.**—The National Quality Lamp Division, Cleveland, has published the first issue of the *National Miniature Mazdafier*. It contains fourteen pages of helpful sales ideas and a useful table giving lamp data for standard 1913 model American motor cars. The new publication will be issued monthly for the dissemination of information on miniature tungsten-filament lamps for the benefit of National Quality salesmen, agents and customers and the larger garage owners in the country.

**An Electrical Primer.**—The Educational Bureau of the New York Edison Company has issued an attractive twenty-six-page booklet, entitled "Electricity in the Home," which contains much practical and interesting information. Included in the contents are definitions of the more general electrical terms, how to read the meter, a list showing the economy of electricity—as, for instance, what it costs to run a vacuum cleaner for an hour—and other similar information, the use and care of cooking appliances and some cooking-dish recipes.

## Personal Mention

**Mr. Fred L. Hunt** has been appointed chief engineer of the Greenfield (Mass.) Electric Light & Power Company.

**Mr. Clyde Ketcham** has succeeded Mr. Harry Chamberlain as superintendent of the municipal electric lighting plant at Weatherly, Pa.

**Mr. T. M. Davis** has been appointed contract agent for the Merchants' Lighting Company, Little Rock, Ark., succeeding Mr. M. A. Cohn.

**Mr. A. H. Maynard** has succeeded Mr. L. H. Reeves as chief engineer at the power plant of the Merchants' Lighting Company, Little Rock, Ark.

**Capt. Elisha G. Abbott** of the United States Signal Corps has been designated by General Barrie as acting signal officer of the Department of the East.

**Mr. G. M. Lucas** is the superintendent of the municipal electric-light plant of Hope, Kan., succeeding Mr. R. A. Whitenack, who resigned some time ago.

**Mr. H. M. Hobart,** of the General Electric Company, returned from England on the S. S. *Baltic* on Oct. 25 after an absence abroad of two and one-half months.

**Mr. J. H. Mathison** has recently been appointed superintendent of the municipal electric-lighting plant at Hardwick, Minn., succeeding W. T. Murray, deceased.

**Mr. Thomas E. Murray,** vice-president of the New York Edison Company, was the subject of a sketch in the magazine section of the *Booklyn Daily Eagle* of Oct. 26.

**Mr. Amos S. Musselman,** of Grand Rapids, Mich., a director in several of the power companies of Michigan, is being urged by his friends to become a candidate for Governor of Michigan on the Republican ticket.

**Mr. W. C. Callahan,** formerly of the Rochester (N. Y.) Railway & Light Company, has been appointed general superintendent of the Helena (Mont.) Light & Railway Company as successor to Mr. W. C. Sharp, resigned.

**Mr. W. C. Sharp,** general superintendent of the Helena (Mont.) Light & Railway Company, has resigned to engage in business in Des Moines with Mr. H. E. Teachout, a capitalist of that city. Mr. Sharp's successor is Mr. W. C. Callahan.

**Mr. D. O. Vaughn,** formerly sales representative for the F. Bissell Company, Toledo, Ohio, has recently been appointed manager of the Union City (Ind.) Lighting Company, which has been acquired by the Albert Emanuel Company of Dayton, Ohio.

**Mr. J. A. Bell,** of Dayton, Ohio, and Mr. Thomas A. Green, of Columbus, Ohio, both operators of telephone companies, were presented with gold medals by Governor Cox of Ohio for sticking to their posts during the March floods and keeping the wires open.

**Mr. W. J. McDowell,** secretary of the Chicago Section of the Electric Vehicle Association of America and one of the best-known electric-vehicle men in that city, has resigned from the Chicago staff of the General Vehicle Company and joined the forces of the General Motors Truck Company. He will be electric-truck salesman for the latter company in Chicago and vicinity hereafter.

**Lieut. Col. Samuel Reber** of the United States Signal Corps, recently signal officer of the Department of the East, has been appointed chief of the new bureau of aviation in the War Department. Heretofore the direction of all matters connected with aviation and aeronautics has been in the hands of the chief signal officer, Gen. George P. Scriven, assisted by Major C. McKay Saltzman.

**Mr. A. E. Grant,** managing director of the Canadian British Insulated Company, Ltd., Montreal, Quebec, has been elected president of the company as successor to his brother, Mr. Lawford Grant, who has entirely severed his connection with the company. As announced in these columns on June 14, 1913, Mr. Lawford Grant has joined the staff of the Eugene F. Phillips Electrical Works, Ltd., of Montreal, Que.

**Mr. Howard R. Sargent,** managing engineer of the wiring supplies department of the General Electric Company and a graduate of the Massachusetts Institute of Technol-

... candidate for alderman on the Citizens' ticket in Schenectady, N. Y. Mr. Sargent, who is well known in electrical contracting and engineering circles, has been connected with the General Electric Company for twenty years and is a member of the American Institute of Electrical Engineers.

**Mr. E. N. Hurley,** president of the Hurley Machine Company, manufacturer of the Thor electric washing machine, was informally asked to accept the position of comptroller of the currency by Secretary McAdoo, but owing to business connections declined the tentative offer.

**Mr. W. H. Richardson,** for twenty-seven years superintendent of the Glenwood Light & Water Company, Glenwood Springs, Col., has retired from active service and moved to Nashville, Tenn. No successor has been named, and Mr. Richardson's duties, including purchasing, will for the present be looked after by the general manager of the company, assisted by Mr. W. M. Tait, assistant superintendent in charge of the power station, and Mr. F. W. Kaiser, assistant superintendent in charge of the distribution system and house-wiring department.

**Dr. Hollis Godfrey,** chief of the bureau of lighting of the city of Philadelphia, has been elected president of the Drexel Institute of Art, Science and Industry of Philadelphia. Dr. Godfrey was born in Boston, Mass., forty years ago and was educated at Tufts College, the Massachusetts Institute of Technology and Harvard University. He organized the department of science in the High School of Practical Science in Boston, spent six years in night-school work in that city and was also one of the organizers of the Garland School, the policy of which in the teaching of science and in extension work he directed for the space of two years.

**Mr. J. H. Hanna,** chief engineer in charge of all construction and maintenance of the Capital Traction Company, Washington, D. C., was elected president of the American Electric Railway Engineering Association at its convention in Atlantic City on Oct. 17. Mr. Hanna was born in Henderson, Ky., in 1871 and was graduated from Princeton University in 1892 with the degree of C.E. For two years after leaving college he was engaged in steam railroad engineering work and then entered the service of the Washington & Georgetown Railroad Company, predecessor of the present Capital Traction Company. He was appointed assistant superintendent of the traction company in 1895 and became superintendent and assistant engineer in 1899. He was appointed to his present position in 1908.

**Mr. D. A. Hegarty,** general manager of the railway and lighting departments of the New Orleans (La.) Railway & Light Company, was elected president of the American Electric Railway Transportation & Traffic Association at its recent convention in Atlantic City. Mr. Hegarty was born in Philadelphia and was educated at the University of Pennsylvania. For six years he was an assistant engineer on construction and maintenance work in the engineering department of the Pennsylvania Railroad and left the railroad company to become engineer in charge of the Richmond (Va.) Electric Railway, which was the first commercially successful electric road in America. Subsequently he became general manager and chief engineer of the company, and when the property was taken over by the Union Traction Company Mr. Hegarty became chief engineer of the Norfolk (Va.) Railway. This position he resigned shortly afterward in order to accept the post of superintendent of the Railways Company General, a holding and operating company. In 1908 Mr. Hegarty joined the operating forces of Ford, Bacon & Davis as general manager and treasurer of the Little Rock (Ark.) Railway & Electric Company. This position he resigned in 1911 to accept his present post at New Orleans.



D. A. HEGARTY

**Mr. Charles N. Black,** who was elected president of the American Electric Railway Association at its convention in Atlantic City on Oct. 16, was born in New York City in 1867. He was graduated from Princeton University in 1888 with the degree of A.B. and received the degree of E.E. after a two-year graduate course in electrical engineering at the same university. Immediately after his graduation he entered the employ of the Brush Electric Company in Cleveland, of which company he afterward became superintendent and general electrician. He resigned from the Brush company to take charge of the New Haven (Conn.) branch of the Walker Manufacturing Company of Cleveland, and in 1899 he became connected with the Westinghouse Electric & Manufacturing Company. Leaving the Westinghouse company he became connected with the consulting engineering firm of Ford, Bacon & Davis and went to Kansas City in 1902 to supervise the reconstruction work of the Metropolitan Street Railway of that city. The work was completed the following year and Mr. Black was induced to continue in Kansas City as chief engineer of the company. On Jan. 1, 1905, he accepted the position of vice-president and general manager of the operating company and became vice-president of the Kansas City Railway & Light Company and also vice-president of the Kansas City Electric Light Company. The latter company is controlled by the former, which is a holding company. In September, 1907, Mr. Black accepted the position he now holds as vice-president and general manager of the United Railways of San Francisco. He is also a director of the company as well as a director and vice-president of the Sierra & San Francisco Power Company. The latter company is the successor to the Stanislaus Electric Power Company and the Tuolumne Water Power Company and is affiliated with the United Railways Investment Company. In March, 1912, Mr. Black became president of the Monterey & Pacific Grove Railway and also president of the Coast Valleys Gas & Electric Company, which was organized to effect the consolidation of several lighting properties furnishing service to Pacific Grove, Monterey, Salinas, King City and other places in California. In July, 1912, Mr. Black was elected a member of the firm of Ford, Bacon & Davis.



CHARLES N. BLACK

## Obituary

Charles Augustus Chapin, president of the Indiana & Michigan Electric Company, of South Bend, Ind., died at his home in Chicago on Oct. 22, as briefly noted last week. Mr. Chapin was born in Edwardsburg, Mich., in 1845. It was while he was very young his parents moved to Niles, Mich., and Mr. Chapin made his home there until fifteen years ago, when he removed to Chicago. He had been ill for about two months and died of heart disease. In early life the decedent was associated in business with his father, Judge Henry A. Chapin, and together they established the South Bend Electric Company in 1883. Out of this company grew the present Indiana & Michigan Electric Company, which develops about 25,000 hp, principally in hydroelectric plants in northern Indiana and southern Michigan. This company was organized by Mr. C. A. Chapin and has water-power plants along the St. Joseph River at Elkhart and Mishawaka, Ind., and Buchanan and Berrien, Mich. It also maintains a steam generating plant, normally held as a reserve, at South Bend, where the general offices of the company are located. Mr. Chapin was a man who avoided publicity and, although connected with the electric-service industry for thirty years, was not widely known among electrical men. He was, however, a man of quick wit, fond of a joke and was highly regarded by his associates. He was a member of the Union League, Glen View, Chicago Yacht and other clubs.

# Construction

## New England

MIDDLETON, MASS.—At a special town meeting held Oct. 15 the Selectmen were authorized to issue bonds to purchase the electric plant of the Middleton El. Lt. Co., to be owned and operated by the municipality.

NORTH ABINGTON, MASS.—At a meeting of the stockholders of the El. Lt. & Pwr. Co. of Abington and Rockland to be held Nov. 7 the stockholders will be asked to authorize the directors to petition the State Board of Gas and Electric Light Commissioners for permission to issue 372 additional shares of capital stock.

NARRAGANSETT PIER, R. I.—The Narragansett Pier El. Lt. & Pwr. Co. is considering extending its transmission lines to Kingston (a distance of 2½ miles), the location of the Rhode Island State College. W. C. Clarke is general manager.

HARTFORD, CONN.—The Young Men's Christian Association is planning to build a new building, to cost about $225,000, bids for construction of which will be received Nov. 8. The cost of equipment is estimated at $25,000 (for which bids will be asked in March) and will include two horizontal tubular boilers of 125 hp each, two electric elevators, two ventilating fans and motors. Shattuck & Hussey, 19 South La Salle Street, Chicago, Ill., are architects. G. C. Herbert is general secretary.

## Middle Atlantic

CENTRAL ISLIP, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, N. Y., until Nov. 7, for additional electric generating equipment at Central Islip State Hospital, Central Islip, N. Y. Drawings and specifications may be consulted and blank forms of proposals obtained at the Central Islip State Hospital, at the office of the State Hospital Commission, 1 Madison Avenue, New York, and at the office of Lewis F. Pilcher, state architect. Complete plans and specifications may be obtained upon application to the state architect.

GREECE, N. Y.—The Town Board has entered into a contract with the Rochester Ry. & Lt. Co., of Rochester, for a new lighting contract, under which the Charlotte Boulevard will be lighted from the city line to Charlotte, the Ridge Road to the railroad, and Dewey Avenue to Barnard. All the cross streets will also be illuminated. The contract calls for the installation of 300 incandescent lamps. Post office address is Greece, R. F. D. Barnard.

NEW YORK, N. Y.—The contract for furnishing and installing lighting fixtures in the Municipal Building has been awarded to the Edward Schroeder Lamp Works, 200 Fifth Avenue, New York, N. Y., at $44,273.

WEEDSPORT, N. Y.—Bids will be received by the Board of Trustees of the village of Weedsport until Nov. 8 for the construction and installation of an electric-light plant, together with a producer-gas engine and suction-gas producer for operating plant. Bids may be submitted for the whole work or a unit thereof, as specified in the plans and specifications on file with the village clerk or at the office of F. M. Parsons. C. D. Allstine is village clerk

CHAMBERSBURG, PA.—The city of Chambersburg expects to install the municipal electric-light plant within the next three months the following equipment: One 625-kva, three-phase, 60-cycle, 2300-volt Curtis turbo-generator set, complete with condensers, etc.; one 375-kva, three-phase, 60-cycle, 2300-volt belted set; two 75-hp, three-phase, 60-cycle, 2300-volt motors and three 50-lamp General Electric double-tube rectifier sets; also within the next 30 days to erect a nine-panel switchboard. J. H. Shirrey is superintendent.

EMPORIUM, PA.—The municipal electric-light commission expects to purchase within the next six months a 150-hp engine, generator and exciter and lamp-posts. C. E. Crandell is secretary and W. W. Knickerbocker is engineer.

INTERCOURSE, PA.—The Intercourse El. Lt., Ht. & Pwr. Co. expects to erect 4 miles of 2300-volt transmission lines. The company has completed its substation and expects to close its present steam-power plant in a few days and connect with the Edison El. Co.'s 11,000-2200-volt transmission line. Enos L. Zimmerman is secretary and treasurer.

JOYSVILLE, PA.—The Sherman's Valley Lt., Ht. & Pwr. Co., of Loysville, expects to install within the next month one 25-hp oil engine to supplement turbine waterwheel. C. A. Widle is treasurer and manager.

OIL CITY, PA.—The Citizens' Lt. & Pwr. Co., of Oil City, expects to install within the next two months one 1500-kw turbine and two 500-hp boilers, automatic stokers for all boilers and new condensers for turbine. Material and equipment for above improvements have been purchased. The company has just completed the reconstruction of 12 miles of 11,000-volt transmission line to Franklin. W. W. Cole is acting general manager.

PHILADELPHIA, PA.—The contract for installing electrical equipment on the Dock Street pier has been awarded to the Thompson El. Co., 160 Sansome Street, Philadelphia. The company was also awarded the contract for electrical equipment for the physical and chemical laboratory to be erected in Altoona for the Pennsylvania Railroad.

SCRANTON, PA.—The United Service Co., of Scranton, expects to install an additional 500-hp boiler at its Coshocton (Ohio) plant; one 1500-kw turbine at its Warren, Pa., plant, also two 250-hp boilers within the next six months. The company also expects to erect 30 miles of 33,000-volt transmission lines in Ohio and 13 miles of 13,500-volt lines in Pennsylvania within the next six months; also material for the above transmission lines. L. H. Conklin, of Scranton, is secretary and manager.

BURLINGTON, N. J.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 1, for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of United States post office at Burlington, N. J. Drawings and specifications may be obtained from the custodian at Burlington, N. J., or from the above office. O. Wenderoth is supervising architect.

WILLIAMSON, W. VA.—The Williamson Lt. & Ice Co. expects to purchase a 100-hp to 125-hp, 60-cycle, two-phase, 2200-volt motor, speed not over 500 r.p.m.

BRISTOL, VA.—Negotiations have been closed between Benjamin L. Dulaney, of Bristol, Va., and Samuel Insull, of Chicago, Ill., whereby the latter will take over the entire property of the Electric Transmission Co., which includes a large power plant erected at the pit mouth of the coal deposits in southwest Virginia. It is understood that the deal will result in the expenditure of several million dollars on the erection of a plant and transmission lines to transmit electricity to various parts of the country. It is also proposed to supplement the hydroelectric plants in dry seasons. The purpose of Mr. Dulaney was to transmit electricity to the Atlantic seaboard, reaching the large factories in the Piedmont region. Mr. Insull, it is said, proposes also to carry electricity westward across Kentucky into Cincinnati, Chicago and other Western cities.

LYNCHBURG, VA.—The Lynchburg Trac. & Lt. Co., it is reported, will install an additional generating unit at its power plant in Reusens, increasing the output of the plant by 1350 hp. Contracts for equipment have been awarded.

## North Central

CADILLAC, MICH.—The Western Michigan Pwr. Co., a subsidiary of the Commonwealth Pwr. Co., has petitioned the Supervisors of Wexford County for permission to construct dams across the Manistee River for power purposes as follows: At Yuma, a 30-ft. dam; at Mesick, a 27-ft. dam; at Sherman, a 60-ft. dam; at Buckley, a 50-ft. dam; at Mystic, a 60-ft. dam; at Manton, a 47-ft. dam; at Baxter, a 35-ft. dam, and at Walton, a 65-ft. dam. The company agrees to furnish electricity in Cadillac at a maximum rate of 9 cents per kw-hr. Plans have been prepared by the company for the construction of a 65-ft. dam at a point where the Pine River flows into the Manistee River. Electricity generated at this plant will be transmitted to Cadillac.

DETROIT, MICH.—The Public Lighting Commission has awarded a contract to the Westinghouse El. & Mfg. Co., of Pittsburgh, for one 500-kw, two-phase, 2200-volt turbo-generator set. Contracts for 19 75-lamp regulators for luminous-arc circuits and lamps, cable, wire and poles, and practically for all supplies that will be required for extensions of the system this fiscal year, have been awarded. F. Mistersky is general superintendent.

EATON RAPIDS, MICH.—The Board of Public Works expects to erect within the next two months 2 miles of three-phase distribution lines (changing from single-phase to the three-phase system), also to purchase within the next year electrically driven pumps and to purchase 300 ft. or 400 ft. of underground cable within the next six months, and to install ornamental lamps on about four blocks; also to purchase electrical appliances and supplies with a view to building up a day load. Within the next three months it expects to purchase some transformers, the number required or horse-power not yet decided upon. I. R. Ellison is superintendent.

HOLLY, MICH.—The Village Council has awarded the contract for street-lighting to the Independent Pwr. Co. for a period of ten years. The contracts provide for the maintenance of 70 lamps.

KALAMAZOO, MICH.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 27 for a conduit and wiring system and lighting fixtures in the United States post office, Kalamazoo, Mich. For details see proposal columns.

CHICAGO JUNCTION, OHIO.—The Board of Public Affairs expects to purchase within the next 30 days lighting fixtures for a public building, the cost not to exceed $275. E. K. McMorris is clerk of Board of Public Affairs.

COLUMBUS GROVE, OHIO.—The Board of Public Service expects to purchase within the next six months three new boilers, one 250-hp engine and generator, with exciter and one switchboard, for the municipal electric-light plant. Earl Anderson is superintendent of municipal plant.

COSHOCTON, OHIO.—The Lafayette Lt. & Power Co. has been granted permission by the Public Utilities Commission to issue $10,000 in capital stock, the proceeds to be used to reimburse the incorporators for expense of organization and the amount expended for engineering services, securing rights-of-way, etc., to the amount of $2,511, the remainder to be used to purchase the right-of-way and for construction and equipment of a transmission line from the power house in Coshocton to the village of West Lafayette.

MIDDLEPORT, OHIO.—The County Commissioners have granted Ruggles & Lyons a franchise to extend the present street car system from the Middleport corporation line to the K. & M. tracks at Dobson. The franchise includes the privilege of building a power house in the vicinity.

NORWALK, OHIO.—Plans have been submitted to the City Council estimating the cost of installing an electric-light plant. One plan provides for the installation of an electric plant in connection with the municipal water-works system and erection of distribution lines throughout the city, at a cost of $103,000; the second plan is to erect a distribution system only and to purchase electricity, which would cost only about half as much as the first proposition. The Cleveland, Columbus & Southwestern Ry. Co. now furnishes electrical service in the city.

SALEM, OHIO.—The electric-lighting system is being extended on three streets; improvements are also being made in the power plant. D. H. Rummell is service director.

SPRINGFIELD, OHIO.—Of the proceeds of the $2,500,000 bond issue by the Springfield Ry. Co., $500,000 will be used to retire outstanding bonds to the amount of $500,000 and the remainder for improvements to its service. The power plant is to be enlarged, new carhouses erected and street railway lines extended.

LEITCHFIELD, KY.—The plant of the Leitchfield El. Lt., Ht. & Pwr. Co. was destroyed by fire on Oct. 25, causing a loss of $15,000. Work, it is said, will begin at once on reconstruction of the plant.

LOUISVILLE, KY.—The firm of Hardin & Palmer, of Louisville, furniture manufacturers, has decided to use electricity to operate its plant instead of rebuilding its steam-power plant, which was recently destroyed by fire. Orders have been placed by the company for 14 motors, ranging from 2 hp to 15 hp. The company has contracted with the Louisville Gas & El. Co. for electrical service.

WHITESBURG, KY.—The city of Whitesburg will soon advertise a sale of an electric-light franchise. The ordinance will be submitted to the voters on Nov. 4. C. H. Burton is engineer.

LA GRANGE, IND.—The La Grange County El. Lt. & Pwr. Co. expects to erect within the next eight months about 10 miles of 6600-volt transmission lines in connection with extending its La Grange line to Wolcottville; also to purchase within the next six months transformers, lightning arresters, insulators, wire, meters, tub transformers, incandescent lamps, etc. The La Grange County Lt. & Pwr. Co. has taken over the plant and holdings of the La Grange El. Lt. Co. L. G. Young is superintendent.

MOHAWK, IND.—The installation of an electric-light system in Mohawk is under consideration. An effort is being made to secure electricity from the Union Trac. Co., of Anderson.

MULBERRY, IND.—The Mulberry Lt. & Pwr. Co. expects soon to purchase some No. 14 National Electrical Code wire. Albert Weidner is secretary.

NEW RICHMOND, IND.—The Montgomery Lt. & Pwr. Co. expects to erect within the next two months 20 miles of transmission lines and distribution systems in Linden, New Richmond and Wingate.

SHERIDAN, IND.—The Sheridan Wtr., Lt., Ht. & Pwr. Co. expects to purchase within the next six weeks a 10-ton ice plant (to be operated by exhaust steam) in connection with the water and light plant.

BATAVIA, ILL.—Plans are being considered by the Batavia Commercial Club for the extension of the ornamental street-lighting system.

CAMBRIDGE, ILL.—The property of the Cambridge El. Lt. & Pwr. Co. is reported to have been purchased by E. O. Brown, of Elmwood, Ill. The Village Board has granted him a 20-year franchise to operate an electric-light system here. Mr. Brown has acquired plants at Altoona, Oneida, Galva and Lafayette, and is reported to have secured options on the plants in Toulon, Woodhull and Geneseo. The systems, it is understood, will be consolidated and energy supplied from a central station to be located at Galva.

ELGIN, ILL.—At an election held recently the proposition to issue $162,000 in bonds for the construction of an electric-light plant was carried.

HILLSBORO, ILL.—Franchises have been granted to the Southern Illinois Lt. & Pwr. Co., of Hillsboro, for extensions of its system into Mulberry Grove, Panama and Donnellson. Preparations are being made by the company to erect a 33,000-volt transmission line from Hillsboro to Greenville to furnish electricity in the villages where franchises have been granted, and also in Greenville.

MANITO, ILL.—Plans have been prepared by Reeves & Baill, of Peoria, architects, for the construction of a new power station for the municipal electric-light plant.

MOLINE, ILL.—The People's Pwr. Co., of Moline, is contemplating changing the present street-lighting system to magnetite-arc lamps.

MOLINE, ILL.—Bids will be received by the Board of Education of Moline until Nov. 4 for the installation of a lighting system, sanitary and plumbing system and a heating system for the new high school building. Plans and specifications can be seen at the office of Eckland & De Arment, architects, of Moline, and at the office of Normand S. Patton, Holmes & Flinn, architects, of Chicago, Ill. Bonds to the amount of $200,000 were voted for the building.

MULBERRY GROVE, ILL.—The Village Board has granted the Southern Illinois Lt. & Pwr. Co., of Hillsboro, a 50-year franchise to operate an electric-light system here. The company was also awarded a contract for lighting the streets of the Village for a period covering 10 years.

STERLING, ILL.—The City Council has appropriated $2,500 toward the installation of a new street-lighting system in Sterling. Funds, it is reported, have been raised for the installation of ornamental lamps on the blocks in Sterling. The Commercial Club is promoting the project.

ANTIGO, WIS.—A proposition for improving the present street lighting system has been submitted to the City Council by the Antigo El. Co. The plans provide for the installation of an ornamental street-lighting system on Fifth Avenue, consisting of 15 Luxolabra lamp standards carrying inverted arc lamps; also replacing the present street lamps in the residence districts with tungsten incandescent lamps. The initial cost of installing lamps on Fifth Avenue is estimated at $1,700.

LA CROSSE, WIS.—The La Crosse Gas & El. Co., controlled by the American Public Utilities Co.) is making extensive improvements to its property, including gas, electric-light and hot-water-heating service, involving an expenditure of $157,600. These improvements consist of four 400-hp new water-tube boilers, four automatic stokers with new machinery, two steel stacks for the new boilers, 160 ft. high by 72 in. in diameter, new larger steam piping for the central-station heating plant, new feed-water heater and purifier, coal and ash-handling machinery, steam turbine, centrifugal pump, new device for heating water with exhaust steam, new hot-water piping, changes in electrical apparatus, increasing the capacity of the heating and electrical department at the Edison station, new 1000-kw generating unit to take care of the growing electric load, rearrangement of switchboards, circuit regulators, etc., and enlarging buildings to provide space for new boilers and generating machinery. Paul Leake, of Grand Rapids, is publicity manager of the American Public Utilities Co.

MANITOWOC, WIS.—An ordinance providing for a bond issue of $150,000 for the purchase of the electric-light plant (the valuation of which is pending before the rate commission) has been introduced in the City Council.

BIWABIK, MINN.—A franchise, it is reported, has been awarded to the St. Louis Pwr. Co., a subsidiary of the Northern Pwr. Co., of Duluth, to furnish electricity for lamps and motors here.

DULUTH, MINN.—A movement has been started by John J. Frey, Judge H. W. Lanners and other business men of West Duluth for the installation of an ornamental street-lighting system on three streets.

MINNEAPOLIS, MINN.—Bids will be received by the Board of County Commissioners of Hennepin County, at the office of the county auditor, Minneapolis, until Nov. 3 for electric wiring all the buildings at the county farm, in accordance with specifications on file in the office of the county auditor. A. P. Erickson is county auditor.

ALBIA, IA.—The City Council has engaged Arthur M. Morgan, consulting engineer, Harris Trust Building, Chicago, Ill., to prepare plans and estimates of cost of the installation of a municipal electric-light plant.

ANAMOSA, IA.—At a special election held recently it was voted to award the Anderson Pwr. Co.'s franchise to parties building the Iowa City-Cedar Rapids Interurban railway. The new owners will make extensions and improvements to the system. The new company is known as the Anamosa Lt. & Pwr. Co. Col. W. G. Dows, I. Smith and J. F. Reed are interested in the new company.

APLINGTON, IA.—Work has begun on the installation of an electric-light plant in Aplington.

DYSART, IA.—The contract for the construction of the municipal electric-light plant has been awarded to the Alamo Engine & Supply Co. of Omaha, Neb., for $12,809, which includes the construction of power plant and erection of overhead distribution system. The Western El. Co. [illegible] was awarded a contract for engines, at $4[illegible]; contract for power station has not yet been awarded.

INDEPENDENCE, IA.—The commissioners of the water and light plant expect to purchase two 150-hp fire-tube boilers within the next two months. George D. Warren is manager.

CALIFORNIA, MO.—The California El. Lt. & Pwr. Co. expects to install within the next eight months one 150-hp boiler, one 125-hp engine and a 100-kw generator. In July the company changed its system from 133 cycles to 60 cycles, three-phase, and established a 24-hour service. A 150-kva, 60-cycle, three-phase generator was installed, replacing a 60-kw, 133-cycle machine. F. T. Porter is owner and manager.

CANTON, MO.—The municipal electric light commission expects to purchase within the next four months one 50-kva to 100-kva, 2200-volt alternator and a 75-hp to 150-hp Corliss engine (both second-hand) for the municipal electric-light plant. W. Dusenberry is engineer.

HAMILTON, MO.—A committee, consisting of Aldermen Whitemore and Arey, has been appointed by the City Council to look into the proposition submitted by Messrs. Miller and Gilber for the construction of a new electric-light plant, installing a system of water-works and the erection of an electric transmission line from Hammond to Kingston.

LEWISTOWN, MO.—The managers of the Lewistown mill and electric light plant expect to purchase within the next five months a 100-hp [illegible] engine for connection to a 45-kw Fort Wayne direct-current generator (belt-driven). A 125-hp Brownell steam engine is being used. J. S. Heavenridge is superintendent.

DRAKE, N. D.—Application has been made to the Board of Trustees by George Todd, of Minot, for a franchise to construct and operate an electric-light plant in Drake.

AUBURN, NEB.—Bids will be received by I. H. Kuper, city clerk, until Nov. 17 for furnishing material and construction of municipal electric-light plant and extensions to water-works system. For details see proposals columns. G. E. Johnson, of Falls City, is engineer and Church Howe is Mayor.

BEAVER CROSSING, NEB.—The Beaver Crossing Lt. & Pwr. Co. expects to purchase within the next two months transformers and meters. L. G. Gake is secretary.

COLUMBUS, NEB.—Arrangements are being made by Willis Todd, 214 First National Bank Building, Omaha, and associates for the construction of a hydroelectric power plant on Birdwood Creek, Lincoln County. The initial installation will provide for 500 hp, which later will be increased to 1500 hp. Transmission lines will be erected to serve the towns of Sutherland, Hershey and North Platte, Neb., and also the Union Pacific and Burlington railroads.

EXETER, NEB.—The Exeter El. Lt. & Pwr. Co. expects to install within the next two months a 125-hp tubular boiler, a 11-in. by 18-in. baby Corliss engine and a 45-kw, 125-volt direct-current generator (700 r.p.m.) in the municipal electric-light plant. Equipment has already been purchased.

HAMPTON, NEB.—The Board of Trustees expects to purchase within the next four months one carload of poles for use in connection with the municipal electric-light plant. William C. Paschke is clerk.

HEBRON, NEB.—The managers of the municipal electric-light plant are contemplating the installation of a street-lighting system within the next six or eight months. O. P. Hess is superintendent.

SILVER CREEK, NEB.—Negotiations have been closed whereby the village will take over the local electric-light plant, to be owned and operated by the municipality.

HOPE, KAN.—The managers of the municipal electric-light plant expect to install three single-pole knife-blade switches. G. M. Lucas is superintendent.

PROTECTION, KAN.—Bonds to the amount of $30,000 have been voted for the purchase of the local electric-light plant and the installation of a water-works system.

## Southern States

DURHAM, N. C.—The Durham Trac. Co. has recently purchased two 250-hp Stirling boilers and smokestack for immediate installation; also 200 kva in transformers for improving the city service. R. L. Lindsey is general manager.

NEWBERRY, S. C.—Bonds to the amount of $30,000 have been voted for the purchase of the electric-light plant and water-works system now in course of construction.

CALHOUN, GA.—The city of Calhoun has recently installed a new boiler, pump and dynamo in the municipal electric-light and water plant.

MARSHALLVILLE, GA.—The city of Marshallville contemplates the construction of an electric-light plant, to cost about $15,000. The present plans provide for a 75-hp development (steam power) and about 28 miles of wiring for the distribution system. J. C. Bouten is Mayor.

MILLEN, GA.—The manager of the municipal electric-light and water plant expects to purchase within the next few months a new boiler (16 ft. by 5 ft. 6 in.). H. B. Davis is manager.

STILLMORE, GA.—The Stillmore El. Lt. Co. expects to erect within the next 30 days ½ mile of feeder line to suburban homes. Within the next six months the company expects to purchase a 60-hp boiler, a 40-hp or 40-hp engine and an alternating-current generator; it also expects to purchase some meters within the next 12 months. W. L. Clark is owner.

JONESBORO, ARK.—The Board of Trustees of the State Agricultural College has decided to rebuild the power plant recently destroyed by fire. Arrangements have been made with the city plant to furnish electrical service until the plant is finished.

BATON ROUGE, LA.—Bids will be received by the water and lighting committee until Nov. 22 for lighting the city of Baton Rouge with electricity for a period of five years, beginning April 2, 1914, with not less than 150 to 200 lamps. Plans and specifications are on file at the city hall, copies of which may be obtained upon application to the water and lighting committee. Philip P. Huyck is chief of police.

FAIRLAND, OKLA.—The Fairland Lt. & Pwr. Co. expects to purchase within the next four months one 30-kw generator and to install storage batteries to maintain 50 house lamps. L. H. Long is manager.

GOLIAD, TEX.—The entire plant of the Goliad Wtr., Lt. & Pwr. Co. was recently destroyed by fire, causing a loss of about $25,000. The town at present is without water or light service. E. F. Glaze is president and manager.

HURLEY, TEX.—The Western Pwr. Co., recently organized, is planning to install an electric plant in Hurley for the purpose of furnishing energy to pump water for irrigation purposes in the Hurley Valley. Offers have been placed for three 400-hp engines. The company is capitalized at $40,000.

## Pacific States

CASHMERE, WASH.—The contract for installing 121 lamps in the business and residence districts in Cashmere has been awarded to Le Page, McKenna & Co., of Seattle.

CENTRALIA, WASH.—The Washington Pub. Ser. Corpn., of Olympia, has applied to the Commissioners of Lewis County for a franchise to construct and operate electric transmission lines from Chehalis to Centralia and from Centralia to the north county line toward Olympia. Milliard Lemo and Wilbur B. Forshay are interested in the company.

EDMONDS, WASH.—The Edmonds El. Lt. & Pwr. Co., of Edmonds, has applied to the Commissioners of King County for a franchise to construct and operate an electric-lighting system in Richmond Beach.

ISSAQUAH, WASH.—Bids will soon be received by the city of Issaquah for lighting the streets of the city. The city has decided to use tungsten lamps for street-lighting.

LYMAN, WASH.—The Pacific Northwest Trac. Co., of Seattle, will soon begin work on the erection of electric transmission lines into Lyman. Transmission lines will also be erected into Hamilton.

OLYMPIA, WASH.—The Washington Pub. Ser. Corpn. has petitioned the Commissioners of Thurston County for permission to erect a transmission line from Olympia to Tenino, thence to Grand Mound and back through Rochester to Gate, to supply electricity for lamps and motors. Milliard Lemon and Wilbur B. Forshay are interested in the company.

POMEROY, WASH.—The Pacific Pwr. & Lt. Co., of Portland, Ore., has applied to the City Council for a franchise in Pomeroy for a period of five years.

SEATTLE, WASH.—The Puget Sound Trac., Lt. & Pwr. Co., of Seattle, is reported to have acquired a power site on the Baker, where a power plant will be erected in the near future.

SEATTLE, WASH.—Plans and estimates have been submited to the Council by the city engineer for the installation of cluster lamps on Fifth Avenue from Virginia Street to Denny Way, to cost about $17,000.

SPOKANE, WASH.—The special committee appointed by the City Council to investigate the proposition of establishing a municipal electric-light and power plant has recommended that Burns & McDonnell, of Kansas City, Mo., be retained as consulting engineers.

ASHLAND, ORE.—City Electrician Butterfield has recently recommended to the City Council that the proposition to issue $25,000 in bonds, the proceeds to be used for the construction of an auxiliary electric plant and extension to distribution system, etc., be submitted to the voters at the coming election.

BAKER, ORE.—The Eagle River El. Pwr. Co., of Baker, expects to purchase within the next 30 days a 500-kw, 60-cycle, 2300-volt turbogenerator set for its auxiliary plant at Baker. J. K. Romig is vice-president and manager.

CORVALLIS, ORE.—The committee appointed by the Council to investigate the proposition to secure electricity from the Oregon Pwr. Co., of Albany, for lighting the city, has reported in its favor.

LEBANON, ORE.—The Lebanon El. Lt. & Wtr. Co. expects to erect within the next three months 22 standards carrying five-lamp clusters, to be operated on 6.6-amp series system. Posts and wire have already been purchased. S. I. Stewart is manager.

PORTLAND, ORE.—The City Council has awarded the contract for lighting the streets with arc lamps and the parks and public building with incandescent lamps to the Portland Ry., Lt. & Pwr. Co. for a period of three years. The contract covers the entire city.

SHERIDAN, ORE.—The Sheridan Lt. & Pwr. Co. expects to erect within the next two months 5 miles of three-phase transmission line connecting Willamina and Sheridan. The company has purchased a switchboard and synchronizing equipment from the Westinghouse El. & Mfg. Co. J. T. Thompson is general manager.

LONG BEACH, CAL.—Contracts have been awarded by the Board of Public Works for the installation of ornamental lighting system on American Avenue from the ocean front to Anaheim Street, to K. T. Bennett, at $11,434; on Broadway from Alamitos to Water Street, to Woodill & Hulse, for $23,525, and for the interior of a comfort station at Knoll Park, to W. D. Lambert, for $495.

OROVILLE, CAL.—Notice has been filed of appropriation upon the waters of the middle fork of the Feather River and upon Fall River. The notice states that the water is to be used for the purpose of generating electrical energy. The water will have a total fall of 1000 ft. and it is estimated that 60,000 hp can be developed. The plans provide for an impounding dam, which will store 15,000,000,000 cu. ft. of water. F. G. Eby, S. H. Wisner and L. F. Breuner, of Sacramento, are interested in the project.

RIVERSIDE, CAL.—Bids will be received at the office of the city clerk, Riverside, Cal., until Nov. 20 for furnishing material, labor and constructing improvements to the water-works system, including furnishing and installing two motor-driven centrifugal pumps in each of the two pumping stations, with piping, connections, etc. (contract 5). Plans and specifications may be obtained upon application to Burns & McDonnell, consulting engineers, Kansas City, Mo. H. C. Cree is city clerk.

POCATELLO, IDAHO.—The Beaver River Pwr. Co., a subsidiary of the Idaho Lt. & Pwr. Co., of Boise, it is reported, will soon begin work on the installation of a plant here. The company was recently granted a franchise in Pocatello.

ANACONDA, MONT.—The Commissioners of Granite County have granted the Northern Pacific Ry. Co. permission to erect electric transmission line over certain portions of the county.

HARLEM, MONT.—The Town Council has engaged A. L. Jacqueth to prepare plans and specifications for a municipal electric-light plant.

## Canada

WINNIPEG, MAN.—Notice is hereby given to contractors that tenders will be received early in 1914 for construction work necessary for the delivery of water from Shoal Lake to the Greater Winnipeg water district as follows: (1) A dike and channel for the diversion of the Falcon River into Snowshoe Bay; (2) 85 miles of concrete aqueduct; (3) 100 miles of pipe line; (4) 900 linear ft. tunnel under Red River; (5) 85 miles of construction railway; (6) telephone line; (7) clearing and ditching. Particulars as to the estimate of cost of the work and map of approximate location and profile of aqueduct may be obtained from M. Peterson, acting secretary of the administration board of Greater Winnipeg Water District.

BRANTFORD, ONT.—The Dominion Pwr. & Trans. Co., of Hamilton, is contemplating the construction of a power plant at Mohawk Lake to develop 2500 hp to take care of its peak load in Brantford.

PORT COLBORNE, ONT.—Arrangements are being made for the erection of a branch transmission line of the Hydro-Electric Power Commission from the new Welland-Niagara Falls line to Port Colborne.

ST. MARY'S, ONT.—The Light and Power Commission has decided to replace the present street-lighting system with ornamental standards carrying five-lamp clusters. A number of 100-cp single lamps will also be installed.

TORONTO, ONT.—The Canadian Stewart Co., which has the contract for deepening the Toronto Harbor, will operate all its machinery by electricity and has contracted with the Toronto Hydro-Electric Commission for energy. The contract calls for between 7000 hp and 8000 hp.

TORONTO, ONT.—The Toronto Hydro-Electric Commission find that instead of 13,000 services for which money was appropriated last January it has had to provide 21,000 services. With this situation to face, the commission needs some of the money that would be provided by the issue of $700,000 unauthorized debentures, and it is expected that the city will be called upon to arrange for payment. The commission is compelled to order supplies and equipment costing $250,000, and has to face the difficulty of financing the purchase with no funds.

WELLAND, ONT.—The Town Council has voted to appropriate $20,000 additional for the Hydro-Electric system in Welland. The system was recently completed, but owing to increased territory due to extension of streets additional funds are needed to extend the service. The Hydro-Electric Commission has placed an order with the Canadian General El. Co. for six transformers, each 3500-kva, 46,000-2300-volts, for use in Welland in connection with the new 46,000-volt line to be erected from Niagara Falls.

WESTON, ONT.—The Weston Water, Power and Light Commission has decided to erect a high candle-power lamp on every pole on the west side of Main Street from one end of the village to the other, also to install lamps on every pole on the east side of Main Street between King and Mill Streets.

MONTREAL, QUE.—Work has begun on the construction of a substation at Rougemont for the Montreal & Southern Counties Ry Co. This station will be equipped with a 300-kw motor-generator set, one bank of transformers, high-and-low-tension switchboards, switching apparatus, etc.

MONTREAL, QUE.—A report has been prepared by A. Parent, superintendent of the civic lighting department, recommending a new lighting scheme for St. Catherine Street in connection with the underground conduits. Mr. Parent recommends an iron standard about 14 ft. high carrying an inverted magnetite lamp; also increasing the number of lamps from 57 to 147. The report also recommends that the single lamp standards should be installed in the downtown districts as soon as the conduits are constructed.

## Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Nov. 3 for furnishing miscellaneous articles under Circular No. 804-A, including 12 1-kw, single-phase, 12 5-kw, single-phase, 12 10-kw, single-phase, six 15-kw, single-phase and one 20-kw, three-phase transformer, to be used on power and lighting distribution systems, and which shall be of the weatherproof pole type and be furnished complete with oil hangers and fuse blocks; 10,000 ft. No. 14 B. & S. gage, duplex, rubber-covered, 3/64-in. stranded stage cable; 10,000 ft. No. 16 B. & S. gage, duplex rubber-covered, 3/64-in., stranded stage cable; 50,000 ft. No. 12 B. & S. gage, solid, double-braid, weatherproof copper wire; 50,000 ft. No. 14 B. & S. gage, solid, double-braid, weatherproof copper wire; 300 10-amp, 50 15-amp, 150 20-amp, 500 50-amp and 400 60-amp standard National Electric Code clip-contact, inclosed, 250-volt fuses; 2000 8-in flat porcelain shades for 2¼-in. holder; 1000 lb. ¼-in. wide navy standard friction tape in ½-lb. rolls, packed in tin boxes. Major F. C. Boggs is general purchasing agent.

GEORGETOWN, BRITISH GUIANA.—The Demerara El. Co., of Georgetown, expects to purchase regular supplies for distribution system including incandescent lamps, etc.; also household labor-saving devices including vacuum cleaners, washing machines, etc. W. B. Gray is manager.

# New Incorporations

LOS ANGELES, CAL.—The Molander Pwr. Co. has been incorporated with a capital stock of $1,000,000. The directors are: Arvid G. Al... J. S. Erickson, F. M. Shepard, A. G. Anderson, W. H. Bratton, J. ... Benjamin, H. A. Goldman, C. G. Cornell and T. E. Burns.

HONESDALE, PA.—The Browntown El. Co., of Honesdale, has been granted a charter with a capital stock of $5,000 to operate in Clint... Township.

AVA, MO.—The Ava El. Lt. Co. has been incorporated with a capital stock of $6,000 by H. S. Wilson, J. W. Petit and Joseph H. Hawkin...

# Directory of Electrical Associations, Societies, Etc.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, H. O. Hanson, Mobile Gas Co., Mobile, Ala.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Permanent secretary, L. O. Howard, Smithsonian Institution, Washington, D. C. Annual meeting, Atlanta, Ga., Dec. 29.

AMERICAN ELECTRIC RAILWAY ACCOUNTANTS ASSOCIATION. Secretary-treasurer, E. B. Burritt, 29 West 39th St, New York.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 29 West 39th St., New York.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION. Secretary, E. B. Burritt, 29 West 39th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary, Eugene W. Stern, 101 Park Ave., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio. Annual meeting, Atlanta, Ga., December, 1913.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, Edwin A. Scott, 29 West 39th St., New York.

AMERICAN WATER WORKS ASSOCIATION. Secretary, J. M. Diven, State St., Troy, N. Y. Annual meeting, May, 1914.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, V. J. Tharp, Little Rock, Ark. Annual meeting, May, 1914.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Geo. Holberton, Pacific Gas & Electric Co., San Francisco, Cal.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, W. T. Snyder, McKeesport, Pa.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, W. Drew, 112 West Adams St., Chicago. Annual meeting, New Orleans, May 19-22, 1914.

CALIFORNIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, W. Hanbridge, 1408 Merchants' National Bank Building, Los Angeles, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Secretary-treasurer, J. Bright, month, 610 Confederation Life Bldg., Toronto, Can.

COLORADO ELECTRIC CLUB. Secretary, C. F. Oehlmann. Meets every Thursday at Albany Hotel, Denver, Col.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

ELECTRIC CLUB OF CHICAGO. Secretary, Fred M. Rosseland, Monadnock Block, Chicago. Meets every Thursday noon at Hotel Sherman.

ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER BOSTON. Secretary, R. S. Hale, 39 Boylston St., Boston.

ELECTRICAL CONTRACTORS' ASSOCIATION OF MASSACHUSETTS. Secretary, I. D. Temple, 30 Foster St., Worcester, Mass.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

ELECTRICAL CONTRACTORS' ASSOCIATION OF THE CITY OF CHICAGO. Secretary, M. N. Blumenthal, 179 West Washington Street. Meets at noon on the second and fourth Wednesday of each month at 424 South Wabash Ave.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Ernest S. Cowie, 1613 Grand Ave., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert Peterman, 626 Lloyd St., Milwaukee, Wis.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, 1343 Marquette Building, Chicago. Annual meeting, Chicago, November.

ELECTRICAL CREDIT ASSOCIATION OF PHILADELPHIA. Secretary, John W. Frum, 1324 Land Title Building, Philadelphia, Pa.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Next meeting, Hot Springs, Va., Nov. 18-20.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Gravely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Meeting, San Francisco, second Thursday of each month.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, Harvey Robinson, 124 West 42d Street, New York.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA, NEW ENGLAND SECTION. Secretary, L. L. Edgar, 39 Boylston St., Boston.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. Chapin, 29 West 39th St., New York.

FARADAY ELECTRICAL ASSOCIATION. Secretary, W. J. Collins, 1129 Masonic Temple, Chicago. Meets at noon on the first and third Wednesday of each month at Planters' Hotel.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla. Annual meeting, May, 1914.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, J. D. Israel, Engineering Societies Building, 29 West 39th St., New York. Sections New York, New England, Philadelphia, Chicago and Pittsburgh.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, A. Newburger, 1153 Myrtle Ave., Brooklyn, N. Y.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind.

INSTITUTE OF OPERATING ENGINEERS. Secretary, L. Hommiller, 29 West 39th St., New York.

INSTITUTE OF RADIO ENGINEERS. Secretary, E. J. Simon, 81 New St., New York. Annual meeting, New York, January, 1914.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNAL-COMBUSTION ENGINEERS' ASSOCIATION. President, Charles Dietsch, 416 West Indiana St., Chicago. Meeting second Friday of each month at Lewis Institute.

INTERNATIONAL ELECTRICAL CONGRESS. Secretary, Dr. E. B. Rosa, Bureau of Standards, Washington, D. C. San Francisco, Sept. 13-18, 1915.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England. Meeting at San Francisco, Sept. 6-11, 1915.

IOWA ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Secretary, H. Maynard, Waterloo, Ia.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, H. E. Wiks, Davenport, Ia. Annual meeting, Cedar Rapids, April 23, 1914.

KNIGHTS OF COLUMBUS ORDER. Jupiter (president), W. N. Matthews, St. Louis, Mo.; Maury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary-treasurer, Ivor Thomas, 237 South Main St., Wichita, Kan.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, W. H. Boer Spangenberg, 625 Poydras St., New Orleans, La.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Waterville, Maine.

MINNESOTA ELECTRIC ASSOCIATION. Secretary-treasurer, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn. Annual meeting, Minneapolis March, 1914.

MISSISSIPPI ELECTRIC ASSOCIATION (affiliated with the National Electric Light Association). Secretary-treasurer, Frank J. Duffy, Natchez, Miss.

MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATER WORKS ASSOCIATION. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis. Annual meeting, May, 1914.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, Wm. L. Smith, Concord, Mass.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York. Annual meeting, Philadelphia, May, 1914.

NATIONAL ELECTRIC LIGHT ASSOCIATION, COMMERCIAL SECTION. Secretary, J. F. Becker, 1170 Broadway, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION, EASTERN NEW YORK SECTION. Secretary, C. S. Van Dyck, Schenectady, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION, HYDROELECTRIC SECTION. Secretary, S. A. Sewall, 29 West 39th St., New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MICHIGAN SECTION. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEBRASKA SECTION. Secretary-treasurer, S. J. Bell, David City, Neb.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEW ENGLAND SECTION. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NORTHWEST SECTION. Secretary, N. W. Brockett, Pioneer Building, Seattle, Wash.

NATIONAL ELECTRIC LIGHT ASSOCIATION, SOUTHEASTERN SECTION. Secretary-treasurer, A. A. Wilbur, Columbus, Ga.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago. Annual meeting, June, 1914.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk Street, Boston, Mass. Open meeting, New York, March, 1915.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, Richard Valentine, Janesville, Wis.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 60 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, H. A. Faulkner, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, S. J. Stewart, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

NEW YORK ELECTRIC RAILWAY ASSOCIATION. Secretary, Charles C. Dietz, 598 Broadway, Albany, N. Y.

NEW YORK ELECTRICAL CREDIT ASSOCIATION (affiliated with the National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Annual meeting, Dec. 9.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 33 West 39th St., New York. Annual meeting, New York, June, 1914.

NORTHWESTERN CEDARMEN'S ASSOCIATION. Secretary, N. E. Boucher, 743 Lumber Exchange, Minneapolis, Minn. Annual meeting, Jan. 6, 1914.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio. Annual meeting, Columbus, Ohio, Nov. 20-22.

OREGON ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, F. C. Green, 291 East Morrison St., Portland, Ore. Annual meeting, April, 1914.

PENNSYLVANIA ELECTRIC ASSOCIATION (State Section N. E. L. A.). Secretary-treasurer, S. C. Pohe, Bloomsburg, Pa.

RAILWAY SIGNAL ASSOCIATION. Secretary-treasurer, C. E. Rosenberg, Times Bldg., Bethlehem, Pa.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. H. H. Norris, Ithaca, N. Y. Annual meeting, Princeton, N. J., June, 1914.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Texas.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Manchester, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 76 West Monroe St., Chicago, Ill. Annual meeting, Cincinnati, Jan. 27-29.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, Stephenson Building, Milwaukee, Wis. Annual meeting, Jan. 15 and 16, 1914.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED OCT. 1, 1912,
Reported by Robert Stark Allen, 16 Exchange Place, New York.

1,076,020. AUTOMATIC SWITCH FOR TELEPHONE EXCHANGE SYSTEMS; E. E. Clement, Washington, D. C. App. filed May 17, 1910. Selective switch, including bank contacts arranged in rows, and wiper contacts on a spindle which is rotated by an electromagnet.

1,076,026. LAMP SOCKET; J. Darby and C. D. Meeker, Orange, N. J. App. filed Feb. 4, 1910. Double-break pull socket.

1,076,027. STORAGE-BATTERY GRID; J. N. Davis, Denver, Col. App. filed March 17, 1913. Body portion which receives active material is made of greater thickness than the frame part.

1,076,032. ELECTRICAL CONNECTION; P. E. Gilling, East Orange, N. J. App. filed July 29, 1910. Friction slip connection for spark plugs.

1,076,041. TELEPHONE TRANSMITTER; W. Kaisling, Chicago, Ill. App. filed March 15, 1906. Interposes damping springs between the main diaphragm and the granule chamber.

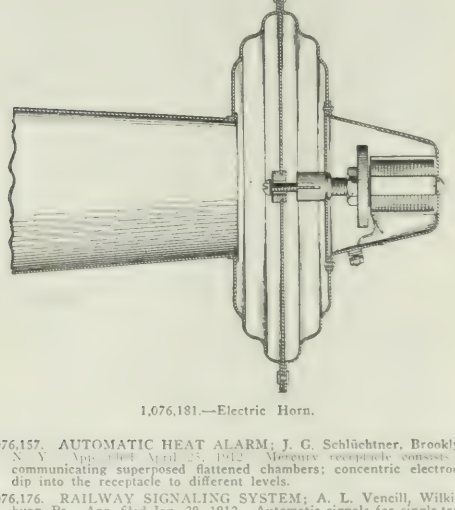
1,076,054. ELECTRODE HOLDER; J. Orr, Schenectady, N. Y. App. filed April 19, 1911. Contact plates linked together and clamped in snug engagement with electrode.

1,076,058. ELECTRIC VAPOR APPARATUS; E. Podszus, Rixdorf, Berlin, Germany. App. filed Oct. 4, 1909. Lamp in which the vapor is forced to traverse the envelope in a narrow jet.

1,076,091. FLASHLIGHT PHOTOGRAPHIC APPARATUS; C. D. Allen, New York, N. Y. App. filed June 3, 1912. Squeezing of bulb opens the shutter and simultaneously closes circuit to set off powder.

1,076,141. PREPARATION OF RADIOTHORIUM; L. Meitner, Berlin, Germany. App. filed Feb. 18, 1913. Electrolyzes solutions containing radiothorium in large excess and no, or very little, thorium, and precipitates the radiothorium at the cathode.

1,076,149. AUTOMATIC ELECTROMAGNETIC SWITCH; J. N. Reynolds, Greenwich, Conn., and A. F. Dixon, Newark, N. J. App. filed Oct. 5, 1910. Has rotatable shaft carrying a series of disks on which segmental contacts are insulatively secured and stationary spring contacts engaged by the segmental contacts.



1,076,181.—Electric Horn.

1,076,157. AUTOMATIC HEAT ALARM; J. G. Schlüchtner, Brooklyn, N. Y. App. filed April 25, 1912. Mercury receptacle consists of communicating superposed flattened chambers; concentric electrodes dip into the receptacle to different levels.

1,076,176. RAILWAY SIGNALING SYSTEM; A. L. Vencill, Wilkinsburg, Pa. App. filed Jan. 29, 1912. Automatic signals for single-track road.

1,076,181. ELECTRIC HORN; G. M. Willis, Chicago, Ill. App. filed [illegible]. Vibrator comprises a flattened [illegible] spring diaphragm and carries a screw, the head of which impinges upon and vibrates the sounding diaphragm.

1,076,207. CONTROL SYSTEM; C. C. Heinzmann, Indianapolis, Ind. App. filed Oct. 11, 1912. Damper-regulating system; prevents damper being left open because of weakening of electrical energy source.

1,076,210. CATAPHORIC ELECTRODE; D. E. Kerr and H. Wilson, Conneaut, Ohio. App. filed Feb. 26, 1913. The electrode is mounted within the medicine container.

1,076,212. PROTECTING MERCURY-VAPOR APPARATUS; O. O. Kruh, Schenectady, N. Y. App. filed Sept. 20, 1907. Prevents cathode spot from shifting to the anode by equalizing the static stress between the cathode and anode.

1,076,213. ELECTROMAGNETIC SEPARATOR; E. Langguth, Neerpelt, Belgium. App. filed April 26, 1912. Comprises a stationary induction body, the separating surface of which represents a closed ring relatively to which a multipolar system of magnets is rotatable.

1,076,214. ELECTRIC RAILWAY AND ELECTRIC MOTOR CONTROL; H. W. Leonard, Bronxville, N. Y. App. filed March 25, 1908. For operating certain sections of the system at low tension (as in a city) and other sections at high tension (as in the country).

1,076,[illegible]. COMMUTATOR BRUSH DEVICE; E. G. Lemon, Lo[illegible]. App. filed May 3, 1912. Resiliently supported brush holder which may be locked in inoperative position.

1,076,[illegible]. SUPPORT FOR ELECTRICAL LAMPS OR OUTLETS; [illegible] Sachs, Hartford, Conn. App. filed June 16, 1911. Magnetic [illegible] carrying lamp sockets or other outlets.

1,076,271. WELDING MACHINE; T. E. Crecelius, St. Louis, Mo. App. filed April 24, 1912. For welding sections of tubing.

1,076,278. SELECTIVE CALLING KEY; M. F. Geer and R. C. Leak, Rochester, N. Y. App. filed Dec. [illegible], 1911. Includes a normally inactive converter and manually operable means for starting the same.

1,076,292. ELECTRODE LEAD; C. A. Kraus, Newton Highlands, Mass., and R. D. Mailey, Lynn, Mass. App. filed June 30, 1910. For use in electric apparatus; tube of highly conductive material sheathed within and without with metal resistant to the action of mercury.

1,076,298. ELECTRIC BRAKE; J. N. Mahoney, Wilkinsburg, Pa. App. filed April 20, 1908. Of the type wherein the brake-applying current is supplied from the car motors connected up to act as generators on a local brake circuit.

1,076,303. SELECTIVE SIGNALING SYSTEM; J. McFell, Chicago, Ill. App. filed April 19, 1910. Selector devices operate annunciators by transmission over the line wire of groups of signal impulses constituting a plural-digit number signal appropriate to an individual station.

1,076,304. FIRE-ALARM AND WATCH-SERVICE SIGNALING MEANS; J. McFell, Chicago, Ill. App. filed May 8, 1911. Has fire and emergency signaling circuits.

1,076,387. DISCONNECTING SWITCH; A. J. Pahl, San Francisco, Cal. App. filed Aug. 13, 1912. Automatically disconnects the burned portion of a high-tension feed line and at the same time grounds the same.

1,076,394. THERMAL CIRCUIT CLOSER; J. F. Scheuer, Two Rivers, Wis. App. filed May 5, 1913. Spring contact soldered to cover; hold it normally on open circuit.

1,076,395. ELEVATOR SIGNAL SYSTEM; N. L. Schloss, New York, N. Y. App. filed Aug. 28, 1912. Signal given on any floor indicates simultaneously in each car of the system from which floor the signal has been given.

1,076,407. LOCOMOTIVE; H. G. Chatain, Erie, Pa. App. filed May 4, 1912. Internal-combustion engine in two principal parts, between which parts is situated the field-magnet frame of the generator which supplies current to the motors whose rotors are mounted on the locomotive axles.

1,076,424. PROCESS OF TREATING LARGE FERMENTATION VESSELS; H. Held, Nuremberg, Germany. App. filed Oct. 22, 1[illegible]. Vessel containing copper electrolyte rotated as a cathode, and then after a silver coating is produced in like manner.

1,076,438. THERMO-ELECTRIC ELEMENT; A. L. Marsh, Detroit, Mich. App. filed Sept. 30, 1912. Nickel and silicon with an added quantity of manganese as an auxiliary to remove shortness.

1,076,445. ELECTROCAPILLARY CONTRIVANCE; A. Orling, London, Eng. App. filed Oct. 6, 1911. Has converging capillary tube.

1,076,448. FREQUENCY INDICATOR; W. H. Pratt, West Lynn, Mass. App. filed Sept. 19, 1911. One of the two relatively movable elements of the instrument is provided with two windings exerting opposing forces on the other element, the circuits of the two windings being tuned to frequencies above and below the average [illegible].

1,076,467. METHOD OF WELDING; E. Thomson, Swampscott, Mass. App. filed March 14, 1910. Heats engaging parts of a wheel rim and a wheel center to plasticity and then forces them laterally together into a common plane.

1,076,477. CLUSTER LAMP SOCKET; C. H. Bissell, Syracuse, N. Y. App. filed March 18, 1912. Has terminals by which either a pendent switch or an additional lamp may be connected to the cluster.

1,076,481. ELECTROMAGNETIC DEVICE; S. C. Bryant, Clarence, [illegible]. App. filed May 29, 1912. For operating a bell of the "locomotive type."

1,076,485. STORAGE BATTERY; W. A. Crowdus, Chicago, Ill. [illegible]. Filed July 16, 1913. Battery plate consists of series of thin lead metal separated by fibrous insulating material and provided at [illegible] vals with interstitial tubes filled with active material.

1,076,[illegible]. PROCESS FOR SEPARATING PHOSPHORIC [illegible] FROM NATURAL PHOSPHATES; M. M. Haff, Ottawa, Ont., Canada. App. filed April 4, 1912. Subjects natural phosphate [illegible] a non-feldspathic aluminum silicate to the heat of the electric arc.

1,076,499. PROCESS FOR SEPARATING PHOSPHORIC A[illegible] FROM NATURAL PHOSPHATE; M. M. Haff and T. L. Wilson, Ottawa, Ontario, Canada. App. filed Oct. 19, 1912. Subjects natural phosphate with silicious material to electric heat and recovers the utilized phosphoric acid.

1,076,518. ELECTRIC FURNACE; I. Rennerfelt, Halmstad, Sweden. App. filed Feb. 26, 1912. Rotatable crucible with end electrodes mounted on adjustable shields.

1,076,530. ELECTRIC FIREARM; A. Tepins, Paris, France. App. filed Jan. 5, 1911. Circuit for firing can be completed only when gun has been carried to the shoulder.

1,076,607. THERMAL CIRCUIT CLOSER; J. F. Scheuer, Two Rivers, Wis. App. filed Feb. 8, 1913. Exposed fusible block [illegible] contact normally away from other contact.

1,076,614. WINDING APPARATUS; J. G. P. Thomas, Holyhead, Wales. App. filed June 29, 1912. For crane work [illegible] and the like; by balanced gearing electrical power is [illegible] operation of an electrical machine during periods of rest [illegible] which power is returned at times of heavy load.

1,076,[illegible]. SUPPORTING STRUCTURE FOR TROLLEY CONDUCTORS; H. P. Davis and T. Varney, Pittsburgh, Pa. App. filed Oct. 19, 1904. For high-tension alternating-current service; [illegible] guard wires or rods encircle the messenger wire which [illegible] trolley wire.

1,076,631. RAILWAY TRAFFIC-CONTROLLING SYSTEM; [illegible] Dodgson, Rochester, N. Y. App. filed March 27, 1903. [illegible]

# Electrical World

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**Central-Station Service Interruption**

A boiler recently exploded in the Staten Island generating station of the Richmond Light & Railroad Company. As noted in our issue dated Oct. 25, no damage was done to the engine equipment and most of the boilers were unharmed, the exploding vertical boiler taking a skyward course and dropping into the river adjoining the station. In its upward flight the boiler tore out a portion of the breeching and a section of the roof, thereby cutting off the other boilers from the stack and strewing wreckage about the room. Our purpose is not here to dwell on the reasons for the explosion, for boilers have a habit of doing this kind of thing when forced to it. We desire to direct attention to the fact that five days were consumed in restoring service in a great and resourceful community like New York. A wide-awake company would have chartered a steamer, made an emergency connection between her boilers and the station header and restored service before the next night, if no quicker means were at hand. Of what avail were the glorious examples at Dayton, Hot Springs and a host of other cities to the company on Staten Island? Can it be possible that the sacrifices and heroic efforts there made to restore service have been in vain? Had the entire station been destroyed, the fault would not have been so great; but under the circumstances the record is not an enviable one. It outrages the grandest tradition of the central-station industry, that of service at all hazards and at any cost. It implies that the interests of the company are distinct from those of the community which it serves and assumes that a lighting monopoly was created to be abused. Happily the central-station industry as a whole has a better sense of its obligations to its patrons than that shown on this occasion. Its progress is not presaged on such errors of omission; otherwise it would dry up the sources of its prosperity.

**The Brush Discharge**

It is curious that in the early history of electricity the electric brush discharge was well known and much studied. Needles and sharp-pointed conductors, connected to frictional electrostatic machine, gave off this discharge, and the experimental display of this in a dark room was once popular in the eighteenth century. At the present time the brush discharge is looked upon as a nuisance in high-tension energy transmission and, as such, to be prevented as far as possible. There is, however, one useful accompaniment of the brush discharge, and that is ozone production in air. This is described at some length by Mr. A. Vosmaer in *Metallurgical and Chemical Engineering* as abstracted in our Digest. It seems that the brush discharge is intermediate to the electric glow on one side and the electric spark on the other. The particular type of air bombardment which accompanies it seems to result in the formation of ozone. The peculiar difficulties to which ozone generators are subject make a narrative of considerable interest.

**Surplus of Public Utilities**

The surplus of a public utility which Mr. Barker, of the Massachusetts commission, had in mind when he wrote the paper published in abstract in this issue is evidently that of a fully regulated company. Since practically all companies are either in this position now or are in a fair way to be subject to close state supervision soon, his discussion has a direct bearing on the general questions involved. It should be borne in mind, however, that owing to the long existence of the Massachusetts policy of regulation a surplus in that State may be regarded as legally open to treatment different from one built up by a company not subject to regulation during the greater part of the period of accumulation. As we understand the substance of the argument, it is that the bargain between the State and the company contemplates that there shall be reasonable rates for service, protection of both the monopoly and the investment and a reasonable rate of return. To this there may be added a definite provision that for unusual economy or efficiency an addition to the rate of return shall be allowed, and we think that such an incentive to development would be an advantage that the State could well afford to give. If a schedule of rates is proportioned properly upon a fair and recognized investment, a surplus accumulates because the natural growth of business tends under normal conditions to reduce the unit costs of operation. In other words, increased volume of business assures increased margin of profits. Under Mr. Barker's plan the increase would be applied, not as a matter of right to extra dividends or directly to the public interested in the service, but to those uses which are the common concern of both parties to the bargain. One of the features of such a plan has been followed for many years by one of the largest railroad companies in the country. "One dollar for dividends, one dollar for improvements," has been its policy. An encouraging element in a plan of this nature, broadened to meet the conditions of other forms of public utility service, is that it will probably help to make good those elements of depreciation which are inevitable in these properties. Mr. Barker recognizes that the losses on unremunerative new extensions must be met from some source until such time as the new additions to the property reach a self-supporting basis. It should be recognized just as clearly that depreciation is an element for consideration in rate-mak-

ing. If the surplus for the future may be used in part to overcome some of the uncontrollable losses in capital value arising from depreciation in the past, the result will be advantageous. This policy is wholly reasonable in cases where, notwithstanding proper management, earnings have not been sufficient to overcome these losses and to yield a fair return on the investment; and it is not an unreasonable policy for the State to elect to follow with many public service corporations where the conditions have been closely similar. We note, however, that Mr. Barker does not feel that it would be prejudicial to the public interest to use at least part of a surplus developed under the general conditions of regulation outlined to increase the otherwise reasonable rate of return upon actual investment of stockholders. This may be done in the form of an allowance for unusual efficiency if management of such a character is developed. It is necessary to be done, however, in cases where a percentage greater than the going market rate for money is demanded by investors who would not otherwise take the risks apparent in the enterprise seeking capital at the time.

## High-Frequency Alternators for Radio-Telegraphy

An article recently published in *La Lumière Electrique*, by M. Bouthillon, as abstracted in our Digest, draws attention to a theory of high-frequency alternators capable of being applied to radio-telegraphy. All of the early radiation experiments of Hertz were made with free oscillations of a few meters wave-length, accompanied by frequencies up to hundreds of millions per second. Later on, radio-telegraphic signals came to be made with free oscillations of a few hundred meters wave-length, accompanied by frequencies of the order of millions per second. Fessenden was the first in this country to point out that great advantages would be secured by substituting forced oscillations for free oscillations. That is, free oscillations are feeble, not only because they have to be separated by relatively long inactive intervals but also because they are necessarily heavily damped by active radiation. If an alternating-current generator could be hitched to the sending-station mast wire, so as to be in resonance with it, the mast could be kept in continuous electric oscillation of great radiative power. The change is like replacing the piano by the pipe organ.

It is well known that when a properly constructed ring-wound or delta-wound three-phase generator is driven at a fundamental frequency of, say, 60 cycles per second, the closed circuit of the armature contains no resultant emf of that frequency, which emf is taken off at 120 deg. taps. Moreover, there will be no resultant harmonic emf of 5, 7, 11, 13, etc., times the fundamental in the closed armature circuit. All such harmonics cancel out all the way round the armature, and their instantaneous sum is individually zero. Such is not true, however, of the triple or 3*n*-ple harmonics. It is well known that the harmonic emfs of frequencies of 180, 540, etc., cycles per second do not cancel out, but add up and send short-circuit currents of those frequencies through the winding of 60-cycle machines, so that such triple-frequency harmonics are designedly kept small. Similarly, a five-phase alternator of the ring-wound type and generating, say, a fundamental frequency of 100 cycles per second would send no short-circuit current of that frequency through the closed armature-ring winding, but the fifth harmonic of 500 cycles per second would leave a resultant emf. If the armature ring were opened at some point and taken to an external circuit, an emf of 500 cycles per second might be looked for in that circuit, but no emf of 100 cycles per second, if the machine was accurately constructed.

Proceeding in this way, if a ring-armature machine of relatively high fundamental frequency be so built as to exaggerate some high harmonic of that frequency, one can cut the ring and find in the external circuit no fundamental frequency, but an augmented magnitude of the harmonic. Consequently, instead of trying to suppress all harmonics and to keep a pure sinusoidal fundamental frequency, as is the modern practice for energy-transmission generators, for radio-transmission generators one should seek to develop a high fundamental frequency, say 2000 cycles per second, and then exaggerate as much as possible a particular glorified high harmonic, say the forty-ninth. Then with forty-nine pairs of poles, when the ring armature is opened at some convenient point, one should find at its terminals no resultant emf of 2000 cycles per second, but a relatively large resultant emf of 98,000 cycles per second. By means of a suitably resonant circuit, this high frequency could be still further augmented and purified. This principle of stimulating an inordinately vicious high harmonic illustrates the proverb that "one man's meat may be another man's poison."

## Electric Ship Propulsion

At first thought to drive a ship by means of electric energy transmitted from generators to motors only a few score feet away would seem to be a misapplication of ingenuity, but such is not the case. Just at the present time two good-sized vessels are under test, both equipped with electric drive of different kinds and for different purposes. One of them is the United States collier *Jupiter*, of which we have already given some account; the other is the cargo boat *Tynemount*, built in England for use on the Great Lakes, as described in this issue. Although absolutely different in equipment, both vessels disclose the great fundamental advantage of electric drive for ships, the complete independence of engine speed and propeller speed. The ordinary reciprocating engine is well fitted for ship propulsion so far as its normal running speed is concerned. Its rotations fit very well those of a propeller able to absorb the power of the engine while retaining an efficient speed. In the *Jupiter* use is made of electric drive for the purpose of getting an efficient propeller speed, while the power is delivered from a turbine-generator running at its most efficient speed. The trouble with turbine propulsion in ships generally, although it is largely used, is that at the speed of maximum efficiency for the turbine the propeller is worked at an inefficient speed, the most efficient speed for the propeller being quite different. Between the two the losses are quite sufficient to justify the use of electric drive.

The *Tynemount* has been equipped in an attempt to get est running conditions for marine propulsion out of a iesel engine. Steady and fairly high speed in the prime over is required, while for the most efficient use of the ropeller in a cargo boat both low relative speed and a fficient range of speed are necessary. A cargo boat is ot ordinarily a fast craft, and engines running at several ndred revolutions a minute are not best suited for the equirements. In the *Tynemount* the motive power is tained from two six-cylinder high-speed Diesel engines, ch coupled to a three-phase generator. The duplicate uipment gives, in the first place, a relay in case of break-wn and, in the second place, an extremely simple and genious method of obtaining reduced speed without loss efficiency. The two generators, which run at the same eed, have six and eight poles respectively. The propeller driven by an induction motor having two separate ator windings, one of thirty and the other of forty les. At normal engine speed these relations give the me synchronous speed of 80 r.p.m. at the motor. The ll-load torque of both engines is available. When re-ced speed is desired the six-pole generator is connected to e forty-pole winding of the motor, and the synchronous otor speed then drops to 60 r.p.m., at which the propeller ves proper load conditions for the single engine in opera-on. It will be seen that the conditions in the *Tynemount* e radically different from those found in the *Jupiter*. owever, the arrangements in each case meet the require-nt of high efficiency in the drive considered as a whole. e shall be very greatly interested in further reports of the tual results of tests on both these extremely ingenious d promising vessels. The possibilities of the turbine ship th electric drive, particularly for naval use, loom very ge, yet the oil engine deserves a good trial, and the in-duction of the electric motor certainly serves to free it m some of its disabilities.

## Indian Hydroelectric System

f building hydraulic transmission plants there is no end, almost of them, to tell the truth, present few features of aking interest, so thoroughly have the apparatus and thods been standardized within the last few years. The ght Indian plant which we describe this week, however, is n exception to this dismal rule. It is not only unusually la e and worked at the highest range of voltage but it pre-se s some very unusual features. The objective point is Bombay, and the situation of the hydraulic works is on the slo s of the great coast range known as the Western Ghats. Th range rises to a height of some 3000 ft., and rain fall-ing on its western declivity runs directly seaward. The southwest monsoon brings an enormous rainfall, and it is on the basis of the storage of this water that the hydraulic scheme has been carried out. The rainfall from thirty years' records on the watershed involved rises to the pro-digious figure of nearly 200 in. The first distinguished feature, then, of this plant is the storage during the rainy season of water on so huge a scale as to carry the plant over all the periods of low water. At the height of the rains there is ample power with very little reliance on the stor-age, but for the most part the artificial lakes are the source of the power. Use is made of three lakes lying nearly fifty miles a little southeast of Bombay. The first and nearest to the power house is peculiarly a storage basin for the in-equalities of the rainy season. The storage at this point is a little short of 500,000,000 cu. ft. Back of this minor reservoir lie two others. The first, about 35 ft. higher in level than the smaller reservoir, will impound more than 2,500,000,000 cu. ft. The third and greatest storage lake lies in a valley with an area of five square miles, and the storage when the lake is full will rise to the tremendous total of 7,000,000,000 cu. ft. This is by far the most elabor-ate and comprehensive storage scheme with artificial lakes which we remember as forming a part of a power develop-ment.

One of the interesting features of the installation is the provision made for regulating the speed of the wheels and protecting the pipe lines against sudden changes of load. The governors are of the oil-pressure type worked by servo-motors so closely set as to limit the variation to 2.5 per cent when quarter load is thrown off. The feature of the governors which is of particular interest is the provision made for taking care of both slow and rapid variations of load. Slow variations are very simply handled by a needle valve, thus economizing water to the utmost. On the occa-sion of a sudden variation due to loss of load the servo-motor of the governor operates the deflecting nozzle with-out at once shifting its needle valve, and then when the nozzle swings back regulation goes on as before. All dan-ger of excess pressure on the pipe line is thus removed. In case of increase of load the whole governing is quickly done with the needle valve.

It should be a matter of much pride to American engi-neers that although the hydraulic equipment and gen-erators are of European manufacture, India had to come half around the world to get the 100,000-volt transformers and switch gear of American manufacture. The transmis-sion line, too, although not supplied from our own country, bears the American earmarks, towers 66 ft. high on 500-ft. spans with suspension insulators. The receiving station is on the island of Bombay and is another monument to Amer-ican enterprise in transformer and switchboard construc-tion. The switch-gear equipment is very thoroughly worked out with all the modern devices for safety. The market for the energy is very largely the cotton mills, where there are more than 40,000 looms and some 3,000,000 spindles. Up to the present these have been operated by isolated steam plants calling for 100,000 hp. Now the electrically trans-mitted energy from the hills will be available for all of them. The system of drive which has been adopted in the mills is the group drive which simplifies the motor service. The motors themselves, being fairly large, are mostly wound for 2000 volts, although some 500-volt machines are in use. Energy is sold at 1.65 cents per kw-hr. when the electric in-stallation is wholly provided by the supply company and at 1.5 cents per kw-hr. when the mills furnish their own motors and equipment aside from the main transformers. Such prices look remunerative, even considering the great cost of the enterprise. Such are the main points of one of the most striking of recent hydraulic installations. Our read-ers will find its details well worth study.

# The News of the Week

**Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.**

## Boston Electrical Contractors Plan Get-Together Meetings

The Electrical Contractors' Association of Greater Boston is planning for the coming winter a series of "get-together" meetings along educational, social and co-operative lines. The first meeting was scheduled for Nov. 5, the speaker assigned being Mr. Alfred L. Cutting, manager of the Sheldon School of Scientific Salesmanship, Boston. The topic announced was "The Development of Human Efficiency," and more than 300 tickets were issued by the association, whose members employ several hundred wiremen and helpers.

## Electrical Inspection for Kentucky Towns

The Kentucky Actuarial Bureau, of Louisville, Ky., an institution of the insurance companies doing business in the State, has organized a department of electrical inspection with Mr. George W. Gano as superintendent. Mr. Gano, who took charge Nov. 1, was formerly with the insurance firm of Marsh & McLennon, Chicago. Inspectors under the new department are stationed at Lexington, Covington and Owensboro, and with the aid of the men in the Louisville office will cover the entire State. Mr. Clem E. Wheeler, manager of the bureau, reports that in Kentucky educational work to show the public how to protect its property from electrical hazards has been badly needed. Every town inspected will hereafter have special attention from an electrical standpoint.

## Water-Power Development on Skagit River

The Secretary of Agriculture has just granted to the Skagit Power Company a permit for the development of two water-power sites on the Skagit and Cascade Rivers in Skagit County, Washington, within the Washington national forest. It is stated by officials of the company that construction work on the Skagit project will be commenced within a comparatively short time. The construction will consist of a concrete diverting dam, 50 ft. in height, a tunnel conduit about 3.7 miles in length, and a power house on the Skagit River about 125 miles from Seattle. In developing power from the Cascade River the flow will be diverted by a concrete dam having a height of 20 ft. and a maximum length of about 200 ft. A flume and tunnel will carry the water a distance of approximately 6 miles to the proposed power house.

## National Industrial Survey

The National Civic Federation, through its industrial economics department, has decided to undertake a survey of the industrial and social situation in this country, with a view to ascertaining whether or not recent decades have produced progress or retrogression. One of the features to be included in this work will be an examination of the principles involved in the movement for the abolition of private ownership in the means of production and distribution of wealth. An advisory council of well-known men and women from all parts of the country is to aid in carrying out this important work. The proposed investigation will include an inquiry into the factors concerned in the production of wealth, the methods by which the wealth produced is distributed among the several factors engaged in its production, and the effect of the existing conditions on the first two items on industrial, social and individual progress.

## Proposed Rate Reduction in Chicago

Present electric-lighting rates in Chicago are based on a maximum tariff of 10 cents per kw-hr. and a second-rate of 5 cents. As the result of the rate investigation by the Commonwealth Edison Company carried on by the City Council committee on gas, oil and electric light, Miller Ray Palmer has found that a reduction amounting to about $636,000 a year can be made. Mr. Palmer has proposed that this surplus be distributed by the establishment of a tertiary or third rate, so that the standard rates would be 10 cents primary, 5 cents secondary and 3 cents tertiary. The company denies that the city has the right to regulate its rates, but nevertheless has been discussing the matter with Mr. Palmer and the City Council committee, and it seems probable that an agreement will be reached, either on the basis proposed or by making the tertiary rate 4 cents instead of 3 cents.

## Investment Bankers at Chicago

The second annual convention of the Investment Bankers' Association of America, held at the Blackstone Hotel in Chicago on Oct. 28-30, was a well-attended and successful affair. Considerable attention was paid to papers and discussions relating to the public utilities securities and financial problems. The committee on public service corporations, of which Mr. George W. Kendrick, of Estabrook, Clark & Company, Philadelphia, was chairman, presented a very brief survey of the conditions of state regulation of public utilities in this country. It was stated that there are commissions in twenty-four states. The report was non-committal, saying that it was still too early to pass on the final result of the work of these state commissions. The committee has made a compilation of the laws of the various states having public-utility commissions.

Mr. Samuel Insull, of Chicago, gave an interesting address on "Electrical Securities." He explained to the bankers his ideas of the proper method of conducting electric-service utilities and said that the item of paramount importance to them in considering the securities is the development of the selling organization of the operating company. His main message was to say that bankers and public service operators make a very great mistake in opposing state regulation of public utilities.

Mr. Delos A. Chappell, of Los Angeles, read a paper on "The Financing and Development of Hydroelectric Power." He described the hydroelectric situation in California from the financial point of view, and said that in that State the water-powers developed are rated at 2,000,000 hp. These are now owned by large corporations and about 700,000 hp is awaiting development. Many of those which remain must wait until there is such an increase in demand as will justify the increased cost per unit

f horse-power development. The water-power development in California to-day is equal to about 1 hp per each x inhabitants. Mr. Chappell urged more rational methods of financing than those at present in vogue. He believes that first-mortgage bonds should be issued under hat is termed an open-end or indeterminate mortgage. his avoids the objection of making a large issue long before the proceeds are required. Bonds may be issued from ear to year during the full period covered by the indenture.

Mr. John E. Oldham, of Merrill, Oldham & Company, oston, read a paper on "Public Utility Bonds," in which e showed by comparison with other forms of investment ie stability and desirability of this form of securities. Mr. ldham said that good public-utility bonds are first-class ecurities for investors.

Mr. George B. Caldwell, of the Continental and Comercial Trust and Savings Bank, Chicago, was re-elected resident of the association.

At the closing banquet Mr. James J. Hill, St. Paul, ttered a note of warning in relation to almost unlimited ond issues. He said that there should be less spending or purposes that can wait and less borrowing on any erms. The country, he declared, is waterlogged with onds and confidence cannot be restored until the name bond" has gone back to something of its old standard.

## nternational Society for Study of Radio-Telegraphy

At a meeting in Brussels on Oct. 13 a "Commission Internationale Scientifique de Télégraphie sans Fil" was stablished for the scientific study of radio-telegraphic aves and their phenomena. The president is Mr. W. uddell, of London; the secretary, M. Robert Goldhmidt, of Brussels; the vice-president, Prof. W. Wien, Jena.

On and after Jan. 1, 1914, at least until March 1, 1914, rtain test messages will be sent from a station in Brus- ls at hourly intervals, on a wave length of 3300 m. Check easurements of the wave frequency, group frequency, wer and other details will be made and recorded at ussels. Observers are invited to measure these signals, often, and at as many different places, as possible. It hoped that national committees may be regularly appointed to co-operate in the movement, the objects of which a to increase the knowledge of electric radiation and n corology.

he distance from Brussels to New York is in the ighborhood of 4000 statute miles, and to Chicago about so; so that the signals which one can hope to receive this country from Brussels are likely to be very weak. However, if the limiting distance at which these signals n be detected is determined in America, that fact will h significance and utility.

## Electrical Day at Dallas, Tex., to Be Made Permanent Feature

ch success attended Dallas' Electrical Day, held Oct. 31 connection with the Texas State Fair, that the feature is to be continued as a permanent annual celebration. ring the morning special trains brought hundreds of electrical men into Dallas from all parts of the State, but the ovian parade in the evening, with its illuminated floats, flaring torches and weird decorations, proved to be the ve of the day. Prominent in the procession were the float of the Dallas Electric Light & Power Company, reproducing the throne of "Queen Electricity"; the Southwes General Electric Company, showing an electrically lighted skyline of Dallas, and the Albright Electric Company which received first prize. An early horse-car with its old-time driver was exhibited by the Dallas Consolidated Electric Street Railway Company. Mr. R. W. Van Valkenburgh, grand marshal, was assisted by Mr. Leon Taylor, chairman of the parade committee, and Messrs. S. W. Davis, M. F. Sterett and W. J. Drury, marshals.

Following the parade a Jovian rejuvenation was held at which sixty-nine candidates were initiated into the order. The degree team, which occupied a float in the procession, was made up as follows: R. S. Wakefield, Waco, Jupiter; F. G. Caldwell, Houston, Neptune; E. F. Hall, Houston, Pluto; Tom A. Hunter, Dallas, Hercules; R. R. Farry, Dallas, Mars; E. A. Abbott, Dallas, Apollo; W. B. Head, Dallas, Vulcan; W. J. Drury, Dallas, Mercury; C. W. Thompson, Dallas, Avrenim, and B. Nelms, Fred L. Warner, Leon Taylor, R. W. Abright and Arthur Z. Barnes, imps.

At the joviation which followed the rejuvenation Mr. C. W. Hobson acted as toastmaster, and those who made addresses were Messrs. R. W. Van Valkenburgh, R. B. Stichter, J. E. Farnsworth, Edward T. Moore, W. W. Lowe and R. W. Abright.

## Electric Automobile Salon at Boston

At a meeting of the Electric Motor Car Club of Boston Nov. 3 President Day Baker announced that the first electric pleasure-car salon to be held on a large scale in this country will be opened at the Copley-Plaza Hotel, Boston, Nov. 17, under the auspices of the club with the co-operation of the Boston Edison company. In the ballroom of the hostelry will be held an exhibition of the latest pleasure cars on a plane calculated to appeal to the society man and woman. An admission charge of $1 will be made to keep the display and its attendance within close lines of interest, although a number of complimentary invitations will be issued by the pleasure-car dealers of Boston and by leading central-station organizations in the metropolitan district. Mr. Herbert W. Moses will be supervisor of committee work, and the chairmen of the various committees are: Exhibition, Mr. W. H. Francis; publicity, Mr. L. D. Gibbs; printing, Mr. Albert Weatherby; reception, Mr. C. J. Hatch; finance, Mr. J. S. Codman; signs, Mr. L. R. Wallis; music, Mr. J. S. Codman; police and parking, Mr. C. F. Smith, and invitations, Mr. O. G. Draper. In addition to the exhibits within doors effort is being made to secure special parking facilities for electric automobiles in the Copley Square district during the salon, which will close on Nov. 19.

## Boston-New York-Chicago Electric Automobile Run

What was perhaps the longest continuous trip ever made in an electric vehicle came to an end Oct. 31, when Col. E. W. M. Bailey, general manager of S. R. Bailey & Company, of Amesbury, Mass., arrived in Chicago in a Bailey roadster after a 1300-mile tour from Boston and New York. The car was equipped with a General Electric motor and sixty cells of A-6 Edison battery.

The travelers left New York City Sunday, Oct. 19, and during nearly the entire journey to Chicago the weather was unfavorable, high winds, heavy rainstorms, snow flurries and muddy roads being encountered. The trip was completed with no accident to the car nor failure of any part. While some of the days' runs were short and the speed slow, no better progress could have been made with a gas car. The car was mired four times, but came out under its own power in every case but one, when it ran off an embankment in the dark. Colonel Bailey reported that had weather conditions been good the run could easily have been made at an average speed of 150 miles a day. As it was, the average running speed up to Cleveland was better than 18 miles an hour.

Colonel Bailey was the guest of the Chicago Section of

the Electric Vehicle Association at luncheon at the Chicago Athletic Club on Nov. 1 and gave a graphic account of his trip. The distance covered by the car from Boston to Chicago was almost exactly 1300 miles. Central-station men were found to be uniformly courteous and obliging, but the charging facilities required were not always available without making special arrangements. In one case the vehicle was charged at a sawmill, and in another it was necessary to start up a 1200-hp engine in order to drive an exciter to get about 12 hp of energy into the little car. At Schenectady the car was charged from a mercury-arc rectifier using the new porcelain-lined iron tube.

The lessons of the journey seem to be that the electric vehicle is ready for touring, but that sellers of electricity should provide suitable charging means to meet the demands of electric tourists, which are rather more exacting than those of the operators of local electric cars. Facilities ranging from 40 amp to 200 amp should be sufficient for all requirements.

## Instability of Electric Circuits

Following a practice of several years' standing Dr. C. P. Steinmetz, of Schenectady, gave his annual lecture in Chicago on Oct. 29 before a joint meeting of the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers. Mr. R. F. Schuchardt presided and presented Mr. L. A. Ferguson, past-president of the American Institute of Electrical Engineers, who introduced the speaker of the evening. Among other things, Mr. Ferguson mentioned Dr. Steinmetz's versatility and alluded to his recent activity in public affairs and his candidacy for president of the Common Council of Schenectady.

Acknowledging the hearty applause of the large audience present, the lecturer announced as his subject "Instability of Electric Circuits." He discussed various situations where conditions of instability make themselves felt in electric circuits. Three main types of instability may be distinguished: First, the transients of readjustment to changed circuit conditions; second, unstable electrical equilibrium, or the condition by which the effect of a cause increases the cause, and, third, permanent instability resulting from a combination of circuit constants which cannot co-exist.

The closing of a switch gives an example of transient instability in electric circuits. Transients intervene for a limited period, usually of very short duration, between periods of stationary conditions. The phenomena of these transients have been investigated to a large extent, but often by the use of the constants of the "phantom" circuit. Theoretical constants are not always the constants of actual circuits. An allowance should be made for this fact. For instance, if voltage is suddenly thrown on a line the wave at the beginning has a very steep front. Theoretically this steepness remains the same throughout the progress of the wave over the line, but in practice this is not the case. Oscillations in cables die out more rapidly than the equations show. There is a wide field for investigation of these transient phenomena.

The second class of unstable conditions, said Dr. Steinmetz, includes conditions where there is an unstable electrical equilibrium. If the effect brought about by a cause is such as to oppose or reduce the cause, the effect must limit itself and finally stability will be reached. If, however, the effect brought about by a cause increases the cause, the effect will continue with increasing intensity; that is, instability results. This principle applies not only to electrical phenomena but to all other physical phenomena. The speaker discussed unstable equilibrium as shown in variations of load and speed in the operation of various types of electric motors. In most cases electric circuits are stable, but there may be unstable circuits. Probably the most important case of unstable electric equilibrium is afforded by circuits containing an electric arc. This characteristic is determining in the stability of arc-lamp circuits and machinery and is possibly responsible for more instability in electric circuits than any other phenomenon.

Circuits with permanent and inherent instability were the third class considered. As an illustration an ungrounded high-potential single-phase transmission line was considered. Assuming that a ground is brought near one end of the line but within striking distance of the voltage to ground, a discharge is supposed to occur over some conductor, as by the puncture of a line insulator. Such an unstable circuit gives a continuous series of successive discharges.

Dr. Steinmetz illustrated his lecture with diagrams and devoted a considerable portion of his time to a consideration of the conditions of cumulative oscillation known as the hunting of synchronous machines. In the synchronous motor the torque is not a function of the speed but is a function of the relative position of the rotor to the impressed frequency. If the average synchronizing power resulting from the lag of the synchronizing force behind the position exceeds the average damping power, hunting results. The condition of stability of the synchronizing machine is that the average damping power shall exceed the average synchronizing power. The more this is the case the more stable is the machine; that is, the more rapidly the transient oscillation of readjustment to change of circuit conditions dies out.

## Accidentally Opened Valve Wrecks 12,000-Hp Power Plant

An accidentally opened valve on the steel penstock supplying water under 450-ft. head to turbines being installed in the 12,000-hp Pioneer Power Station of the Utah Light & Railway Company at Ogden, Utah, on Oct. 26, burned out the loaded machinery, flooded the plant and carried away portions of the brick curtain walls. A large portion of Ogden was thrown into darkness for several hours and street-car service was stopped.

Two addition S. Morgan-Smith 3750-hp Francis turbines had just been installed by the Lynch-Cannon Engineering Company. These turbines are supplied through 72-in. steel penstock with 24-in. double-faced Renssel: motor-operated valves at the turbines. Each face was in. thick, heavily ribbed. The 36-in. draft tube elbow had been removed from one of these turbines for inspecti. The 24-in. motor-operated valve opened, allowing water to rush past the wicket gates. This water cut power from the motors which operated the valve, and wh great difficult it was closed by hand. However, the ru of water carried away the rear half of the double valve: the front piece closed, holding the pressure for one minu; then it gave way, allowing the full flow through the 24- opening to continue for five hours, flooding the plant burning out the loaded machinery.

The main intake pipe was protected by a Builders' I Foundry 42-in. valve. The seat of this valve was a bro ring, which by some unknown means was broken blocked the valve, allowing it to close about one-half. main 72-in. steel pipe was protected by a 72-in. v operated by hydraulic pressure. This valve closed the pressure became balanced, leaving an opening of ab 12 in. No hand valve being provided at this place, e main intake valve at the head of the 6000-ft. wood-st pipe was closed by hand, requiring two and one-half ho The motor operating this valve was cut off.

The station building is a steel-frame fireproof struc having brick curtain walls. All steel work and foundat are intact. No accurate estimate of the loss can be d termined at the present time.

## State Commissioners on Telephone Rates and Service

At a meeting of the National Association of Railway ɔmmissioners, held in Washington from Oct. 28 to 31, a port was made by a committee on telephone and telegraph tes and service.

The report gives instances of telephone rates in cities here competitive conditions exist and also where monopoly ɔnditions prevail and states that scientific rate-making has ɔt been developed. Without question, the report continues, ɔmpetition has been the means of the public receiving rvice at a lower cost, but this does not necessarily mean at the rates are either reasonable or remunerative. Many ɔmpanies have entered the field of competition with low tes and in a short time found it necessary to get nearer e plane of their competitor, or, in some cases, the com-ɛtitor has met the lower rate, this nearly always resulting a consolidation of the two plants within a short period time. A remedy for these conditions is being sought by ɔth the public and the utility operators. There can be no uestion that duplicate plants in the same city are a waste money and a public burden. State control of such utili-es offers the best remedy for these conditions. Govern-ent control has not proved entirely successful. For ex-mple, the Japanese government had on March 31, 1911, ,000 persons on the waiting list for telephone service. here are now twenty-eight states exercising control over lephone utilities.

The question of establishing a scientific basis for tele-ıone rates is worthy of very deliberate consideration. Of e suggested bases of present worth or depreciated value, ɔok value or replacement cost, the one that is receiving ost favorable consideration generally at this time is the st-named. However, the committee deemed it best to frain from making specific suggestion and left the matter ien for general discussion or a specific report to be made l a special committee. The committee had little to say ɾative to telegraph rates and service further than that ɔm investigation there was apparently less complaint ɜainst this utility than against any other.

## Issenden Wireless Patents Upheld by Court of Appeals

n a lengthy but exceedingly interesting opinion handed dɯn on Oct. 20 by the United States Circuit Court of Aɔeals for the Third Circuit, in the patent infringement cɛ of the National Electric Signaling Company et al. vs the Telefunken Wireless Telegraph Company of the Uted States, written by Justice Buffington, the Fessenden Uted States patents Nos. 918,306 and 918,307 were up-he. These patents cover a method of wireless signaling an apparatus therefor, employing group impulses hav-ing a group frequency higher than commercially used alternating currents, but within the limits of audition. At the same time Fessenden's United States patent No. 92:171, relating to means for tuning the circuits of wire-les apparatus, was held to be void for lack of inventive ɔ ity.

e present case came up on appeal from the United Stɜs District Court for the Eastern District of Penn-sylvɔnia, where the plaintiffs lost. The decision of the low court is now reversed, and the case is remanded for a nv decree in accordance with the finding of the higher cou, and also ordering an accounting.

Tɛ primary object of the invention described in the two Fessenden patents first named, for which applications wer filed respectively on July 1, 1907, and Aug. 25, 1908, bothissued on April 13, 1909, was the prevention of at-mosɛeric disturbances in wireless signaling. The prior art nsisted of employing a spark frequency correspond-ing to an exciting current having a periodicity of 60 cycles per second, or 120 sparks per second. Under such conditions the interferences caused by atmospheric disturbances or lightning were very troublesome and frequently made receiving impossible. That is to say, such disturbances excited the receiving circuit and interfered with the audition of received impulses from the sending station.

Blondel, in patent No. 824,682, described an attempted means of overcoming such troublesome effects by employing a higher spark or group frequency in conjunction with a tuned receiving circuit, but such means were found by experiment to be unsuccessful. Fessenden was the first to make practical use of Lord Rayleigh's discovery, in which he claims to have been a co-discoverer, that the human ear, instead of being uniformly sensitive to a wide range of disturbing frequencies, reaches a peak or maximum of sensitiveness at about 920 impulses per second, decreasing rapidly with frequencies above or below this limit. Accordingly he employed a correspondingly high spark frequency, but coupled it with an ordinary untuned receiver and relied upon the natural or physiological selective power of the human ear to distinguish the radio signals from the atmospheric disturbances which had hitherto been so troublesome.

As the testimony abundantly showed, his method was highly successful, and whereas the extraneous disturbances could be heard in the receiving telephone as before, the shrill pitch of the new signals proved to be highly penetrating and easily distinguished even in the presence of disturbances of greater volume than the signals themselves. An exceedingly interesting account was presented in evidence describing the first transmission of such signals of high group frequency from the Brant Rock (Mass.) station during the night of Dec. 11, 1905, and their receipt by an operator at San Juan, Porto Rico, who reported the matter to the Bureau of Equipment of the United States Navy. The bureau undertook at once an investigation to determine the source and character of these new and novel signals, finally locating the station whence they emanated. The commercial value of high-frequency spark signaling was attested both by several well-known experts and a number of radio-operators. It was also shown that whereas a tuned receiver would respond at its natural frequency when excited by atmospheric disturbances and thus interfere with signaling, an untuned receiver when thus disturbed would enable the operator to distinguish sharply between the noise or disturbance caused by atmospheric discharges and the characteristic high shrill pitch of the incoming signals, thus clearly establishing the value of Fessenden's combination of high spark frequency at the sending station and an untuned receiver at the receiving station.

## Saturating the Dollar with Energy

Mr. Samuel Insull, president of the Commonwealth Edison and Middle West Utilities Companies of Chicago, addressed the convention of the Investment Bankers' Association of America in that city on Oct. 30, his subject being "Electrical Securities."

Early in his remarks Mr. Insull made the point that there are two classes of engineering influencing the electric-service industry. One is the mechanical and electrical engineering—that is, the engineering construction—and the other is first-class selling engineering. Referring to the first classification he exhibited curves to show the remarkable improvement in reduction of operating cost, comparing the relation of pounds of coal consumed to kilowatt-hours generated. From 1900 to 1904 the ratio of coal consumed in Chicago central stations to kilowatt-hour output was almost constant, but since then there has been a steady drop in the amount of coal necessary to produce a kilowatt-

hour. Only about 40 per cent of the coal burned per unit generated ten years ago is now required for the same output. To illustrate the engineering of selling, the speaker referred to a diagram showing that from 1896 to 1912 the business of the Commonwealth Edison Company had grown from about $1,000,000 a year to about $16,000,000, the latter figure being divided into $8,000,000 for lighting, a little more than $4,000,000 for industrial motor service and a little less than $4,000,000 for energy for transportation purposes. Curves were also given to show the reduction in rates for electrical energy in Chicago. Improvements in lamp efficiency helped decrease the cost of electric light.

Mr. Insull spoke of his work of the last ten years in relation to the wholesaling of energy in very large quantities, and he described the fight that has been made and is still being made to fill up the valleys in the load curve. Backed by the courage of a body of investors which has stood behind him for more than twenty years in Chicago, Mr. Insull has been enabled to try out several experiments, with the result that he has been able to bid for classes of business not until recently supposed to be handled by electric-service companies. The problem is to keep the investment working for as many hours of the day and as many days of the week as is possible. About 1902 this effort to fill up the valleys as much as possible was begun, and it was so successful that by 1912 the Commonwealth Edison Company was using its investment 31 per cent more of the time than ten years before. Notwithstanding what has been done in Chicago, it is probable that the company still performs only one-third to one-half of the possible electric-service business of the city. If the business is to be developed to the saturation point in other communities as well as in Chicago, the enormous amount of money that will be required to take care of the investment necessary can be imagined.

In the production of electrical energy the greatest item of expense is not the cost of labor nor the cost of coal, but the cost of money. First-class selling engineering makes it possible to get useful work from the dollar of investment for the longest possible time. Mr. Insull made the interesting statement that he thought that if he had to choose between first-class construction engineering and first-class selling engineering he would select the latter, as it would give him the use of more money on the dollar invested with which to make up for possible mistakes made in constructing engineering. The item of paramount importance in the financial aspects of the electric-service industry is not the replacement value of the central station or the distribution system, but it is the assurance that the selling organization of the company under consideration is of the highest possible order. Mr. Insull advised his hearers when dealing with the securities of a company to see to it that the methods are of the most enlightened nature so far as the selling of the product is concerned.

In the supplying of electricity the tendency is toward conservatism of investment. This fact is illustrated by statistics which show that in 1898, when the Commonwealth Edison Company had something over 5000 customers, the investment per customer was $1,579. In 1912 the number of customers was nearly 180,000 and the investment per customer had dropped to $417. In 1898 the annual gross income per customer was $210 and in 1912 it had dropped to $87. Elucidating these figures, Mr. Insull made a striking statement when he said: "While steadily reducing our price and endeavoring to put ourselves in closer accord with our customers, we have at the same time produced a greater saturation of the dollar with energy." The gross income was 13.5 per cent of investment in 1898 and 21 per cent in 1912.

Another interesting curve showed that from 1896 to 1900 the company was selling on the average energy that cost it about 12 cents per kw-hr. for a little over 10 cents. Nevertheless, the company made a profit, and this fact was largely due to the policy existing at that time of selling and installing isolated plants. However, it is a fact that at the time mentioned the company did not really know what it was costing it to produce electrical energy. At that time central-station companies knew so little about their business that they did not really know how to figure cost.

"If I were judging of the character of securities," said the speaker a little later, "I would lay the greatest stress on the general information which could be obtained in relation to the business policy, the ability to sell the product properly and the ability to get the best results out of the smallest amount of money invested."

Mr. Insull then went into the consideration of the diversity factor to show the advantages of concentration of production in supplying a large area with different demands as, for instance, the State of Illinois. If the lighting business, local and interurban railways, ice-making plants, coal mining, water-works pumping, drainage pumping and so on are supplied from the same source of energy, striking economies can be effected by utilizing the diversity factor. Small, uneconomical plants are bound to disappear. Securities based on these small plants must be taken care of of course, but centralized operation offers such a greatly extended field for industrial activity that it is possible to do this and also issue the new securities founded on the new business and the economies that may be effected by extended consolidation. Further, it is usually the case that small country properties are poorly constructed and inefficiently operated. Their absorption into the large system means better service for the community at a lower price. This in turn means increased popularity in the local centers and appreciation of the necessity for new securities.

In relation to holding companies, Mr. Insull said that the great danger here is the multiplication of securities and the creation of so-called prior-lien securities of the holding company based upon the junior securities of the operating company or companies. If the deed of trust underlying the collateral trust securities is rigid enough to protect the purchaser against the creation of a large floating debt by the operating company, there is no reason why the stocks of operating companies should not be put up as security for collateral trust bonds of holding companies. But this subject is one that deserves very serious consideration on the part of investment bankers. The mere creation of paper securities does not add anything to the actual cash invested in the companies. The dealer in securities ought to be fully posted as to the value of the property mortgaged and the relation of that value to the gross and also to the net income. If the difference between the gross and the net income is very great, the banker should look carefully into the relation that the company issuing the securities has with the community in which it operates.

Mr. Insull spoke earnestly also in relation to the subject of regulation of public utilities. He thinks that regulation is the best thing that can possibly happen to the industry. He quoted from his presidential address in 1898 to the National Electric Light Association, in which he advocated public control as the proper safeguard to the interests of consumers, taxpayers and investors. In the fifteen years that have elapsed Mr. Insull has not changed his opinion. Generally speaking, the creation of the numerous state public-utility commissions has been for the good of the industry and for the good of the securities based on the industry, as well as the good of the people in the communities served. In the principal cases where regulation has seemed to be unfriendly it will no doubt often be found that the men in control of the property have not had a proper appreciation of the underlying principles governing business. When an administrative board gets to understand its task, if it is made up of honest men it will give public utilities a fair return on the money invested provided that money has been judiciously spent and provided the business is judiciously conducted.

The great crime and waste of competition must be brought home by the establishment of commissions or some other form of regulation on the part of the various states. On this point Mr. Insull said: "My main message in speaking to the investment bankers of this country is to say that they and men in positions like myself make a very great mistake in opposing the fair regulation of an industry which can only be run as a monopoly, and no business should be run as a monopoly without a fair oversight on the part of the State."

The closing words of the address were devoted to the stability of electric-service investments. Mr. Insull said he did not recall any case where scrapping on the part of first-class engineers had ever been more than 25 per cent of the value of the property. The general tendency is toward increase in the value of materials entering into plant and equipment. Investors have little or nothing to fear from even such drastic scrapping as must necessarily take place in absorbing a series of isolated community plants into a large central system operating over a wide area.

Mr. Insull was heartily applauded by the bankers, and a rising vote of thanks was given to him.

## Relation of the Bureau of Standards to Commissions

In an address delivered before the National Association of Railway Commissioners at Washington on Oct. 29, Dr. Edward B. Rosa, chief physicist Bureau of Standards, gave an outline of the work of the bureau and of the directions in which it hopes to co-operate with state public service commissions.

Dr. Rosa said that the bureau has been making a study of some of the problems in public utility regulation, partly in response to a demand from the state commissions and cities which (in the absence of state commissions) regulate their own utilities, and partly in response to a demand for information from the operating companies and from engineering societies which are largely made up of representatives of such companies.

One of the first of these problems studied was the preparation of specifications for the quality of illuminating gas and gas service and methods of testing such gas. The results of this investigation are embodied in two publications, one recently issued in its second edition and the other now about to be sent to press. In the course of this work, in which the bureau had the co-operation of many of the most experienced gas engineers in the country as well as of several representatives of cities and state commissions, the problem was studied from the standpoint both of the user and of the maker of the gas. In fixing the heating value it is necessary to inquire what is the most economical quality of each different kind of artificial illuminating gas to make, assuming that the price is to be proportional to its heating value, within the range of heating value that will give good service. This study brought up the whole subject of gas making and gas distribution, as well as the testing for chemical impurities and heating value and candle-power. It demonstrated that it is not practicable intelligently to fix requirements for quality and service without taking full account of economic conditions and the variation of such conditions from place to place and from time to time. A thorough investigation was also made of the standards used for testing the candle-power of gas, and of the instruments and methods employed in taking the heating value of gas.

Another investigation that has yielded results of great practical importance, Dr. Rosa said, concerned the electrolytic corrosion of gas and water pipes and lead cable sheaths by earth currents due to electric railways. The bureau has made a very thorough study of the various proposals that have been made for applying protective coatings to such pipes and also for protecting them by bonding to negative busbars and by using insulated negative feeders from the track itself. In the course of this investigation the engineers of the bureau have made field examinations in many cities, both large and small, and with the co-operation of the gas, water, telephone and railway companies examined the pipes and made electrolytic surveys of earth currents. A complete system of electrolytic mitigation has been worked out for two cities and is being put into operation. The work has progressed far enough to demonstrate that the method may be successfully applied in many cases. This is a matter of great practical importance because hundreds of millions of dollars' worth of underground pipes and cables are subject to damage by electric railway current, and the bureau believes that the public service commissions can render a great service by seeing that the railways take such precautions as to reduce this damage to a minimum.

Such questions should be kept out of the courts entirely, and the bureau believes that when the engineering aspects of the subject are better understood street railway companies will generally be ready to co-operate with the public service commissions and to remove, as far as possible, the cause of the trouble. In two of the cities studied by the bureau it was found that the saving of electric power effected by the methods of mitigation proposed was enough to pay a fair return on the entire cost of the changes and new construction required, and the systems will be in better operating condition for the change. The work was conducted as a scientific investigation, although it was done in a thoroughly practical way and all conclusions verified by frequent reference to working conditions.

Another investigation of great practical importance recently undertaken is on the life hazard in electrical work. Manufacturers can help by improving the design and construction of certain kinds of apparatus; constructing engineers can help by using better materials in many cases and installing dangerous apparatus with greater thought of the life hazard; operating companies can help by educating their employees and by adopting stricter rules for their protection and providing them with more and better safety appliances; public service commissions and city authorities can help by adopting better regulations and having frequent inspections; the press can help by creating public sentiment in favor of attaching greater value to human life and warning the public of the danger. The operating companies and electrical engineering societies are cordially assisting the bureau in this investigation, and the bureau hopes to place some preliminary results in the hands of the public service commissions at an early date.

Another investigation of practical bearing to the public service commissions is on the instruments used in electrical measurements and the methods of testing. The traveling inspectors employed by the state commissions render the companies and the public great service by checking up the master meters of the stations. These meters are usually not very portable, and traveling inspectors who are prepared to test them and to give local inspectors information and assistance in their work render an important service.

For the lack of a sufficiently large scientific and engineering staff, the bureau has been unable to do as much as it would wish and has been unable to give the assistance to some of the state commissions which it has been asked to give and should have been very glad to give if possible. It is hoped that by another year the resources will be greater, and that the bureau can take up in a thorough and scientific way many other problems connected with the public utilities.

One of the most serious objections that have been urged to the regulation of public utilities by commissions is that if the same rate of return on the capital invested is allowed to all companies it removes in many cases all incentive to the responsible officers of utility companies for enterprise,

hard work and economy, and that in consequence both the public and the stockholders are losers and great injury is done the industries. As yet so little experience with rate-making has been had that one cannot say perhaps whether this has already occurred in some degree or not. Nevertheless, this is a tremendously important consideration, and it must not be ignored.

Dr. Rosa called attention to the fact that the California Legislature recognized the importance of the matter and provided for it in the public utility act of 1911 in the following paragraph:

"Nothing in this act shall be taken to prohibit any public utility from itself profiting, to the extent permitted by the commission, from any economies, efficiencies or improvements which it may make, and from distributing by way of dividends or otherwise disposing of the profits to which it may be so entitled, and the commission is authorized to make or permit such arrangement or arrangements with any public utility as it may deem wise and for the purpose of encouraging economies, efficiencies or improvements and securing to the public utility making the same such portion, if any, of the profits thereof as the commission may determine."

The State of Idaho embodied the same paragraph in its recent public utility law, and the still more recent Pennsylvania law expresses the same idea in the following language:

"It shall be lawful for every public service company . . to participate, to such an extent as may be permitted by the commission and deemed by the commission wise, for the purpose of encouraging economies, efficiencies or improvements in methods or service, in additional profits which may be afforded by such economies, efficiencies or improvements in methods or service."

These are clearly just and wise provisions if they can be realized. But the question at once arises, How shall the public service commission decide whether a given company has made such economies, efficiencies and improvements as to entitle it to additional profits? Standards of efficiency and economy must be set, and a given company claiming to have considerably exceeded the average and asking to be allowed to pay dividends higher than the normal must be judged by such standards. On the other hand, if a company is poorly managed, its performance will show it when measured by the same standards. Such a system would tend powerfully to promote economy and enterprise, and yield large benefits to the stockholders and the public. It is a flexible and just sliding scale, but to carry it out successfully requires an exceptionally well-equipped commission. Its realization would certainly constitute a long step toward the scientific regulation and control of public utilities.

But few state commissions can maintain engineering staffs large enough and able enough to do all that is required to realize such a scheme. If, however, the states could co-operate effectively in this work, so as to utilize their combined resources most efficiently, and with the federal government assisting and co-ordinating the work, it is possible that standards of economy and efficiency could be set and operating data determined that would be of vast service not only in enabling the commissions to act more intelligently and more justly but also in securing greater uniformity of action among the various commissions. The bureau hopes to be in position soon to do something in this direction.

To carry forward and develop the work of regulation in all the states will require the same constructive ability and the same earnest thought and hard work as have been displayed by those who have pioneered the movement. Without it, Dr. Rosa added, failure may follow, with a reaction in the public mind concerning the success of regulation by commission. With it success is assured from the outset in far greater measure than has yet been realized anywhere.

The benefits are not merely the material advantages accruing to the utilities and to the public which is served by the utilities, but also those accruing to the cause of good government and to business and political ethics.

The relation of the Bureau of Standards to the public service commissions is unlike that of the Interstate Commerce Commission in some respects and like it in others. It is like it in representing the federal government and in co-operating with the state commissions and striving to bring the latter closer together. But it has no legal authority over the utilities, holds no hearings of complaints and renders no binding decisions. Its work is primarily scientific investigation, some of which is theoretical and refined (such as fixing of primary standards and methods of measurement) and some is very practical and concrete, and includes many of the most interesting problems of present-day engineering. Dr. Rosa believes that there is an immense opportunity for usefulness in assisting to solve some of the problems presented by the public utilities, co-operating in this work with the state commissions and assisting them as far as possible to get full and reliable information, but not assuming any responsibility that belongs to them nor interfering in the slightest degree with their freedom of action. The bureau will thus serve in some measure as a clearing house for technical information and in some degree as an agency for scientific and engineering investigations.

The Bureau of Standards is still young and has not yet a complete equipment for all lines of work. Nevertheless, it is the largest national standardizing laboratory in the world and in many lines of work has an unrivaled equipment.

## Relation of Surplus to Rate-Making

Mr. F. E. Barker, chairman of the Massachusetts Board of Gas & Electric Light Commissioners, read a paper on the "Relation of Surplus to Rate-Making" at the meeting of the National Association of Railway Commissioners in Washington on Oct. 30. The paper was part of the report of the committee on railroad taxes and plans for ascertaining fair valuation of railroad property. In large part the report dealt with the general subject of valuation rather than with that of railroad valuation alone.

Mr. Barker said that whatever may be true under ideal conditions, it may be noted that in ordinary practice neither the existence nor the amount of surplus can be reliably determined by a cursory inspection of the company's balance sheet. "Surplus" there is found in the list of liabilities and is merely the difference between the total assets and the total liabilities as there stated. Either of the terms "assets" and "liabilities" may cover a multitude of sins. Items of property among the assets may be carried at figures above or below their actual value, according to the purpose and policy of the corporation. The list may include items of no real value, items which are mere fictions of accounting, or even those which indicate liabilities in suspense. It may or may not include those permanent additions to the plant which have been paid out of profits, or the unearned increment of value, either of which is sometimes of substantial importance. Neither, on the other hand, is the real surplus to be diminished or dissipated by liabilities, whatever their title, which are the mere creation of the accountant and are in fact only divisions of the actual surplus, whether appearing as capital stock or some other equally elusive designation. The analysis of the balance sheet suggested as necessary for the discovery of the real surplus involves no implication of intentional fraud or deception, since the actual conditions result more often from some theory sincerely held as to proper corporate methods or policies born of certain opinions as to business necessities or corporate rights.

A prudent management, even when considering only th

interests of the shareholders, will rarely divide among them all the annual profits, said Mr. Barker. Where it is considered inexpedient to issue new securities for plant additions unless such plant will add appreciably to earning power, conditions may arise that will call for investment in plant out of profits. Prices are fixed in advance and based upon certain expectations, while unexpected conditions of prosperity and growth may develop profits to which the management is unwilling to invite immediate public attention through a dividend declaration. Only a moderate amount annually so retained will in a series of years reach a considerable sum. Even where rates are determined by governmental authority, it is doubtful if they can practically be safely made with such closeness to expenses and maintenance as to prevent, under ordinarily competent management, the acquiring of a surplus unless it be dissipated in unreasonably or unexpectedly high dividends.

The conviction now widespread of the necessity of governmental regulation is ample evidence of public acceptance of the failure of the competitive theory for the adequate control of such concerns, and of their position as virtual monopolies. It is by no means certain that, under the schemes of regulation over steam railroads now so imperiously demanded by the public, some pooling arrangement, which of itself implies monopoly, may not be found essential, even where competition now apparently exists, to effect a proper public regulation.

By public service company is to be understood, Mr. Barker continued, not only a company bound to serve the public generally, but one performing a service which the public, or some political division of it, might perform for itself if it should deem such a course expedient for the public interest. When profit is to be received, but its amount is not fixed, from the very nature of the grant the mutual expectation must be assumed that the affairs incident to service will be managed with economy and efficiency, and that the compensation in the form of divisible profits will be fair and reasonable, but no more. The proposition may not have been formally considered in every case, but if considered at all could be stated in no other way. If more than reasonable compensation is in fact obtained, the public has to that extent been overcharged for the service furnished, although it may be not with deliberate intention. The fact of the surplus implies that this overcharge has been retained in the possession of the company. Where for any reason it has been dissipated or has disappeared is not the situation under consideration.

It may be at once conceded that the company is in the full possession and enjoys the legal ownership and use of this surplus and cannot be deprived of either. It may well be that its existence may be due largely to the skill and good judgment of the management itself. But, on the other hand, it should be noted that the actual direct contributions by the shareholders from their own individual funds compose no part of what is here termed surplus.

The practical problem necessarily arises as to how far the existence of a surplus creates new rights or new duties, either on the part of the company or of the public, with respect to the making of rates. There is a prevailing view that rate-making is properly, and in a monopoly necessarily, based solely on cost, and that a primary factor in that cost is the value of the property requisite to perform the service. Accordingly it is assumed that in fixing a reasonable rate, whether in the first instance by the company or upon proper proceedings by a public commission, an essential prerequisite is the determination of the amount and value of the property employed in performing the service. Viewed merely from this standpoint, no consideration of surplus as such enters into the problem, except that a rate is made is reasonably certain to produce a new surplus.

A surplus should be retained in the company's assets, Mr. Barker added. To distribute it among the shareholders would be as unjust to the public as any attempt by the public to wrest it from the company would be unjust to the shareholders.

In the present consideration it is immaterial whether surplus has been acquired in the ordinary and natural conduct of the business without special intent, or whether it has been deliberately obtained through charges made for the express purpose of its acquisition. Local conditions make inflexible rules for the use of the surplus impracticable, almost certainly inadequate, perhaps impossible. Much can often be properly used to extend and improve the service where the prospect of an immediate normal return upon the expenditure required cannot be clearly seen, yet where the convenience of the public will obviously be served. It may be used to encourage or aid in the development of new processes or methods of business, the wisdom of whose adoption can be conclusively determined only by actual experience. It may also facilitate reductions in rates where, in view of the ever-present possibility of changed conditions, there may be some lack of certainty as to what the result of a given rate will be.

Its existence will undoubtedly give added security to regular dividends, and it may even be used in part at least to increase, without prejudice to the public interest, the otherwise reasonable rate of return upon the actual investments by the shareholders from their individual funds. The existence and acquisition of such a surplus may, therefore, prove highly advantageous both to the company and the public, so much so that the public may find it expedient, reasonable and profitable to encourage by a proper recognition in the amount of divisible earnings permitted that quality of management which, while just to the public, will promote its development. While its existence should not be imperiled, unless with the promise of some advantage to the public, neither should it in any event or under any conditions be the instrument of increasing the otherwise reasonable burden upon the public.

Mr. Barker expressed the opinion that upon the various boards and commissions charged with the duty and responsibility of regulating these corporations must devolve in large measure the difficult task of determining those equities which are consistent with a sound public policy. Those which are involved in the treatment of the surplus are by no means the least of these. It must be the recognized duty of these boards to hold the scales of justice in equal poise with the company and the public with no purpose to embarrass or oppress and with no attempt to be vindictive on account of past corporate transgressions.

A liberal recognition by the management of the corporation of its public duty in respect to its accumulated surplus would undoubtedly be met by a more liberal public attitude to be evidenced in the action of regulatory boards. Properly understood and applied the principles involved will not hinder but, rather, stimulate enterprise and progress.

If it be claimed that this proposition vests too great authority and discretion in the regulating boards, it must devolve upon those who make the claim to show some other way by which a just relation can be attained.

From his own observations Mr. Barker did not hesitate to say that the correctness of the principles suggested herein was fully recognized a quarter of a century ago by the dominant interests in the public service companies of Massachusetts, nor it is altogether absent from the policies of many of the companies of to-day.

Other papers presented in connection with the report of the committee were by Dr. A. F. Weber, chief statistician New York Public Service Commission, First District, on "Depreciation and Its Relation to Fair Value"; by Dr. Robert H. Whitten, librarian-statistician New York Public Service Commission, First District, who discussed decisions on the subject of valuation issued by that commission; by Mr. Max Thelen, member of the California Railroad Com-

ission, on "A Just and Scientific Basis for the Establishent of Public Utility Rates"; by Mr. George A. Henshaw, ember of the Oklahoma Corporation Commission, on Elements of Appreciation in Railroad Valuations"; by rof. Edward W. Bemis, of Chicago, on "The Accounting ide of Rate-Making," and by Mr. Halford Erickson, ember of the Railroad Commission of Wisconsin, on Relation of Fair Return to Fair Value."

## cceptance Tests of Watt-Hour Meters in New York

New regulations governing the acceptance tests of watt-our meters have been issued by the New York Public ervice Commission, First District. They took effect on ept. 30 and superseded the rules prescribed in an order ntered by the commission on June 25, 1909. In the prepa-ation of the revised rules the commission states that it as substantially aided by the work done by the joint meter ommittee of the National Electric Light Association and he Association of Edison Illuminating Companies. In the ourse of the preparation of the revised rules it was pointed ut that should they be adopted by commissions in other tates, as has been done in the past, they would include any types of meters now in use by the operating com-anies, which were approved under the original specifica-ons adopted by this commission and which are still in use n the First District of New York. In order to obviate ny such results the commission provided that the revised ules and regulations should not be deemed to be retro-ctive, but should apply only to watt-hour meter types ereafter submitted for approval.

The specifications for accuracy of direct-current meters rovide for seven tests, relating to initial accuracy of reg-stration, effect of variation in voltage, equality of ele-ents in three-wire meters, effect of external magnetic elds, effect of variation in temperature, effect of temporary verloads, and voltage drop in series coils. The provisions overning the test for initial accuracy of registration are s follows:

"Item No. 1. None of the meters shall creep with 110 er cent of calibrated voltage.

"Variations in accuracy:

"To pass successfully test No. 1, the accuracy of a meter, fter running for at least one hour with 10 per cent of ated load, shall not deviate from 100 per cent by an amount xceeding that specified below.

"Conditions: The test shall be made at calibrated oltage."

| Item No. | Percentage of Rated Current | Maximum Deviation from 100 Per Cent. Shall Run Continuously |
|---|---|---|
| 2 | 2.0 | |
| 3 | 5.0 | 3.0 |
| 4 | [illegible] | 2.0 |
| 5 | 50.0 | 2.0 |
| 6 | [illegible] | 2.0 |
| 7 | [illegible] | 2.0 |

The difference between the accuracy at 10 per cent rated current and that at 100 per cent rated current shall not exceed 3 per cent.

The specifications for accuracy of single-phase induction meters provide for nine tests. The two in addition to those provided for direct-current meters are effect of variation in power-factor and effect of variation in frequency. The specifications for the test of initial accuracy of registration are as follows:

"Item No. 1. None of the meters shall creep with 110 per cent of calibrated voltage.

"Variations in accuracy:

"To pass successfully test No. 1, the accuracy of a meter after running for at least one hour with 10 per cent of rated load, shall not deviate from 100 per cent by an amount exceeding that specified below.

"Conditions: The test shall be made at calibrated voltage, rated frequency and unity power factor."

| Item No. | Percentage of Rated Current | Maximum Deviation from 100 Per Cent. Shall Run Continuously |
|---|---|---|
| 2 | 2.0 | |
| 3 | 5.0 | 3.0 |
| 4 | 10.0 | 1.5 |
| 5 | 20.0 | 2.0 |
| 6 | 50.0 | 2.0 |
| 7 | 100.0 | 1.5 |
| 8 | 150.0 | 3.0 |

The difference between the accuracy at 10 per cent rated current and that at 100 per cent rated current shall not exceed 1.5 per cent.

Specifications are also provided for the accuracy of polyphase meters.

Commissioner Milo R. Maltbie, in an opinion accompanying the order, says that the progress in the art of manufacturing watt-hour meters has been so rapid during the past four years that the requirements outlined in the previous order may now be revised and made more stringent.

These rules have been prepared by Mr. Clifton W. Wilder, the electrical engineer of the commission, with the assistance of other engineers in the department. The joint meter committee of the National Electric Light Association and the Association of Edison Illuminating Companies has made many suggestions that have been of great value and assistance. Extended use has also been made of the meter code of these two bodies.

Mr. Maltbie adds that the rules and regulations submitted should apply to all types of meters hereafter submitted for the approval of the commission. They do not require that meters installed with the approval of the commission should be removed. The order is not retroactive in effect, and, if any action is taken regarding the removal of meters now in use which do not measure up to these specifications a separate order should be adopted

## Public Service Commission News

### Massachusetts Commission

The Postal Telegraph-Cable Company has filed a complaint with the Massachusetts Public Service Commission against the New England Telephone & Telegraph Company, alleging that the latter, as a subsidiary of the American Telephone & Telegraph Company, is improperly diverting business to the Western Union Telegraph Company. It is contended that the New England company has purposely been delaying telephone connections requested by would-be patrons of the Postal company and has discriminated in favor of the Western Union company. The complainant urges that the identity of the telegraph companies be concealed in listed numbers in the telephone directory, and that patrons be required to look up the name and number of the desired company in dispatching messages.

### New York Commissions

According to the reports of the engineers of the Public Service Commission for the First District, there is now under contract $83,000,000 worth of work on the new subway lines of the dual system of rapid transit and an average daily force of 7000 men employed thereon. Of the $83,000,000 worth of work, about $38,000,000 is on lines to be operated by the Interborough Rapid Transit Company and $45,000,000 on the lines to be operated by the New York Municipal Railway Corporation. Of the latter, however, the Fourth Avenue subway in Brooklyn and the Centre Street Loop subway in Manhattan, costing together about $28,000,000, are practically completed. It is

estimated that the construction work on the city-owned lines will cost about $200,000,000. There is, therefore, more than one-third (to be exact about two-fifths) of the value of this work already under contract. Of the remainder, to cost $117,000,000, it is expected that more than one-half will be under contract before the end of the year, so that by that time, nine months after the signing of the dual system operating contract, actual construction work will be in progress on three-quarters of the city-owned lines

### Wisconsin Commission

The Wisconsin Railroad Commission has authorized the Water & Light Commission of the city of Fort Atkinson to amend the rate schedule prescribed by the commission for certain classes of consumers. The rates for power and heating consumers whose load is connected for six months or less are to be increased by 10 per cent of the fixed charge on the active connected load, except in cases where the consumers agree not to use power at times of peak load and take satisfactory measures to prove such times of use. Under the rates as amended, all consumers of a temporary nature who cannot be expected to be liable for the reconnection charge must pay for energy at the primary rate. The city is authorized to charge the same rates for heating and cooking as were authorized for power service. Where energy is used for such purposes, the active connected load is to be 90 per cent of the first 2 kw of nominal rated capacity, 65 per cent of the next 3 kw and 50 per cent of all connected load in excess of 5 kw.

The commission has denied the petition of the Ettrick Telephone Company for authority to extend its lines into the town and vicinity of Glasgow. The extension was opposed by the Western Wisconsin Telephone Company, which now serves the territory. The commission's investigations showed that a considerable portion of the Western Wisconsin Telephone Company's subscribers were urging the extension with a view of taking service from the petitioner because of the lower rates. It developed that the exceptionally low rates offered were made possible by an inadequate depreciation fund, the payment of low wages and the failure to keep up the system in first-class shape. The Western Wisconsin Telephone Company is earning about 7 per cent on its investment and is furnishing excellent service but could not afford to reduce its rates, as would be necessary if it had to compete with the petitioner. The commission held that the low cost of service on the part of the petitioner was not a sufficient justification for its entrance into the field as a competitor.

The La Crosse Gas & Electric Company has been authorized to issue $126,000 in 5½ per cent bonds. The proceeds are to be used in the rehabilitation of the plant, the purchase of new units and repairs and extensions for the hot-water-heating system. The total cost of new improvements is estimated at $157,600.

### Indiana Commission

Mr. Thomas C. Duncan, chairman of the Public Service Commission of Indiana, has just completed negotiations with Mr. Gilbert H. Hendren, state examiner of the Indiana State Board of Accounts, which have resulted in the establishment of a specific dividing line between the operations of the two big state departments in regard to investigations of all municipally owned utilities in the State. The commission's activities with regard to any investigation of municipal utilities that may be made will be devoted specifically toward collecting statistics for rate-making or service problems, and the particular city fund that any particular account is paid from will not enter into the commission's consideration, except as it affects rate-making or service. The commission in its statistics pays strict attention to the unit of cost, the resultant rate and the service; the State Board of Accounts treats the situation entirely from a bookkeeping standpoint.

# Current News Notes

Chicago Vehicle-Charging Revenue $200,000.—During a recent twelve-month period the income of the Commonwealth Edison Company from vehicle-charging service alone was $200,000. For the preceding year this revenue amounted to $130,000.

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Winnipeg's Municipal Hydroelectric Plant.—At the recent "municipal dinner" of the Chicago Association of Commerce Mayor T. R. Deacon of Winnipeg, Manitoba, said that his city had invested over $6,000,000 in its municipal hydroelectric plant. He added that the development was for 100,000 hp and that the city was able to sell energy to its citizens at 3 cents per kw-hr. If energy is taken in large quantities and under favorable conditions, the rate goes down to less than 0.5 cent per kw-hr.

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Chattanooga & Tennessee River Power Company's Station Complete.—On Nov. 13 the station of the Chattanooga & Tennessee River Power Company at Hales Bar on the Tennessee River near Chattanooga will be formally opened. The occasion is to be celebrated in Chattanooga with much pomp, government officials in high places having promised to take part. The development, which was started by the late A. N. Brady, is the largest in the South and represents an investment of approximately $9,000,000. It is rated at 65,000 hp.

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Little Falls, Minn., Celebrates.—Little Falls, Minn., gave a "white way and home-coming" celebration on Oct. 25. The celebration was in honor of the "white-way" lighting on Broadway, Second Street and other streets installed by the Little Falls Water Power Company. The system consists of 108 posts, each supporting five tungsten lamps. Sixteen city blocks are lighted in this manner. The rate paid to the company is $3.50 per month per post. Governor Eberhart attended the celebration and spoke in favor of the proposed public utilities commission for Minnesota. Mr. T. C. Gordon, of the Little Falls Water Power Company, was one of the other speakers.

* * *

Dr. Steinmetz on Railroad Electrification.—Two hundred and eighty men attended the meeting of the Electric Club of Chicago on Oct. 30 to hear Dr. Charles P. Steinmetz. In meeting objections which sometimes are made regarding the substitution of electric locomotives for steam, Dr. Steinmetz said that the former are economical only in large sizes, while electrical operation is most satisfactory where the load to be hauled is distributed among several trains whose schedules are arranged to produce a high load-factor. The development of a new product does not necessarily require the replacement of the old, but requires the reconstruction of old methods to conform with the new idea. In substituting electric locomotives for steam this idea should be carried in mind.

* * *

Inspection of Coon Rapids Plant.—By invitation of General Manager R. F. Pack of the Minneapolis General Electric Company, the Mayor and other officials of that city inspected recently the Coon Rapid hydroelectric development now under construction by H. M. Byllesby & Company on the Mississippi River near Anoka, Minn. The visitors were surprised at the magnitude of the work and the progress made and praised the modern methods employed for the housing and care of the large construction force. On Oct. 14 the Minneapolis General Electric Company made a new high record of output, the figure being 347,930 kw-hr., and as the business is increasing rapidly the additional energy that will be obtained from the new hydroelectric plant is needed.

Liberty Raises Its Voice.—The town of Liberty, Ind., has complained to the Public Service Commission of Indiana that it is required to pay more for electrical energy for street lighting than the neighboring town of West College Corner, although the electricity, as alleged, is obtained from the same source. The town of Liberty is supplied by the Liberty Light & Power Company, and it is charged that the same company, in the name of its president, Mr. Robert S. Ashe, is giving service to West College Corner. The complaint alleges that the source of energy in both cases is a generating station at Richmond, which is 14 miles from Liberty and 20 miles from West College Corner. It is said that the rate in Liberty is $4 a month for each 50-cp street lamp, while for corresponding service in West College Corner the rate is $3 a month.

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## SOCIETY MEETINGS

Colorado Electric Club.—Lieut. Ernest A. Brooks, U. S. N., addressed the Colorado Electric Club at its luncheon held at the Albany Hotel, Denver, Oct. 30, on the topic of "Uses of Electricity in the Army and Navy." Lieutenant Brooks was formerly on the electric-driven collier *Jupiter*.

* * *

Oregon Contractors' Next Annual Convention.—The next annual meeting of the Oregon Electrical Contractors' Association will be held in April of next year. The officers of the state association are: President, Mr. R. G. Littler; secretary, Mr. F. C. Green, and treasurer, Mr. J. R. Tomlinson, all of Portland.

* * *

Pittsburgh Jovian Luncheon.—About seventy-five members were in attendance at the weekly luncheon of the Jovian Order in Pittsburgh, Pa., last week. The letter of Mr. J. H. Collins to the recent annual Jovian congress in New York was read for the benefit of those who had been unable to attend the convention and was received with much enthusiasm.

* * *

Washington Section of Radio Engineers.—The Institute of Radio Engineers now numbers twenty-five members in Washington. At a recent meeting of the committee for the formation of a Washington Section it was decided to hold a meeting in that city on Dec. 3. Emil J. Simon, 81 New Street, New York, is secretary of the Institute of Radio Engineers.

* * *

Louisville Engineers' Club.—A reception and housewarming marked the recent opening of the new quarters of the Engineers and Architects' Club of Louisville, Ky. Club rooms have been fitted up on the fourteenth floor of the new Stark Building. Mr. G. Wilbur Hubley, chief engineer of the Louisville Gas & Electric Company, is a past-president of the club and also one of its directors.

* * *

Proposed Association of Electric Sign Manufacturers.—A meeting of electric sign manufacturers will be held in Chicago, Ill., on Dec. 1 at 10 a. m. in the La Salle Hotel for the purpose of organizing an association of electric manufacturers to promote electric advertising. Preliminary arrangement details are being looked after by Mr. H. C. Menefee, editor of *Signs of the Times*, Cincinnati, Ohio.

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Meeting of the Radio Engineers.—Dr. Lee De Forest presented a paper on "The Audion—Detector and Amplifier" at a meeting of the Institute of Radio Engineers held at Columbia University, New York, on Nov. 5. He discussed the principles of the operation of this device, described its use as a sensitive detector for radio communication and its more recent adaptation as a practical amplifier of exceedingly minute pulsating currents. The paper was accompanied by demonstrations of the apparatus described by Dr. De Forest.

* * *

Formation of Richmond (Va.) Society of Engineers.—A number of the professional engineers of Richmond, Va., met Oct. 16 and took the first formal steps for the formation of a local engineering society which will draw its members from all branches of engineering in that city. The present membership numbers fifty-three and a larger enrolment is expected. The officers chosen for the year are: President, Mr. Arthur Scrivenor; vice-president, Mr. James Bolton; treasurer, Mr. P. Parsons Pilcher, and secretary, Mr. Edwin Wortham.

* * *

Exposition by the Lumber Manufacturers' Association.—The National Lumber Manufacturers' Association is planning a "forest products exposition," with the object of exploiting wood, wood products, methods of use, and wood as a general commodity. The exposition will open in the Coliseum, Chicago, April 30, 1914, and will close May 9. It will then be moved to the Grand Central Palace, New York, where it will be open from May 21 to May 30. Mr. George S. Wood, 1621 Otis Building, Chicago, Ill., is manager of the exposition.

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Colorado Women's Co-Electric Club.—Early in the summer the wives, sisters and daughters of the members of the Colorado Electric Club of Denver organized "The Co-Electric Club" for the purpose of broadening sociability among the women relatives of local electrical men. The Co-Electric Club meets at some prominent Denver hotel on the second Thursday of each month, when luncheon is served followed by cards. So far three dances have been given by the women's club to entertain the members of the Colorado Electric Club. On Oct. 28 a "harvest home" dance was held. Refreshments and light lunch have been features of these entertainments. Each member of the Co-Electric Club pays dues amounting to $1 per year. Following is a list of the club's officers: President, Mrs. Benedict Shubart; vice-president, Mrs. W. A. Carter; recording secretary, Mrs. A. F. Traver; corresponding secretary Mrs. W. A. Roper; treasurer, Mrs. R. A. Lewis; monitor Mrs. E. W. Woodbury, and historian, Mrs. A. R. Cliff.

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National Association of Corporation Schools.—The National Association of Corporation Schools has been organized following a recent conference at the plant of the National Cash Register Company in Dayton, Ohio. Its objects are to develop the efficiency of the individual employee, to increase general efficiency in industry and to cause established educational institutions to introduce courses relating to industry. The association is composed of representatives of corporations which conduct schools for employees. Its officers are as follows: President, Mr. Arthur Williams, New York Edison Company; first vice-president, Mr. E. St. Elmo Lewis, Burrough Adding Machine Company; second vice-president, Dr. C. P. Steinmetz, General Electric Company; secretary, Mr. Lee Galloway, New York University; treasurer, Mr. E. J. Mehren, *Engineering Record*; assistant secretary-treasurer Mr. F. C. Henderschott, New York Edison Company. The executive committee is composed of Messrs. A. F. Barcwell, Yale & Towne Manufacturing Company; J. W. Hale, Pennsylvania Railroad; M. W. Mix, Dodge Manufacturing Company; E. C. Wolf, Curtis Publishing Company; William D. Kelley, Consolidated Gas Company; C. R. Dooley, Westinghouse Electric & Manufacturing Company; L. L. Park, American Locomotive Company; J. H. Rogers, National Cash Register Company, and Mr. Henderschott.

# The Electrically Operated Ship "Tynemount"

**Great Lakes carrier employing Diesel-type engine prime movers and Mavor multi-frequency alternating-current drive**

IN the field of naval architecture the electric propulsion and electric steering of ships are attracting an increasing measure of interest. Afloat as well as ashore the advantages of electric drive are still constantly unfolding, revealing economies and conveniences of operation unknown with the elementary forms of mechanical propulsion. On board ship electricity early found recognition as a safe means of lighting poorly ventilated quarters where fire is always a dread menace. Close thereafter followed the use of electric heating, so that to-day all the great ocean leviathans have their cabins equipped with resistor radiators.

But, aside from small boats propelled by battery power, electric drive was first suggested as a means for ship propulsion in order to couple the inherently high speed of the steam turbine with the stubbornly slow velocity at which the screw propeller has its highest efficiency. The advantages gained lie in greater flexibility of control and even the possibility of manipulation from the bridge. The Chicago fireboats with their turbine-driven direct-current generators and twin motor-driven screws are examples. These interesting vessels are in fact not only propelled but also steered through the busy Chicago River by their two motor-driven propellers. Alternating-current generators and motors have been used with success on the new electric-driven United States Navy collier *Jupiter*, described in these columns Aug. 3, 1912. On her sea trials this vessel recently made 14.78 knots per hour, exceeding her guarantee by nearly three-quarters of a knot.

### General Features of the "Tynemount"

The following paragraphs are devoted to an account of the electric-driven ship *Tynemount*, recently completed in England and designed for operation on the waters of the Great Lakes of North America. Measuring 250 ft. in length and 42.5 ft. in beam, with a 19-ft. draft, she is one of the largest ships to be thus far fitted with electric drive. Her prime-mover equipment is of the Diesel internal-combustion type, the engines driving alternators which in turn operate the special Mavor 500-hp motor which drives the single propeller.

Built as a freighter, the *Tynemount* has one steel deck and three cargo holds with seven large hatches. Forecastle and navigating bridge are located forward, and the poop aft. The machinery is also accommodated aft, beneath the poop. Use can be made of the ship's double bottom for carrying an extra supply of fuel oil in addition to the contents of the two tanks on deck forward of the poop bulkhead.

### Internal-Combustion Prime-Mover Set

The prime movers of the *Tynemount* installation consist of a pair of six-cylinder, high-speed, internal-combustion engines of the Diesel type, manufactured by Mirrlees, Bickerton & Day, Ltd. Each is capable of developing 300 brake-hp at 400 r.p.m. on the four-stroke cycle, the diameter of the cylinders being 12 in. and the stroke 13.5 in. The engines are totally inclosed, forced lubrication being employed throughout.

A substantial bedplate is provided, cast in two pieces which are bolted together and joined with the alternator bedplate at the flywheel end of the engine. The six cylinders are divided into two groups of three each, the vertical shaft which drives the cam shaft being placed between the two groups. The crank shaft is built in two pieces, the gear wheel which transmits the motion to the vertical shaft being bolted between the two flanges of the central coupling. These flanges are turned solid with the shafts.

The engines which are connected to the alternators by the usual couplings are placed on the forward end of the machinery space, on the port and starboard sides. A hand-lever barring gear working in an internal rack on the fly-



FIG. I—THE ELECTRICALLY OPERATED SHIP "TYNEMOUNT"

wheel provides for turning the engine into the starting position when required. Starting is effected by compressed air, the three cylinders at the flywheel end being fitted with starting valves. Their operation is rendered easy by a system of bell-crank levers and coupling rods transmitting the motion from a control pillar on the engine-room floor near the air receivers. Means for stopping the engine and

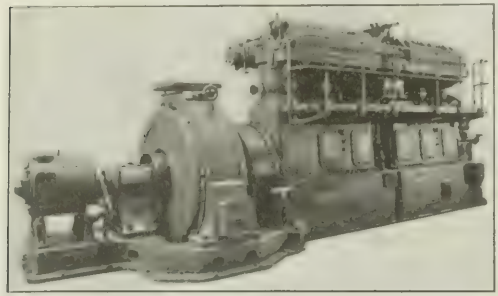


FIG. 2—COMBINED GENERATING SET

for controlling the amount of air delivered by the compressor are also provided on the same pillar. Near at hand also is the electric controller of the transmission system, the whole providing a compact and centralized arrangement for the operation of the propelling machinery.

At the rear of each engine is a three-stage air compressor, direct driven from a shaft extension which also drives the lubricating and circulating-water pumps.

The valves are situated in the cylinder covers and are operated by cams and levers. The fuel valves are of the ordinary needle type, and open upward, while the exhaust and air valves open downward. An important feature of the valve actuating levers is the provision of a hinged and bolted joint in each, which, by the undoing of one bolt, allows any lever to be folded back so that the work of withdrawing the valves is reduced to a minimum. All the valve seats are made separate from the cylinder covers and can be withdrawn bodily with the valves. Spare valves and seatings are carried, so that all grinding-in can be done on the bench at the engineer's convenience.

The pistons are of the trunk pattern and have separate

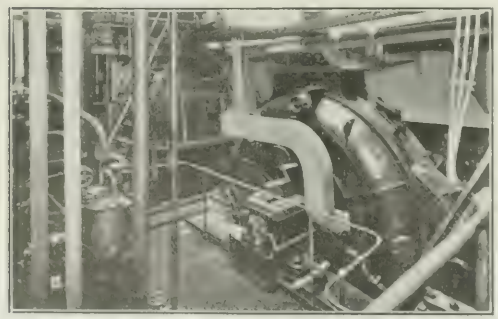


FIG. 3—REAR OF ENGINE ROOM, SHOWING PROPELLER MOTOR

heads. The top ends of the connecting rods are fitted with gun-metal bushes working on case-hardened piston pins.

The fuel pumps for delivering oil to the cylinders are situated on either side of the vertical shaft gear casing and are driven by eccentrics from the cam shaft. Each of these eccentrics operates a small crosshead to which are fitted the three plungers of each pump. Fuel oil is fed by gravity to the fuel-pump suction chamber from the "ready-use" tanks, which are situated on the forward bulkhead of the engine room. The amount of oil passing to the cylinders is determined by the governor, which is fitted on the upper portion of the vertical shaft. A system of coupling rods and levers connects the governor arm with a small spindle passing through the fuel-pump suction chamber. To this spindle tappets are fixed, which determine, according to the position of the governor, the length of time the fuel-pump suction valves remain off their seats. Until the suction valves are closed no oil is delivered to the fuel valves on the cylinder covers.

The two groups of cylinders composing each engine are carried by inclosed columns each cast in a single piece but provided with inspection doors of ample size. Access to the valves and valve gear is provided by grated patforms running the length of each engine.

The circulating water after passing through the engines goes to the exhaust pipes, which are also water-cooled. Thence it passes from each engine through a water-flow indicator into a branch fitting from which two pipes are led, one going to the discharge valve on the ship's side and the other to the suction side of the circulating pump.

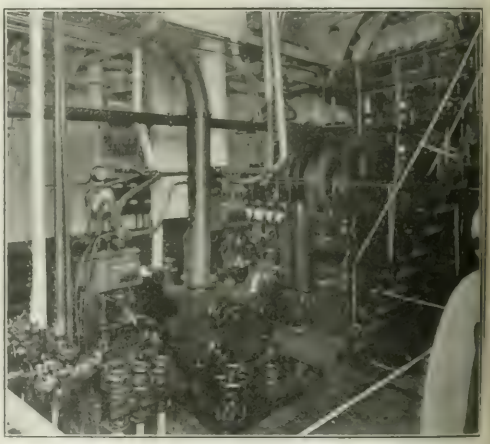


FIG. 4—ENGINE ROOM, SHOWING ONE GENERATOR SET

In this way when the ship is sailing in cold waters warm water can be mixed with the incoming water from the weed traps. When the ship is running in fresh water it will also be possible to pass the hot circulating water from one engine into the feed tank of the donkey boilers. When the engines have been stopped and are cooling off it has been arranged that the sanitary pumps may pass circulating water through them and thus lessen the chances of precipitation of salts or alkaline matter in the jackets.

### Alternating-Current Apparatus

The electrical equipment consists of two Mavor & Coulson three-phase alternators, each direct-coupled to one of the Diesel engines. The alternators when running at full load at their normal speed of 400 r.p.m. generate a pressure of 500 volts and currents of 270 amp per phase. They are provided with six and eight poles respectively, making the frequency produced by one 20 cycles per second and that of the other 26.6 cycles per second.

An exciter is directly connected to each alternator and is capable of giving an exciting current of 30 amp for ordinary operation, which can be increased up to 50 amp while maneuvering.

The output from these two generating sets is led to

500 brake-hp induction motor of special construction, built under the Mavor & Coulson patent. Its rotor is of the squirrel-cage type but the stator is provided with two different and entirely separate windings, one having 30 and the other 40 poles. When these two windings are supplied with current at 20 and 26.6 cycles respectively, they give the same synchronous speed of 80 r.p.m. The motor will then absorb the full power of both engines and drive the propeller to which it is directly coupled at a speed of 78 r.p.m. This propeller speed corresponds to the fastest speed of the vessel.

To obtain a slower speed the connections are changed so that the 20-cycle alternator supplies the forty-pole winding of the motor. The 26.6-cycle alternator can then be shut down, while the thirty-pole winding of the motor is also out of use. The synchronous speed of the motor with the propeller is now reduced to 60 r.p.m. Only one of the engines is now available, but as the speed of the ship is reduced to about three-quarters of its rate of travel, half of the total engine capacity is ample. In this way the great advantage is obtained of being able to shut down entirely that part of the plant which is not required at the low speed.

From the foregoing description it will be noted that the two alternators, when both at work, are connected to entirely separate circuits and that they are therefore never in parallel. Obviously, the paralleling of two alternators, necessitating that they should be run up to speed and synchronized before being switched onto the load, is quite unsuitable for ship work; for this operation not only requires skill and care but would involve considerable delay in starting the propeller motor.

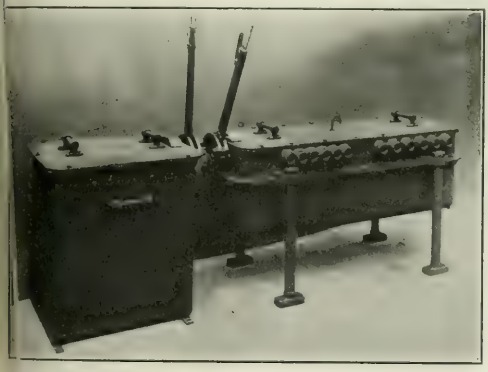


FIG. 5—SWITCH GEAR

In the case of the *Tynemount*, the motor is readily reversed by interchanging the connections of two of the phases.

### Switching Apparatus for Control

The switch gear which effects the necessary changes in connections is itself very simple, consisting of two parts. The main switch is of the railway-controller type having the five different positions, "full ahead," "half ahead," "stop," "half astern," "full astern." The second and smaller switch serves to introduce resistance into the shunt circuit of the exciter.

The contacts of both switches work under oil, but it is unadvisable that the contacts of the main switch should be required to break the large main current flowing to the motor. The two switches are, therefore, so interlocked that it is impossible to work the main switch except when all the resistance has been introduced into the exciter field coils. There is then practically no excitation and the whole system is "dead." With the resistance in the exciter field circuit, the main switch can be moved to any one of its four working positions, and when the main connections have been made for the new running position the shunt switch lever is pulled over so as to cut out the resistance and restore the excitation. Until the main switch is definitely on one set of contacts the shunt switch

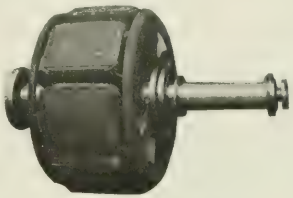


FIG. 6—ROTOR OF ALTERNATOR

is locked so that the excitation cannot be restored, thus eliminating possibility of burned contacts.

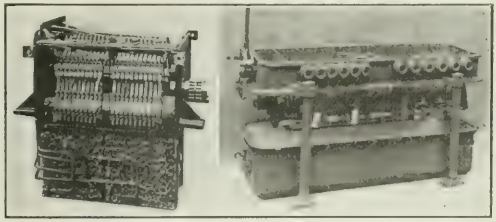
It is thus clear that the whole handling of the ship can be carried out by means of two levers which are so interlocked as to be practically fool-proof. In the case of the *Tynemount* these switches are installed in the engine room, but it is evident that by lengthening the connecting cables they could be placed on the navigating bridge.

The number of electrical instruments provided has been kept down to a minimum. There are one ammeter and one voltmeter for each alternator, and an ammeter and a voltmeter for each exciter. The handling of the switch gear is so simple that no necessity exists for multiplication of the measuring instruments.

Use of electrical drive enables the speed of the ship to be altered without altering the engine speed. It also permits a convenient gear ratio, enabling the engines and the propeller respectively to be run at their most efficient speeds, and also provides for the ready reversal of the propeller while the engines continue to run in their normal direction.

In addition to the above advantages, it is found that in many cases the electric system allows of a reduction in the machinery space and also in the bunker space required, thus increasing the cargo capacity of the vessel. As a subsidiary advantage it lends itself readily to distant control. In any case where advisable the switch gear can be put on the bridge and the control of the motor driving the propeller be put directly into the hands of the navigating officer.

The system of electric drive used is that designed by Mr. Henry A. Mavor. The *Tynemount* was built by Swan, Hunter & Wigham Richardson, Ltd., of Wallsend, to the classification of the British Corporation B. S., and to the order of the Electric Marine Propulsion Company, Ltd., a corporation formed to develop the system associated with the name of Mr. Mavor.



FIGS. 7 AND 8—EXCITER SWITCH REMOVED FROM CASE AND MAIN SWITCH WITH COVER REMOVED AND OIL TANK LOWERED

# 100,000-Volt Transmission Into Bombay, India

**Features of the Tata high-head development utilizing the 200-in. rainfall of the Western Ghats—Ultimate 66,000-kw system with cotton mills as principal load**

CONSERVING the phenomenal precipitation of 200 in. per year which falls on the lofty slopes of India's Western Ghats, and conducting this unfailing supply through an almost sheer drop of 2000 ft. to the 56,000-kw power house on the plains below, the great Tata water-power development will shortly be supplying hydroelectric energy to the ancient Parsee city of Bombay. Transmission over the 43-mile distance will be accomplished at 100,000 volts, the lines being carried on modern steel structures—Bombay's latter-day "towers of silence"—to adapt the title of those grim mortuary buildings, strewn with carrion, which are found to the northward of Malabar Hill.

Among the commercial applications of this imported hydroelectric energy, electric drive of cotton mills will demand large blocks of power. Bombay has eighty-three cotton mills, with 3,000,000 spindles and 43,000 looms, which are now operated by isolated steam plants aggregating 100,000 hp in rating. The Indian coal used in these plants costs about $5 per ton. Already, however, some 10,000 hp in electric motors is installed in India's textile mills.

While the Tata development which is the subject of this article is by far the largest undertaking of its kind in the peninsular empire, India has not been slow in the utilization of her natural water-power resources. Hydroelectric schemes have already been carried out in Mysore, Kashmere and Afghanistan. Of these the first named, which is on the Cauvery River, is the most important. With a capacity of 13,000 hp it furnishes energy to the towns of Mysore and Gangalore, respectively 35 and 60 miles away, and to the Kolar gold fields at a distance of 92 miles. The transmission-line pressure is of 35,000 volts. This system has been in successful operation for several years and is now being brought up to 20,000-hp capacity.

### System of Storage Lakes

The Western Ghats, India's famous coast range fronting on the Arabian Sea, rise precipitously in horizontal layers of trap rock to a height of 2000 ft. to 3000 ft. above ocean level. Rain falling to the west of this sharp edge runs down directly to the Arabian Sea, and it is on the collection and storage of the tremendous rainfall occurring annually during the southwest monsoon that the present water-power scheme is based.

Thirty years' records of this precipitation taken at stations in the center of the locality give a mean annual fall of nearly 200 in., or about five times the average fall in the United States. By storing this run-off in mountain lakes, a continuous supply is made available to operate the turbo-generators in the power plant on the plains, nearly 2000 ft. below.

The storage lakes and hydraulic works of the Tata development are near Lonawla, a hill station at the summit of the Bhor Ghat. The lakes have been formed by constructing masonry dams across the Lonawla, Walwhan and Shirawta valleys, as shown in the accompanying map. During the monsoon period, however, water will be used directly from the rainfall.

The Lonawla Lake is the storage basin provided for the "burst" and "breaks" of the monsoon, and has a capacity sufficient to provide water over the longest break on record. Two dams form this lake. The main dam is 3600 ft. long and 40 ft. high. The smaller dam, in which the sluices are

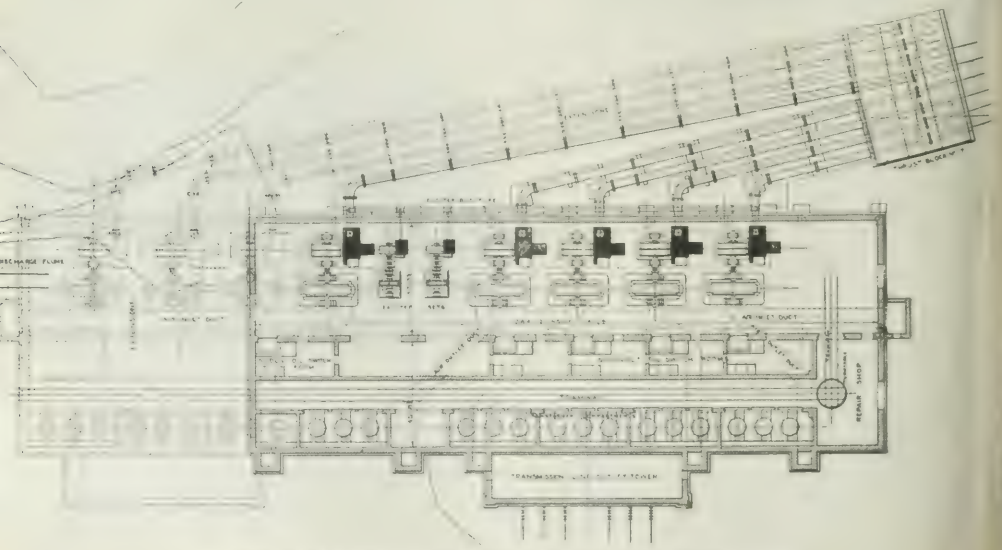


FIG. 1—PLAN OF HYDRAULIC AND ELECTRICAL EQUIPMENT, POWER STATION

located, measures 1900 ft. long and is 26 ft. above lowest level of valley across the headwaters of the Indreyani River. The area of this lake will be 986 acres, or 1.54 sq. miles, and the total capacity 466,000,000 cu. ft. in the 19-ft. range between outlet level and the full supply level at an elevation of 2051 ft.

For the rest of the year water will be drawn from the other two storage lakes. Malwhan Lake, near the village of that name, is formed by constructing a dam 4500 ft. long and 75 ft. high. This lake when full will have an area of 1535 acres, or 2.4 sq. miles, with a total capacity of 2,560,000,000 ft. between its outlet and full levels. Its full-supply level has an elevation of 2086 ft. above sea level. The dam will be provided with waste escapes and ample sluices of large dimensions, and the top will carry a footpath and a tramway with parapets on each side.

Shirawata Lake is the second storage basin, which is formed by constructing an 8000-ft. dam, 100 ft. high, across a valley to the north of Walwhan Valley. Its area when full will be 3174 acres, or 5 sq. miles, and its available capacity 7,102,000,000 cu. ft. The outlet will be at the same elevation as the full-supply level of Walwhan Lake, with which it will be connected by a tunnel 5000 ft. long through the trap-rock of the hills.

### Four-Mile Masonry Duct

From Walwhan Lake water is led to the forebay at the edge of the Ghats by a masonry duct, 4 miles in length. The difficult country encountered here has required the construction of numerous aqueducts, tunnels, cuttings and embankments, besides crossing en route the Bombay Poona road and the G. I. P. Railway. The duct has a total capacity of 120,000 hp and terminates at the forebay,

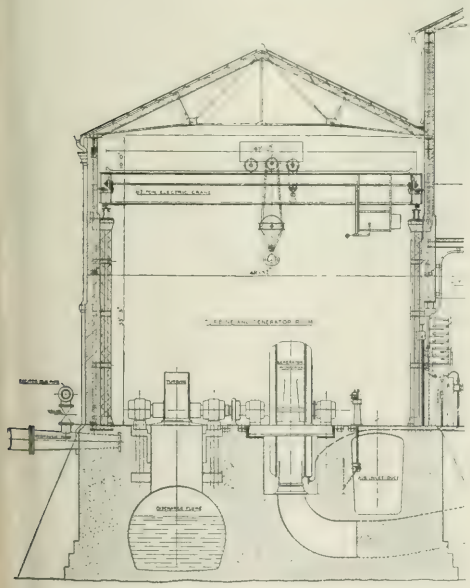


FIG. 2—SECTIONAL ELEVATION OF GENERATING STATION AT KHOPOLI

which is formed by masonry walls in a small valley at the edge of the cliff near Khandalla.

The duct from Lonawla Lake is 2150 ft. long and joins the Walwhan duct at a point 2.45 miles from the Walwhan dam.

Messrs. Pauling & Company, of London, are the contractors for the dams, ducts and forebay.

### Steel Pipe Line to Power House

From the forebay the pipe line, one of the largest ever built, conveys the water down the cliffs and steep slopes to the power house on the plains below, near Khopoli. This conduit has been designed in two sections, with two upper and eight lower pipe lines.

The initial installation (which constitutes half the

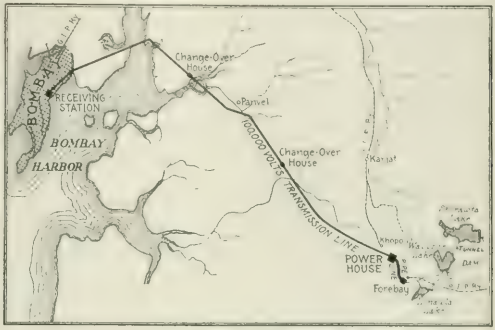



FIG. 3—MAP OF STORAGE LAKE AND TRANSMISSION LINE OF TATA DEVELOPMENT

scheme) will comprise one upper pipe line, a distributing pipe and four lower pipes, the total route length being about 13,000 ft., divided into 8200 ft. of upper pipe line and 4800 ft. of lower pipe line. The first section of the upper pipe line, starting at the forebay, is of riveted steel tube, 82 in. in internal diameter and 0.375 in. thick, while the second section is 77 in. in internal diameter and 0.375 in. to 0.8125 in. thick. The third section, ending at the distributing pipe, is of lap-welded steel tube 72 in. in diameter and 0.6875 in. to 0.8125 in. thick.

The distributing pipe consists of a bend and a straight pipe section, 72 in. in internal diameter and 0.9375 in. thick. Its length is about 46 ft. and it opens into five 42-in. branches.

The first section of the lower pipe line, starting from the distributing pipe, is of lap-welded steel tube 42 in. in internal diameter and 0.5 in. to 0.6875 in. thick. The second section, which sustained the greatest pressure of any part of the the pipe line, is of lap-welded steel tube 38 in. in internal diameter and 0.875 in. to 1.25 in. thick.

Both the riveted and welded pipes are made from open-hearth Siemens-Martin steel plates. The riveted type have tensile strengths between the limits of 28 tons and 32 tons per sq. in. and an elongation of 20 per cent. The lap-welded pipes have tensile strengths of 24 tons to 28 tons per sq. in. and an elongation of 26 per cent. The strength of the welded joints is estimated to be at least 90 per cent of that of the solid plates. The factor of safety of both the upper and lower pipe lines, calculated on minimum tensile strengths and maximum static heads, is not less than 4.5.

The whole of the pipe line is laid above ground, provision being made for variations of temperature from 50 Fahr. to 127 Fahr., by means of expansion joints. At these fixed points angle-iron rings are riveted to the pipes and anchored securely to the masonry by means of iron bars, the concrete thrust blocks being strengthened by reinforcement with I-beams.

The waste-weir elevation at the forebay is 2032 ft., and the power-house floor is 307 ft. above mean sea level, giving a static head of 1727 ft. with a corresponding pipe pressure of 743 lb. per sq. in. With four turbines developing 11,000 hp each, the total loss of head due to friction is approximately 66 ft. The pipe line will be capable of supplying water simultaneously to four 11,000-hp turbines

nd two 850-hp turbines, with provision for connecting an additional 11,000-hp turbine to the upper pipe line.

Messrs. Escher, Wyss & Company, of Zurich, are the ontractors for the pipe lines.

### The Power House at Khopoli

The Tata development has been designed for the ultiate installation of eight main units of 11,000 hp each,

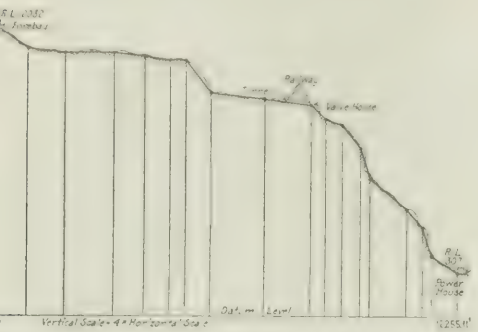



FIG. 4—PROFILE OF HIGH-PRESSURE PIPE LINE

wo exciter units of 850 hp each, eight banks of step-up ransformers of 10,000 kva each, and the necessary switch ear and auxiliary apparatus.

The power-house building, although capable of extension s required, provides at present for five main and two xciter sets, with five transformer banks and switch gear. The equipment now being installed includes, however, only our main units. The generator room, 254 ft. by 48 ft. n dimensions, is spanned by a 67-ton electric traveling rane.

Each waterwheel set comprises an 11,000-hp Escher-Vyss horizontal impulse turbine running at 300 r.p.m., oupled to a Siemens 8000-kw, 5000-volt, 50-cycle, three-hase generator capable of 20 per cent overload for ten ours. There are two exciter units, each comprising Escher-Wyss 860-hp turbines, running at 600 r.p.m. and oupled to 600-kw, 250-volt, shunt-wound, direct-current Siemens generators.

Four banks of step-up transformers will be installed, ach consisting of three 3333-kva oil-insulated, water-ooled, 5250/100,000-volt, 50-cycle, single-phase units, con-ected delta to delta and having 20 per cent overload apacity for ten hours.

The turbine wheels have cast-steel disks with cast-steel uckets. The shafts are of Siemens-Martin steel with two-ing lubricating bearings equipped for water cooling. The ast-steel nozzles are of the deflecting type. The govern-rs, which operate by oil pressure, are fitted with hydraulic utomatic servo-motor precision gearing which is guaran-eed to limit the turbine speed variation to 2.5 per cent, 5 er cent and 12 per cent respectively when one-quarter, alf or full load is suddenly thrown off.

Each deflecting nozzle is fitted in its inlet pipe by means f two bearings made water-tight on both sides by leather ollars. The servo-motor which actuates the nozzle con-ists of a casing with differential piston (of which the ower small piston is under constant water pressure and he upper large piston is under variable water pressure) nd a dash-pot connecting the deflecting nozzle and auto-natic speed governor, the needle only being rigidly con-ected to the governor.

In the event of a sudden closing movement, the servo-notor of the governor lifts both the lever of the main egulating shaft and also the dashpot. The discharge valve ocated immediately below the latter then opens a slot hrough which the water above the piston can escape. The piston of the servo-motor and the entire deflecting nozzle are thus lifted so that the jet is diverted from the runner wheel, the levers being so arranged that during this operation there is no movement of the needle to close the nozzle, thus guarding against an increase of pressure in the pipe line. The nozzle then begins to return to its normal position, the needle at the same time decreasing and closing the jet outlet. This movement follows automatically by the action of the dash-pot, the piston sinking slowly and closing the discharge valve situated below, while pressure water enters the large cylinders of the servo-motor. The latter's piston is thus forced downward, and the deflecting nozzle returns to its normal position. With a slow closing movement of the regulator the nozzle is not deflected, owing to the slow movements of the dash-pot piston, the needle being slowly operated directly from the regulator. With an opening movement of the regulator the nozzle is simply opened as in the case where no deflecting mechanism is used.

The thrust in the inlet bend caused by the deflection of the water is taken up by a thrust-plate fitted on the end cover of the outside bearing, the bearings being connected by four strong rods. The exciter turbines are tangential wheels with separately fastened cast-steel buckets and governors similar to those on the main units. The guaranteed full-load efficiencies are 82 per cent for the main units and 79 per cent for the exciter turbines.

### Electrical Equipment in Generating Station

The main generators have continuous full-load rating of 8000 kw, developing 5000 volts between phases. Their regulation at unity power-factor is 9 per cent and at 80 per cent power-factor 22 per cent. The guaranteed full load efficiency at 80 per cent power factor is 94.3 per cent. The Siemens Brothers Dynamo Works are the contractors for the generating plant and exciters, with Escher, Wyss & Company, of Zurich, as sub-contractors for the main and auxiliary turbines.

Each step-up transformer bank consists of three General Electric single-phase, oil-immersed, water-cooled, 5000-5250/100,000-volt, 50-cycle transformers designed for a full-load output of 3333 kva at 80 per cent power-factor. The water circulation required at full load is 950 gal. per hour. The guaranteed regulation at full load with unity power-factor is 0.8 per cent and at 80 per cent power-factor 4.6 per cent. The full-load efficiency at 80 per cent power-factor is 98.1 per cent.

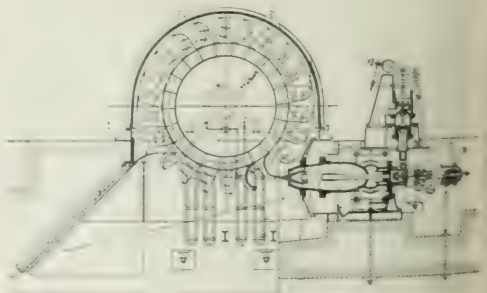


FIG. 5—SECTION THROUGH 11,000-HP TURBINE WHEEL

These transformers are of the shell type, having flat primary and secondary coils placed vertically and surrounded by laminated sheet-steel cores. The high-tension bushings are of the compound-filled pattern.

Following are the dimensions and weights of each transformer: Height to top of high-tension lead, 16 ft.; to cover, 13 ft.; diameter of tank, 8 ft.; weight, assembled and filled with oil, 24 tons; weight of core and coils, 11 tons

The amount of oil required for filling is 2300 gal., equivalent to 8 tons.

All switch gear in the Khopoli power house is electrically operated from a benchboard on the gallery overlooking the generator room at a point which will eventually be the center of the building. In addition an auxiliary switchboard for station service, exciter control, generator field-switch panels and signal apparatus are located on the generator-room floor.

The six-panel benchboard, built of blue Vermont marble, controls the four main generators with their step-up transformer banks, two exciters and the two outgoing 100,000-volt, 36,000-kva, three-phase lines. The exciter-switch panels carry single-pole solenoid-operated circuit-breakers and the generator-field switch panels double-pole solenoid-operated field switches. The generator-field series rheostats, the turbine governors and the air-duct shutters are all operated by 220-volt motors. The air-duct shutters are interlocked with the generator-field switches so that when the fields are energized the shutters will be open. The low-tension or 5000-volt buses are of copper-bar section.

In the transformer high-tension circuits to the outgoing lines automatic oil-break switches are employed, each circuit having three single-pole, single-throw solenoid-operated switches in iron tanks. Each of these switches has a rupturing capacity of 50,000 kva, automatic protection being afforded by means of series inverse-time-limit overload relays.

The 100,000-volt oil-switch room is located on the floor above the transformer compartments, all of this high-tension apparatus being connected up with copper tubing carried on post insulators. The layout of the wiring has been arranged for a spacing of 5 ft. between phases and a minimum striking distance of 3 ft. to ground. The lightning-arrester equipment is of the indoor type, the horn-gaps and cells being located in the transmission-line exit tower. Each outgoing line is protected with choke coils and 10000-volt, aluminum-cell arresters, complete with horn gaps, disconnecting switches, discharge alarms and discharge recorders.

The General Electric Company of America is the contractor for the transformer and switch-gear equipment installed in both the generating plant and the receiving substation.

### 100,000-Volt Transmission Line

The route of the transmission line from Khopoli to Bombay is shown on the map herewith. It starts at the power house at Khopoli and terminates at the receiving station on the island of Bombay, with a total length of 43 miles. En route the line crosses two tidal creeks (one 10,000 ft. wide and 42 ft. deep at high tide), a railway and several roadways. Ultimately there will be four transmission lines normally working in parallel, and carried on two lines of towers. Two "change-over" stations with disconnecting switches are provided, by which it is possible to divide the line into three sections for cutting out or interconnecting different sections as conditions demand. The present contract covers, however, only two transmission circuits carried in one set of towers.

The copper conductors used have a section of 0.095 sq. in. They are installed with a spacing of 10 ft. 6 in. between wires, and are carried on six-unit suspension-type insulators. The towers are of Siemens-Martin steel with a tensile strength of 28 tons to 32 tons per sq. in. They are built in two sections, a superstructure and a base, riveted together at the site. Three kinds are required—suspension towers, anchor towers and special structures for the creek crossings. In all, about 500 towers are used in the line. The suspension towers have been designed for the condition of any two conductors breaking, and the anchor towers for all the conductors breaking on one side. Wind pressures of 25 lb. per square foot were taken in making the computations.

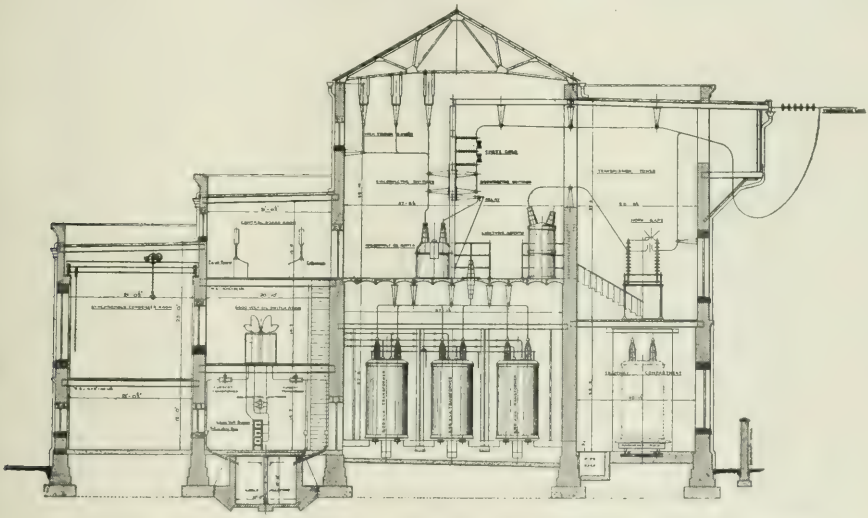


FIG. 6—ARRANGEMENT OF HIGH TENSION EQUIPMENT IN BOMBAY RECEIVING SUBSTATION

The standard towers are 66 ft. high and are spaced 500 ft. apart. The special crossing towers are spaced 1175 ft. apart and have a height of 160 ft. to comply with the government requirements that no part of the transmission line shall come within 80 ft. of the water at high tide. The sag of the wires is regulated to give a strain, due to their weight, of not more than one-fourth of the breaking load at 50 deg. Fahr. and the minimum wind pressure.

Each insulator unit is designed to withstand a direct mechanical strain of 3 tons and when tested under conditions of service must pass a test of 1.5 tons strain. Electrically each unit must also undergo a pressure test of 70,000 volts dry, and each assembled insulator 300,000 volts dry and 200,000 volts wet, without flashing over or showing defects.

The [illegible] for the towers and insulators are [illegible] Limited, of London, and for the copper conductors Felten & Guilleaume.

### Receiving Substation at Bombay

The receiving substation is located at Sewree on the east of Bombay, about two miles from the docks. It has been designed for an ultimate capacity of 74,880 kva in eight step-down three-phase transformer banks of 9,360 kva each.

The present building provides for five such transformer banks, four of which are now being installed. Each bank consists of three single-phase, oil-immersed, water-cooled, 9,360-kva-capacity transformers, rated at 3150 kva. The windings are connected delta to delta and the units are designed for continuous full-load operation at a temperature rise not exceeding 35 Fahr. above cooling water at 70 Fahr.

The switch-gear equipment is generally similar in design, arrangement and layout to that in the power house already described, and consists of remote-controlled electrically operated oil switches and other apparatus actuated from a centrally located benchboard. This benchboard, which is capable of extension as required, is of blue Vermont marble and contains twenty-three panels for controlling and

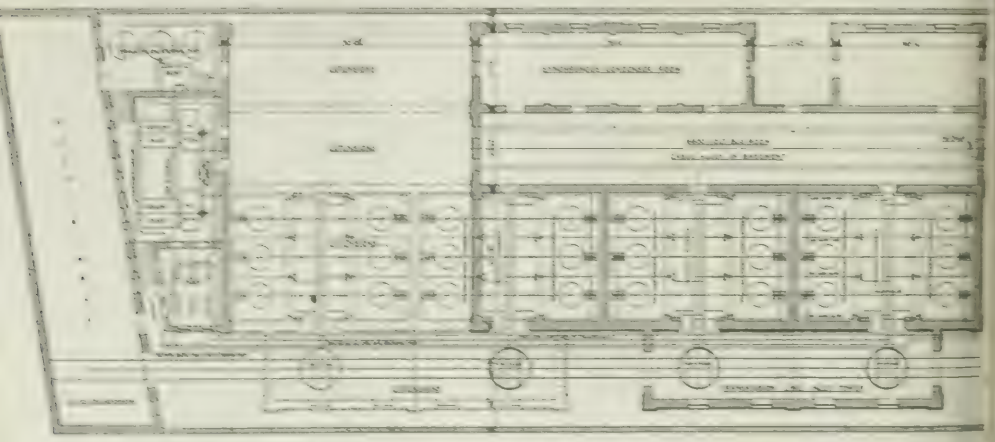


FIG. 7—GROUND PLAN OF RECEIVING SUBSTATION AT SEWREE, ISLAND OF BOMBAY

els and are energized from the secondary sides of current transformers. The secondary relays of the transformer circuits are arranged to trip both the solenoid and motor-operated oil-switches.

The auxiliary switchboard is also of blue Vermont marble and controls the 120-kva, 6600/220-volt station-service transformer bank. The station operating battery has a capacity of 60 amp for eight hours and furnishes 220-volt energy for the remote-controlled switches.

The low-tension bus system is arranged in compartments on the ground floor, the oil switches being located on a floor overhead and connected through blade switches and current transformers to the buses and to the cable distribution system by cables run on racks in a special alleyway. The low-tension sides of the transformer circuits are connected to the oil switches by varnished-cambric insulated, fireproof-taped cables.

Each incoming line is protected with choke coils and aluminum-cell lightning-arrester equipment. A ground bus runs the length of the station.

### Motor Equipment in Mills

It was in 1916 that Messrs. Tata, on behalf of the syndicate, first applied for power to carry through the present undertaking. The project was opposed, however, by the

hr., such consumption being separately metered and being also limited in quantity to 20 per cent of the energy supplied for motor drive.

The question of the best system of motor drive to meet the requirements of the Bombay industry was another problem which has been carefully investigated, many textile mills having been visited and the systems in use studied. After careful consideration the plan of group drive was recommended, using direct-coupled motors running at 290 and 365 r.p.m. These motors are of the 50-cycle, three-phase, slip-ring type and are wound for 2000 volts in sizes ranging from 50 hp to 500 hp. In special cases where the starting conditions admit squirrel-cage motors are employed in the smaller sizes. In some mills 500-volt motors will also be used.

The motors are designed to give full-load rating continuously at a temperature rise of 70 Fahr. in air at 100 Fahr., and also 50 per cent overload for periods of half an hour without injury. The motors at 290 r.p.m. have full-load efficiencies and power-factors ranging from 87 per cent and 74 per cent, respectively, for 50-hp motors to 92 per cent and 82 per cent for 500-hp machines. The motors at 365 r.p.m. have efficiencies and power-factors ranging from 86 per cent and 75 per cent for 50-hp motors to 92 per cent and 84 per cent for 500-hp sizes.

The three-phase feeder distribution system from the re-

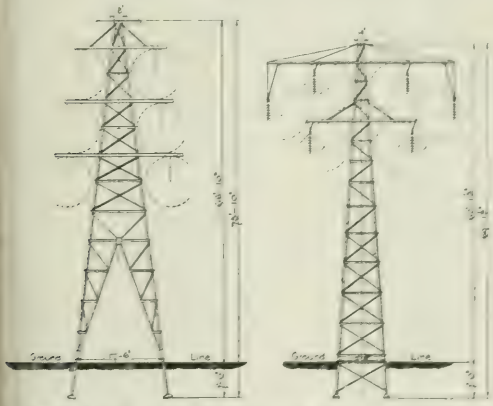



FIG. 8—ANCHOR AND INTERMEDIATE TOWERS 100,000-VOLT LINE

eiving substation to the mills is designed to operate at 6600 volts with ungrounded neutral, the cables being of the hree-conductor, paper-insulated, lead-sheathed type. They re installed on the "solid" system, being embedded in itumen in clay conduits.

### System of Ring Feeders for Emergency Use

For distribution purposes the mills are divided into roups, each group having a feeder to each mill besides a ng feeder for all the mills of the group, for use in case f emergency.

Three-phase, oil-insulated, air-cooled, core-type transformers are used for stepping down from the 6600-volt pply to 2200 volts and 550 volts. The transformers are ar-connected on both sides and are furnished in four andard sizes, 500, 600, 700 and 900 kva. They are designed to have a full-load efficiency of 98 per cent at 80 r cent power-factor, and a regulation of 2.5 per cent.

The standard customers' substation switch-gear equipment includes the high-tension buses to which the feeder rcuits and high-tension side of transformer circuits are nnected through disconnect links and the low-tension ses with their disconnect links current and potential transformers, wattmeters, etc. The motor circuits are run from the low-tension buses in paper-insulated, lead-sheathed cable to the switch pillars, and in single-conductor cable from the pillars to the motors. These switch pillars are of the ironclad interlocking design, each fitted with a triple-pole automatic oil-break switch with overload and no-voltage release, ammeter, potential transformer and isolating plug box. The interlocking design prevents accidental contact with live parts as the switch lever has to be in the "off" position before the pillar can be dismantled for overhauling.

The Callenders Cable & Construction Company, Ltd., is the contractor for the feeder system complete, the power-house and receiving substation connecting cables and the cables for wiring the mill equipments.

The British Westinghouse Electric & Manufacturing Company is the contractor for the mill equipments. The present order represents probably the largest mill-electrification contract ever placed, since it comprises sixty-four transformers aggregating 40,400 kva and 205 motors aggregating 36,150 brake-hp. An interesting feature of the motor equipment is that with one design of motor both single and double drive has been provided for. Sixty-four of the motors are arranged for inserting in the mill shafting and driving from both ends.

### Administration and Engineering

Credit for bringing into existence the development above described is ascribed to the foresight and energy of the late Mr. J. N. Tata and his sons, Sir Dorabji J. Tata and Mr. Ratan J. Tata. The elder Tata was first convinced of the practicability of utilizing the run-off from the Western Ghats for generating electrical energy as far back as June, 1899. Encouraged by the Indian and Bombay governments, with the aid of the late Mr. D. Costling, of Bombay, he continued his investigations down to 1905. In that year Messrs. Tata, Sons & Company sought the advice of Alfred Dickinson & Company, consulting engineers, of London and Birmingham, who were afterward appointed consulting and constructing engineers for the entire scheme. This firm has had the able assistance of Mr. R. B. Joyner in carrying out the hydraulic work, and of Dr. John Mannheim, Mr. H. P. Gibbs and Mr. E. S. Wollard Moore on the electrical section of the installation.

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## Company Defrays Cost of Employees' Schooling

Any employee of the Edison Electric Illuminating Company of Brooklyn may select any course at any school or college in New York City which will be of assistance in his or her work with the company and have the tuition fee, subject to approval of the company's scholarship committee, paid in advance by the company, the amount being deducted in weekly instalments sufficient to pay for the course at its completion. If at the end of the term the employee passes the examinations with a grade of 66 per cent or better, the amount deducted from the salary list will then be returned to the employee, the company itself defraying the cost of instruction. If, however, the grade received falls below 66 per cent, no refund will be made. Where an employee severs his connection with the company during the school year the amount paid for tuition, less the sum already [illegible] will be taken from the salary. Exception is [illegible] in the case of graduates required to take up unforeseen duties, owing to transfers within the company.

Last year [illegible] employees, male and female, signified their intention of taking courses of instruction under the conditions above outlined. Of this number [illegible] annually started and fifty-one of these students completed their courses successfully.

## Swiss and Italian Transmission-Line Construction

By Dr. Louis Bell

The first sight of the transmission lines in Switzerland causes a person familiar with American practice to take notice immediately because they violate all our holiest traditions. Wooden poles are used almost exclusively save for an occasional line with lattice steel poles, generally square and rather slender.

The wooden poles are at first glance a shock, but when you think it solemnly over you revise your hasty conclusions and see what really clever engineering they represent considering all the circumstances. The typical transmission line is of surprisingly slender and beautifully straight poles seldom over 10 m out of ground and often hardly more than 9 m. They are seldom cut pyramidal at the top but are roofed with neat sheet-iron stampings. The normal spacing is 35 m to 40 m only, and the poles seem hardly more than half the weight of our own and taper notably less. Cross-arms are a rarity. The ordinary scheme is to use three hook-shaped steel supports passing through the pole as bolts and carrying small porcelain insulators. Two such hooks are on one side of the pole and one on the other, forming an equilateral triangle much smaller than we would commonly use. The pole is not weakened by cutting gains, and the top is left free for the cap.

The poles are quite generally of pine, but treated by impregnation, as ours seldom are, and their life is reported as good, quite up to our own untreated cedar or chestnut poles. The philosophy of this construction is interesting. In that territory poles of the sort described are cheaper than with us and labor is also much cheaper. Hence the Swiss can afford to use light poles spaced rather closely, when our own cost of poles and setting demands, for economy, fewer and hence stouter poles and wider spacing. And with the lighter construction the strains on the insulators are less and the supports may be correspondingly lighter.

Incidentally they do not seem to fear lightning as we do. I have yet to see a ground wire installed, although there are plenty of simple horn arresters, usually mounted on the pole tops, to bear witness that thunderstorms are not forgotten. I wonder whether our high poles and great steel towers are not really considerably more exposed than these and whether they do not hence require greater and far more costly precautions. The difference in practice is really astounding at first sight. Moreover, for the same voltage the insulators in Switzerland are uniformly much smaller than ours, yet the net results seem to be good. One large system with a transmission length of nearly 100 miles had a record last year of only seven interruptions of service, totaling a few minutes over an hour. Comparing this with some American lines I could mention, it would seem that we have not learned everything about transmission, though I am bound to say that our climate is worse to contend with.

Swiss engineers have no use for the beautiful light steel A-poles common in northern Italy; wood is cheaper. At angles in the lines there is excellent bracing by auxiliary poles, and at railway crossings strong steel poles are in quite general use, this practice being as a rule obligatory. Voltages range on the whole lower than with us. There is one German 100,000-volt line, but even 60,000 volts is a rare pressure, most of the lines being of only moderate length. Our own very long lines over troublesome country have produced a special type of construction, very admirable for its purpose, but copied, I think, too often, in cases where it is really quite unnecessary and a much simpler and cheaper line would serve the purpose just as well with an equally high factor of safety.

Along the route from Lake Como to Milan, Italy, where transmission lines are very much in evidence, there is a transition from the Swiss type of construction with wooden poles to the Italian with light steel poles, as befits a country where timber is scarce. A few Italian lines are wooden, in the timber country, but on the plains steel prevails. The poles are of various types, A-poles, slender quadrilateral lattice poles and tubular poles, none of them high, mostly from 10 m to 12 m, and usually spaced from 40 m to 50 m, with insulators of porcelain that always seem small compared with ours for similar voltage. Sometimes there are two circuits on one pole line, but more generally only one. In Switzerland transmission poles bear commonly a bright red band; in Italy the white placard with a skull and crossbones is a common symbol, and many lines have a circle of downward pointing prongs to discourage climbing. Grounded wires above the circuits are conspicuous by their absence, and simple horn arresters are frequent.

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## The English Tramway and Motor Bus

From the railway point of view the motor-bus situation in England is getting to be a serious matter, and it is therefore particularly interesting to note the attitude taken by the English railway managers. An elaborate scheme for making England a network of motor-bus routes has already been put forth and serious work is being done to make it a reality. In viewing the situation one must realize first that in and about London the motor bus is an enormously important element in the transportation system at the present time. It is reasonably fast, reasonably commodious and covers a wide area of activity. Motor buses may be found running far out into the suburbs, nearly always loaded with passengers and doing admirable service in the general handling of traffic. Whether the "tube" receipts actually show the effect of the bus traffic in any noticeable degree is dubious since London is growing at such a rate that an increase in any transportation facilities merely decreases the congestion a little. Small grades and good roads, of course, help the situation immensely about London, but there is no doubt that the motor buses pay reasonably well and are of great value to the public. London would be in a bad way if the motor bus were to drop out of sight.

The railway managers are obviously somewhat alarmed over the situation, for the motor bus makes no such contribution in the way of taxes and upkeep of roadbed as does the railway. This freebooting feature of the motor bus traffic would be specially noticeable if a comprehensive scheme extending over a large part of the country were carried out. Local railways would then be put into sharp competition with buses having no local allegiance or responsibilities, and the result might be serious. In some instances local authorities who have the right to regulate traffic have interposed to prevent this piratical competition. Since it is a fact that the motor bus with its great weight and fairly considerable speed tears up roadbed at a very serious rate, one is inclined to the opinion that local authorities may very well lay the restraining hand on the new vehicle until such time as in return for its passenger-carrying rights it makes some adequate contribution to the upkeep of the roads on which its activities are exercised.

At the recent convention of the Tramways and Light Railways Association all sorts of opinions came to the front, but they may be best typified by taking the extremes. One railway manager took the ultra-conservative view and tried to build up a case for the probable failure of the motor bus from the standpoint of permanent financial returns. No one, however, who has seen the motor buses loaded with paying passengers following their routes through the streets of London can doubt for a moment that the motor bus has come to stay and has excellent possibilities of returns.

The running expense of the motor bus was stated by a London company last year at a little less than 20 cents per

mile. On a route with scant traffic this might mean failure, but for metropolitan service the case is quite otherwise. At all events the motor bus is young in the game and will undoubtedly be improved in economy. At present in the London service it gets only some 7.5 miles per gallon of gasoline, a figure which may not seem excessively low to those who are operating big "sixes" in this country, but which from the English viewpoint is scandalous. When one remembers that the English automobile makers specialize on high economy on account of the cost of gasoline and that one can buy light touring cars guaranteed to travel 30 miles per gallon, it does not seem unreasonable to expect that the gasoline consumption of the motor bus may be reduced.

The strongest point of the motor bus is its traffic load-factor, because a fleet—if one may use the word—of motor buses can be adjusted to fit the traffic over any one route, and buses not needed there can be immediately shifted into service wherever traffic promises. In fact, the underlying theory of the operation of the motor-bus system is to distribute the service when practicable so as to follow the requirements of traffic, and also to utilize the best available routes from the traffic standpoint. The case made out against the bus on economical grounds does not seem a very strong one when one looks a little forward to the traffic situation.

The reverse attitude was taken by the manager of the Sheffield Tramways, who is the president of the association. Instead of giving the bus the cold shoulder and groaning over its certain financial disaster, he extended a cheerful, if not absolutely joyous, greeting to it as a valuable and perhaps necessary adjunct in doing the transportation work of a city. His railway system saw the handwriting on the wall about a year ago and has operated ten buses since near the beginning of the present year. These buses are used on four regular routes, with a fifth one soon to be opened, and have proved reliable in service. They have now run over 100,000 miles. Moreover, it is expected that next summer a still larger fleet of buses will be put in service and that routes will be extended to meet the convenience of the passengers. Still further, it is suggested that it might be an interesting and valuable experiment to take an existing railway route, on which the traffic is known, and temporarily at least withdraw the car service and supplant it by motor buses, to the advantage of the residents in the lessened noise, the absence of rails and the probability of more frequent service.

Here are, then, two radically different and opposed opinions on the part of railway experts who have actually come to collision with the motor-bus problem. On the one hand, there is the view of conservatism, where doubtless the wish is father to the thought in the prophecy of financial failure. On the other hand, there is the view of the optimist who, seeing the possibilities for the community in a new kind of service, promptly takes it up, instead of waiting for a competitor to do so, and tries to make the most of its good features. Probably, as usual, the truth of the matter lies somewhere intermediate between the extremes.

The operating expense and depreciation of motor buses are not light. That improved construction will reduce these items is reasonably certain, but, on the other hand, the effect on the roads is so grave that undoubtedly charges must be added to the operating expense to cover this item, which sooner or later will inevitably come back on the operators of these fast and heavy vehicles. From reading the discussion and observing the conditions the impression left is decidedly favorable to the motor bus as an auxiliary, taking up as it does routes which for one reason or another may be impracticable for street cars and possessing wonderful capacity for following the movement of traffic as it shifts from hour to hour or day to day.

In America the situation with respect to operating costs is undoubtedly different from that in England. The roads are not so good and a much higher depreciation must probably be reckoned. Yet, looking at the matter in a broad way, it seems altogether probable that the motor bus will be an increasingly important factor in urban transportation where good loads of passengers can be regularly obtained.

## Central-Station Saving with Electric Trucks

For several years the Schenectady (N. Y.) Illuminating Company has had in its service a number of horse-drawn wagons, electric trucks and gasoline motor-tricycles used for routine handling and delivery duty. Including various renewal costs, replacing tires, battery, etc., over a period of thirty months, Mr. C. S. Van Dyke estimates the total operating cost for the 1000-lb. truck to have been $1,600 per year, of which $564 is represented by depreciation. For the 2-ton truck, with depreciation counted at $460, running expenses at $1,603, and housing at $17 per month, or $204 per year, the total cost was **$2,267 per year.**

The gasoline motor-tricycles were adaptations of standard motor-cycles and were used for meter-setting and other light haulage jobs. Considerable trouble was, however, experienced with the breaking of their frames until adequate reinforcing was added. With these tricycles an average of twenty-three and one-fifth jobs could be completed per day, at an average cost per job of $0.199, compared with $0.244 per job for horse-drawn wagons or motor cars.

On a daily basis the cost of keeping in service the various vehicles used by the Schenectady company was as follows, exclusive of driver: Two-ton truck, $2.71; 1000-lb. truck, $3.71; one-horse wagon, $1.26; line-wagon team, $2.71; three-wheel cycle, $2.21.

After study of these costs it was decided to replace altogether the existing horse and gasoline equipment by four electric trucks, using one battery-driven 1000-lb. vehicle to take the place of three single-horse rigs, and another, a runabout, in place of the motor-tricycles. To the 2-ton truck all heavy work was then to be assigned.

The cost of operating the 1000-lb. wagon under these conditions, including driver and helper, was estimated to be $1,922, while the horse-drawn vehicles had cost $2,510 per year. Here alone a saving of $587 per year was shown, representing an annual return of about 35 per cent on the investment. The light runabout was estimated to cost $1,748 per year. The work it now does was formerly performed by two motor-tricycles, which, with employees' car fares during breakdowns, cost $1,880 per year. In addition, $459 is credited from the maintenance of the emergency wagon, bringing up to $2,340 the former expenditure now obviated by the electric wagon. The resulting annual saving is therefore $591, or 30 per cent. In the case of the 1000-lb. electric vehicle which replaces the service wagon, electric operation, it is estimated, is costing slightly more than by the former method, but the electric wagon enables nine instead of seven services to be installed daily. It also avoids idle standing, so that here again a virtual saving of $577 is estimated, a return of 22 per cent on the $2,100 investment required.

The following table gives the mileage efficiency of the Schenectady machines in kilowatt-hours per mile:

| | Kw-hr. per Mile |
|---|---|
| 4000-lb. truck, lead cells | 1.20 |
| 1000-lb. wagon, lead cells | 0.69 |
| 1000-lb. wagon, nickel-iron cells | 0.85 |
| 500-lb. roadster, nickel-iron cells | 0.70 |

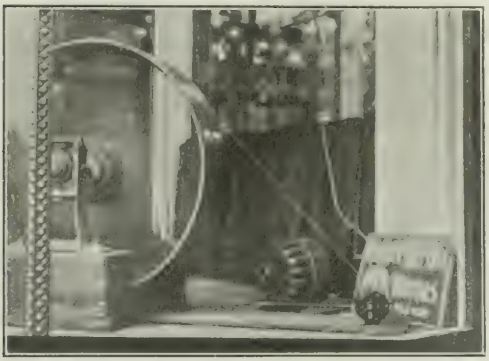
The truck and wagons average 22 miles per day, while the roadsters make 45 to 50 miles. The trucks are actually in service 280 to 290 days per year, while the roadsters are "ready" every day throughout the 365. Schenectady has 58 miles of paved streets, all within a radius of two miles from the business center.

# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## An Effective Motor Demonstration

To emphasize to the laymen the compactness and efficiency of the small motor as a source of power the Worcester (Mass.) Electric Light Company installed in one of its show windows a ball-bearing grooved pulley 4 ft. in diameter and of 8-in. face, which is driven by a 1/32-hp, 110-volt induction motor through an ordinary piece of twine.



WINDOW POWER DEMONSTRATION, WORCESTER, MASS.

The contrast in size between motor and load attracted much attention, the motor diameter being hardly one-tenth that of the pulley. Both were mounted on temporary wooden blocking in the window seat, and the ease with which the little motor started the huge pulley and brought it up to full speed after a stop occasioned much interested comment from passers-by.

## "We Have the Power"

The Business Men's Club of Sterling, Ill., through the efforts of the commercial department of the Illinois Northern Utilities Company, has adopted an unusual but striking slogan for attracting manufacturers to its city. This motto reads simply: "We have the power." The club has also contracted with Mr. C. B. Yonts, general contract agent of the Illinois Northern Company, for a 65-ft. sign to be erected on the bridge across Rock River. The letters in this sign are to be 4 ft. high and will be hung on a 2-in. mesh wire screen, 5 ft. high and 65 ft. long.

## Electric "Showers" for Brides

Bridal "showers" of linen, books, kitchenware, glassware and the like are familiar enough. But "showers" of domestic electric appliances are not so common, and the Nashville (Tenn.) Railway & Light Company wants to know why not. It is calling attention to the subject in its newspaper advertising. The bride of to-day, it points out very truthfully, faces housekeeping problems under new conditions. Electric cooking devices and other electrical conveniences in the home will go far toward solving these problems of the newly wed. So, says the wise and kindly Nashville company, give the young woman contemplating matrimony a "shower" of these aids to domestic happiness. Make it, it implies, a regular downpour of such things as percolators, disk stoves, flatirons, curling irons, fans, toasters, electric grills, chafing dishes, heating pads and the like.

## Electrically Driven Ensilage Cutters and Dry-Feed Grinders in Farm Service

On the Battle Creek Estate, not far from Muncie, Ind., motor drive has been applied to all farm machinery where savings seemed possible. The two illustrations herewith show some of the motors performing work at which they have proved particularly advantageous. In Fig. 2 is to be seen a 15-hp motor belted to an ensilage cutting and blowing machine, which cuts the green fodder into shreds and elevates it to the top of the 30-ft. silo. The induction motor, auto-starter and fuse blocks are mounted on a movable platform, so that when the services of the apparatus are required at different places on the farm a team may be hitched to the skids and the motor and starting apparatus transferred intact to the new location. Arrange-



FIG. 1—MOTOR-DRIVEN DRY-FEED GRINDER, BUCK CREEK FA

ments have been made for establishing service connections at several convenient points about the barn and surrounding buildings.

Although at present no cost data are available on this particular installation, tests made on a similar silo in an Eastern state showed that a steam engine and an engine could be hired to cut the fodder and elevate it into the c

tainer at a cost of $45 for a full charge. The same silo was filled the following year by means of a 15-hp electric motor operated by the farmer alone, at a total cost for energy of $16. It is estimated that with the equipment described above ensilage can be cut at the rate of 13 tons an hour.

Fig. 1 shows a small dry-feed grinder belted to the



FIG. 2—MOTOR-DRIVEN ENSILAGE CUTTER, NEAR MUNCIE, IND.

countershaft in the workshop on the Buck Creek Estate. An attachment to the shafting drives a small emery wheel. The motors on this farm are all operated from the circuits of the Muncie Electric Light Company. Sixty-cycle energy is delivered to the farm over a short three-phase transmission line at 2200 volts and is transformed to 220 volts for motor service and 110 volts for lighting.

## A Successful Flatiron Campaign

Under the direction of Mr. D. Kramer Gratz, representing the Electric Specialties Company of Lansing, Mich, the Indianapolis Light & Heat Company is conducting another electric-flatiron campaign, supplementing successful efforts of this kind in former years. The iron put out is known as the "Sta-hot," and the utensil is left with all domestic customers for ten days' free trial. If retained, the price charged is $2.75. The "campaign" began on Aug. 11, and up to Sept. 4 2472 irons had been placed and but 262 returned. Eleven per cent of irons returned is exceptionally low in placing flatirons.

## Increasing the Efficiency of a Truck Fleet

The economies obtained with motor trucks can be greatly increased if they are kept continuously at work carrying as nearly as possible their full rated loads. Delays at the platform are serious factors in the success of a truck movement. A large wholesale grocery house in Los Angeles, Cal. which recently installed a fleet of ten motor trucks has increased the earning power of the equipment 30 per cent by the following method of eliminating delays in getting shipments started from the establishments: Sectional half-bodies of equal size are employed. These box-like sections are fitted with wheels so that they may be easily trundled about on the various warehouse floors. Overhead on each of the floors are trolley beams running to and connecting with similar beams on a large elevator. After the half-bodies have been loaded with various goods for delivery on the warehouse floors they are suspended on an electric trolley which runs on the overhead beams. From points on the different floors the half-bodies are then carried to the elevator, lowered to the ground floor and run out upon the shipping platform. There they await the return of an empty motor truck, to which they are easily and quickly applied, the two half-bodies in each case making a truck load. As all loading and routing is done within the warehouse, the entire working day of each truck is employed in actual delivery operations.

## Increase in Tungsten Lamp Sales at Fort Wayne

The light and power department of the Fort Wayne & Northern Indiana Traction Company a year ago instituted a tungsten-lamp campaign with a view to reducing the free renewals of carbon lamps among the customers. Among the many advertising novelties found useful in this campaign, the demonstration board shown in the right half of the accompanying window display was considered one of the best. Mounted upon the board were successively a 10-watt, a 15-watt, a 20-watt, a 25-watt, a 40-watt, a 60-watt and a 100-watt tungsten lamp, while lower at the left was a 16-cp carbon lamp. Any of the lamps on the board could be operated through the meter, snap switches being provided for making the connections.

By this method of operation the relative energy consumption of any two lamps or any combination of lamps could be actually contrasted by interested customers who took the


6% INTEREST

is a fair return on your investments. A portion of your money can be used, however, to give you a return of

700% Interest

You can do this by replacing your old-style **CARBON LAMPS** with the new-style **MAZDA** or **TUNGSTEN LAMPS.**

For example: Suppose that you replace a 60-watt, 16-c. p. Carbon Lamp with a 25-watt, 20-c. p. Tungsten, and that you use this lamp 800 hours during the year.

| | |
|---|---|
| Investment (cost 25 watt Tungsten | $ .28 |
| Cost current with odd 16 cp. carbon .060x800x.08 | 3.84 |
| Cost current with new 20 cp. Tungsten .025x800x.08 | 1.60 |
| Total saving in Current | $2.24 |
| Less Investment | .28 |
| Total return on 28 cents Investment | $1.96 |

Could You Use Your Money To Better Advantage?

Fort Wayne & Northern Indiana Traction Company

1025 Calhoun Street : : : Fort Wayne, Indiana
Telephone 298 and 299

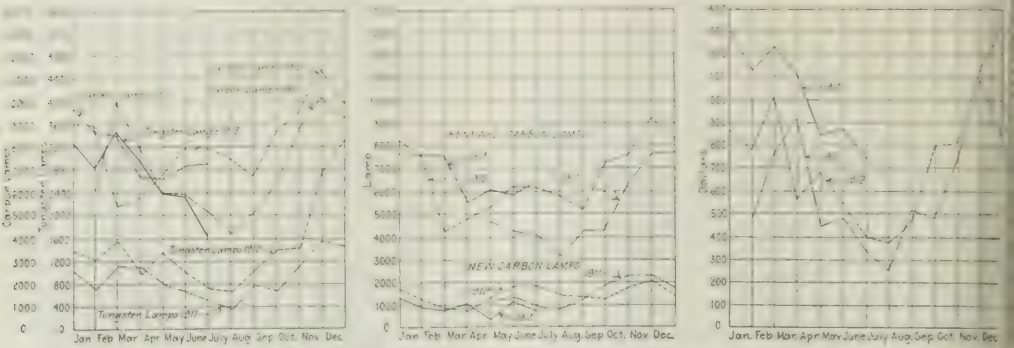

FIG. 1—ADVERTISEMENT USED IN TUNGSTEN-LAMP CAMPAIGN AT FORT WAYNE, IND.

time to watch the speed of the meter disks. A small placard above each individual lamp gave its rating and its price in plain and frosted types. When the window display was dismantled the lamp board was preserved and was mounted in the room of the sales department to be used for demonstrating various lamps to buyers who were in doubt as to the size they desired to purchase. The board has become

a factor in helping customers to decide against the carbon lamps in spite of the latter's free-renewal offer, for the speed of the meter disk connected to the 16 cp carbon filament lamp when compared with its neighbor measuring

advantage the benefits of the device which they were selling.

The sheet showing the total carbon and total tungsten lamps sold and renewed speaks for itself. The improved




FIGS. 2, 3 AND 4—CURVES COMPARING TUNGSTEN AND CARBON LAMP SALES AT FORT WAYNE, IND.

the energy taken by a 25-watt tungsten lamp presents a graphic contrast.

Syndicated newspaper advertising, interspersed with original advertisements worked up in the company's office, was also freely used to aid lamp sales. One of these advertisements which seemed to be particularly effective is reproduced herewith. The promise of a 700 per cent return on an investment set many lamp users to thinking and to figuring upon what saving might be effected in their own particular case. The results of this advertising are to be seen very clearly in the accompanying curve sheet showing the returns from lamp sales plotted against the months of the year. Although the curve for November shows but little gain in 1912 over the previous year, the continued upward trend of the 1912 curve and the break in the 1911 curve at Dec. 1 show that the spirit of enterprise was making itself felt. The 1913 curve, although following the general shape of the curves of the previous years, shows an increase in the volume of sales which was in advance of any former yearly increase.

Referring to the curve sheet which gives the number of carbon lamps renewed monthly and the number of new carbon lamps sold, it will be seen that the effect of the

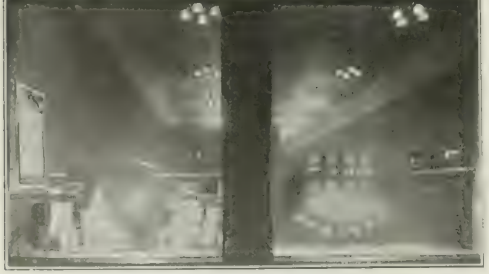


FIG. 5—WINDOW DISPLAY USED IN TUNGSTEN-LAMP CAMPAIGN AT FORT WAYNE, IND.

tungsten campaign made itself felt from the very beginning in the sale of new lamps. That the renewal curves for the latter part of 1912 are at all above those of previous years is ascribed to the fact that lamp and appliance solicitors in house-to-house canvasses have used inquiries regarding lamp renewals as a means of obtaining admittance to customers' houses in order to extol to better commercial methods have kept the tungsten curve for 191 well above all previous records, while the carbon lamp are slowly but surely losing prestige.

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## The Electric Vehicle and the Central Stations

The fourth annual convention of the Electric Vehicl Association of America, held at Chicago Oct. 27 and 2 was reported in a general news account appearing in th *Electrical World* of Nov. 1. Following are abstracts o several of the remaining convention papers of special ce tral-station interest, together with brief accounts of th discussion they caused.

### The Merchant and the Electric Truck

In his paper entitled "The Merchant, the Central St tion and the Electric Truck" Mr. F. Nelson Carle, Gener Vehicle Company, Long Island City, N. Y., said that ce tral stations have a great opportunity to aid in introducin the electric truck, since they act in no small degree as co sulting engineers to their local industries and communitie The confidence which the public already imposes in t central station should be capitalized in building up a d mand for the electric truck. In discussing the problem distribution the author emphasized the principle that t most economical method of distributing merchandise co sists not in the blazing of new trails but in utilization existing channels. Since the central-station company e joys both the local rate and the yearly-quantity rates advertising in the daily papers of its community, Mr. Ca urged that the company should use these mediums more popularize electric vehicles. In support of this content he added that advertisements signed by the central stati carry more interest and more conviction than those comi from outside manufacturers. The author commented up the educational work of the Electric Vehicle Association America. In closing he declared that if central st would look upon the 10,000,000 city horses as 10,000,0 small isolated plants, and pursue this problem with the sa energy as is devoted to real isolated plants, the mercha the central station and the electric-truck manufactur would soon all be doing a more remunerative business.

*Discussion*

In the discussion Mr. C. D. Marsh, of New York, e phasized the fact that the public has more confidence in electric-vehicle indorsement coming from the central s tion than in one from the manufacturer. Mr. E. Witherby spoke of the inconsistency which some cent

stations display toward the electric vehicle, adding that one company had just ordered eighteen gasoline trucks for its own use. Mr. Day Baker said that remarkable success in the sale of electric vehicles has attended the encouragement given by New England central-station companies. Mr. G. D. Smith, of Cleveland, suggested that the members of the vehicle association attend central-station conventions and present their views to the electrical men. He spoke of the results attained by committees in the Ohio and Indiana central-station associations, citing the establishment of vehicle departments by several electric-service companies in those States.

Mr. E. H. Hewins, of Boston, defended the central stations against the criticism offered concerning them. He recently visited forty cities and said that all of these central stations were assisting in the vehicle campaign. Mr. E. S. Mansfield, Boston, suggested that electric-service companies and vehicle manufacturers combine in campaign efforts rather than act individually. Mr. J. A. Hunnewell Lowell, Mass., advised that all central-station men be asked to join the Electric Vehicle Association, and spoke of his own personal efforts to keep Eastern companies informed of the work being done by the association.

### Electric-Vehicle Salesmanship

In this joint paper Messrs. George H. Kelly and E. J. Bartlett, of Cleveland, Ohio, declared that the important problem now presented to the association is one of cooperative salesmanship between the electric-vehicle manufacturer and the central-station operator. The authors believe that there has been entirely too much criticism of the manufacturer by the central station and of the central station by the manufacturer. The Baker Motor Vehicle Company recently instituted a plan which, it was hoped, would draw central stations and manufacturers together into a well-defined, systematic and harmonious relationship. The results, however, have been very discouraging. From 1400 central stations solicited but twenty replies were received, and not all of these were favorable. In commenting upon the opportunity of the association for reaching both parties to the controversy the authors included ten suggestions as an outline of the work which in their opinion the association might profitably carry on. Most of these suggestions were relative to circularizing the central-station field with electric-vehicle literature and matter of interest from the salesman's viewpoint. It was suggested that this canvass be made in the 228 cities having a population of more than 25,000.

### *Discussion*

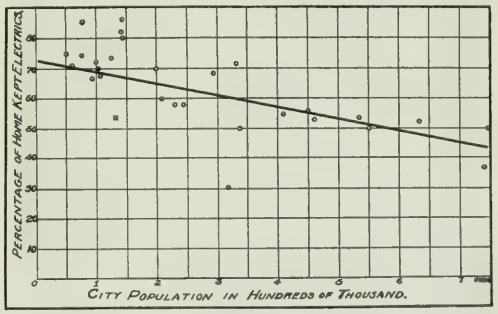
Considerable discussion followed, among those taking part being Messrs. C. K. Chapin of Memphis, F. C. Creager of Chicago, Hayden Eames of Cleveland, W. H. Conant of Washington, E. S. Mansfield of Boston, E. M. Jackson of Denver, E. E. Witherby of Chicago, and F. W. Smith of New York. Mr. Chapin suggested that it would be a good idea for manufacturers' representatives to visit the electric-service companies rather than ignore them. Mr. Creager believes that manufacturers should furnish the central station with more data on the operating cost of electric vehicles, as that is the subject in which the latter are most vitally interested. In answer to this Mr. Eames stated that considerable data have been furnished by manufacturers and published in technical journals. He mentioned articles which have appeared in the *Electrical World* during the last few years.

Mr. Jackson stated emphatically that the Denver Gas & Electric Light Company can afford to support a vehicle department, as the revenue from 914 vehicles was $6,720 during the month of September. He added that by allowing the head of the vehicle department to attend vehicle conventions and visit the various vehicle and battery factories his company is in a position to give its consumers excellent advice on the type of car to use and how to maintain it.

### Charging of Vehicles in Unattended Garages

Among the interesting curves presented by Mr. Maxwell Berry, of the Electric Products Company, Cleveland, Ohio, in his paper on charging equipment for private garages, was one showing the percentages of electric vehicles garaged at home in cities of various sizes. The figure ranges from 75 per cent in places of 100,000 population down to 45 per cent in cities of over 700,000 where land is more expensive and apartment-house and hotel life is more general. Expert attention is also, of course, more prevalent in public garages in the larger cities, explaining the tendency away from private stabling. The field of the private electric garage in smaller communities is therefore a large one and has not reached the degree of saturation observed in large cities.

For proper vehicle charging in an unattended garage it is essential, said the author, that the batteries receive a suitable current strength for a suitable period. Mr. Berry then passed to a description of standard charging methods, pointing out their advantages and drawbacks and closing with an account of the automatic "soakometer" control of a vertical rotary rectifier. A cut-off pointer on the voltmeter scale opens the circuit when the proper charge has been given. Occasional overcharging is automatically provided by a clock hand whose slow movement gives an adjustable soaking charge of fixed duration after the normal charge is finished. The presence of a short-circuited cell is indicated by the failure of the lower pointers to engage. Positive indication is also given when the charge has been completed, leaving no doubt that interruption has been caused by line troubles.




PERCENTAGE OF HOME-GARAGED CARS IN CITIES OF VARIOUS SIZE

### Standard Charging Plugs Discussed

On recommendation of the standardization committee the association voted to recommend as standard practice a larger plug in addition to the standard charging plug already adopted; also that the outside terminal be made positive and the inside terminal negative. The committee reported that it is considering standardization of tires, speed and mileage on one battery charge, automobile lamps and data sheets. Mr. Chapin, of Memphis, Tenn., declared that several operating companies have thought that the concentric plug was not what it ought to be. The subject should be considered in connection with the standardization of plugs for other electrical purposes, and the co-operation of the National Electric Light Association should be sought. "Yes, and that of the Society of Automobile Engineers also," supplemented Mr. W. H. Conant, of Washington, D. C.

Mr. Ralph Temple, an automobile dealer, of Chicago, gave a brief talk. He dwelt especially on the value of organization, which, he said, means education, and that is the groundwork of success. Mr. Temple believes in the agent giving free inspection service.

# Illumination and Wiring

## Decorative Lighting in a Theater

A decidedly novel method of lighting a London moving-picture theater is shown in the accompanying illustration. The method is interesting as showing how the indirect



INTERIOR LIGHTING OF LONDON THEATER

method of lighting can be introduced without giving rise to the impression of "flatness" of which some people complain.

It will be seen that the greater part of the light is derived from the illuminated dome. This dome has a blue and gold style of decoration, so that it gives, in a sense, the effect of an "artificial sky." It is lighted by twelve concealed 25-cp amber lamps. Round the dome is a ring of forty-eight amber lamps above diffusing glass disks. The remainder of the lighting is provided by concealed lamps, which also serve to illuminate the decorative painted panels in the background.

The objection of "something missing" sometimes urged against indirect lighting seems to rest on a psychological basis. People are so used to the idea of having a lamp in a room that when the room is lighted without any apparent source there is a feeling that the installation is somehow incomplete. The use of a dome, as shown in the illustration, seems to avoid this impression. The brightly illuminated dome surface is involuntarily accepted by a person entering the interior as being separate from the ceiling and itself constituting a source of light. The feeling of flatness is also skilfully removed by the use of the concealed lighting over the panels. Altogether the effect in this theater is decidedly novel. The lighting scheme was worked out simultaneously with the design of the building, and the installation shows what a decided advantage it is when the architect and lighting engineer combine in this way.

The use of a colored lighting effect (in this case, as stated above, the lamps are mainly amber, but some are orange) is becoming common in theaters. Besides its decorative value, this method seems to have another advantage. It separates the general lighting of the theater from the lighting of the screen. It is becoming usual in some of the London theaters merely to dim the lighting but not to turn it off completely while motion pictures are being shown. It may be suggested that when this is done the "color-separation" idea alluded to above has a certain value. It may be added that in this theater the lamps are turned on and off gradually by means of a dimmer. This practice should be generally recommended, for the abrupt shock caused by sudden switching on of the lamps in picture theaters is admittedly trying to the eyes.

The photograph shown in the illustration, which was taken entirely by the artificial light, illustrates the high degree of perfection to which artificial light photography has now attained. It is of interest to mention that the exposure had to be done in two stages, the central dome being illuminated for only a portion of the time. Otherwise an exposure sufficient to bring out the panels in the background would have been too much for the brightly lighted pattern in the interior of the dome and the detail in this part of the picture would have been lost.

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## Electric Service in a Department Store

For many months before Stern Brothers' new store on Forty-second Street, opposite Bryant Park, in New York City, was opened for business a huge electric sign on the front of the uncompleted structure told passers-by that the store was to be supplied with electrical energy from the mains of the New York Edison Company. At night the illuminated sign, centered on the broad face of the building, did much to call attention to the fact that the department store would soon move to its new home. Behind the doors shown in Fig. 1 are hung the three electroliers shown in Fig. 2. The fixtures are of bronze and all of the light is



FIG. 1—ELECTRIC SIGN IN FRONT OF STERN BROTHERS' NEW STORE BEFORE COMPLETION OF BUILDING

furnished from the twelve small globes suspended from the canopy of the unit.

The principal selling floors are lighted by a fixture shaped somewhat like an acorn. The bulb is provided with five sides, and each panel is made of a glass containing blue and opal hues so that the resulting light is much whiter than is ordinarily given by the tungsten lamp. In the top of the reflector is concealed an indirect ventilating device which

carries off the heat from the lamp without allowing light rays to play directly upon the ceiling. By this method streaks and spots on the white surface above are avoided. The height of the ceilings differs on the various floors, but all are approximately 17 ft. In all instances the lamps are suspended at a distance of 10 ft. from the floor, this height having been selected after several trials at different elevations. Two of the acorn units are hung in each bay



IG. 2—THREE ELECTROLIERS IN LOBBY OF STERN BROTHERS' STORE

nd spaced 11 ft. on centers in one direction and 21 ft. on enters in the other direction. Throughout the entire intallation 250-watt German tungsten lamps are used. The pper floors are lighted with tungsten lamps and open reectors. The showcase illumination is furnished by standrd I. P. Frink linolite units.

The cubical content of the building has been estimated to e approximately 10,000,000 cu. ft. and the total connected ghting load is about 750 kw. There are in all 280 lighting



FI 3—ACORN UNITS USED ON PRINCIPAL SELLING FLOORS

tits which supply the general illumination for each of the se ng floors.

he central-station services enter the building at three se rate points and the local feeders are distributed from se n groups of panelboards. All ceiling outlets are contrced from push-buttons located on panelboards. The showcases, which are fed from floor outlets, are locally controlled by switches at each case. The wiring in all pa of the building follows the standards used in all buildings of the present day, which have been described from time to time in these columns.

Seventy-seven motors, ranging from 1.5 hp to 35 hp in rating and aggregating approximately 1235 hp, are used to drive twenty-five elevators, ten dumb-waiters, a pneumatic-tube system, a vacuum-cleaning plant, a ventilating system, carriage calls and many other devices. Some of the freight elevators have been made large enough to accommodate the motor trucks of the firm, and the loaded vehicles are run into the elevator and taken to the desired floor for distribution of their contents.

The lighting fixtures and electroliers were furnished by Cassidy & Son, New York, and all wiring and installation was done by the firm of J. Livingston & Company, of the same city.

## Chauffeur's Reading Lamp

The electrical equipment of the modern automobile is generally so complete that it antedates popular demand, and the automobile manufacturer really educates the public to his standard of convenience. Occasionally, however, details have escaped notice and a car owner improves upon the factory product. Mr. Arthur Fox, of Brooklyn, N. Y., the owner of a Hudson car of the 1912 model, has added a portable electric reading lamp to his automobile which is interesting because of its diversified utility. The equipment consists of an 8-ft. flexible insulated conductor having at one end a miniature lamp, reflector and socket and at the other an attachment plug. The lamp is of the 6-volt type, and although of small candle-power, it gives sufficient light for reading or for examining the engine. The home-made reflector is permanently attached to the socket and is equipped with a screen for guarding the lamp. The attachment plug fits the socket in the side-lamp receptacle. For reading while waiting at railway stations Mr. Fox suspends the small lamp and reflector from the diagonal ribbons in the automobile top just above the wheel.

## Grounding to Water Mains in Arid Districts

In the southwestern section of the State of Texas, where rains are infrequent compared with the amount of precipitation enjoyed in other districts, the problem of obtaining adequate grounds for electrical purposes is often one of great difficulty. Mr. John A. Walker, of the San Angelo (Tex.) Water, Light & Power Company, reports that at San Angelo the plan of driving pipes into the earth and connecting ground wires to them has been tried, but in most instances it was found that the grounds thus obtained were not sufficient to carry off any considerable amount of current. After a prolonged season without rain the earth surrounding the pipe would soon become very dry and for all practical purposes almost an insulator. The surface soil, however, might be moistened by an occasional shower, so that under these conditions a very considerable difference of potential could exist between the end of the ground wire and the surface of the ground. The plan of burying plates of copper or cast iron deep in the earth was next tried, but with little better results.

The company then began to make use of the local water-main system, and its experience seems to show this to be the only method that is really satisfactory in this locality. In making the connections to the mains a 7/16-in. hole is first drilled in the hub of the pipe, the hole then being tapped out and refilled with a brass tap screw having a solder lug. As no current flows normally through this connection there is little possibility of trouble from electrolytic action.

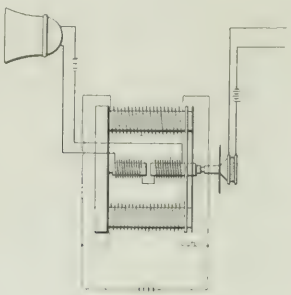
Considerable paving was laid in San Angelo during the last two years, and the company made it a special point to

[illegible] grounding wires put down in advance of this work, wherever there was any likelihood of needing such ground connections for present or future use. From its own experience the company further recommends having each ground wire well protected near the surface by passing through and being connected to a 0.5-in. pipe, which should extend up the pole about 8 ft. Otherwise the wire may break off or be cut near the ground line, a condition which, remaining long undiscovered, may introduce a serious element of danger.

## Recent Telephone Patents

A patent granted to Mr. W. P. Stung, of Lansdowne, Maryland, under the title "cushion for diaphragms" describes a spring-wire cushion piece to form the mechanical support of the diaphragm. A ring of spring wire bent into several different planes forms a cushion between the diaphragm and the usual peripheral seat. This device is used to improve the sensitiveness both in repeaters and receivers.

A method of constructing a repeater invented by Mr. C. Adams-Randall, of Boston, Mass., is shown in the accompanying illustration. The right-hand middle core is free to move, being supported solely by a thick spring strip, the end of which rests upon the poles of the magnet. The movement of this core under the combined influence of the various magnetic fields drives the movable electrode of the transmitting part.



NEW REPEATER

### Duplex System

A duplex system of telegraphy designed for the simultaneous transmission of two independent messages over the same wire in opposite directions is described in a patent granted to Mr. S. Kitser, of Philadelphia, Pa. There is no reciprocal facility but the circuit is designed to permit continuous transmission in both directions. The operation of the system depends upon maintaining the receiver terminals at equipotential for the instantaneous values as far as effects from the transmitter of its own station are concerned. To this end two induction coils, one of which is adjustable, are provided for the transmitter. Both secondaries are included in the line at each end, and the receivers are bridged across the terminals of the adjustable coils. As the coils at one end act simultaneously, adjustment of the auxiliary coil must be such that it raises the potential at the line terminal of the receiver just the amount that this would be lowered by the primary coil acting through the combined effective resistance of line and apparatus.

A step-by-step call system has been invented by Mr. O. N. Lindsey, of Senatobia, Miss. In this system each impulse serves to connect the call apparatus at one station while the succeeding impulse serves to disconnect it. Impulses of a different sort serve to release all apparatus and permit everything to come to the zero position when any accident occurs.

# Letter to the Editors

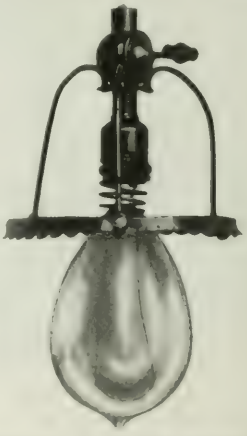
## A Veteran Incandescent Lamp

*To the Editors of the Electrical World:*

SIRS:—In your issue of Oct. 11 I read with interest a note on "A Veteran Incandescent Lamp," but I believe that the lamp I am sending you [shown in the accompanying photograph] can go the preceding instance "one better." This early English lamp, which was taken from the home of Mr. B. B. David, of Cheyenne, Wyo., about eighteen months ago, when his house was rewired, had previously seen service for twenty-three years. Mr. David reports that his installation of electric lighting was first supplied from a storage battery which was placed under the front porch. These cells were charged daily by the local company. It is also claimed that some of the first incandescent lamps used in this country were installed here in Cheyenne in the old Popp Block, although this we have been unable to verify except by the testimony of some of the old inhabitants of the town.

THEODORE THIELE,
*Superintendent Wyoming-Colorado Engineering Company.*
*Cheyenne, Wyo.*

[The filament of the veteran incandescent lamp shown herewith is still intact in its twenty-fifth year even after its recent 2000-mile parcels-post journey to this office. Attention is directed to the method of mounting the lamp proper, a construction which at first glance might seem to anticipate the latter-day shock absorber for tungsten units. In fact, however, the large helical spring merely serves to hold firmly in place the wire hooks engaging the leading-in wires—themselves a small fortune in platinum—and, except for lateral flexibility, the mounting is fairly rigid against transmitted shocks. The base and receptacle are of the bayonet-joint type with spring contacts resembling closely those of a modern door-bell push-button. The switch casing, made from a brass casting turned up in a lathe, is highly reminiscent of gas-valve design, as are also the 0.25-in. threaded fittings and the set-screw holder for the glass shade. Mute stumps projecting from the gas-fixture-like stem reveal that this particular socket was last wired up with No. 18 bell wire covered with paraffined cotton, the positive and negative conductors being very carefully distinguished by the use of yellow and green wrappings which still retain all their original beauty and luster. This interesting relic shows how far indeed electrical construction has come in the quarter century spanned by this sturdy unbroken filament.—EDS.]



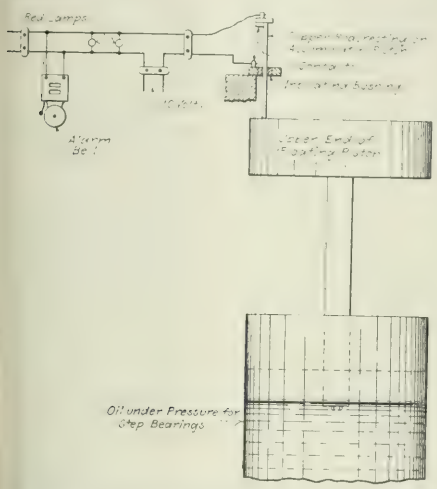
VETERAN INCANDESCENT LAMP

# Field of the Operating Engineer

**A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers**

## Alarm Circuit for Step-Bearing Accumulator

Trouble is always in store for an engineer of a turbo-generator station if the oil pressure on the step bearings is not maintained. In order that such a condition shall be detected as soon as the pressure falls the operating force of the Marion (Ind.) Light & Heating Company has placed in operation an alarm circuit the essentials of which are given




ARM CIRCUIT WARNING ENGINEER IF STEP-BEARING OIL PRESSURE DECREASES

herewith. As will be seen from the drawing, a copper rod rests upon the top of the accumulator and when the pressure of the oil is holding the piston afloat the top of the rod is about 5 in. above the alarm contact. Should the pressure fall, the contact on the movable rod and the one on the stationary guide will be brought together by the downward movement of the piston and the electrical circuit will be completed, ringing the alarm bell and lighting the two red lamps which have been included in the circuit.

## Scotch Mechanical Stoker with V-Grate

The interest of English engineers has been aroused by a new stoker invented by a Scotchman, the feature of which is a V-shaped grate. One of these furnaces has recently been in experimental operation at Motherwell in large steel works, where it has been applied satisfactorily to a pair of water-tube boilers of the Babcock & Wilcox type. It is also being applied to other types of boilers in different works in the west of Scotland. The fire-bars rest on an ash trough situated at the bottom of the flue, and the top part of the firebars forms a short platform along which the coal is conveyed on either side by two interrupted screws. These coal-feeding screws take the fuel from hoppers at the front of the boiler and gradually feed it along the whole length of the furnace. The interruptions are so arranged that there can be no banking of coal on any particular part along the line of the furnace. Should the fuel burn out more rapidly at any point the new coal finds its way there and supplies the deficiency. In the ash trough there is an extracting screw which breaks up the clinker and takes the ashes uniformly from the back to the front of the furnace. The feeding of the coal and the extraction of the ash are thus both automatic, and are regulated so as to work in unison. The furnace is claimed to be absolutely smokeless and to give higher coal and boiler efficiency, with the expenditure of very little labor, than the older methods of stoking and cleaning.

## Insulating and Grounding Motors and Generators—II

By Terrell Croft

Where a motor or generator that is directly connected to some prime mover or machine must be insulated therefrom, it is necessary to insert an insulating coupling in the shaft between the electrical machine and the other machine. The construction of one type of such a coupling is outlined in Fig. 6. A disk, usually of fiber, is bolted between the two faces of the flanged coupling, and the coupling bolts are insulated with washers and bushings, which are also usually made of fiber. Couplings of the type outlined in Fig. 6 are not self-aligning; i.e., the only members that prevent the two shafts from being forced out of line with each other are the bolts through the coupling. It is necessary, therefore, where a coupling of this type is used, to have a bearing supporting the shaft reasonably close to and at each side of the coupling. It is difficult to design an insulated self-aligning coupling, and where one is designed it is ordinarily quite expensive. Hence it is usually cheaper to provide the additional bearings required with a coupling of simple construction, like that of Fig. 6, than it is to install a self-aligning bearing and thereby eliminate possibly one or two bearings.

It is practically impossible to insulate a large heavy direct-connected electrical machine in such a way that it will remain in accurate alignment with the prime mover that drives it or the machine that it drives. For this reason it is the almost invariable practice to ground such machines.

Where belt-driven electrical machine frames are insulated from the ground, trouble frequently results from

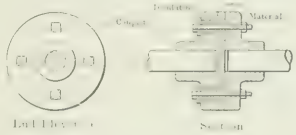


FIG. 6—TYPICAL INSULATING COUPLING

static electricity generated by belt friction, which, because it cannot find a low resistance path to ground through the machine frame, will discharge from the belt driving or being driven by the machine, or may discharge from some portion of the machine frame to a grounded object. While these static discharges may not be dangerous to life, it has

been found that they frequently have an injurious effect on the insulation used on the windings and sometimes cause breakdowns. A metallic comb, connected to ground, arranged close to but not touching the belt that tends to discharge static electricity, will usually eliminate the discharges, or grounding the frame of the machine, if grounding is permitted, should accomplish the same result. If




FIG. 7—GROUNDING A MACHINE FRAME ON A PIPE AND ON A GROUND PLATE

direct grounding of the frame is not permitted, a high resistance ground, consisting of a piece of ground-glass having a lead-pencil mark on it, possibly an inch long, can be used in series between the generator frame and the ground. A sheet-metal terminal should make contact with each end of the pencil mark, and to these metal terminals are connected respectively the leads to the ground and to the frame of the machine. Although the resistance of such a pencil mark is exceedingly high, the static electricity will readily flow through it.

Probably the best method of grounding a frame is to connect it to a water pipe. As noted above, the frames of generators directly connected to steam prime movers are thoroughly grounded through the steam and exhaust piping to the engine. Fig. 7 shows two methods of grounding the frame of a machine. At the left of the arrangement a ground conductor is connected, in a manner to be described hereinafter, to the frame of the machine and to a water pipe. At the right the ground conductor connects to a metal plate embedded in charcoal. The method of constructing a ground connection with a metal plate and charcoal is described in detail in the National Electrical Code. To be effective the charcoal must always be moist, and it is not always that this condition can be assured. Where a ground connection for any purpose is required and a water pipe is not available, it now appears to be the accepted practice to drive a series of ground pipes into the earth somewhat after the manner indicated in Fig. 11.

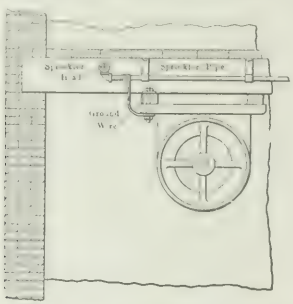
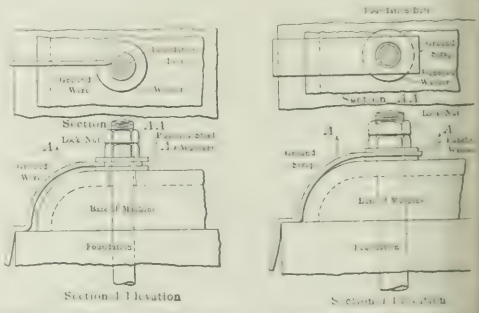



FIG. 8—MOTOR FRAME GROUNDED TO SPRINKLER PIPE

In Fig. 8 is detailed an installation wherein a motor mounted on a ceiling in an industrial plant is grounded to a sprinkler pipe. In buildings of non-fireproof construction sprinkler pipes are usually available and constitute an excellent method of securing a good ground. Some judgment should be used in grounding a motor frame to a sprinkler pipe. A very large motor should not be grounded on a very small pipe. It is probably permissible to ground a 10-hp or 15-hp motor to a ¾-in. branch pipe, but a 50-hp motor should be grounded on one of at least 2-in. nominal diameter. The pipe selected should in every case be of such size that there would be no possibility of its overheating when carrying the current which the fuses protecting the motor will safely convey. Obviously, if the current through the motor frame and ground wire to the sprinkler pipe becomes greater than that which the motor fuses will pass, the fuses will blow and open the circuit.

A system of ground pipes for grounding a large capacity electrical machine in a location where no water pipe is available is outlined in Fig. 11. A series of ground pipes which should extend far enough into the earth so that a good portion of their lower ends will always be in damp soil are driven into the ground around the foundation of the machine. These pipes are all connected in multiple with a heavy ground wire, one end of which is carried up to and connected on the frame of the machine. It should be understood that this multiple ground-pipe connection is not nearly so good a one as that provided by a pipe connecting to an extensive water system.

Figs. 9 and 10 show two methods of connecting ground conductors to frames of electrical machines. In Fig. 9 ground wire is shown. Where wire is used it should always be of sufficient section to carry, without appreciable



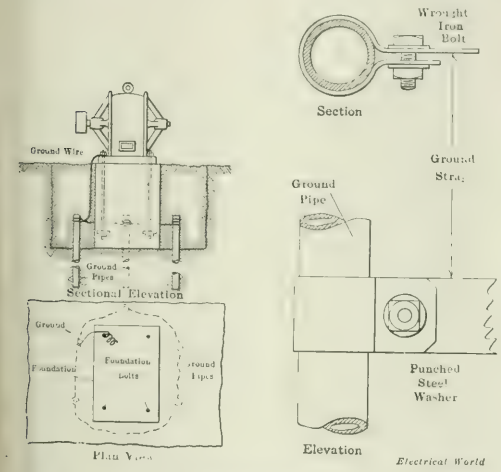

FIGS. 9 AND 10—METHOD OF CONNECTING GROUND WIRE MACHINE AND METHOD OF CONNECTING GROUND STR TO MACHINE

heating, the current that the fuses protecting the machi will pass. It should also be of such size that it cannot accidentally broken. The wire is clamped between t punched washers by a nut turning on the bolt that ho the base of the machine to the foundation. These punch washers should be used to insure effective clamping, a so that the nut in being turned on the bolt will not into the wire. It is a good plan to provide, as shown lock nut on top of the first nut which will prevent loos ing if there is vibration. Sometimes the two punch washers and the end of the ground wire are "tinned" order to prevent the corrosion that might otherwise caused at the point of contact between the bare c per and iron. The end of the ground wire should be b around the bolt in the same direction that the nuts t on—that is, in a right-handed direction—so that any tw ing action due to the nuts will tend to wrap the wire arou the bolt rather than to unwrap it. Copper should alw be used for ground wire.

A strap of copper is used for the ground connection Fig. 10. In general, the requirements for the strap regards mechanical strength and current-carrying capac are the same as those for a ground wire, as outlined in above paragraph. Where a large machine is being stalled a strap connection is preferable to a wire, beca with it sufficient cross-section can be secured in a f that can be readily bent into any desired contour. A la

round wire cannot be conveniently formed around the foundation, into the corners and around the bends which it must follow in its route to the earth. Where a strap is used it can be of possibly ⅛-in. thickness and of sufficient width to provide the necessary current-carrying capacity, and it can always be formed without difficulty into any desired contour. The end of the strap clamped between the punched washers and the washers themselves should be "tinned" to prevent corrosion.

A ground wire, if it be not too large, can be connected to the ground pipe with one of the specially designed clamps of which there are many forms in the market. If clamps are not available, the point on the pipe at which it is desired to connect the ground wire should be carefully cleaned, and the ground wire can be soldered thereto. In soldering a copper wire to an iron pipe, the pipe should be filed until it is bright and should be "tinned" by heating it,




FIGS. 11 AND 12—ARRANGEMENT OF GROUND PIPE AROUND AN ISOLATED MACHINE AND METHOD OF CONNECTING GROUND STRAP TO PIPE

using powdered sal ammoniac as a flux and applying the solder. The previously "tinned" end of the ground wire is then wrapped around the pipe several times, the whole heated and solder applied.

A ground strap can be connected to a pipe as detailed in Fig. 12. The pipe should be clean at the point where the strap clamps around it, and both the strap and the pipe should preferably be "tinned."

## Meaning of Diversity Factor

I have heard the term diversity factor used in so many different ways at I should be glad to have its correct definition. B. E.

By diversity factor is meant the ratio between the simultaneous demand of a number of individual services for a specified period and the sum of the individual maximum demands of those services for the same period. It is expressed in per cent and can never be greater than unity unless expressed in terms of its reciprocal.

## Value of the Standard Volt

Will you kindly publish the present value of the standard volt, which I understand was recently changed slightly? A. G. A.

On Jan. 1, 1911, the Bureau of Standards by international agreement introduced a slight change in the standard volt. The electromotive force of the Weston normal cell was changed in rating from 1.01913 volts at 20 deg. to 1.01830 volts at 20 deg. C., a reduction of 0.08 per cent, or, expressed in another way, the new standard volt was increased in magnitude by 0.08 per cent. The standard ampere became likewise a larger unit to a similar extent and the watt, or unit of power, became increased by 0.16 per cent.

## Testing High-Tension Switchboard Wiring

Is there any recognized standard test for high-tension switchboard wiring? If so, what are the working voltages? S. E. A.

It has been recommended that all high-tension switchboard wiring be subjected to high-voltage tests before use. Such tests should approximate at least two and one-half times the working pressure of the system for a period of at least five minutes, and preferably for thirty minutes. The insulation most favored for this class of work is varnished cambric protected by a slow-burning outer covering, if installed without lead sheath. Careful attention should be paid to methods of installation such as the separation of conductors, freedom from loops, stability of supports, accessibility for repairs or renewals, etc.

## Operation of Transformers in Parallel

Is it possible for two transformers of similar size and rating not to operate satisfactorily in parallel? M. T.

In order to secure perfect parallel operation transformers of the same rating should have exactly the same ratio of high-tension and low-tension turns, the same *IR* drop and the same impedance drop. For all practical purposes, however, two transformers having the same ratio of turns and approximately the same impedances will operate satisfactorily in parallel even if the *IR* drops are different. Duplicate transformers ordinarily should possess the same characteristics and share the load equally. Transformers of different make may possess different characteristics, so that measurement should be made to determine if each will carry approximately its share of the load. Where the impedances differ the load on the transformer with the smaller impedance will be greater than that on the other transformer, the portions of the load assumed by the two units being approximately in inverse proportion to the two impedances.

## How to Obtain Government Records

Will you kindly advise me what steps to take in order to obtain government publications? B. W. J.

Government publications are in general classed either as congressional or departmental documents and are deposited for distribution as follows: (1) With the document rooms of the Senate and House of Representatives, (2) with the bureau under which the work is carried on, and (3) with the superintendent of documents. Publications from the document rooms of the Senate and House of Representatives are distributed only on the order of members of Congress, to whom all applications for congressional documents should be sent. Most of the departmental publications deposited with the bureaus in which the work is done are distributed free of charge, although a nominal price is placed on certain issues in order that they may not fall into the hands of persons other than those who actually need them. All publications deposited with the superintendent of documents are sold, the price fixed being only sufficient to cover the cost of paper, press work, binding and distribution. Most government bureaus issue complete indexes, bibliographies, maps and other guides to the results of their work, and the *Monthly Catalog, United States Public Documents*, issued by the superintendent of documents, gives a complete list of all government reports issued during each month.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*High-Frequency Alternator.*—Boutillon.—A mathematical article in which the author shows that by superposing in a conductor a certain number of periodic emfs of equal frequency with proper phase differences between each other, a resulting emf is obtained with a frequency which is a certain multiple of the original frequency. By this means it is possible to obtain in a polyphase alternator with windings of the ordinary type currents of an increased frequency. The two types of machine studied by the author are alternators with a rotating iron core, permitting high speeds of rotation. His calculations show that, using a peripheral speed of not more than 196 m per second, it is possible to design a machine of more than 100 kw output with a frequency of 96,000 cycles per second. This type of alternator is thought to be suitable for wireless telegraphy.—*La Lumière Elec.*, Sept. 13, 1913.

*Double-Commutator Machines.*—Karl Pichelmayer.—With the aid of the Ossanna voltage polygon diagram it is shown that in machines with a double commutator the voltage conditions are in general not the same on both sides of the machine. This point has to be taken into account in estimating the distribution of the load of the two commutators and in the choice of polyphase connections, etc.—*Elek. u. Masch.* (Vienna), Sept. 14, 1913.

*Dynamo with a Central Pole.*—An article on a machine which, as shown in Fig. 1, is characterized by two concen-

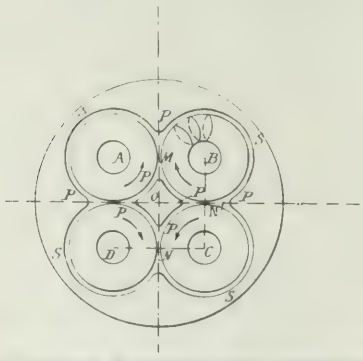



Fig. 1—Diagram of Dynamo with a Central Pole

ric primaries, one in the center and the other at the periphery, the two being of opposite polarities. The peripheral primary may be replaced by several pole pieces all of the same polarity, which may enter into the central space in a more or less pronounced way as shown in the illustration. This sketch shows four secondaries turning around the axes *A, B, C, D*. Such a machine permits obtaining high tensions and high frequencies and allows variation of the armature reactions within rather wide limits.—*La Lumière Elec.*, Sept. 27, 1913.

*Definition of Direction of Rotation of Vectors in Alternating-Current Diagrams.*—A French translation in abstract of the recent discussion in *Elek. Zeit.* by Strecker, Georges, Breisig and Wagner.—*La Lumière Elec.* Sept. 13 and 20, 1913.

*Silent Operation of Electric Machines.*—S. Pontecorvo.—A translation of his German paper, noticed some time ago in the *Digest*, on the design of electric machines for quiet operation. The causes of noise are discussed together with methods of overcoming them.—*Elec. Journal*, September, 1913.

### Generation, Transmission and Distribution

*Electric Power Plant at Coal Mine.*—R. Rinkel.—The author sketches the development of the lignite industry in the Cologne district and the part which has been played in this development by the erection of the electric power plants at the mines for selling electricity in bulk to the surrounding cities and towns. He describes especially the electric plant erected at the Fortuna mine, which has at present a capacity of 16,000 kw but is to be enlarged to 32,000 kw during this year. The lignite is conveyed directly from the mine to the boiler house. For the generation of electricity large turbo-generators of 4000 kw and 8000 kw have been installed so that the first cost of the plant is relatively low. The item of wages is also low, since automatic machinery is used wherever possible. The generating cost is below 0.5 cent per kw-hr. The largest consumer is the city of Cologne, to which three-phase energy is transmitted at 25,000 volts through cables. At the city limits this pressure is stepped down by transformers. Distribution throughout the city and sale to consumers are both in the hands of the municipality. The city has made a thirty-year contract with the mine. Details of this agreement are kept secret, but it is known that the city can buy the electricity cheaper from the mine plant than it can be generated in the municipal plant. For this reason the city has decided not to enlarge its present 16,000-kw power plant. The cost of generating electricity at the municipal plant, inclusive of distribution cost, was in 1911 0.88 cent per kw-hr., of which amount the coal cost alone was 0.485 cent, and the central-station cost 0.7 cent. It is, therefore, believed that the Fortuna Mine plant sells energy to the city at 0.6 cent to 0.75 cent per kw-hr. at the transformer substation. The Fortuna Mine power plant also has other large consumers, among them the city of Muelheim. When the electric service was operated there by the municipality itself, the output was 1,334,484 kw-hr during the first six months of 1912. After the Fortuna Mine power plant company had taken over the supply 2,413,135 kw-hr. were sold in Muelheim in the first six months of 1913. The increase in kilowatt-hours sold was thus 80.82 per cent in one year. Meanwhile the number of customers had increased from 745 to 1305, or by 75 per cent. Energy is sold in this case on a two-rate schedule, the usual rate being 2.5 cents per kw-hr., except during certain evening hours, which are 4:30 to 10 p. m. in January, 5:30 to 10 p. m. in February, 6:15 to 10 p. m. in March, 7:30 to 10 p. m. in April, 8:15 to 10 p. m. in May and August, 6:30 to 10 p. m. in September, 5:30 to 10 p. m in October, 5 to 10 p. m. in November, and 4:15 to 10 p. m in December. During these specified evening hours the price charged for the first 2000 kw-hr. is 11.25 cents per kw-hr., and for consumption in excess of this, 6.25 cents per kw-hr. Meters are installed and house connections made free of charge. If a consumer does not like the double-rate schedule, he can have his electricity supplied at a straight rate of 7.5 cents per kw-hr. With large consum-

ers using 30,000 kw-hr. or more special contracts are made. Another power plant is being installed at the Rodder lignite mine. Large electrochemical works now in course of erection near Cologne will be supplied with energy from this plant.—*Elek. Zeit.*, Oct. 16, 1913.

*Water-Power Plant.*—E. FREYE AND O. ALBRECHT.—A continuation of their long detailed illustrated description of the Wyhlen power plant of the Rheinfelden power transmission system. Following an account of the arrangement of the generators and the switchboard the authors describe the transformer plant. There are six transformers, each rated at 2600 kva, which raise the pressure from 6800 volts to 47,000 volts.—*Elek. Zeit.*, Oct. 16, 1913.

*Mississippi River Water-Power Plant.*—M. NORDENSWAN AND C. W. SCHMIDT.—The first part of an illustrated description of the 300,000-hp hydroelectric plant of the Mississippi River Power Company at Keokuk, Iowa.—*Elek. Zeit.*, Oct. 16, 1913.

*Fuel and Lubricants for Internal-Combustion Engines.*—B. H. ARNOLD.—The great demand for gasoline as a fuel for internal-combustion engines has inflated its price to a point where the expense of operating gasoline engines of large size has become a matter of considerable moment. Lower fuel costs have been the subject of much recent investigation by corporations and engineering societies, especially along the line of improved engine design and the adoption of specifications for petroleum distillates. The author shows that the prevailing practice of specifying gasolines according to their specific gravities affords a much less accurate indication of the fuel values than specifications based on fractional distillation. Curves are included which show that, although the specific gravity of one grade of gasoline may be less by 10 or 15 per cent than that of another, the fuel of greater density may by analysis be the better. Typical specifications for gasolines for slow and medium-speed engines and for high-speed engines are given. A satisfactory economical lubricating oil should possess the qualities of wearing well and burning clean. What the viscosity of the oil should be is a matter determined by the design of the engine.—*Gen. Elec. Review*, October, 1913.

*Atmospheric Disturbances.*—G. CAPART.—A paper read before the Vienna Electrical Society. In the first part the author discusses those meteorological phenomena which have an influence on overhead transmission lines. In the second part the protection of lines against such disturbances is discussed and protective apparatus, especially the Riles valve, is described.—*Elek. u. Masch.* (Vienna), Sept. 14 and 21, 1913.

### Traction

*Overhead-Line Construction.*—J. SIMY.—An illustrated article on the pantograph overhead-line construction of the Chemins de Fer du Midi.—*La Lumière Elec.*, Sept. 20, 1913.

### Installations, Systems and Appliances

*French Central Stations.*—P. BIZET.—An illustrated article on the equipment, the tariffs used and the financial results obtained at the central stations of Rouen, Nancy and Marseilles. An interesting comparison is made between the results at Nancy and at Rouen. The capital invested in these two plants is about the same, $1,670,000, but the application of more favorable rates at Nancy has resulted in a much greater utilization of electrical energy there than in Rouen. In Nancy 9,700,000 kw-hr. were sold last year; in Rouen 3,280,000 kw-hr. were sold; and although the average price per kilowatt-hour in Nancy was half that in Rouen (4 cents compared with 8 cents), the financial results are somewhat better in Nancy. This comparison shows that through a liberal rate schedule not only are the customers better served by the central station, but also the central station itself derives better returns.—*La Lumière Elec.*, Oct. 4, 1913.

*Switchboard Design.*—EMIL BERN.—After a short description of the familiar vertical switchboard the author deals with the requirements which have caused the development of the bench type of board and gives a description of the elementary benchboard. This is followed by a further description of the construction and layout of several modifications designed for special conditions, with a presentation of the advantages of each.—*Gen. Elec. Review*, October, 1913.

*Electric Heating and Electric Power.*—P. BIZET.—The author first discusses electric heating and cooking for domestic purposes and in bakeries and then takes up the advantages of the use of electric motors with central-station energy supply instead of the installation of isolated plants.—*La Lumière Elec.*, Oct. 18, 1913.

*Use of Electricity in Agriculture.*—C. J. ROHRER.—An article illustrated by numerous diagrams from actual data on the question of how much electricity might be used by the average farmer. The author presents in concise tabulated form a quantity of data collected from some 130 farms supplied with electric service from transmission lines in their vicinity. Five electric companies are represented and the character of the rural service of each is analyzed in detail. From the figures given it is obvious that a purely lighting load would afford poor returns in most cases on the necessary investment, but experience goes to show that once the farmer is made acquainted with the capabilities of the electric motor he is quick to adopt it, thus providing a profitable source of revenue to the company. Of the total service supplied by these five companies, fully two-thirds is for power, the principal demand for which comes during the daytime and is thus a most desirable day-load builder.—*Gen. Elec. Review*, October, 1913.

*Choke Coils.*—R. EDLER.—An article on the calculation of choke coils. From experiments with a choke coil of simple construction, the author draws some conclusions, especially on the effect of the air-gap, which permit precalculation of such coils. A numerical example is given.—*Elek. u. Masch.* (Vienna), Sept. 21 and 28, 1913.

### Electrophysics and Magnetism

*Skin Effect.*—R. SWYNGEDAUW.—The first parts of a highly mathematical article on the skin effect in cylindrical conductors, plates and rails.—*La Lumière Elec.*, Oct. 11 and 18, 1913.

*Attraction of an Armature by an Electromagnet.*—J. BETHENOD.—A. Vaschy has developed the following formula for the attraction $F$ of an electromagnet excited by a current $i$ upon a soft-iron armature at the distance $x$, if $l$ is the coefficient of self-induction of the electromagnet for the distance $x$:

$$F = \frac{1}{2} i^2 \frac{dl}{dx}$$

The present author discusses the more general instance in which the electromagnet is excited by two or more independent currents. In this case the general formula becomes

$$F = \frac{1}{2} \sum I_k^2 \frac{dL_k}{dx} + \sum I_k I_j \frac{dM_{kj}}{dx}$$

where $I$, $I$ are the exciting currents, $L$ the coefficient of self-inductance and $M$ the coefficient of mutual inductance. The application of this formula to the theory of circuit-breakers is discussed.—*La Lumière Elec.*, Oct. 18, 1913.

### Electrochemistry and Batteries

*Brush Discharge.*—A. VOSMAER.—A long article on the author's extended researches on brush discharge, with special reference to the generation of ozone. In the first part the author deals with the brush discharge through air without the use of solid dielectrics, in the second part with the use of solid dielectrics.—*Metall. and Chem. Eng'ing*, November, 1913.

*Electric Furnaces.*—W. McA. Johnson and C. N. Sieger.—A continuation of their fully illustrated article on electric furnaces and their design, characteristics and commercial applications. The authors deal with the electric furnace, structurally considered, the use of refractories, methods of laying an arch, methods of water-cooling, and the heat insulation of furnaces.—*Metall. and Chem. Eng'ing*, November, 1913.

*Electric Zinc Smelting.*—An illustrated article by F. Louvrier describing his electric zinc furnace, in which he claims to have succeeded in condensing zinc in liquid form with only very little production of blue powder. A second article, by F. L. Clerc, discusses the different effects which must be taken into account in condensing the zinc gas to liquid in the presence of inert gas.—*Metall. and Chem. Eng'ing*, November, 1913.

### Units, Measurements and Instruments

*Use of the Synchronous Commutator in Alternating-Current Measurements.*—Frederick Bedell.—A paper in which the author describes the uses of the synchronous commutator for the following measurements: Determination of average value of alternating electromotive force and current; use as zero instrument; determination of form factor of alternating current or voltage; determination of wave-form and maximum value of alternating magnetic flux. The author then takes up the determination of wave-forms and maximum values of alternating currents and electromotive forces by means of three methods, namely, the air transformer method, the condenser current method and the condenser discharge method. He finally deals with the determination of phase difference. The article is illustrated by numerous diagrams.—*Journal Franklin Inst.*, October, 1913.

*Quantitative Spectrum Analysis.*—G. A. Shook.—In the third article of his serial on this subject the author deals with industrial applications and describes the calibration of a Koenig-Martens polarization spectro-photometer and the determination of concentration for colorless solutions.—*Metall. and Chem. Eng'ing*, November, 1913.

*Sea-Water Temperature Annunciator.*—A note on a recent British patent (No. 9695, 1913) of A. McNab. The indicator is placed in the hull of the vessel and subjected to a continuous flow of sea water. The indicator itself consists of a thermometer containing conducting and non-conducting liquids, while a series of insulated conducting studs is provided, so that a test lever, whose position is determined by the height of the liquid columns (in turn controlled by the temperature of the water), closes the circuit through the conducting liquid and an incomplete alarm circuit, part of which is formed by the insulated studs in the thermometer.—London *Elec. Eng'ing*, Oct. 16, 1913.

### Telegraphy, Telephony and Signals

*Telegraph Experiment Station.*—K. Strecker.—The conclusion of his illustrated description of the German telegraph experiment station in Berlin. Details are given of the system of current supply to the laboratories and of their equipment for investigations in telegraphy, wireless telegraphy, testing of materials, photometry, etc.—*Elek. Zeit.*, Oct. 16, 1913.

*Sine-Wave Transmission in Submarine Cables.*—H. W. Malcolm.—A continuation of his long mathematical article illustrated by diagrams. The author discusses the influence of apparatus, the effect of a single oscillation and of a semi-oscillation, battery signal, sending-end phenomena, and distress of the cable.—London *Electrician*, Oct. 17, 1913.

*Pupin Coils.*—A note on a recent British patent (No. 12,565, 1913) of Siemens & Halske. To avoid cross-talk and other effects on physical phantom circuit combinations, Pupin coils are made with the different coils divided into concentric sections. There is a different number of winding sections belonging to the separate coils in every plane of the winding, and an approximately uniform field distribution in every plane of the winding.—London *Elec Eng'ing*, Oct. 16, 1913.

*Simultaneous Telephony and Telegraphy.*—H. S. Warren.—An article on the joint use of wires for telegraph and telephone service discussing simplex and composite combinations and phantom circuits.—*Elec. Journal*, September, 1913.

### Miscellaneous

*Electrical Congress in Moscow.*—Some notes on the proceedings of the Moscow Electrical Congress. Messrs. Tschernischoff and Goreff read a paper on "The Comparison of the Present Methods of Measuring Tensions and Forces in High-Voltage Lines." Goreff presented a report on direct-current and polyphase systems with several conductors, Kamensky one on the choice of systems and of voltages in city networks, and Veretschaguine one on the relative status of the different systems on electric wiring and cable networks. For cities with small population the overhead network is recommended, for cities with medium population a mixed system employing both overhead wire and cables, and for very densely populated cities an underground cable system. Pavlitsky read a paper on the electrification of city water supplies, recommending their connection with central stations and the employment of motors and electrically driven pumps. Belateloff read a paper on the development of Moscow as a telephonic center for interurban connections, Polivanoff discussed the question of a rapid-transit electric railroad in Moscow and emphasized that it would not be detrimental to the tramway system since they could exist side by side. Chapirer discussed accidents due to electricity and Steinhaus legislation regarding an electric unit and governmental control of measuring apparatus and instruments in different countries.—*La Lumière Elec.*, Oct. 4, 1913.

*Influence of the Presence of Gas Upon the Inflammability of Coal-Dust in Air.*—W. M. Thornton.—An abstract of a paper read before Section B of the British association, giving an account of experiments made to find the least current which will ignite a mixture of dust and gas, the percentage of gas in this case being kept constant in the successive trials while the circuit is broken with differe

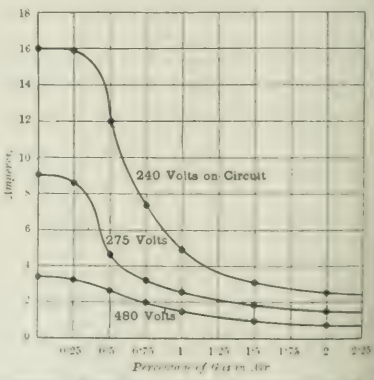



FIG. 2.—CURVES SHOWING CURRENT NECESSARY TO IGNI NEWCASTLE COAL-GAS

currents flowing. The explosion vessel was closed by flap valve at one side, which prevented air entering dur the mixing but yielded to pressure from within. T results obtained with Newcastle coal-gas are given in F 2. There is at each of the three voltages a definite r tion between the least igniting current and the percenta of gas. The height of each curve is the least curr

which at the given voltage and percentage of gas causes a full ignition, and it is seen from the figure that 0.25 per cent of gas has little or no effect in forwarding ignition, though with more than this there is a rapid increase in sensitiveness. The same result is obtained with pit gas. In Fig. 3 the results of the experiments are plotted with the least igniting current as ordinates and volts as abscissas.

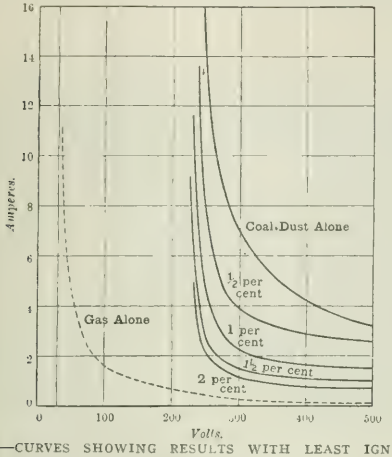



FIG. 3—CURVES SHOWING RESULTS WITH LEAST IGNITING CURRENT

There is a potential (about 200 volts in this case) below which ignition of clouds of dust, even with 2 per cent of gas present, is exceedingly difficult. The nest of curves is symmetrical about a line drawn through this point on the base and through the nearest point on the "no-gas" curve. This would, therefore, appear to be about the highest voltage which may be regarded as relatively safe in a gassy and dusty atmosphere where the percentage of gas is not above 2 and where very large open flashes are not possible. Although the gas has so great an influence in forwarding the combustion, it is clear that the dust is still the dominant factor in the explosions. The gas must be regarded as the auxiliary, not as the principal factor, in the ignition of the combined mixture of gas and dust at low percentages.—London *Electrician*, Sept. 26, 1913.

# Book Reviews

Electrical Instruments and Testing. By Norman H. Schneider. Including Testing Telegraph Wires and Cables and Locating Faults, by Besse Hargrave. Revised and enlarged edition. New York: Spon & Chamberlain. 256 pages, 133 illus. Price, $1.

A very practical elementary textbook on electrical testing and testing instruments, for the use of electrical operators in the engine room, telephone exchange, telegraph office or power plant. The underlying principles are explained in very simple terms, and the mathematical formulas employed are of the fewest and simplest. The ordinary electrical testing instruments, such as keys, galvanometers, Wheatstone bridges, voltmeters, etc., are fully illustrated and explained. The chapter on "testing with the voltmeter" will be found to be a particularly practical presentation of its subject. The book as a whole will be useful not only to students of elementary electrical engineering but also to operators, wiremen and artisans. It will appeal as well to the large class of non-electrically trained electrical workers who welcome a clear and easily understood textbook on the principles of their art.

Railway Signal Engineering (Mechanical). By Leonard P. Lewis. New York: D. Van Nostrand Company. 358 pages, 250 illus. Price, $3.50.

This book is a carefully written, well illustrated and rather detailed description of the mechanical (manually operated) railway signals now in use in England. It is complete enough to give one who is not informed on railway signal work a good idea of British practice and apparatus. The requirements of the Board of Trade, the different classes of signals, schemes of signaling and methods of operating trains are described. The explanation of interlocking apparatus and the use of tables and diagrams are especially clear and interesting.

Cours de Physique Générale. Vol. II. By H. Ollivier. Paper, 296 pages, 112 illus. Paris: Librairie Scientifique, A. Hermann et Fils. Price, 10 francs.

This is the second volume of a textbook on mathematical physics. This volume deals with thermodynamics and radiant energy. The treatment is very condensed, mathematical, thorough, and intended for advanced students. The book is divided into two sections, dealing respectively with thermodynamics and radiation. The first section comprises eleven chapters relating to the following subjects: Introductory, first principle of thermodynamics, applications of the first principle, second principle of thermodynamics, available energy, general deductions from the first two principles, perfect gases, uniform fluids, solids, certain single-variant systems, other applications of thermodynamics, kinetic theory of gases. The second section comprises thirteeen chapters on the following subjects: General properties of radiation, Kirchhoff's law of emission and absorption, black-body radiation, other types of radiation, incandescence, radiation pressure, relations between emission, absorption and dispersion, luminescence, Zeemann's phenomenon, the effect of magnetic fields, solar radiation, stellar radiation, gaseous radiation. The book is logically arranged and carefully prepared.

Engineering as a Profession. Scope, Training and Opportunities for Advancement. By A. P. M. Fleming and R. W. Bailey. 288 pages. Price, 2s. 6d. London: John Long, Ltd.

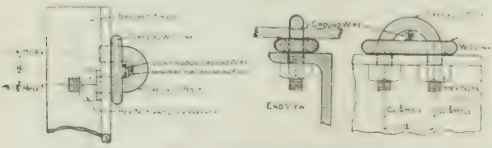
Although a book published in England for the avowed purpose of assisting the youth, parent or guardian in the choice of a profession is necessarily of special interest to Englishmen, yet there are many, not only in the British colonies but also in America, to whom the book may be of the greatest value. The education and training of young men taking up engineering in the British universities and colleges is generally recognized as being sound and thorough, especially in the matter of civil engineering, and a very large percentage of young men attending these schools are from the British colonies and South America. To such this book will be almost invaluable if it is carefuly studied before deciding upon the steps to be taken after landing in England. The ground covered includes lists of the universities and colleges, with full particulars as to fees and approximate cost of living; comparison of the engineering profession with other professions; advice as to the course to pursue in order to obtain the requisite training, whether the means at the disposal of the student are ample or modest, and, finally, the possibilities in the matter of salaries and prospects of advancement after the term of training is complete. In one chapter a comparison is made between the English, German and American systems of training, and much useful advice and information are given for the guidance of young engineers to whom England and British institutions are little known and strange. The book undoubtedly meets a demand, and it may be strongly recommended to those in need of such information as it purposes to give.

# New Apparatus and Appliances

**An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers**

## Ground-Wire Clamp

The Belcher ground-wire clamp is a device for fastening continuous overhead ground wires to the supporting bayonet, pole or transmission-line tower. It is designed to take the place of special malleable castings, bolts and plates heretofore required for the purpose. In Fig. 1 is shown the "J" type, suitable for wood, concrete or steel pole lines

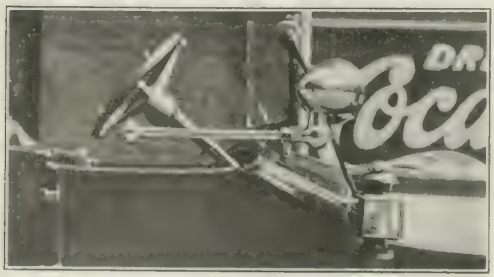


FIGS. 1 AND 2—GROUND-WIRE CLAMPS

with spans up to 200 ft. There is only one nut, and it will be favored by linemen on account of the ease of its erection. The "U" clamp, shown in Fig. 2, is used with transmission towers or steel poles, two usually being required for each ground wire. At turns in the line a thimble is used which acts as a shackle. These clamps are manufactured by Hubbard & Company, Pittsburgh, Pa.

## Revolving Electric Lamp for Motor Cars

To meet the increasing requirements of auxiliary lighting on automobiles the Herrick Aiken Company, Inc., Lawrence, Mass., is placing on the market a special rotating lamp which permits the projection of a beam of light at any vertical or horizontal angle. The lamp rotates in two planes at right angles to each other and, as shown in the accompanying illustration, embodies a parabolic reflector at the ends of rods attached to the car body and easily reached by the chauffeur. The lamp is controlled from a



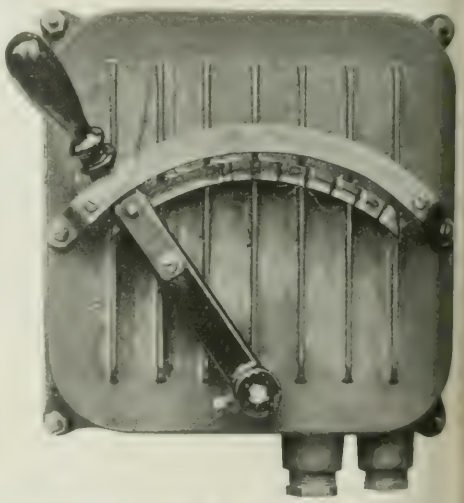
ROTATING LAMP FOR MOTOR CARS

hand-hold which contains a starting and cut-out switch just behind the steering wheel, miter gears being used to give the necessary turning. All the wiring is concealed, and in the usual equipment a 24-cp, 6-volt lamp is used, which can be operated from any source of electrical supply such as dry cells, storage batteries or the automobile lighting generator. These revolving lamps are built for both motor-boat and vehicle service, and a test installation has been driven 25,000 miles without developing any operating troubles. For "picking up" highway signs on country roads, lighting curbings and steps, or investigating machinery, this equipment gives another illustration of the convenience of electricity in motoring and allied activities.

## Water-Tight Controller for Rock Drill

The accompanying illustration shows a Ward-Leonard waterproof controller for operation with an electric rock drill. The requirements for this service are unusually severe, for the controller must be capable of operating continuously at any point of its range. It must be strong, substantial and rugged in every part and must be thoroughly water-tight.

The resistor element in this controller is enameled on the inside of the cast-iron inclosing case, and the spindle



WATERPROOF CONTROLLER FOR ELECTRIC ROCK DRILL

which drives the operating contact enters the controller through a stuffing-box. The lead wires are provided with similar boxes. The controller is arranged with an open-circuit paint, a suitable magnetic-blowout device being incorporated in the box. This makes it possible to use the controller both as a switch and a speed regulator.

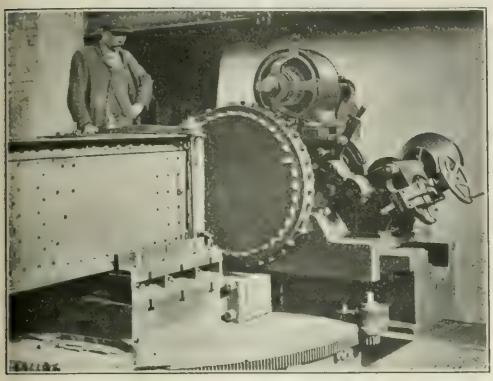
In electric drills of this kind the drill is started at about quarter speed and kept running at approximately this rate until it has made a shallow hole in the rock. The speed is then increased slightly and the hole deepened, and when the drill has worked its way down 3 in. or 4 in. into the rock the full current is turned on and the drill runs at full speed.

After continuous service under severe test conditions the controller shown was allowed to remain under 4 ft. of water for five days and on being taken out was found to operate perfectly when again put into service. The co

troller has a notched rack which retains the operating handle in any particular position. This is, of course, very necessary, as the controller is usually mounted on one leg of the drill tripod, and is thus subjected to tremendous vibration.

## Motor-Driven Rotary Planer

The accompanying illustration shows a form of planer for very large work, such as facing the ends of columns,



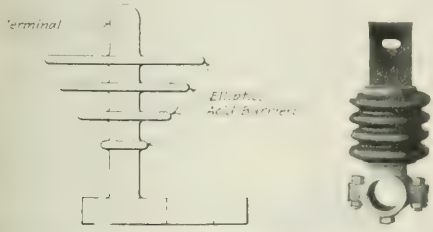
ROTARY PLANER WITH MOTOR DRIVE

cast-iron bedplates, stringers, etc., and machining engine frames and other heavy castings. The cutting tools are arranged in a circle and rotate when in operation.

The machine can handle work 40 in. wide and 6 ft. long. It is mounted on a circular base on which it can be turned, thus increasing its range of operation. The planer is manufactured by the Newton Machine Tool Works, Philadelphia, Pa., and is driven by a Westinghouse motor.

## Non-Corrosive Terminal for Small Storage Batteries

The Philadelphia Storage Battery Company, Philadelphia, Pa., has recently added a non-corrosive terminal to the small storage batteries which it makes for starting and lighting automobiles and for general ignition purposes. As shown in the accompanying sketch, the main stem of the terminal is cast with four elliptical flanges located at regu-

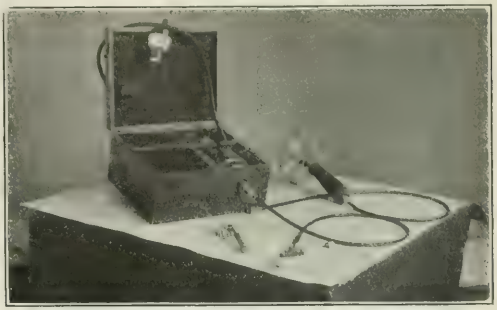



TERMINAL FOR SMALL STORAGE BATTERIES

r intervals along its length, the largest being at the top. hen the terminal is placed in the finished cell these nges are embedded in the composition used to seal the r. Thus the path of the acid in reaching the external rminal is made long and tortuous. The manufacturer ims that such a terminal will last during the full life of battery, allowing no acid to escape from the cell by s route.

## An Electric Razor

An electric razor has been patented and will be placed on the market shortly by the Vibrating Electric Razor Company, 937 East Fifty-fourth Street, Chicago, Ill. It consists of a safety razor connected to a motor by means of a flexible shaft, the blade being actuated in such a way as to cut the beard by impact or blows. The blades, therefore, do not need to be so sharp as in hand-shaving. No soap is necessary, wetting of the skin being sufficient, and a clean shave can be accomplished, it is declared, in a very short

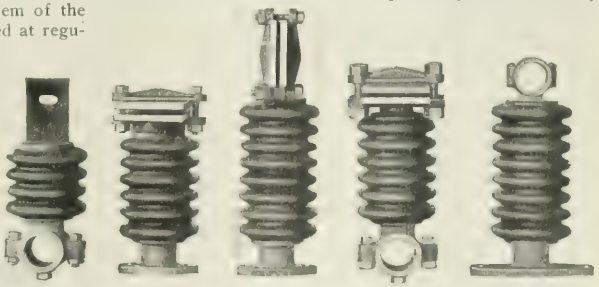


ELECTRIC RAZOR

time. The after-effects are described as being those following a mild massage. A plug is provided for attaching the razor to any lamp socket. In the accompanying illustration is shown a combination razor set with a small electric fan which is useful in drying women's hair. The whole is inclosed in a neat box.

## High-Tension Busbar Supports

A new "unit-type" high-tension support for interior station wiring, busbar work, compartment service, etc., is illustrated herewith. The fundamental unit is made up of wet-process glazed brown porcelain and contains a recess into which is "key-cemented" a threaded malleable-iron thimble. With such a design any desired fitting can be secured to the insulator unit. A few of the various commercial forms are shown in the accompanying illustrations. With the standard fittings commercially available, over 7000 combinations can be made up, and by their use many



BUSBAR SUPPORTS

different problems encountered in laying out busbar compartments, etc., can easily be solved.

A distinct advantage of this new type is the decided gain in space possible when building compartments owing to the fact that there are no overhanging projections cutting down the creepage distance. The compartments also can be made smaller than necessary with the older forms, and this in turn effects a large saving as compartment work is

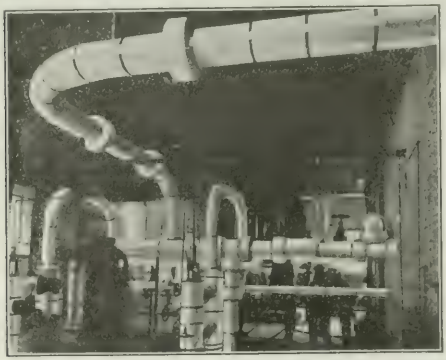
relatively expensive. The characteristics of the "unit-type" support are well illustrated by the following tabulation showing the high factor of safety secured:

[illegible]; flashover test voltage, 30,000 volts
Normal rated voltage, 13,200 volts; flashover test voltage, 54,000 volts
Normal rated voltage, 22,000 volts; flashover test voltage, 75,000 volts

This busbar insulator is manufactured by the Delta-Star Electric Ccompany, Chicago, Ill.

## Combination Asbesto-Sponge Pipe Lagging

The H. W. Johns Manville Company, New York City, has recently added another combination-asbestos product, known as "asbesto-sponge felted pipe and boiler covering," to its line of heat-resisting materials. Recent tests made by Prof. C. L. Norton, of the Massachusetts Institute of Technology, are said to have shown that the yearly cost of maintaining 100 sq. ft. of steam pipe at a pressure of 100 lb. gage is $225 for bare pipe, $35.90 for pipe carrying molded insulation 1 in. thick, and $25.40 for the asbesto-sponge insulation. The new product is made of many lay-



STEAM PIPES WITH ASBESTO-SPONGE COVERING

ers of thin felt composed of asbestos fiber and finely ground sponge, and it is said to be tough and flexible, so that vibration, moisture, heat or rough usage will not cause it to lose its insulating efficiency. It is fireproof and can be removed and replaced many times without deterioration. The illustration herewith shows a set of steam pipes covered with this insulating material.

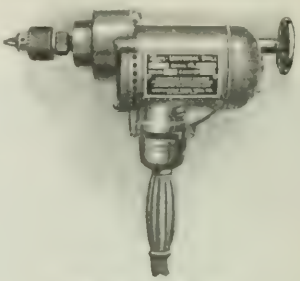
## Electric Drills with Ball and Roller Bearings

Two additions have recently been made by the Independent Pneumatic Tool Company, Chicago, to its line of

| Maximum Size Hole, In. | | Reaming Capacity, In. | Full Load Speed, R.P.M. | Weight, Lb. |
|---|---|---|---|---|
| Steel | [illegible] | | | |
| 0.25 | 0.375 | 0.1875 | 1500 | 6 |
| [illegible] | [illegible] | 0.25 | 750 | [illegible] |

motor-driven drills. The two principal features of these new drills are the provision of universal motors for operation on either direct or alternating current and the use of bearings which are a combination of the ball and roller types. The motors are designed for 110-volt and 220-volt operation and for any commercial frequency.

The holes shown in the aluminum case provide sufficient ventilation for the motor and when it is desirable to clean the commutator the removal of one nut makes the segments easily accessible. Although both of these drills are furnished with 10-ft. lengths of flexible conductor, an attachment is provided which makes it possible to use the



MOTOR-DRIVEN DRILL

drill with cords of different lengths. The accompanying table gives a few mechanical details concerning the two types of drills, which are called Thor universal drills.

## Electric-Iron Cord Holder

An electric-iron cord holder, designed to meet a long felt want in the laundry, has been put on the market by the Paragon Electric Company, 9 Clinton Street, Chicago, Ill. Cords on electric irons often give trouble by getting in the way, becoming tangled with the clothes and being wetted by dragging over moist garments, all resulting in unnecessary injury and wear.

The holder herewith illustrated keeps the cord out of the way and has enough tension to prevent the cord from sagging, without producing a drag on the motion of the iron. The holder is fastened to the right-hand side of the ironing board or table by means of a clamp, and the cord is looped



CORD HOLDER FOR ELECTRIC IRON

over a rubber-covered "V." It can be adjusted in such way that, with the iron directly under the arm, the cord will run straight up to the "V." If the operator is left-handed and wishes to use the holder on the left-hand side of the board the mere change of two screws will permit the arm to be attached on the other side of the clamp.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**A 35,000,000-Kw-Hour Customer.**—One of the largest customers of the Commonwealth Edison Company of Chicago has been acquired comparatively recently. This is the Universal Portland Cement Company, which takes 5000 kw. measured maximum, at 80 per cent load-factor. This customer is supplied on an off-peak basis, and its requirements amount to about 35,000,000 kw-hr. a year.

**Refrigerating Machine Sales Fall Off with the Approach of Cold Weather.**—Since the last report, sales of refrigerating machines by the York Manufacturing Company have fallen off over 50 per cent, owing to the cold weather dullness in that line. The aggregate sales during October amounted to only 318 tons capacity, and the largest single machine was one of 100 tons rating, sold to the Ebner Ice & Cold Storage Company, of Vincennes, Ind.

**Federal Control and Conservation of Coal Resources.**—In testimony given before the Ohio Coal Mining Commission recently, Prof. Edward Orton, Jr., of the Ohio State University, claimed that only under federal control could conservation principles be applied to the coal-mining industry. It was admitted that the cost of the coal under these conditions would be greater, but it was urged that such control would provide for the mining of coal in a manner to prevent waste, a thing which it is impossible to do under the present competitive conditions.

**Tour of Inspection of Export Shipping Facilities at New York.**—In view of the growing export business in this country, of which movement the electrical industry is in the van, a tour has been arranged, under the auspices of the National Association of Manufacturers, to inspect the facilities at hand at the port of New York for efficiently handling goods for foreign shipment. The tour will be made on Nov. 11 and 12, and on the first day it will be devoted to inspection of the docks and transfer facilities along the east and west waterfronts of Manhattan. At a luncheon to be given at the Machinery Club on Nov. 11 there will be given short talks by experts on packing for export, freight-handling and refrigerating methods. On the second day of the tour attention will be given to the docking facilities along the New Jersey and the Brooklyn waterfronts.

**Kerr Turbines Sold for Various Services.**—The Kerr Turbine Company, of Wellsville, N. Y., has recently obtained an order from the Edgar Thompson Steel Company, of Pittsburgh, Pa., for two 1000-hp turbine units for driving the water-supply pumps at the works of the latter concern. Among the other companies which have recently placed orders for Kerr turbines are the Duquesne Light Company, of Pittsburgh, Pa., which is purchasing one unit of 250 hp, eight of 200 hp and eight of 22 hp capacity; the New Britain (Conn.) Gas Light Company, the John Simmons Company, the Citizens' Light, Heat & Power Company, of Johnstown, Pa., and Swift & Company, of Chicago. Turbo-generator equipment totaling 700 hp has been ordered by the Citizens' Electric Company, of Williamsport, Pa., the J. B. Jenkins Coal & Coke Company, of Elkins, W. Va., and the North Carolina Teachers' Training School, at Greenville, N. C.

**Westinghouse Electric Company Busy.**—The business of the Westinghouse Electric & Manufacturing Company during October was reported to be equal to that during August and in excess of that during September. For the first half of the company's fiscal year, or from April 1 to Sept. 30, it is estimated to have earned over 6 per cent on its common stock, but this rate of earnings is not expected to continue for the next six months. Enough orders are said to be now on the company's books to keep it working for the next five months if no others were received. During the last couple of months the company has not been a heavy purchaser of copper, and it is possible that extensive buying of that metal may be done shortly, if the present prices continue in effect. In connection with some financing operations carried on in the past, a suit has been brought by the First-Second National Bank of Pittsburgh against the Chase National Bank to determine the right of the Westinghouse company to set off its deposit in an insolvent bank against that bank's participation in a loan, which participation was gained by the agreement that a deposit should be made with the bank.

**Difference of Opinion Regarding the Copper-Wire Business.**—Some difference of opinion has been observed concerning the present business conditions in the wire industry. A manufacturer of bare wire visited within the past week made no secret of the fact that his business has fallen off 25 per cent from normal, and, while he admitted that the cause of the slump in buying is not entirely clear to him, he seemed to look upon it as a healthy condition which would eventually react to produce a gradually increased demand. He thought that with the present unsettled condition of the country, financially and politically, it is a good thing that business has fallen off a little. On the other hand, a manufacturer of high-grade insulated wire interviewed very recently was in a particularly optimistic frame of mind and stated that his business was continuing exceptionally good. This apparent paradox may be accounted for, at least in part, by the fact that the bare wire is very largely used in transmission-line extension work, and, owing to the tightness in the money market for some time past, there has been little activity in that field, through inability to finance extensions on favorable terms. The insulated wire, on the other hand, is used to a large extent on small work and in constructing machinery, and the natural tendency is for an increase in this kind of work during periods when the big operations are necessarily suspended.

**Electric Locomotives Ordered for the New York Central.**—The New York Central & Hudson River Railroad Company has recently ordered six additional powerful electric passenger locomotives from the General Electric Company for terminal service out of New York City. Early in the year ten electric locomotives of the most powerful type ever built were ordered from this company for the same service. These engines weigh 100 tons each and are each equipped with eight GE-89 bipolar, gearless motors, all the weight of the machine being carried on motor-driven axles. While the new machines are of the same type and construction, they are somewhat heavier, weighing 110 tons, and owing to recent advancement in locomotive design have materially increased capacity. The increase in weight in these machines is accounted for mainly by the greater amount of material in the motors, which are of larger capacity. The speed and torque characteristics of the locomotives have been practically the same as those of the former ten machines, but the new locomotives are capable of hauling approximately 40 per cent greater tonnage in continuous service. The previous ten 100-ton locomotives have a capacity for developing 1460 hp continuously, 2000 hp for one hour and can develop as high as 5000 hp for short periods. The six new electric engines will develop 2000 hp continuously, or 2600 hp for one hour. The motors are electrically connected permanently in parallel in pairs, and the pairs can be connected in three combinations, viz., series, series-parallel and parallel. They are insulated for 1200 volts, so that if at any future time it should be desired to operate the locomotive on this voltage, the pairs of motors could be changed from parallel to series connections and the same speeds and control combinations obtained as at present on 600 volts. The new locomotives are now under construction in the works of the General Electric Company, at Schenectady, N. Y., and will be placed in operation as soon as completed.

**Fertilizer Plant to Install Electrical Equipment.**—The General Electric Company has received an order from the Export Phosphate Company for extensive electrical equipment for its plant at Boston, Mass. The apparatus purchased includes two 400-kva, 2300-volt alternators, eight motors, ranging from 10 hp to 375 hp and aggregating 1055 hp, together with switchboards and auxiliaries.

**Copper Market Stagnant.**—The American copper market is at present very dull. Purchases are reported to be covering only the absolute necessities of consumers, and buying for future delivery is practically at a standstill. Several factors probably combine to produce this state. Prices are rather high, and it is not so long since fears were entertained of a large increase in prices, due to the decrease in production and to a period of continued large demand. It is possible that this impending crisis forced consumers to curtail their purchases. Also it is reported that one of the big electrical manufacturing companies has on hand a supply of copper sufficient to care for its needs for the next six months, if necessary, so that it can afford to hold up present purchases. No doubt, many other large copper consumers took advantage of the low prices during the past summer to accumulate reserve stocks and are now in a position to decrease their purchases with safety. The copper situation abroad is reported to be about the same as it is here, possibly a little better, so there may be factors entering into the local depression which are not of strictly local origin.

**General Business Conditions in Electrical and Allied Fields.**—Talking with the New York representative of a firm that does a country-wide business in auxiliary equipment for steam power plants, both for public utility and for private service, the fact developed that, while the business of this company has been about normal of late, its ratio between estimates given and contracts received has been unusually high. This concern, therefore, inclines to the belief that, in general, business in those lines is not particularly brisk at present and is, in fact, getting poorer rather than better. It has made preparations for decreasing its production if the present slump continues and begins to affect its own business. If the opinion of this company represents the prevailing sentiment concerning the present trend of events, there has developed so far no radically pessimistic feeling, and any slump that has started has been very gradual. There have been a number of disturbing influences during the past quarter, any one of which might be expected normally to exercise a depressing influence on business conditions, and that their combined effect should fail to be felt is hardly likely. At the same time, the fact that the slump has not been more marked would seem to be a matter for congratulation and apparently indicates that the fundamental conditions are very favorable. It might not be an inaccurate prediction that an early settlement of the currency issue and a satisfactory solution of the Mexican problem would bring on a period of prosperity, in spite of the lowering of tariff rates.

NEW YORK METAL MARKET PRICES

| | Oct. 28 | | Nov. 5 | |
|---|---|---|---|---|
| | Electrolytic | Lake | Electrolytic | Lake |
| | Selling Prices | | Selling Prices | |
| Copper wire base | 17.50 | to 17.75 | 17.50 | to 17.75 |
| Sheet zinc, f.o.b. smelter | 7.50 | | 7.50 | |

*OLD METALS

| | |
|---|---|
| | 15.00 |
| | 9.75 |
| Brass, light | |
| Lead, heavy | |
| | 4.37½ |

*COPPER EXPORTS

# Corporate and Financial

**Minnesota Gas & Electric Company Bond Issue.**—An issue of $325,000 first-mortgage sinking-fund 6 per cent gold bonds of the Minnesota Gas & Electric Company, of Albert Lea, Minn., is offered through P. W. Brooks & Company, New York, at par and interest. The bonds are due on Aug. 1, 1933, but are redeemable on or after Aug. 1, 1918, at 103 and interest. A new electric plant was placed in operation by the company in September, bringing its generating capacity up to 1350 kw.

**Chapin Estate Still to Control Indiana & Michigan Electric Company.**—Charles A. Chapin, of Chicago, who died on Oct. 22, was the principal owner of the stock of the Indiana & Michigan Electric Company, of South Bend, Ind., which operates a string of hydroelectric plants in southern Michigan and northern Indiana. By the terms of his will, disposing of an estate valued at $4,651,000, his widow and seven children are all named as trustees of the estate. It is provided that any sale, transfer or conveyance of any part of the trust estate, including stock in the electric company, cannot be made except by the consent of all the trustees.

**United Wireless Telegraph Company Matters.**—In connection with the acquisition, in 1912, of the assets and patents of the United Wireless Telegraph Company by the Marconi Wireless Telegraph Company of America, the Wireless Liquidating Company was formed as an intermediary. Stockholders of that company will vote on Nov. 17 on the proposal to dissolve it and to instruct its directors to distribute its holdings of stock of the Marconi company. In case this action is taken and some stockholders shall become entitled to receive fractions of shares, it is planned to transfer the shares representing the fractional interests to a trustee who shall issue scrip, exchangeable for full shares. This will be the last move in the consolidation of the two operating companies.

**Merger of Georgia Utility Companies.**—Control of the Georgia Public Service Corporation has recently passed into the hands of the Central Georgia Power Company, and the properties of the former concern will hereafter be operated in connection with those of the latter. The Georgia Public Service Corporation was organized in May, 1912, by W. J. Massey, formerly president of the Central Georgia Power Company, and until its acquisition by that concern was in active competition with one of the latter's subsidiaries, the Macon Railway & Light Company, for the electric-lighting business of Macon, Ga., and vicinity. During the rate war between these two concerns the price of energy fell to a comparatively low figure, and, now that a consolidation has been effected, an application is to be made to the Georgia Railroad Commission for approval of a raise in rates for lighting service.

**United States Light & Heating Company's Annual Report.**—The annual report of the United States Light & Heating Company was issued to the stockholders on Oct. 31, over the name of W. S. Crandall, treasurer. Income from sales during the fiscal year ended June 30 last amounted to $3,318,585, and net earnings, after deducting manufacturing costs, selling expenses and overhead charges, came to $346,030. The total assets of the company were given as $16,686,137, of which $13,701,375 was the value assigned to the item of patents and good will. During the year 1912-'13 the company's manufacturing plant at Niagara Falls, N. Y., was extended, providing about 100 per cent increased capacity, which was rendered necessary by the increased business in electric starting and lighting equipment for automobiles. In this branch of the company's business, according to the report, all expiring contracts were renewed and several new contracts were received, while both the railway-car-lighting and the storage-battery branches were reported to have done a good business. The report touched briefly upon the period between July 1 and Nov. 1, 1913, stating that during this time a substantial increase in both gross and net earnings had been realized over figures for the same period in 1912. The company is making an endeavor at the present time to reach the European market, and one large English automobile manufacturer has contracted for electrical a

essory equipment of its make. A statement by J. A. Smith, president of the company, on July 23 gave fuller details concerning the extraordinary expenses of the last fiscal year, together with a brief explanation of the passing of the semi-annual preferred dividend, payable in July. Recently there has developed some dissatisfaction among the minority stockholders of the company, the claim being made that they have not been kept informed of the company's policies and movements, and that action prejudicial to their interests has been taken by the officers of the company. It is not known just how generally this feeling is entertained, but it is rumored that an official reply to the charges will appear shortly.

**Pennsylvania Utilities Company Mortgage.**—In the Oct. 18 issue of the *Electrical World* note was made of the proposed merging of the Eastern Pennsylvania Power Company and the Pennsylvania Utilities Company. Announcement is now made that this plan has been approved by the stockholders of both concerns and that, following the completion of the legal steps necessary to the consolidation, the directors of the new company, known also as the Pennsylvania Utilities Company, have formulated a plan for a large bond issue by that concern. It is reported that a part of the proceeds of this issue will be used for canceling the debts of the old companies and that the remainder will be held for future extensions and repairs. A meeting has been called for Dec. 30 at which the plan will be submitted for the stockholders' approval. The officers of the new company are: C. M. Phil, president; A. D. Lord, vice-president; F. B. Shannon, treasurer, and A. B. Cheadle, secretary.

**Public-Utility Bonds as Investments.**—Some interesting facts were brought out by Mr. John E. Oldham, of Merrill, Oldham & Company, Boston, in a paper entitled "The Place of Public-Utility Bonds in the Investment Market," read at the recent Chicago convention of the Investment Bankers' Association of America. Public-utility bonds are considered to mean the bonds of corporations which furnish light, power, transportation or telephone service. Mr. Oldham gave instances to show that while municipal and railroad bonds have depreciated somewhat in value in the last ten years, public-utility bonds have generally appreciated in value. A computation was made by the author to show the comparative returns from the three classes of bonds between 1901 and 1912. Representative public-utility, municipal and railroad issues were selected, and every effort was made to make a fair investigation. It was shown that the purchaser of $1,500,000 of public-utility bonds would have received an income on his total investment from date of purchase to July 1, 1912, of $487,500 and a gain in market value of $27,377, or a total of $514,877. From the municipal bonds the income was $326,551 and the loss due to depreciation $106,989, leaving a net return of $219,562. Income from the railroad bonds was $399,691 and the loss due to depreciation $70,065, leaving a net return of $329,626. Therefore, the net difference in favor of public-utility over municipal bonds was $295,315 and over railroad bonds $184,891. Public-utility bonds selected for this comparison should meet the following requirements: First, the net earnings should be equal to one and three-quarters times the interest charge; second, the corporation should have gross earnings equal to or exceeding $500,000; third, the original distribution of the issue among investors should be made by a prominent and conservative banking house or banking houses. As a safe division of gross earnings Mr. Oldham suggested 70 per cent for operation and depreciation, 20 per cent for bond interest and 10 per cent for dividends. Upon the financial make-up of the public-utility company will depend its ability to finance itself economically or otherwise. A great responsibility rests upon the investment banker in accepting and marketing these securities. He should investigate the character and permanency of the field of operation and should see that the proper protection is afforded by the franchises, that the legal proceedings in connection with the issue have been properly taken, that the trust deed has been properly drawn, that the financial statements by the company are based on good accounting practice and can be relied upon to reveal the real financial position of the company—in short, he should investigate everything which may affect the integrity of the investment.

## Business Notes

**The Steel City Electric Company,** of Pittsburgh, Pa., announced the appointment, effective Nov. 1, of the Ohio Distributing Company, Hearst Building, Chicago, as its sales representative in the Central West.

**The Auto Electric Equipment Company,** of Buffalo, N. Y., is starting to handle electric supplies and equipment for automobiles and motor boats and will establish a salesroom with a service and repair station at 721 Main Street, Buffalo.

**The C & C Electric & Manufacturing Company,** of Garwood, N. J., has made the following additions to its list of representatives: the Robertson-Cataract Company, 37 Court Street, Buffalo, N. Y.; the Gurley Engineering Company, Ellsworth Building, Chicago, Ill., and F. L. Robbins, Grubb Building, Salisbury, N. C.

**The Bristol Company,** of Waterbury, Conn., has taken over the business of the Goodwin Hollow Set Screw Company and has made arrangements for the exclusive manufacture of its product. Better facilities for manufacturing these set screws will be provided and shipments are now being made from the main factory of the Bristol Company.

**The Multi-Lux Illuminating Studios Company,** of Cleveland, Ohio, is making a new form of showcase reflector, which presents an unbroken line along the entire length of the case and is designed especially for use with the new straight-filament tungsten lamps recently put on the market. This concern is also putting out an emergency lighting unit for theaters, auditoriums and similar service. Mr. J. B. Shields is president of the company and Mr. F. C. Murdock its sales manager.

## New Industrial Companies

**The Star Advertising Company,** of Springfield, Ill., has been incorporated with a capital stock of $1,500 by L. E. Wheeler, W. H. Conkling and J. H. Spurway. The company proposes to deal in electric signs, etc.

**The Ampere Supply Company,** of Ampere, N. J., has been incorporated with a capital stock of $100,000 by A. K. Solden, Jr., F. F. Townsend and R. R. Mitchel, of Ampere. The company proposes to manufacture electrical appliances.

**The New England Cable Company,** of Lowell, Mass., has been incorporated with a capital stock of $40,000 to manufacture and deal in insulated wires, etc. The incorporators are: D. J. Macdougall, S. Dunsford and T. F. Cuff, of Lowell.

**The Metropolitan Appliance Company,** of Chicago, Ill., has been incorporated by George W. LeVin, W. F. Cummings and W. J. Maher. The company is capitalized at $1,000 to manufacture and deal in mechanical and electrical devices.

**The Mutual Electric Manufacturing Company,** of Chicago, Ill., has been incorporated with a capital stock of $350,000 to manufacture and deal in electrical goods and appliances. The incorporators are: H. A. Boissat, T. Dimmock and E. C. Parsons.

**The Freeport Tungsten Lamp Company,** of Hoboken, N. J., has been chartered with a capital stock of $100,000 to manufacture tungsten lamps. The incorporators are: H. J. Jaeger, R. H. Herschman, of Hoboken, and G. V. Williams, of New York, N. Y.

**The Automatic Safety Signal Company,** of New York, N. Y., has been incorporated by Herman Ziegler, Paul R. Feig and Morris M. Becher, 538 West 143d Street, New York. The company is capitalized at $25,000 and proposes to deal in lamps and appliances.

**The Struthers Manufacturing Company,** of Peoria, Ill., has been incorporated with a capital stock of $200,000 to manufacture and deal in lightning rods, light fixtures, hardware specialties, etc. The incorporators are Reuben F. Struthers, John H. Owens and Arthur Otman.

## Trade Publications

**Water and Air Flow Meters.**—Steam, water and air flow meters are exhaustively treated in Bulletin No. A4157, issued by the General Electric Company.

**Electric Rainbow Fountain.**—The Feature Advertising Company, 209 Pacific Street, Brooklyn, N. Y., has issued a small folder describing the "Rainbow Fountain" as an advertising feature.

**Second-Hand Machinery.**—MacGovern & Company, 114 Liberty Street, New York, have issued their November list of used electrical and steam machinery, cars, car equipment and other apparatus, indexed for easy reference.

**Switch and Outlet Boxes.**—The Chicago Fuse Manufacturing Company, 1014 West Congress Street, Chicago, has published Catalog No. 27, which illustrates and briefly describes its switch boxes and outlet boxes and covers.

**Electrical Supplies.**—With its new price list and discount sheet applying to Catalog No. 21, the Illinois Electric Company, 308 Madison Street, Chicago, is sending out a complementary order book for the convenience of its patrons.

**Fixtures.**—Catalog "C" of the National X-Ray Reflector Company, Chicago, shows its full line of "Eye Comfort" fixtures, printed in loose-leaf form. Catalog No. 17 illustrates and describes some new reflectors for show window and direct lighting.

**Electrical Drills.**—A fully illustrated description of the portable electrical drills and grinders made by the Cincinnati Electrical Tool Company, Cincinnati, Ohio, is given in Part I of Catalog No. 6. Part II is devoted to tool post grinders, bench, aerial, floor and internal grinders.

**Oil Separators.**—The Harrison Safety Boiler Works, Philadelphia, Pa., have recently published the last section—"E"—of Catalog No. 550, which pertains to low-pressure receiver oil separators, for removing oil and water from exhaust steam for use in low or mixed pressure turbines.

**Electric Buses.**—Field electric buses are the subject of a 24-page pamphlet recently issued by the Field Omnibus Company, Singer Building, N. Y. The booklet gives data in regard to the earnings, operation and maintenance of the Field bus, which is equipped with the Edison nickel-steel storage battery.

**Electricity in Railway Terminal.**—The important part that electricity plays in the New York terminal of the New York Central Railroad is described and illustrated in an artistic brochure of sixteen pages, issued by the General Electric Company under the title "Electricity on the New York Central." The information is well presented and is interesting alike to engineer and layman.

**Thermometers.**—The Hanovia Chemical & Manufacturing Company, Chestnut Street and New Jersey Railroad Avenue, Newark, N. J., has issued Supplement I, devoted to Heraeus quartz glass resistance thermometers, with special reference to telehygrometers for cold stores, breweries, cotton mills and wherever a knowledge of the humidity of the air and its measurement is of much importance.

**Tube Cleaners.**—Catalog M, issued by the Lagonda Manufacturing Company, Springfield, Ohio, contains information in regard to scientific scale removal by means of mechanical tube cleaners and some remarks on the harmful effects and reduction in economy resulting from the accumulation of scale in boiler, in condenser and in evaporator tubes. The catalog contains twenty-four pages and is fully illustrated.

**Voltage Regulation.**—Bulletin No. 4972, recently issued by the General Electric Company, describes its "KR" system of voltage regulation, which can be successfully employed on systems having such large fluctuations of voltage that the standard method is ineffective. The system described gives a broad range of excitation and the voltage furnished the fields of the main alternators is not limited either by the voltage range of the main exciters or the amount of current flow interrupted by the contacts of the regulator.

## Personal Mention

**Mr. A. A. Albany** retired on Nov. 1 as manager of the Eastland (Tex.) Light & Power Company. He has been succeeded by Mr. G. W. Bishop.

**Mr. G. Lundgren,** formerly of the Cherokee (Ia.) Electric Company, has become manager of the Clear Lake (Ia.) Electric Light & Power Company.

**Mr. W. D. Weaver,** formerly editor of the *Electrical World*, has received from the French government the decoration (violet rosette) of Officier de l'Instruction Publique.

**Mr. R. M. Jennings** has been appointed manager of the Oregon Power Company at Marshfield, Ore. He was formerly manager of the Eugene (Ore.) division of the same company.

**Mr. Zenas W. Carter,** formerly secretary of the Electric Development Association of Boston, has been appointed manager of sales of the Ensign Manufacturing Company, builder of electric calculating machines, Boston, Mass.

**Mr. F. E. McKenna,** formerly manager of the new-business department of the Pacific Power & Light Company at Walla Walla, Wash., has recently been appointed manager of the Coquille plant of the Oregon Power Company.

**Mr. A. Norman,** formerly manager of the Freeport (Ill.) Railway & Light Company, has been appointed manager of the Eugene division of the Oregon Power Company, with headquarters at Eugene, Ore., succeeding Mr. R. M. Jennings.

**Mr. J. J. Doyle,** formerly assistant manager of the Central New York Gas & Electric Company, of Newark, N. Y., has been appointed manager of the electrical division of the properties of the Hagerstown & Frederick (Md.) Railway Company.

**Mr. William G. Furlong,** private secretary to the late A. N. Brady, has been elected secretary of the Municipal Gas Company, Albany, N. Y., succeeding Mr. E. P. Gabit, who has been promoted to the dual position of vice-president and treasurer.

**Mr. Val A. Fynn,** consulting engineer for the Wagner Electric Manufacturing Company, of St. Louis, Mo., has returned from his annual summer trip to Europe. Mr. Fynn is a mountaineer and a guide as well as a designer of single-phase motors.

**Mr. Edward S. Mansfield** has been appointed superintendent of operating bureau accounts of the Edison Electric Illuminating Company of Boston. Mr. Mansfield was born in Wakefield, Mass., in 1870, and in 1889 entered the employ of the General Electric Company at Schenectady, N. Y., where he was engaged for three years. In 1892 Mr. Mansfield entered the Massachusetts Institute of Technology, from the electrical engineering department of which he was graduated in 1897. During the vacation periods he worked in various capacities for the Boston Edison Company, and after his graduation he obtained a permanent position with the company as a statistician in President Edgar's office. He subsequently became head of the correspondence division in charge of the real estate of the company and later head of the statistical division in charge of the electric vehicle division. His work in connection with the electric vehicle division has been eminently successful. Owing to the rapidly broadening scope of the work of the operating bureau it was necessary to create a new office of superintendent of operating bureau accounts, to which Mr. Mansfield has just been appointed. Mr. Mansfield is a director of the Electric Vehicle Association of America, vice-chairman of the New England Section of the association, and vice-president of the Electric Motor Car Club of Boston.



EDWARD S. MANSFIELD

**Mr. Howard R. Sargent,** managing engineer of the wiring supplies department of the General Electric Company, and a candidate for alderman of the Eleventh Ward, Schenectady, N. Y., on the Citizens' ticket, was elected to that office on Nov. 5 by the largest plurality given to any alderman in the city in that election. The entire Schenectady Socialistic ticket was defeated.

**Mr. L. E. Polhemus,** mechanical and electrical engineer of the Ventanas Mining & Milling Company, Ventanas, Durango, Mexico, has joined the staff of the Nevada-California Power Company at Bishop, Cal. Mr. Polhemus was previously mechanical and electrical engineer of the Cubo Mining & Milling Company at Guanajuato, Mexico, and for four years was assistant master mechanic of the Mexican Light & Power Company at Nacaxa, Mexico. He left Mexico owing to the activity of the rebel forces in the State of Durango.

**Mr. Homer E. Niesz,** for several years manager of the Cosmopolitan Electric Company of Chicago, has been made secretary of the budget and expense committee of the Commonwealth Edison Company, following the absorption of the Cosmopolitan company by the Commonwealth company. This committee, of which Vice-president L. A. Ferguson is chairman, has an important function in the administration of the great Chicago electric service organization. For a number of years Mr. Niesz was connected with the Chicago Edison Company, predecessor of the Commonwealth company, so that he is returning to his old home and associates. Mr. Niesz is widely known among electrical men. He is chairman of the Chicago Section of the Electric Vehicle Association and Jovian statesman for Chicago.

**Mr. Ell C. Bennett,** who was re-elected Mercury at the recent Jovian Congress held in New York City, was born at Hannibal, Mo., Sept. 15, 1878, his parents having moved from Virginia to Missouri shortly before his birth. Mr. Bennett was brought to St. Louis at the age of four by his mother, who had owned and edited the Hannibal *Courier*, a daily newspaper, when she disposed of her interests in that paper and moved to St. Louis as part owner and associate editor of the *Missouri Republican*. Mr Bennett was educated in the public schools of St. Louis and, his family having met with financial reverses, he started to work at the age of fifteen. For three years he worked in the office of Lieut.-Gov. Charles P. Johnson of Missouri, and for four years in the office of Probate Judge J. Gabriel Woerner, of St. Louis. What leisure time he possessed was devoted to acquiring proficiency in shorthand reporting at night school and also to studying law. The untimely death of Judge Woerner upset his plans for becoming an attorney, and increasing responsibility at home made it necessary for him to enter commercial life. He began as a clerk in the Liggett & Myers Tobacco Company, became cashier and traveling passenger agent for the White Star Line, went into the office business and finally took up publicity work. He organized and operated the Electric St. Louis Publishing Company, publisher of load-building magazines for central stations, of which he is at present president and managing editor. Mr. Bennett's Jovian work began as a special investigator of the work of the central offices then located in Chicago, at the solicitation of Jovians and by appointment from Ninth Jupiter J. Frank Dostal in the last three months of the latter's incumbency. Mr. Bennett was elected Mercury and put in sole charge of the Jovian central offices at the Ninth Jovian Congress, held in Denver, October, 1911. He was re-elected at the Pittsburgh Congress and again at the New York Congress. In 1903 he married Katherine Louise Bain, of St. Louis, and is now the father of a family consisting of three boys and two girls.



ELL C. BENNETT

**Mr. H. C. Hoagland** has been appointed general manager and treasurer of the Fort Smith (Ark.) Light & Traction Company, succeeding Mr. J. W. Gillette, resigned. Mr. Hoagland will also retain his position as general manager of the Muskogee (Okla.) Gas & Electric Company.

**Mr. A. J. Reed,** recently connected with the Dayton office of the Westinghouse Electric & Manufacturing Company, has severed his connections with that company to assume duties with the Robbins & Myers Company in the capacity of manager of its newly opened branch office in Cleveland, Ohio.

**Mr. Charles E. Mann,** until recently clerk of the Massachusetts Railroad Commission and acting secretary of its successor, the Massachusetts Public Service Commission, has been appointed executive secretary of the board and will take charge of the records of the commission's proceedings and have the custody of its documents.

**Mr. Andrew A. Highlands** has been appointed secretary of the Massachusetts Public Service Commission, with headquarters at 20 Beacon Street, Boston. Mr. Highlands is a native of Fall River, Mass., and was graduated from the Harvard Law School in 1898. He will have general charge of the correspondence and office work of the Public Service Commission.

## Obituary

**James H. Ryan,** of Chicago, a sales agent for the General Electric Company, died on Oct. 22. Mr. Ryan was a member of the Electric Club of Chicago.

**Grafton Stevens,** of Chicago, by profession a mechanical engineer and vice-president of the Oelwein (Ia.) Light, Heat & Power Company, was burned to death, with his wife, in their suburban home at Wilmette on Oct. 31. Mr. Stevens was graduated from the Armour Institute of Technology in 1903 and went with H. M. Byllesby & Company as an assistant to Mr. H. B. Brydon, of the engineering department, in 1907. He was greatly liked by his employers and associates. He resigned from the Byllesby organization in April of this year and opened an office in Chicago for himself as a manager of utility properties, acquiring an interest in the Oelwein plant. Mr. Stevens was a member of the American Society of Mechanical Engineers, the Phi Kappa fraternity, the Hamilton Club of Chicago and other clubs.

**James Pass,** of the well-known firm of Pass & Seymour, Syracuse, N. Y., died at his home in that city Oct. 30, at the age of fifty-seven. Mr. Pass was born in Burslem, Staffordshire, England, June 1, 1856, and came to the United States with his parents when seven years of age. His father, Richard Pass, was a manufacturer of pottery and first settled in Cincinnati, later in Trenton and finally in Syracuse. His son, James, was apprenticed to a pottery manufacturer at Trenton, and when he came to Syracuse at the age of eighteen was made foreman in the Onondaga pottery. He afterward succeeded his father as superintendent of the pottery, soon became general manager and later vice-president of the works. In 1890, with Mr. Seymour, Mr. Pass formed the firm of Pass & Seymour, manufacturers of porcelain insulation, etc. Mr. Pass was at one time president of the United States Potters' Association and was a charter member of the American Ceramic Society. He was also a member of the Engineers' Club of New York, the Syracuse section of the American Chemical Society and the Century, Citizens' and Country Clubs of Syracuse. He is survived by his widow, two sons and a daughter.



JAMES PASS

# Construction

## New England

GREENVILLE, N. H.—The Greenville El. Ltg. Co. expects to purchase within the next month one marine set with 5-kw to 10-kw generator, one small kw to drive steam turbine with generator, also one 2-kw to 4-kw direct current generator to operate an exciter for a 60-kw alternating current generator. H. F. Hall is treasurer.

BRISTOL, VT.—The Lake Dunmore Pwr. & Trac. Co., of Bristol, expects to purchase an additional boiler, smokestack and turbine waterwheel. J. D. Blackwell is manager.

BURLINGTON, VT.—The Municipal Electric Light Department of Burlington expects to erect within the next two months 3 miles of 2300-volt primary transmission line and to purchase two 300-hp Sturtevant fuel economizers and 40 new street-lamp fixtures to be operated on an extension of one of the present circuits. A new breakwater is now being built at the power house on Lake Champlain to protect the circulating water intake well. J. R. McBroom is manager.

CONCORD, MASS.—The managers of the municipal electric-light plant have contracted for and will soon install a 500-kw turbo-generator set and jet condenser, and will also purchase within the next three months meters, transformers and line material to take care of the regular service; also heating appliances and household labor-saving devices as called for. A. W. Lee is manager.

EASTHAMPTON, MASS.—The State Board of Gas and Electric Light Commissioners has granted the Easthampton Gas & El. Co. permission to issue $100,000 in additional capital stock, making a total of $450,000.

TORRINGTON, CONN.—The Connecticut River Pwr. Co. (controlled by the Stone & Webster Corpn., of Boston, Mass.) has begun work on the construction of a substation in Torrington to distribute electricity here. The company is building a large hydroelectric power plant at Falls Village, on the Housatonic River, and will transmit electricity to the local substation at 66,000 volts.

## Middle Atlantic

BUFFALO, N. Y.—The Board of Estimate has instructed the committee on lamps and the commissioner of public works to submit a general plan and estimates of cost for the installation of a municipal electric-light plant.

GOWANDA, N. Y.—The State Conservation Commission has approved the plans and specifications submitted by the Keyes El. Co., of Gowanda, for the construction of a dam in the Cattaraugus Creek (No. 55, Erie watershed) in the towns of Persia and Colins.

KINGS PARK, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until Nov. 21, for furnishing additional power house equipment, boilers, air compressor and connections, new elevators and wiring thereto at Kings Park State Hospital, Kings Park, N. Y. Drawings and specifications may be seen and blank forms of proposals obtained at the Kings Park Hospital, office of the State Hospital Commission, No. 1 Madison Avenue, New York, and at the office of the state architect, Capitol, Albany. Plans and specifications will be furnished upon application to Lewis F. Pilcher, state architect. J. H. B. Hanify is secretary.

MANLIUS, N. Y.—W. J. Phillips, owner of the local electric-light plant, has applied to the Public Service Commission for permission to extend his transmission lines from the eastern limits of the village of Manlius through the towns of Manlius and Sullivan to the village of Chittenango. Mr. Phillips was recently awarded a contract for street-lighting in Chittenango.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities, foot of East Twenty-sixth Street, New York, until Nov. 13, for furnishing material and labor for installation of additional mechanical equipment for the power house and laundry building at Randall's Island. Blank forms and further information may be obtained at the office of Frank J. Helme, architect, 190 Montague Street, Brooklyn, where plans and specifications may be seen.

RANSOMVILLE, N. Y.—The Lake Shore Pwr. Co. has applied to the State Highway Department for permission to erect a transmission line from Lewiston to Ransomville. The company purchases electricity from the Niagara, Lockport & Ontario Pwr. Co. and is now furnishing electrical service in Wilson.

CHERRY TREE, PA.—The Cherry Tree El. Ht., Lt. & Pwr. Co. has discarded its arc lamps and has erected about 40 100-watt incandescent lamps throughout the town. C. J. Cameron is secretary and treasurer.

HUMMELSTOWN, PA.—The Hummelstown Consol. Wtr. Co. is [illegible] and expects to purchase [illegible] generator to take the place of a smaller machine. J. E. Nicholson is superintendent.

JUNIATA, PA.—The Raystown Wtr. Pwr. Co., of Huntington, has [illegible] increase to furnish electrical service at Juniata.

NEW WILMINGTON, PA.—The managers of the municipal electric light plant expect to purchase one new 70-hp Pennsylvania boiler, one 40-kw and one 50-kw direct-current generator and one 75-hp Foss gas engine, with switchboard equipment, motors, switch and breaker and poles, lightning arresters, meters and incandescent lamps. J. B. Anderson is engineer.

OLYPHANT, PA.—The electric light commissioners expect to purchase within the next six months one 50-lamp tub transformer. M. P. Malley is secretary.

WILSON, PA.—The Eastern Pennsylvania Pwr. Co., of Easton, has submitted a proposition to the commissioners of Wilson Township for lighting the streets of the town.

DOVER, DEL.—The town of Dover is making several improvements to the municipal electric-light plant, including changing the system from single-phase to three-phase, material for which has been purchased. A 200-kva generator manufactured by the Fort Wayne El. Works has been ordered. T. F. Cooke is superintendent.

CLIFTON FORGE, VA.—The Virginia-Western Pwr. Co., of Clifton Forge, has recently placed contracts for the following equipment, which will soon be installed in the new addition to its power house: To the General Electric Co. for one 750-kw Curtis steam turbine; Heine Safety Boiler Co., of St. Louis, Mo., for one 400-hp boiler; Henry R. Worthington, of New York, N. Y., for one surface condenser, and Paul C. Crowe for stokers for boilers. A. C. Ford is manager.

WESTPOINT, VA.—The People's Lt., Ht. & Pwr. Corpn., of Westpoint, expects to purchase within the next three months one 250-hp boiler, one 200-hp simple four-valve or compound slide-valve engine directly connected to a 150-kva alternator and a three-panel switchboard. C. L. Maskey is president.

WEYER'S CAVE, VA.—The Weyer's Cave Lt. & Pwr. Co. expects to erect within the next few months 1 mile of distribution line into the farming country adjoining Weyer's Cave. L. E. Long is secretary and treasurer.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until Nov. 14, for one steel tower for radio station (250 ft. high), approximate weight 65,000 lb., in accordance with specifications 510a. Major W. L. Clarke is disbursing officer.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until Nov. 20, for furnishing the following supplies: One common-battery lamp line, three position, 600 common-battery lines, 40 magneto lines and 45 cord circuits, completely wired switchboard, but only equipped for 400 common-battery lines, 20 magneto lines and 50 cord circuits, as per proposal No. 686. This switchboard is for installation in the tropics. Major W. L. Clarke is disbursing officer.

WASHINGTON BARRACKS, D. C.—Bids will be received at the office of the engineer depot, United States Army, Washington Barracks, D. C., until Nov. 14 for furnishing eight ventilating blowers connected to 110-volt, alternating-current, single-phase motors (right-hand); two 18-in. disk or propeller fans directly connected to 110-volt, alternating current, single-phase motors, complete with solder, and four 18-in. disk or propeller fans directly connected to 110-volt direct-current motors, complete, with inclosed starting rheostat and main switch. Further information may be obtained upon application to Lt.-Col. Joseph E. Kuhn

## North Central

JACKSON, MICH.—The State Railroad Commission has authorized the Economy Pwr. Co., of Jackson, to increase its capital stock by $1,630,000 the proceeds to be used to pay outstanding indebtedness and for the development of plants recently acquired.

KALAMAZOO, MICH.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 28 (change of date from Nov. 27) for a conduit and wiring system, etc., in the United States post office in Kalamazoo, Mich.

CALDWELL, OHIO.—Bids will be received by the Board of Public Affairs, Caldwell, Ohio, until Nov. 24 for furnishing material, labor and machinery for remodeling and equipping the electric-light plant and waterworks system. The work will include the construction of a new power station and new equipment, consisting of a vertical multi-cylinder [illegible] to develop a rating of at least 125 kw, to drive an existing Fort Wayne alternating-current generator, now located at the old plant, and a new switchboard with instruments. New transmission lines will be [illegible] to the new power house. Arc lamps on the street circuit will be replaced with tungsten lamps mounted on ornamental brackets. Meters will also be required. The compound pump which is now in use at the pumping station will be replaced by a new [illegible] pump [illegible] by a motor of the same capacity. A centrifugal pump [illegible] capacity of approximately 80 hp, belt-driven) will be installed to drive the new pump. Bids will be received on the above as a whole or on [illegible] Plans and specifications may be seen at the office of the board [illegible] clerk.

CLEVELAND, OHIO.—The contract for general building construction of the municipal electric-light plant has been awarded to W. B. McAllister Co., of Cleveland, for $60,800, to be completed in 100 days.

COLLEGE CORNER, OHIO.—The Town Council has granted a franchise to John H. McCray to construct and operate an electric-light plant in College Corner. Later the Council will enter into a contract with Mr. McCray for lighting the streets with 20 or more street lamps.

GREEN SPRING, OHIO.—The electric plant of the Green Spring El. Lt. & Pwr. Co. was entirely destroyed by fire on Oct. 26. The town will be without electrical service for several weeks.

MAUMEE, OHIO.—It is reported that interests controlling the Auglaize Pwr. Co., the Defiance Gas & El. Co., the Valley Lt. & Pwr. Co. and the Maumee Valley El. Co. are contemplating the construction of a 3000 hp steam-power plant in Maumee, to be used as an auxiliary to the hydroelectric power plants. The headquarters of the company are in Defiance. W. P. Wallace is general manager.

NEW BREMEN, OHIO.—The City Council is reported to be considering the question of contracting with the Western Ohio El. Ry. Co. to furnish electricity to operate the municipal electric-light plant and waterworks system.

OAKWOOD, OHIO.—The Village Council is contemplating the installation of an electric-light system. It is proposed to install an electric generator in connection with the power plant in the tile yard.

TOLEDO, OHIO.—The Toledo Rys. & Lt. Co. is installing a 12,500-kw General Electric horizontal steam turbine with a Westinghouse Le-Blanc surface condenser, which will be put in operation about Dec. 1. The company is also installing five Stirling boilers with a rating of 3300 hp and a 1000-kw rotary converter for the down-town lighting system. A 1500-kw Westinghouse frequency changer has just been added to the plant.

WINDHAM, OHIO.—The power plant of the Windham El. Co. was closed down last June and energy for operating the local system is secured from the Trumbull Pub. Ser. Co., of Warner, which has erected a 22,000-volt transmission line through Windham to Garrettsville. The company has established a 24-hour service in Windham and is extending its distribution lines into the country to furnish the farmers with electricity for lamps and motors.

WOOSTER, OHIO.—The Wooster El. Co. has placed a contract with the Allis-Chalmers Co. for a new generating unit, consisting of a 350-kw alternating-current generator and other machinery, to cost $13,000.

CARROLLTON, KY.—Plans are being considered for making improvements to the municipal electric-light plant, including changing the system from direct current to alternating current.

CLAY, KY.—Preparations are being made by the Clay Lt. & Ice Co. for the installation of a 75-kva, 2200-volt Fort Wayne generator and an Erie Ball engine; equipment already purchased, also material for distribution system, including poles, cross arms, insulators and wire. Transformers have not yet been purchased. The company will purchase at once fixtures for about 5000 lamps. C. R. Clark is secretary.

CONNERSVILLE, IND.—The Hydro-Electric Lt. & Pwr. Co., of Connersville, has installed within the past few months a 500-kw steam turbo generator set and 25-kw motor generator exciter set, two 280-hp Stirling boilers, chain grate stoker, surface condenser and additional switchboard equipment for generator and exciter. W. E. Lowe is superintendent.

MISHAWAKA, IND.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 8, for the construction, including mechanical equipment, electric conduit and wiring system, interior lighting fixtures and approaches, of the United States post office at Mishawaka, Ind. Drawings and specifications may be obtained from the above office or from the custodian at Mishawaka. O. Wenderoth is supervising architect.

NEW CARLISLE, IND.—The managers of the local electric-light plant are contemplating the purchase of some poles. George W. Doughty is clerk.

NOBLESVILLE, IND.—The Noblesville Ht., Lt. & Pwr. Co. has erected during the last five months 15 miles of distribution lines through the farming districts to furnish electrical service on the farms. John T. Foster is manager.

CHESTER, ILL.—A new boiler, engine and generator has recently been installed in the Chester light and ice plant. J. Fred Gilster is secretary and treasurer.

FARMER CITY, ILL.—The managers of the municipal electric light plant expect to purchase within the next 12 months about 24 ornamental lamp posts for cluster lamps.

FITHIAN, ILL.—At an election held recently the proposition to purchase the local electrical distribution system and franchises, owned by O. Winsong, was carried.

GENEVA, ILL.—The city of Geneva expects to purchase within the next eight months two boilers and one motor-driven air compressor. Olaf Peterson is superintendent.

JACKSONVILLE, ILL.—An ordinance has been introduced in the City Council providing for a bond issue of $50,000 to equip the municipal electric-light plant to furnish electricity for commercial and city lighting.

JACKSONVILLE, ILL.—The Jacksonville Ry. & Lt. Co. expects to contract within the next few months a switchboard gallery and to purchase two 300-hp boilers and an 8-ft. by 150-ft. smokestack, new switchboard panels and material to put the present installation in first-class order. The company also expects to rebuild its 2300-volt transmission lines throughout the city within the next three weeks. W. N. Christensen is operating engineer.

KENNEY, ILL.—The Mount Pulaski El. Lt., Ht. & Pwr. Co., of Mount Pulaski, will take over the plant of the Kenney El. Co. by Jan. 1, 1914, and will furnish electricity to operate the local system from its plant at Mount Pulaski.

NAUVOO, ILL.—The City Council has awarded a contract for street-lighting to Joseph Nelson, president of the Nauvoo El. Lt. & Pwr. Co. The contract calls for thirty 350-watt tungsten lamps.

PEORIA, ILL.—A petition has been presented to the City Council by residents on Barker Avenue (from University Avenue to Western Avenue) for the installation of ornamental lamp standards. They agree to furnish the standards, provided the city will maintain the lamps.

ROCKFORD, ILL.—The installation of an ornamental lighting system on Seventh Street, from Charles Street to Railroad Avenue, is contemplated by the Seventh Street business men.

SULLIVAN, ILL.—The City Council (it is reported) is contemplating equipping the municipal electric-light plant to furnish electricity for commercial lighting.

WARSAW, ILL.—The installation of an ornamental street-lighting system in Warsaw is under consideration.

WATSEKA, ILL.—A movement has been started by the business men for the installation of an ornamental street-lighting system in the business district. Iron standards carrying five-lamp clusters will probably be used. Julius Shapiro is interested.

MENOMONIE, WIS.—The City Council has awarded the Chippewa Valley Ry. & Ltg. Co., of Eau Claire, a contract to light the streets of the city for a period of four years.

CROOKSTON, MINN.—The Red River Farm & Land Co., of Crookston, is now erecting a hydroelectric power station and dam on the Red Lake River, about 4 miles above the city, and will put in operation one unit next month. The company has purchased one 750-hp, 90 r.p.m. Smith turbine and one 500-kva Westinghouse horizontal generator with switchboard and exciter unit. E. Peterson is treasurer.

EVELETH, MINN.—The Home El. & Ltg. Co., of Eveleth, has recently installed two Jones underfeed stokers with auxiliary apparatus in its plant. R. M. Dungan is general manager.

GILBERT, MINN.—The St. Louis Pwr. Co., it is said, will soon begin work on the erection of a transmission line from Gilbert to Biwabik, where it was recently awarded a contract to furnish electricity to operate the municipal electric-light system.

ADAIR, IA.—Orders were placed Oct. 10 for a 150-hp Ridgway engine, a 100-kw generator, switchboard and all accessories, to be installed at once. C. E. Morse is superintendent of light and power plant.

CENTERVILLE, IA.—The Centerville Ltg. & Trac. Co., it is reported, will install a new engine and generator, directly connected, in its power plant.

DEDHAM, IA.—Application has been made to the town of Dedham by John Neuburg for a franchise to install and operate an electric-light system in Dedham.

DENISON, IA.—The Denison El. Lt. & Pwr. Co. expects to build a new power station and erect 28 miles of transmission lines within the next eight months; also to purchase three 72-in. by 18-ft. boilers, two Corliss engines, one 200-kva and one 125-kva generator, two boiler-feed pumps, one car load of 25-ft. poles and one car load of 30-ft. poles with 6-in. tops, one tub transformer and 300 6-amp tungsten lamps within the next six months. Within the next 12 months the company expects to purchase a sample of most of the cooking apparatus as well as heating devices. E. Gulick is president.

GERLED, IA.—It is reported that a movement is on foot for the construction of an electric plant in Gerled to furnish electricity in Bancroft, Swea City, Ledyard and Germania.

GLIDDEN, IA.—Of the proceeds of $10,000 in bonds (recently authorized), $5,400 will be used to take up outstanding indebtedness and the remainder for the purchase of an additional unit for power plant. Contracts have been placed for a 175-hp Ridgeway engine and 100-kva generator (directly connected). O. B. Morehouse is city clerk.

GREENE, IA.—The Greene Lt. & Pwr. Co. expects to purchase within the next few months a storage battery. R. Miner is secretary.

McGREGOR, IA.—The McGregor Lt. & Pwr. Co. has been granted a 25-year franchise to furnish electricity for lamps and motors in McGregor, and to erect and maintain a transmission line to Monona. The company will also furnish electrical service to farmers residing along the route of the proposed transmission line.

MEDIAPOLIS, IA.—Work has begun on the installation of a street-lighting system in Mediapolis, consisting of 50 tungsten lamps. A temporary steam plant will operate the electric generator until next spring when the transmission line of the Mississippi River Pwr. Co. will be extended from West Burlington northward to serve Morning Sun and other towns in that vicinity.

MILFORD, IA.—A franchise has been granted to O. E. Logan, of Sheldon, to install and operate an electric-light system in Milford.

MONONA, IA.—The Monona Lt. & Pwr. Co., recently incorporated, with a capital stock of $20,000, will erect a substation at the town limits,

connecting with the transmission line of the McGregor Lt. & Pwr. Co., which will furnish electricity to be distributed by the Monona company. W. A. Wellman, L. N. Nelson and H. Wellman, all of Monona, are interested in the Monona company.

OELWEIN, IA.—A special election will be held Nov. 18 to vote on the proposition to grant a franchise to the Oelwein Lt., Ht. & Pwr. Co. A. F. Heeb, T. J. Mulgreen and T. J. Fitzpatrick, all of Dubuque, Ia., are interested in the company. An item published Oct. 18 stated that a franchise has been given to the above parties. C. D. Sheppy is city clerk.

ROCKWELL CITY, IA.—The local electric-light plant was recently purchased by H. B. Rutledge, of Minneapolis. The new owner has contracted for considerable new equipment, which will be installed at once.

WASHINGTON, IA.—The railroad companies, it is said, will pay for electroliers at all railroad crossings and the city will maintain them.

EDINA, MO.—The Edina Lt. Co. expects to purchase within the next three months one 150-hp boiler and one 125-hp Corliss engine, and within the next six months it expects to purchase a series tungsten lamp street-lighting system. M. C. Hunter is secretary and treasurer.

FAYETTE, MO.—The Fayette Lt., Ice. & Coal Co. expects to purchase within the next 12 months one Corliss engine direct connected to a 200-kw to 250-kw, three-phase, 60-cycle, 2300-volt generator. The company would like to purchase a good second-hand outfit. John B. Bell is president.

LA PLATA, MO.—The property of the La Plata Lt. & Pwr. Co., consisting of an electric-light plant, water-works system and ice factory, has been purchased by Abraham Vogel, formerly connected with the Bowling Green El. Lt. Co.

MAPLEWOOD, MO.—The Board of Aldermen has granted the Independent Lt. & Pwr. Co. a franchise to furnish electricity for lamps and motors in Maplewood. The company was also given a contract for street-lighting, under the terms of which the company is to furnish street lamps of 100 cp at $15 each per year. The franchise and contract will be submitted to the voters for approval. H. P. Taussig, president of the Western Manufacturers Co., of St. Louis, and Horace C. Pugh, of Terre Haute, Ind., are interested in the company.

DALLAS, S. D.—The Martin El. Lt. & Pwr. Co., of Dallas, S. D., expects to purchase within the next three months transformers, lightning arresters, insulators, meters, etc.; also electrical appliances, including heating and cooking apparatus, vacuum cleaners, washing machines, etc. B. H. Martin is president and manager.

FLANDREAU, S. D.—The Flandreau Lt. & Pwr. Co. expects to extend its service to Egan and Coleman within the next six months, to furnish electrical service in both towns. A. H. Savage is treasurer.

HENRY, S. D.—The Henry Lt. & Pwr. Co. expects to purchase within the next two or three months one 18-kw or 20 kw, 125-volt direct-current generator and some meters. Ernest Reincke is secretary and manager.

LENNOX, S. D.—The Lennox Milling Co., recently incorporated, with capital stock of $30,000, proposes to supply electricity in Lincoln County, covering a territory of 25 miles. The company will also operate a flour mill. H. B. McFarland, T. K. Colesfi, of Lenox, and A. B. McFarland, of Centerville, are interested in the company.

SALEM, S. D.—The Salem Milling, Ltg. & Htg. Co. expects to purchase soon a 60-in. by 16-ft. horizontal tubular boiler. The company is also interested in condensing apparatus. L. V. Schneider is president and manager.

ALMA, NEB.—The managers of the municipal electric-light plant expect to purchase within the next 30 days one 150-kva generator and a 5-kw, 125-volt exciter; also to purchase within the next six weeks switchboard equipment, including one exciter panel, one distributing panel, one series incandescent panel with accessories; also interior wiring supplies, heating appliances and labor-saving devices within the next month. A. H. Reed is city clerk.

COLUMBUS, NEB.—The Columbus Lt., Ht. & Pwr. Co. is now installing a 550-hp compound condensing engine and a 450-kva alternator and will soon install a 15-ton ice manufacturing plant. Willis Todd, 214 First National Bank Building, Omaha, is general manager.

DAVID CITY, NEB.—The city of David City expects to purchase within the next 12 months one 200-hp water-tube horizontal boiler, one 150-kw and one 75-kw generator, a three-panel or four panel switchboard, two small exciters for above generators for the municipal electric-light plant; also wire meters, lightning arresters, insulators, poles, 25 or 30 transformers, wiring supplies, washing machines, flatirons, etc. Henry J. Bremers, Jr., is water and light commissioner.

FUNK, NEB.—The local electric-light plant, owned by O. Cobb, was recently purchased by A. S. Erickson.

GRAND ISLAND, NEB.—The Water and Light Commission is now installing one 500-kw Allis-Chalmers turbine and condensing apparatus and also 140 ornamental standards carrying five-lamp clusters. J. H. Miller is water and light commissioner.

LINCOLN, NEB.—Since Oct. 15 the municipal electric-light plant has been furnishing electricity for commercial lighting. The Water and Light Commission expects to purchase at once transformers, lightning arresters, meters and incandescent lamps; also within the next few months condenser for water and light plant. Paul W. Doen is assistant water and light commissioner.

## Southern States

WENDELL, N. C.—The Lee mill property on Little River, 2 miles east of the city, is reported to have been purchased by the city of Wendell on which a hydroelectric power plant will be erected to supply electricity to light the city.

WILSON, N. C.—The date for receiving bids for electric power-plant equipment (advertised to be received Nov. 4) has been postponed indefinitely. Parties having received specifications are requested to preserve them, as it is the present intention to call for bids at some future date on the same specifications. Gilbert C. White, of Charlotte, N. C., is engineer, and D. S. Boykin is chairman of Board of Public Works.

BENNETTSVILLE, S. C.—The Board of Public Works expects to erect within the next 30 days a 2300-volt transmission line to the grounds of the Marlboro County Fair Association, material for which has been purchased. The company also expects to purchase within the next six months three-wire underground cable for maintaining street-lamp standards and transformers for same. Within the next three months the company expects to purchase additional five-lamp and one-lamp standards for street-lighting. E. C. Morrison is manager.

MOUNT PLEASANT, S. C.—The Isle of Palms Improvement Co., of Charleston, will build a new substation in Mount Pleasant, work on which will begin Jan. 1, 1914. The equipment will include a seven-panel switchboard, two 300 kw rotary converters, 6600-volt, primary, 60-cycle. The distribution system will consist of 2 miles of aerial three-phase pole line. A transmission line about 2 miles long will be erected with 1¼ miles of submarine cable additional to connect the substation in Mount Pleasant with the power station in Charleston. Contract has practically been placed for the above line. The submarine cable will be laid across the Cooper River. W. W. Fuller, of Charleston, is engineer in charge.

BRUNSWICK, GA.—The Mutual Lt. & Wtr. Co., of Brunswick, expects to purchase within the next year one 250-hp water-tube boiler. The company also contemplates changing its system from 125 cycles to 60 cycles. The city has purchased 50 lamp-posts and material for an ornamental street lighting system, which the company will install. J. M. Armstrong is superintendent.

FORT GAINES, GA.—Bonds to the amount of $8,000 have been voted for the installation of a municipal electric-light plant.

MARSHALLVILLE, GA.—Plans are being considered for the installation of a municipal electric-light plant. The present plans provide for a 50-kva plant and 3 miles of transmission lines, 30 lamps of 100 cp and 1000 16-cp lamps. E. L. Sammons is secretary.

AVON PARK, FLA.—The installation of an electric-light plant in Avon Park is under consideration. The Board of Trade is said to be interested in the project.

CHIPLEY, FLA.—The Chipley Lt. & Pwr. Co. expects to erect within the next six months a 10-ton ice plant to be operated in connection with its electric plant. E. H. Hale is general manager.

CLERMONT, FLA.—The installation of an electric-light plant in Clermont is under consideration. J. F. Knapp is reported to be interested in the project.

MAYO, FLA.—At an election held recently the proposition to issue $15,000 for the installation of an electric light and ice plant was defeated. O. B. Dees, it is reported, will apply for a franchise to install an electric light plant at once.

PENSACOLA, FLA.—Application has been made to the Board of County Commissioners by L. W. Harvey for permission to erect a dam on the lower Perdido River and to erect a large hydroelectric power plant. The proposed plant will furnish electricity in Pensacola, Mobile and other nearby cities.

JACKSON, TENN.—The Jackson Ry. & Lt. Co. expects to build within the next few months 2 miles of new street railway line and also to purchase a 250-kw rotary converter and four steel cars. John Wisdom is general superintendent.

JEFFERSON CITY, TENN.—The Jefferson City Milling & El. Co. expects to erect within the next four months a 5-mile transmission line for three-phase system; also to purchase a 75-kw, three-phase, 6600-volt generator and a 100-hp turbine wheel (possibly). C. A. Bales is manager.

MORRISTOWN, TENN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 10, for construction, complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Morristown, Tenn. Drawings and specifications may be obtained at the above office or from the custodian of site at Morristown.

BRIDGEPORT, ALA.—The installation of an electric-light plant at Bridgeport is under consideration. J. W. Adams, of Chattanooga, Tenn., and others are reported to be interested in the project.

HOLLENDALE, MISS.—The town of Hollendale recently purchased a 70-hp boiler and expects to install same within the next 30 days, making a battery of two boilers. T. H. Russell is clerk.

BEEBE, ARK.—The property of the Beebe Lt. & Pwr. Co. was recently purchased by A. C. Ward at a receiver's sale. Mr. Ward proposes to make improvements to the plant and eventually move the plant and operate it in connection with his machine shop.

MALVERN, ARK.—The Malvern El. Co. expects to erect within the next three months a new power house and also to purchase a 150-k

three phase, 60 cycle, 2200-volt unit (directly connected), with switchboard and 75 meters. T. Edwards is manager.

NEWPORT, ARK.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 2, for the construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office, in Newport, Ark. Drawings and specifications may be obtained at the above office or from the custodian of site at Newport. O. Wenderoth is supervising architect.

ARCADIA, LA.—The North Louisiana Lt. & Pwr. Co., of Arcadia, is considering two or three propositions in regard to the erection of high-tension transmission lines, but as yet nothing definite has been decided upon. J. B. Herring is president and general manager.

FRANKLINTON, LA.—The plant of the Franklinton El. Lt. & Pwr. Co. is reported to have been purchased by T. J. Hood, who, it is said, will enlarge it.

DURANT, OKLA.—The Durant Ice & Lt. Co. expects to erect within the next three months a new engine house. The company has purchased and expects to install within the next 90 days a 312-kva Westinghouse turbo-generator with Le Blanc condenser and switchboard. W. E. Riddle is cashier.

BRENHAM, TEX.—The Brenham Compress Oil & Mfg. Co. expects to erect within the next 30 days a 225-hp Diesel engine directly connected to a 200-kva, 60-cycle, 2300-volt Fort Wayne generator. Equipment has already been purchased. James C. Kennedy is secretary.

CANADIAN, TEX.—The Canadian Wtr., Lt. & Pwr. Co. expects to purchase within the next six months about 50 meters. J. S. Hood is manager.

GOLDWAITE, TEX.—The Goldwaite Lt. & Ice Co. expects to purchase within the next few months a 25-hp steam engine and a 15-kw to 20-kw, 220-volt generator. Edward Geeslin is manager.

MARSHALL, TEX.—The Marshall El. Co., it is reported, is contemplating increasing the output of its power plant from 525 hp to 725 hp. Two boilers of 400 hp each will also be installed.

SMITHVILLE, TEX.—The Smithville El. Lt., Wtr. & Pwr. Co. expects to purchase within the next three months a complete series street-lighting system, consisting of about 50 lamps. Emil Buescher is owner and manager.

## Pacific States

EATONVILLE, WASH.—The City Council has decided to purchase electricity from the Tacoma municipal electric plant in preference to building a municipal plant. A transmission line will be erected from La Grande, bids for construction of which will be received until Nov. 14 by Charles C. Biggs, town clerk.

EDMONDS, WASH.—The Edmonds El. Lt. & Pwr. Co. has been granted a franchise to erect transmission lines in Kings County. Work will begin at once on the erection of a transmission line from Edmonds to Richmond Beach to furnish electricity for lamps and motors. W. R. Ammon is general manager.

NORTH YAKIMA, WASH.—The Pacific Pwr. & Lt. Co., of North Yakima, has applied to the County Commissioners for a franchise to erect and maintain a 3-mile transmission line to furnish electricity for irrigation and power purposes in the vicinity of Zillah.

PULLMAN, WASH.—The City Council has decided to install additional tungsten lamps in the down-town districts, including Grand Street, Olson Street and Kamicken Street and side streets.

SEATTLE, WASH.—A resolution has been adopted by the City Council appropriating $1,250,000 for the installation of a 5000-kw steam auxiliary power plant.

SEATTLE, WASH.—Permits have been granted by Secretary Houston to the Skagit Pwr. Co. for the development of water power on the Skagit and Cascade Rivers, in the Washington State National Forest. It is estimated that more than 50,000 hp can be developed.

SPOKANE, WASH.—Bids will be received until Nov. 13 by the City Council for installation, operation and maintenance of an ornamental street-lighting curb system on Riverside Avenue from Division Street to Washington Street, for a period of 10 years from the date of installation. Plans and specifications are on file in the office of C. M. Fassett, commissioner of public utilities.

SUMAS, WASH.—The Board of County Commissioners has granted the Sumas El. Co. a franchise to erect a transmission line from Sumas to Everson.

COQUILLE, ORE.—The property of the Coquille River El. Co., operating in Coquille and Myrtle Point, Ore., has been taken over by the Oregon Pwr. Co., a holding company of H. M. Byllesby & Co. The Oregon company is making arrangements to establish a 24-hour service and is now constructing a new steam plant, to be equipped with two 150-kw generators driven by individual engines. One unit was put in operation on Oct. 27. The company has secured contracts for street-lighting in both cities and has completed the installation of a series system in Coquille consisting of 20 three-lamp clusters on poles and 62 single lamps erected on brackets throughout the residence district. A similar installation, with a smaller number of lamps, is being installed in Myrtle Point, a General Electric constant transformer being used for each system. Electricity is supplied in Myrtle Point over a 10-mile, single-phase transmission line. This line will shortly be rebuilt and changed to a three-phase system. A new distribution system will be installed in Coquille immediately after the completion of the Myrtle Point series system, which will require approximately 4 tons of copper wire, which is being furnished by John A. Roebling's Sons. White cedar poles will be used exclusively. F. E. McKenna is manager.

MEDFORD, ORE.—The California-Oregon Pwr. Co., of Medford, Ore., expects to purchase within the next three months fifty 2200-volt lightning arresters and 50 electric ranges. H. C. Stoddard is division superintendent

NEWPORT, ORE.—The Yaquina El. Co., of Newport, expects to purchase within the next eight months transformers and meters as required by new business; also some flatirons. George Blanchard is manager.

PORTLAND, ORE.—The light committee of the City Council has announced that 660 electric arc lamps will be installed in various parts of the city during the coming year.

STOCKTON, CAL.—The Western States Gas & El. Co. of California, of Stockton, expects to purchase within the next 12 months material and apparatus for distribution system as needed for ordinary extensions, also material for 22 blocks of underground construction. Samuel Kahn is vice-president and general manager.

WILLITS, CAL.—The Willits Wtr. & Pwr. Co. expects to install within the next month one 100-kw General Electric generator. J. W. Heap is superintendent.

MULLEN, IDAHO.—The City Council has decided to replace the arc lamps on Main Street to the city limits east with tungsten lamps; all other streets throughout the city will also be lighted with tungsen lamps. The Hunter Mining Co. contemplates extending the new lighting system from the city limits to its properties.

POCATELLO, IDAHO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 11, for construction, complete, including mechanical equipment and lighting fixtures, of the United States post office and court house at Pocatello. Drawings and specifications may be obtained from the above office or from the custodian of site at Pocatello. O. Wenderoth is supervising architect.

OGDEN, UTAH.—The power plant of the Utah Ry. & Lt. Co. was badly damaged by the breaking of a large valve controlling the water flow, causing a loss of from $50,000 to $100,000.

SALT LAKE CITY, UTAH.—Application has been filed with the state engineer by George H. Barnhart (an Eastern capitalist), requesting the use of 150 cu. ft. of water per second, to be diverted from the Uinta River in Wasatch County. The application states that the water is to be used for power purposes and that the length of the diverting channel will be 15 miles. E. C. Lackner, local attorney, filed the application.

JEROME, ARIZ.—The United Verde Copper and Upper Verde Public Utility Co., of Jerome, expects to install within the next six months a 1500-kw Allis-Chalmers turbine, with complete switchboard equipment; also to purchase equipment for the installation of an entire distribution system for a town of 2000 inhabitants. T. C. Roberts is chief engineer.

CASPER, WYO.—The L. L. Nunn Co., which was recently granted a franchise to furnish electricity in Casper, is reported to have taken an option on the Boysen dam and power plant, on the Big Horn River, 100 miles west of Casper. The purchase price is said to be $4,000,000. If the deal goes through, a transmission line will be erected to Casper.

## Canada

CALGARY, ALTA.—Bids will be received until Nov. 16 by J. J. Miller, city clerk, for furnishing one 1000-kw synchronous motor-generator and exciter set.

CALGARY, ALTA.—The City Council has entered into an agreement with the Calgary Pwr. Co. to purchase 5000 hp per year for a period of five years at $26 per hp per year.

WINNIPEG, MAN.—The Winnipeg El. Ry. Co. has secured the Great Falls Pwr. Co.'s water rights on the Winnipeg River, situated midway between Lac du Bonnet (the site of the company's present plant) and the mouth of the river.

NEWCASTLE, N. B.—The corporation of Newcastle is considering the establishment of a 24-hour service. The inauguration of a day service will necessitate the installation of an additional generator and engine at the power house.

BROUGHTON, N. S.—The Cape Breton Coal, Iron & Ry. Co. is contemplating installing electrical equipment in its collieries. Two units of 1000 kw each will be installed. C. J. Coll is general manager.

BROCKVILLE, ONT.—The Town Council has passed a by-law authorizing a further expenditure of $69,000 for improvements to the light and power department.

SANDWICH, ONT.—Arrangements have been made between the Essex County Lt. & Pwr. Co., of Windsor, and the Canadian Salt Co., of Sandwich, whereby the former will purchase steam power from the latter. A new 715-kw steam turbine will soon be installed in the plant of the Essex County Lt. & Pwr. Co. in Sandwich.

CATHARINES, ONT.—The Hydro-Electric Power Commission has submitted estimates to the Grantham Council to furnish electricity to Grantham Township. A by-law will soon be submitted to the voters. Other townships in Lincoln County will soon apply to the commission for electrical service.

YORK, ONT.—The Township Council will apply for an order in council giving it authority to enter into a temporary agreement with a private company to provide street-lighting service in the districts on the outskirts of the city. The Hydro-Electric Power Commission, finding that the business was not profitable at present, is unwilling to carry out the agreement to furnish electrical service for these districts. The Council proposes to enter into an agreement with a private company, with a provision that the Hydro-Electric Commission may take over the system when the population is sufficient to make the business profitable.

OUTLOOK, SASK.—A by-law will be submitted to the ratepayers authorizing an expenditure of $10,500 for extensions and improvements to the electric-light plant

## Miscellaneous

KETCHIKAN, ALASKA.—The Citizens' Lt., Pwr. & Wtr. Co., of Ketchikan, is installing a 1000-hp McCormick (Francis type) turbine directly connected to a 600-kva, two-phase, 2300-volt Westinghouse generator (second unit). J. C. Barber is president.

PANAMA.—Bids will be received by Major F. C. Boggs, general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Nov. 22 for transformers, switchboards, motor-generator sets and miscellaneous electrical apparatus, as per circular No. 806. For further details see proposal columns.

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Nov. 14, for furnishing window frames and sashes for hydroelectric station and varnished-cambric, lead covered cables. Blanks and general information relating to this circular (No. 805) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

## New Incorporations

DUNCOMBE, IA.—The Duncombe Lt. & Pwr. Co. has been incorporated with a capital stock of $10,000. The officers of the company are: W. J. Wagner, president; J. J. Claussen, vice-president; D. Maricle, secretary, and Elias Nelson, treasurer, all of Duncombe.

TOMPKINSVILLE, KY.—The Tompkinsville El. Lt. & Ice Co. has been incorporated with a capital stock of $2,000 by John Brown, B. Brown and O. Brown, all of Tompkinsville.

LUTCHER, LA.—The Lutcher Ice & Lt. Co. has been granted a charter with a capital stock of $25,000 to generate and distribute electricity for lamps and motors and to manufacture and sell ice. R. J. Younger is president and J. A. Daspit secretary.

BIRD ISLAND, MINN.—The Renville County El. Co. has been incorporated with a capital stock of $50,000 to furnish electricity for lamps, heat and motors; also to furnish steam for heating and power purposes. The incorporators are: H. B. Rutledge, B. F. Allen, of Glencoe; W. R. Rutledge, of Howard Lake; A. J. Richardson, of Bird Island, and A. M. Ericson, of Hector.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED OCT. 28, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,076,672. VAPOR RECTIFIER FOR HIGH-POTENTIAL CIRCUITS; J. Le R. Hayden, Schenectady, N. Y. App. filed June 16, 1905. Avoids "striking back" or arcing by preventing excessive heat at the anode.

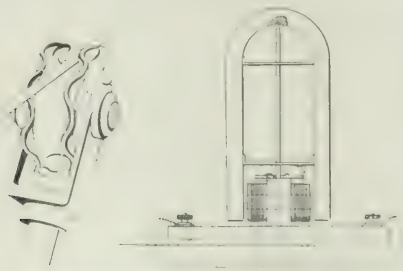
1,076,754. SAFETY APPLIANCE FOR ELECTRICAL INSTALLATIONS; W. F. Force, Flatbush, N. Y. App. filed Jan. 24, 1912. To prevent unauthorized substitution of fuse strips of different capacity from those intended to be used.

1,076,788. TROLLEY; J. J. Sabo, Pittsburgh, Pa. App. filed Aug. 19, 1912. Has pivoted upstanding finder fingers.

1,076,789. PRIMARY BATTERY; A. L. Saltzman, East Orange, N. J. App. filed Feb. 10, 1911. Battery elements supported from the cover by a single frame.

1,076,858. ELECTRIC HEATER; W. S. Andrews, Schenectady, N. Y. App. filed June 12, 1908. Metallic heating element wound on a quartz rod inclosed within a quartz tube.

1,076,870. CONDUIT FISH-WIRE MACHINE; B. Dahl, Minneapolis, Minn. App. filed June 15, 1912. Wire is fed by a revoluble disk having a spiral groove in which the wire is laid.



1,076,871 and 1,076,872. Trolley Wheel or Sheave, and Electromagnetic Motor.

1,076,873. MANUFACTURE OF INCANDESCENT FILAMENTS; G. Dobkevitch, Paris, France. App. filed July 7, 1909. Heats metalliferous decarbonized filament to a white heat in an atmosphere of hydrogen and ammonia.

1,076,884. VAPOR RECTIFIER FOR HIGH POTENTIAL CIRCUITS; J. L. R. Hayden, Schenectady, N. Y. App. filed Oct. 25, 1905. Decreases arcing between the anodes by locally cooling the cathode.

1,076,887. ELECTRIC MELTING FURNACE; L. E. Howard, La Grange, Ill. App. filed Feb. 6, 1909. Secondary of the induction coil consists of a fused portion of the bath within the furnace basin and unfused conductor outside of and below the basin.

1,076,896. ELECTRIC SIGNALING SYSTEM; C. E. Lee, Chicago, Ill. App. filed Jan. 24, 1913. Calls parties wanted at telephone by a signal sounded simultaneously at a plurality of locations in the establishment.

1,076,907. LOCK ATTACHMENT FOR SNAP-SWITCHES; C. L. Platt, Bridgeport, Conn. App. filed Feb. 12, 1913. Key-operated switch; guard with points prevents unauthorized person from turning switch spindle.

1,076,908. ANTISEPTIC PROTECTOR FOR MOUTHPIECES; C. T. Porter and R. J. Osborne, San Francisco, Cal. App. filed June 19, 1913. Antiseptic pad supported on telephone mouthpiece.

1,076,927. BATTERY HOLDER; G. N. Waterbury, Jr., Washington, D. C. App. filed Dec. 7, 1911. Holder for dry cells, with spring connectors between cells.

1,076,944. TELEGRAPHIC PERFORATING RECEIVER; H. Bille, Copenhagen, Denmark. App. filed Nov. 3, 1911. Constantly rotating motor and signal-controlled devices act together to actuate a tape perforator.

1,076,949. VALVE TUBE; E. W. Caldwell, New York, N. Y. Application filed April 19, 1912. Self-regulating Villard type valve tube.

1,076,990. TELEPHONE SYSTEM; C. W. McGonigle, Algona, Wash. App. filed July 15, 1913. Provides for concurrent conversations over a single main line and insures remote instruments receiving as distinct communications as nearer instruments.

1,077,018. TROLLEY; S. G. Valles, Havana, Cuba. App. filed April 8, 1913. Brushes at sides of wheel have their ends clamped in a pyramidal recess in end of trolley pole.

1,077,024. AUTOMATIC ELECTRIC REGULATOR; P. Werner and E. Juillard, Geneva, Switzerland. App. filed Sept. 8, 1910. Utilizes liquid under pressure to actuate an electric regulator.

1,077,038. AUTOMATIC CONTROLLING DEVICE FOR ELECTRICALLY HEATED APPARATUS. E. W. Brawner, Augusta, Ga. App. filed June 30, 1911. For incubators and the like.

1,077,140. SUBMARINE CABLE; F. Jacob, Westcombe Park, England. App. filed April 30, 1912. Provided with artificial self-induction loading and with insulation composed of balata closely surrounding each conductor.

1,077,147. TROLLEY WHEEL OR SHEAVE; A. E. Lineburg, Wilkes-Barre, Pa. App. filed Feb. 26, 1913. Flanges of wheel formed with inwardly extending projections.

1,077,163. MEANS FOR PROTECTING ELECTRIC CIRCUITS FROM EXCESSIVE RISES IN PRESSURE AND SIMILAR DISTURBANCES; R. Rüdenberg, Charlottenburg, Germany. App. filed March 14, 1913. Concentrated inductance and a resistance in parallel in one side of the line and a concentrated capacity connected between the two sides.

1,077,175. STORAGE-BATTERY POWER AND CHARGING EQUIPMENT; C. H. Thordarson, Chicago, Ill. App. filed June 27, 1910. Plurality of storage batteries alternately switches from and to the charging and load circuits.

1,077,179. ELECTROMAGNETIC MOTOR; A. I. V. Wilson, Atlanta, Ga. App. filed Aug. 18, 1910. Electromagnet for stator and permanent magnet for rotor.

1,077,185. PARTY-LINE SYSTEM FOR AUTOMATIC TELEPHONY; [illegible] Antwerp, Belgium. App. filed Oct. 22, 1912. Selective ringing current applied to a party line by ringing current selectors independent of the connectors or final selectors which establish the connection with the wanted line.

1,077,196. THERMAL GENERATOR; W. W. Coblentz, Washington, D. C. App. filed Aug. 8, 1913. Thermal elements consisting of cementitious material and joined together on both sides of said material with heat-absorbing material surrounding one set of junctions. (Dedicated to the public.)

1,077,225. TELEPHONE-SYSTEM STATION INSTRUMENT; A. Keith, Hinsdale, Ill. App. filed Dec. 10, 1909. Transmitter, receiving mechanism, and dial in one portable structure.

# Electrical World

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**Commission as Arbitrator**

At the request of Governor Ralston of Indiana, the Public Service Commission of that State is acting as a board of arbitration to settle differences between the Indianapolis Traction & Terminal Company and its striking employees. It is reported that before the commission decided to act the company was forced to consent to arbitration as a method of settlement. This is an astonishing procedure. Nothing in the law provides that the commission shall arbitrate labor difficulties. Everything in the spirit of public service commission regulation is rigidly opposed to such an act on the part of a body of this character. We are not discussing the question of whether the company should have been forced to arbitrate. Perhaps that seemed to the public authorities to be the only possible method of settlement of a disastrous and murderous strike. The Public Service Commission, however, was not the one to force it. Its duties with respect to the companies are definitely and clearly set forth in the law. It can do no higher service to the State than to administer the law so as to assure a reasonable policy on the part of the corporation and the public toward each other in regard to matters over which it has jurisdiction. When it goes beyond those matters and takes upon itself the painful task of arbitration in a case like this it opens the way to an alarming loss of prestige. Such arbitration seldom gives satisfaction to both parties. We hope that the Indiana commission, which may have gone into the arbitration without a full realization of all that it meant, will conduct itself so creditably as to disarm criticism. The precedent which it has set is one that should be avoided by other commissions.

**Developments Near Chattanooga**

The hydroelectric development of the Chattanooga & Tennessee River Power Company, built by the late A. N. Brady, at which he never saw, was placed in operation on Thursday of this week with appropriate ceremonies. Erected at a cost of approximately $9,000,000, the station has the distinction of being the largest single hydroelectric plant in the South. The lock which forms part of the dam is also the largest single-lift lock in the country, and it is hoped that owing to the improvements in the river thus secured important water traffic will be inaugurated between Chattanooga and the sea. Certainly the government has spent an enormous amount of money on improvements in the Tennessee River in addition to that which was spent at Hales Bar by Mr. Brady for the sake of enabling a few boats to reach Chattanooga from the Mississippi and the Gulf. Great as are the advantages to Chattanooga from this dual enterprise, it is unfortunate that the station is without appreciable load, and it will be a long while before anything is realized on the investment. An immense amount of time and money was consumed in erecting the dam and station owing to fissures in the rock on which they are built. At the time work was started there was an excellent market for the energy. Meanwhile, however, the first hydroelectric development of the Tennessee Power Company on the Ocoee River was begun and completed and the second development also completed. The transmission lines of the latter company extend now as far south as Rome, Ga., and supply energy to Cleveland, Knoxville, Nashville and Chattanooga, Tenn., and other cities in the immediate vicinity. In other words, while the Hales Bar station was being built the cream of the business was taken by the Tennessee Power Company, owned by E. W. Clark & Company, of Philadelphia, and Hodenpyl, Hardy & Company, of New York City. There is still, however, a vast quantity of smoke and soot in Chattanooga, so that the market for electricity is by no means saturated. It would not be surprising, therefore, in view of the great hydroelectrical developments at its doors, if Chattanooga should become the electric city of the South.

**Patent Litigation**

Probably there are few better examples of the intricacies and vicissitudes of patent litigation, not to mention the huge burden of expense, than the last decision in the suspension insulator case, given on another page. Taking the case in abstract, one inventor conceived a patentable idea and procured a patent in the usual way, proceeding thereafter to use the patent for commercial gain in an established business. The Patent Office some time afterward announced that the patent was "inadvertently" issued and declared interference with a prior application for a patent not then issued. Here it may be observed that, under present procedure, applications may be kept dangling in the office for years, if desired, and such practices are sometimes resorted to as a dragnet to catch possible competitors and involve them in litigation. By the same means the life of the inventor's (or his assignee's) monopoly is extended. Then the examiner of interferences, after due hearings and proceedings, all expensive for the inventor, decided in this case that the earlier applicant was the prior inventor. This decision was appealed to the board of examiners, and the first decision affirmed. Subsequently the two inventors appealed in turn to the Patent Commissioner, the Court of Appeals of the District of Columbia, the United States District Court and the United States Court of Appeals, and possibly the case will finally go to the Supreme Court. A better argument for a single court of patent appeals

with considerable cutting out of intermediate appeals in the Patent Office, could hardly be imagined. The obvious advantages of such a court in curing existing abuses have been widely extolled, even by those who hold that patent reform as a whole has no ground to stand upon. This, of course, is only one of the fragments in a situation which needs the prolonged and careful study of the ablest body of disinterested, high-minded men which can be drawn together. The signs are not wanting that when Congress next convenes in regular session the champions of patent reform will be able to accomplish something.

## Wave-Form in Surges

The general laws of the growth and decay of electric currents in conductors are now fairly simple in their outlines, which means that these outlines are fairly well understood. The detail of these laws is, however, still enshrouded in abstract lengthy and non-arithmetical mathematics, which means that this detail is not yet fully understood. A ponderous equation is ordinarily a cloak for the safer protection of ignorance, although it may have been fairly arrived at and may honestly represent the best existing human knowledge on the subject.

It is now generally admitted that when an electric circuit is closed to an electromotive force of any assigned type an electric wave runs out into space, permeating the insulating medium, but guided by the conductor of the circuit. The wave advances through the insulating medium at the "light velocity" of that medium and undergoes reflections or refractions at discontinuities either in the medium or in the conductor. The initial electric disturbance is propagated through the insulator, while the final steady transmission of electricity is propagated through the conductor. The entire set of phenomena, in insulator and conductor combined, is called an electric current.

The propagation of electric disturbance through the insulating medium is subject to laws of wave motion in an elastic medium. It was worked out mathematically by Maxwell, and experimentally by Hertz. The steady process of current flow, or the handing on of electric charges from point to point along a circuit, apparently involves movements of electrons in conducting material and follows the law of Ohm. But the moment a steady current is interrupted by opening a switch, or, going further, the moment a current is changed suddenly from one steady strength to another, electric wave disturbances are propagated over the circuit through the surrounding dielectric. Under very simple conditions, these waves may be computed with ease, but under the varying conditions that occur in practice they are so complex that they elude all known quantitative methods. A long article on overvoltage surge wave-forms by Dr. P. M. Verhoeckx has recently appeared in *Elektrotechnik und Maschinenbau*. The mathematical theory of the wave transmission is there developed in studious but somewhat forbidding form. It shows that, even in comparatively simple cases, a complete solution of the problem is very difficult to secure. What is most needed is experimental development of the subject under definite, fairly simple conditions, whereby statistics may be obtained and accumulated, even although they can be explained only imperfectly. Later on the mathematical treatment will doubtless become simplified to meet the statistical requirements.

## Swiss Single-Phase Locomotives

The latest locomotives built for the Loetschberg line, opened early this summer, are among the most powerful, if not actually the most powerful, locomotives utilizing single-phase energy. The detailed description elsewhere in our columns gives a good idea of the characteristics of the machines and the particular features of construction that have been introduced to meet the difficulties of the service. The Loetschberg system is operated by single-phase energy at 15 cycles per second, and the working conductors carry 15,000 volts. The locomotives take energy from the line by two pantograph trolleys, which, it may be added, work with the utmost smoothness. The heavy service, with express trains operating over grades exceeding 2 per cent, requires a large machine and each locomotive actually weighs 107 metric tons.

Perhaps the most striking feature of the locomotive is the rather remarkable mechanical drive. The whole machine, which is some 52 ft. in over-all length, is provided with five pairs of coupled drivers and a pony axle and wheels at each end in addition. The two large motors to furnish the 2500 rated hp required are placed side by side in the center of the locomotive, the transformers and switch gear being at each end. Each of the motors drives through helical gearing a crank shaft, and the two crank shafts, each counterbalanced, are connected to each other and to the crank pin of the center driving wheels by means of a triangular steel truss which serves as a connecting rod. The two motors therefore pull together on the central axle by ordinary external connecting rods uniting this central pair with the other four pairs of driving wheels. Similar driving wheel connections are to be found on the Sondrio-Lecco line in Italy, and while they certainly look queer to the casual observer, they seem to function admirably.

The lateral flexibility required on the Loetschberg line, which has some fairly sharp curves, is provided in an unusual way. Obviously the particular nature of the connecting gear forbids anything like true articulation, and hence the freedom of motion is obtained by giving liberal end play to the center driving axle and to the two end driving axles, the intermediate pair of axles having little or no play and the pony axles having even more than the driving axles adjacent to them. It is apparent that the arrangement is in effect an articulation as regards the driving axles, the center axle and end axles virtually pivoting about the intermediate one by reason of the end-play. Electrically, although the two motors are coupled together, each half of the equipment is independent so that the locomotive can be driven by one motor if necessary.

The motors themselves are of the compensated series interpole construction, with sixteen poles and wound for a maximum emf of 590 volts. The power-factor at normal speeds is about 95 per cent, and the efficiency from trolley to rim of driving wheel runs as high as 88 per cent. The

ximum drawbar pull of the locomotive is about 40,000 and its full-load drawbar pull about 30,000. The motors their work well and the operation is reported to be ctically sparkless and altogether satisfactory. Of course, severest test of such motors is during the period of eleration when the maximum heating occurs. On the ole, the performance seems to be highly successful. It altogether the most spectacular main line electric railway uipment in Europe, and the results obtained with it are h as to give much encouragement to trunk line elec- fication.

## Effective Reactance and Resistance

The article by Mr. Waldo V. Lyon which appears on ge 1006 draws attention to certain conditions in alternat- -current circuits not generally recognized but of con- erable practical importance. When a sinusoidal emf s upon a simple circuit of resistance and inductance, h no losses except simple joulean losses in the conductor, apparent resistance of the conductor, as judged from its pedance, is known to be substantially equal to the re- tance as measured by continuous current. This, at st, is the practical condition when the frequency of the ernating current is, say, less than 100 cycles per second, such as is used in ordinary industrial distribution cir- ts. When the frequency of the current runs into the ephonic range, then it is well known that, even when no re losses occur, the change in current density over the oss-section of the conductor, commonly referred to as the kin effect," causes the apparent resistance of the con- ctor, as judged from its impedance, to exceed that en- untered by continuous currents. The effect is very rked at radio frequencies. For this reason the author ifines his attention to alternating currents of industrial r frequency.

t is further shown that when core losses occur, whether y are due to hysteresis or to eddy currents in the core, ly invariably tend to advance the phase of the current in circuit, thus bringing the impressed emf and current re nearly into phase. They also tend to increase the parent resistance with respect to the continuous-current sistance and to diminish the apparent reactance with re- pect to the actual reactance. The only essential differ- nce in this respect between hysteretic loss and eddy- current loss in the core lies in the fact that the former in- volves distortion in the current, especially by the develop- ment of a powerful triple-frequency harmonic component of current, whereas the latter does not involve distortion. It is shown, moreover, that the increase in apparent resist- ance is greatest when the angle of core-loss advance amounts to 45 deg.—a fact not generally known.

Although the author considers only reactance coils and does not specifically refer to secondary circuits, yet, by implication, such secondary circuits are involved with eddy-current losses, and the reasoning applies to transformers in general, as well as to reactance coils. The final vector diagram might, therefore, be considered as applying to transformers under load, except that the component of eddy-current loss would have to be made capable of some range of phase variation, in order to include secondary-circuit loads. The relation pointed out, that the angle of core-loss advance has for its tangent the increase in apparent resistance divided by the apparent reactance, is a useful one. Strictly speaking, of course, it applies rigidly only to sinusoidal currents. Although the concept of equivalent sinusoidal currents may be used with advantage when the distortion is small, it is well known that it may break down completely when the distortion is great.

## Industrial Lighting

Mr. Ward Harrison's article in this issue on lighting will serve as an admirable guide to those who are installing incandescent lamps for industrial purposes. It is a careful and thorough account of the general requirements of such lighting and the methods that have proved effective in meeting them. From a practical standpoint it should prove most useful and is sufficient in detail to serve well for general purposes. Of course, one must understand at the start that general methods, even when so clearly put as they here are, cannot be used for every imaginable purpose. There are times when to meet certain specific conditions there is needed a great deal of finesse which nothing but the combination of keen intelligence and considerable experience can provide. In applying the principles laid down by the author the chief difficulty will be found in cases where rigid economy is necessary and where consequently every device that ingenuity can suggest in the way of getting efficient lighting has to be utilized, sometimes to the confusion of general schemes of illumination.

Of the many features of the subject to which, did space permit, we should like to call attention, one has so often been misunderstood that it deserves special comment, namely, glare. To this Mr. Harrison refers in extremely plain and most sensible terms. His definition as "light out of place" conveys perhaps the best idea of its characteristics, but the particular fact which Mr. Harrison brings to the surface is that quantity of light as well as position of the lamps is an important matter. It is, in all probability, true that the effect of glare depends very largely on the total light flux involved in it, a consideration which is too often forgotten.

After all, glare is merely a question as to the amount of light energy that reaches the retina and disturbs its normal activities. For instance, one may receive specular reflection from an arc lamp half a mile away without being disturbed by it in the slightest degree, while if it were 20 ft. away the effect would be disagreeable in the extreme. This is, of course, an exaggerated case, but it points an important moral which we are glad to find in Mr. Harrison's paper. Extraneous light falling on the retina even from diffuse sources will prove troublesome if there is enough of it, and will be harmless if small in amount. These quantitative relations of light and vision have been kept altogether too much in the background in the earlier work on illumination. In point of fact, they are all-important and deserve very close investigation. As a general account of the methods and appliances used in industrial lighting Mr. Harrison's paper deserves close reading and will prove stimulating and valuable.

# The News of the Week

**Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.**

## Service in Cleveland Crippled by Blizzard

On Sunday night a terrific storm struck the city of Cleveland, Ohio, and continued unabated with heavy snow all during Monday and Tuesday, inflicting heavy damage to manufacturing and shipping as well as crippling the services of the telegraph and telephone companies, the electric-light company, the railway companies and the trunk lines entering the city. As we go to press no estimate of losses can be made by the companies having wire systems in the city. In various sections poles were broken and wires were piled in tangled masses for blocks. This was especially true near 105th Street, East, and in Collinwood, a suburb of Cleveland, as well as along Superior, St. Claire and Euclid Avenues and in the southern part of the city. The damage was not less severe on the West Side, where street railway service was suspended until Wednesday morning.

For hours Sunday night there was a vivid display of light caused by broken wires coming in contact with each other, but only one fatality from this cause has been reported notwithstanding that the ground was apparently covered with wires. The Cleveland Electric Illuminating Company opened its circuits as soon as the conditions became known, and many of the sections of Cleveland were still without electric service for lamps and motors on Wednesday night. The company advertised extensively in the local papers, stating that under the circumstances it would adhere to the policy of "Safety before service."

The city was entirely isolated from other portions of the country on Monday, neither telegraph nor telephone lines working, and even on Tuesday no lines other than the press wires were open for service. Telegrams were carried on trains by messengers in the shortest time possible, or sent by special delivery mail. The telephone service was badly crippled locally, and where greatest havoc was wrought by the storm no service is yet being rendered. The telegraph companies on Thursday were getting their lines cleared up and expected to have them in fair shape shortly. Up to Thursday morning it was impossible to make repairs on the lines and service of both the lighting and telephone companies. The wires were at that time being gathered from the streets and preparations made for rapid repairs. It is expected that complete lighting and telephone service will be restored by the end of the week.

## National Conservation Congress

The official call for the fifth National Conservation Congress, which, as already noted in these columns, will be held in Washington, D. C., on Nov. 17, 18, 19 and 20, says that protection of forests and waterways is the great conservation issue to-day, and that within the next few months it will be discussed in the United States Congress and in State legislatures. For this reason the congress is to be devoted largely to forest conservation, in which there is public interest because upon the proper solution of the various problems depends the cost of wood, the perpetuation of the timber supply, the development of hydroelectric power, the utilization of non-agricultural lands, the availability of water for irrigation and the preservation of forest areas for health and recreation.

It is expected that President Wilson will address the congress, as well as members of the Cabinet, senators, representatives and chiefs of government bureaus. The following committee of delegates to attend the congress has been appointed by the American Institute of Electrical Engineers: Mr. H. G. Stott, New York, chairman; Mr. H. C. Eddy, Washington, D. C.; Mr. John H. Finney, Washington, D. C.; Mr. S. Z. Mitchell, New York, and Mr. F. B. H. Paine, New York.

## Annual Meeting of the American Society of Mechanical Engineers

Among the papers to be read at the annual meeting of the American Society of Mechanical Engineers, to be held in New York from Dec. 2 to 5, several which are of interest to electrical engineers are as follows: "The Hazard in Turbo-Generators," by Mr. G. S. Lawler; "Notes on the Further Operation of Large Boilers of the Detroit Edison Company," by Mr. J. W. Parker; "Properties of Steam," by Mr. R. C. H. Heck; "On Setting Tasks for Firemen and Maintaining High Efficiency in Boiler Plant," by Mr. Walter N. Polakov, and "Extinguishing Fire in Oils and Volatile Liquids," by Mr. Edward A. Barber. On Wednesday evening, Dec. 3, Mr. John W. Lieb, Jr., past president American Institute of Electrical Engineers and past vice-president American Society of Mechanical Engineers, will deliver an address, illustrated by lantern views, on "Leonardo da Vinci—Engineer and Artist."

Mr. Lieb's address will follow the presentation of the Grashof Medal by the Verein deutscher Ingenieure to Mr. George Westinghouse, past-president and honorary member of the American Society of Mechanical Engineers.

## New Decision in Suspension-Insulator Patent case

In a decision by the Commissioner of Patents in the interference proceedings known as Steinberger versus Hewlett, recorded in our issue of Dec. 21, 1912, page 1300, priority of invention of the suspension or disk strain type of insulator was awarded to Steinberger, validating his patent No. 904,370, issued Nov. 17, 1908. The invention in question consisted of a disk strain insulator comprising suspension members partially enveloped by a mass of insulating material and having a disk portion provided with annular collars or flanges extending in opposite directions therefrom and generally parallel with the suspension members. Although a patent for this had been issued to Louis Steinberger, the examiner of interferences on Nov. 2, 1911, awarded priority to another claimant, Mr. Hewlett. The examiners in chief upheld this decision on April 29, 1912, but the First Assistant Commissioner reversed the findings in a decision dated Aug. 6, 1912. On April 26, 1913, the Court of Appeals of the District of Columbia upheld Steinberger's priority. Subsequent proceedings were then instituted by the General Electric Company in the United States District Court for the Southern District of New York, before Judge Chatfield in Brooklyn, the complainants availing themselves of a right granted in Section 4915 of the United States Revised Statutes

Judge Chatfield rendered a decision on Oct. 9 reversing e award to Steinberger and declaring Hewlett the prior ventor. Supplementary opinions were filed on Oct. 18 d Oct. 21. The District Court held that the patentable vention lay in the use of annular flanges, which would complish watershedding and insulating area-protecting rposes, under the conditions described in the drawings d specifications of the applicants.

An appeal from Judge Chatfield's decision has already en filed by the defendant.

## The Anglo-American Exposition

In connection with the Anglo-American Exposition nich is to be held in London, England, to celebrate the ntenary of peace and progress in the arts, sciences and dustries of the United States and the British Empire om May to October of next year, Past-president W. M. ordey of the Institution of Mechanical Engineers, at a eeting recently held in London, spoke on behalf of the ectrical committee which is arranging for the British exbits. He said that it seemed fitting that the electrical enneers of America and of England should co-operate in owing to the world the wonderful engineering develop-ents of the past century. He gave a résumé of the work the pioneers in electrical science—Franklin, Faraday d Davy—and declared that a place of honor at the expotion rightfully belongs to electrical engineering develop-ents.

The object of the Anglo-American Exposition is to inease the friendly feeling between the British and Amerin peoples. The Shepherd's Bush section of London is e site of the exposition grounds. Prominent members of e American Society in London, with whom the idea of e celebration originated, and many of the most influtial men in English affairs are interested in its success. he American executive offices are in the Woolworth uilding, New York. The general offices are in the Adinistration Buildings, Shepherd's Bush, London, W. C., ngland.

## roposed Co-operative Plan of Electrical Distribution in Los Angeles

Addressing the City Council of Los Angeles on Oct. 29, r. R. H. Ballard, speaking for the Southern California lison Company, the Los Angeles Gas & Electric Corporan and the Pacific Light & Power Company, made an imrtant proposition intended as the basis of a plan of coeration between the companies and the city. The city hi in the Los Angeles Aqueduct a source of hydroelectric wer, but it has at present no means of distributing this ergy. It has been proposed on the part of the city to ie bonds to raise money to build an electric distributing stem parallelling the systems of the private companies. Te companies now propose to lease their distributing stems to the city with the possibility that the city ultiately may acquire these distributing systems. The details o the proposal made by Mr. Ballard on behalf of the compies have not been worked out; but, subject to the apval of the Railroad Commission of the State of Califnia, the companies offer to lease their distributing systes within the city of Los Angeles to the municipality for a riod of ten years.

fter the meeting Mr. Ballard is reported to have said to newspaper reporter that the upshot of his proposal, if it carried out, would be a 5-cent maximum rate for electricity in Los Angeles by co-operation between the city, wi its cheap source of energy, and the companies, with the existing distribution facilities. He said that after the ity had paid the companies for the lease of the lines and also paid the expenses of distribution the remainder left from collections for the sale of energy would be more than $900,000 for the first year, increasing to $1,150,000 a year subsequently. If the city should build a duplicate distributing system, its expenditure would be more than $9,000,000 before it could secure 25 per cent of the business, and it would force competition between the city and the companies, resulting in substantial losses to both. If the companies' proposal is accepted by the city authorities and approved by the state commission, it will go to the citizens to be voted upon.

## Meeting of the Electrical Manufacturers' Club

The Electrical Manufacturers' Club held its annual meeting at the Homestead Hotel, Hot Springs, Va., during last week. There were fifty members present, making one of the largest meetings ever held by the club. Following the practice introduced a year ago, an address on topics of public interest and concern was made by a speaker of national prominence. Ex-president William H. Taft, who was the speaker this year, read a paper on "Signs of the Times." It will be remembered that one year ago Dr. Charles W. Eliot, president emeritus of Harvard University, delivered an address before the club in which he discussed questions relating to conditions of labor. It has been decided that the club shall have at each annual meeting a similar address by a prominent man.

Mr. Taft's address, which was presented on the evening of Nov. 6, was about 10,000 words in length and required about two hours to present. Mr. S. O. Richardson, Jr., president of the club, who introduced the speaker of the evening, spoke of him as a progressive of a true, not a false, type. In acknowledging this introduction Mr. Taft expressed his amusement and said that there were some places where that portrait of himself would not be recognized. Mr. Taft's address dealt with many of the principles which he enunciated in public addresses during his career as President. As he stated when his term of office as President expired, he felt that he should do all that he could to strengthen the conservative forces in our government. This, in fact, was the main subject of Mr. Taft's remarks. He stated that he feels it to be his duty to carry on a campaign for conservatism in government. He declared that he enjoys being a private citizen and that he is in the position of a man up a tree and can now keep watch on everything. Mr. Taft argued at length against the referendum, declaring that only 16 per cent of the population of the country vote and that one-half of the voters pay no attention to the referendum attached to ballots. This means, he stated, that only a little more than 4 per cent of the population rule. The address touched on various other subjects of general public interest.

The club will follow the same plan with Mr. Taft's address that it did with that given by Dr. Eliot a year ago. It will be published in pamphlet form for circulation. It is stated that the address will be issued in this way in about a month. The publication of the address is in the hands of the prize essay committee, of which Mr. A. B. Houghton, Corning, N. Y., is chairman.

Among the subjects considered by the club was the work of the Society for Electrical Development. Forty-one manufacturers belonging to the club have become members of the society, making an aggregate annual subscription of $80,000 by them for this movement. Other members of the club are considering affiliation with the society. Mr. S. O. Richardson, Jr., in introducing the subject of membership in the Society for Electrical Development, expressed his warm personal indorsement of the movement, and stated that his company, the Libbey Glass Company, joined some months ago. Mr. J. Robert Crouse made a brief address and emphasized the principles of the organization of the

society so far as they relate especially to manufacturers. Mr. Gerard Swope, vice-president Western Electric Company, explained in detail the plan of organization of the society and the balanced representation of the logical great divisions of the industry. He declared that the plan and personnel of the officers and directors give every promise of economical and efficient expenditure in the work. Mr. F. S. Terry, manager National Lamp Works, also addressed the meeting in regard to the results which the society can accomplish. He stated that the result of early efforts in this work in 1906 and 1907 greatly exceeded expectations and indicated that an efficiency in market developments can be obtained by these methods which cannot be secured in any other way.

The annual election of officers of the Electrical Manufacturers' Club resulted as follows: President, Mr. S. O. Richardson, Jr.; vice-president, Mr. Walter Carey; treasurer, Mr. Herbert Sinclair; secretary, Mr. S. O. Richardson III; commissary, Mr. C. I. Hills; members of the board of governors for 1913-14, Messrs. S. O. Richardson, Jr., B. M. Downs, A. H. Pease and A. W. Berresford; members of the board of governors, terms to expire in 1915, Messrs. E. B. Hatch, A. D. Page, S. L. Nicholson and C. H. Wilcox; prize essay committee, Messrs. A. B. Houghton, L. A. Osborne, A. D. Page, L. M. Downes and H. B. Crouse.

## New Buildings for Massachusetts Institute of Technology

General plans for the new buildings of the Massachusetts Institute of Technology on the Cambridge Esplanade, fronting the Charles River Basin, at Boston, have been announced. The plans provide for a division of the site, which is more than one-fourth of a mile square, into two parts. On the western portion will be erected the largest educational structure in the world, composed of nine separate but contiguous buildings, each devoted to a separate department of the institute's work. The easterly portion of the site will be devoted to housing of students, athletic and other activities. The buildings will be of white Indiana limestone and of classic architecture and will cost approximately $10,000,000. Nearly 75 per cent of this sum has been pledged in the past two years. They will occupy a site on the basin directly opposite the Back Bay district, and apart from their engineering interest will form one of the most conspicuous architectural groups in America. Unit laboratories and classrooms, a central library with a dome higher than Bunker Hill Monument, drafting room space of 2.5 acres and 20 acres of departmental floor space will be noteworthy features.

## Complication in Rate Negotiations in Chicago

After a compromise settlement in the Chicago rate negotiations had been reached on Nov. 6, the committee on gas, oil and electric light of the Chicago City Council upset the arrangement at a subsequent meeting on Nov. 10.

The arrangement governing rates of the Commonwealth Edison Company, which was to have gone into effect under the settlement of Nov. 6, provided that, beginning on Dec. 1, 1913, the rates would be 10 cents per kw-hr. primary, 5 cents secondary and 4 cents tertiary. On March 1, 1914, it was agreed that the rates should be further reduced to 10 cents, 5 cents and 3 cents. The agreement contemplated that the company should contribute $5,000 a year for an electric-service complaint bureau to be established by the city. It was also provided that the company should supply 12,000-volt, three-phase, 60-cycle energy for street lighting to be delivered at the Sanitary District terminal station at West Thirty-first Street and Southwestern Avenue for a primary charge of $1.25 per kw per month and a secondary charge of 0.4 cent per kw-hr. for energy consumed. Other rates were provided for energy delivered to any substation in the city of Chicago for subway lighting and for city buildings, and it was further provided that where the company furnished arc-lighting service the rate should not be greater than $75 per lamp per year for all night lamps equivalent in illuminating value to the flame arc lamps now used by the city and taking 465 watts per lamp.

At the meeting on Nov. 6 the committee ordered the ordinance printed. The plan was to introduce the ordinance in the Council on Nov. 10, if possible, as it was desired to obtain speedy action before the Public Utilities Commission of Illinois goes into office on Jan. 1. It was expressly provided in the ordinance that the rates were adopted subject to possible modifications by the State Commission to be appointed or a court review of the commission's findings.

At the meeting of the committee on Nov. 10 one of the members of the committee, Alderman M. J. Healy, who has been identified with the electrical workers' unions, offered an amendment providing that the company should pay the established organized-labor wages for any construction work that might be done in extending street-lighting service for the city. The aldermen who were present voted unanimously for the amendment. Alderman Merriam moved that the term of the contract, which was fixed at five years in the ordinance, be changed to two years. M. Ray Palmer, city electrician, protested against this and deplored obstructive tactics at the eleventh hour, but nevertheless the Merriam amendment was accepted. These changes made a patchwork measure that satisfied nobody and so, when the question came up on the adoption of Section 1 of the proposed ordinance, as amended, the committee refused to adopt the section. This was tantamount to striking out the enacting clause and left the whole result of eighteen months' work in the air. Mr. William J. Arthur, attorney, and Mr. W. J. Norton, rate expert, represented the company, but had little to say as the committee struggled with the difficulties of the situation. Leaving the matter in this unsatisfactory way, the committee adjourned to meet again within a few days.

## To Encourage Use of Water-Power in Georgia

The Georgia Chamber of Commerce has appointed a committee on water-power development whose purpose is to enlighten the farmer on the uses of electricity in agriculture, to reach out after manufacturers of other states and to show the possibilities of irrigation as applied to intensive farming. In order to secure the active co-operation of the people of the State in the movement, the committee points out some of the fallacies regarding hydroelectric developments which prevail among the uninformed. Many citizens have been led to believe that water-power is a means of getting from nature something for nothing. This, the committee shows, is a mistaken idea, for it costs vast sums to harness the water-powers of the State; interest must be paid on this money; dividends must be returned to those who have hazarded their fortunes to make possible this cheap power; machinery must be renewed, and transmission lines must be kept up to the end that the citizens can enjoy these great benefits.

The committee on water-power and water-power development has as its head Mr. Charles F. Howe, a consulting engineer of Macon, who has been connected as chief engineer with the development at Jackson owned by the Central Georgia Power Company. Associated with Mr. Howe are Messrs. S. W. McCallie, State geologist, Atlanta; B. F. Hall, consulting engineer, Atlanta, who has been employed by the government on irrigation projects and was

power development in the West and Porto Rico; Paul Norcross, Atlanta, of the Solomon-Norcross Company, hydraulic engineers; G. F. Harley, Columbus, hydraulic constructing engineer; W. A. Carlisle, Gainesville, who has been closely identified from its inception with the North Georgia Electric Company and the Georgia Power Company; Nisbet Wingfield, Augusta, who as city engineer has had charge of the water-powers of that city and the construction of the great dike to protect the city from flood water; Charles A. Caldwell, the well-known engineer of Macon; C. D. Flannigan, Athens, another pioneer of water-power development in Georgia, together with a number of other gentlemen equally well known and specialists in their line.

It is expected that this committee will endeavor to its utmost to foster the interests of Georgia through the use by its citizens of the water-powers at hand, as well as in inducing manufacturers and capitalists to come from other states.

## Hydroelectric Energy on New York Canals

Mr. George Clinton, of Buffalo, read a paper before the New York State Waterways Association at Albany on Oct. 30 on the subject "State Generation of Hydroelectricity." He declared that experience had shown that when the government entered upon the province of private enterprise it always involved great injury to private investment and infraction of private legal rights or tremendous cost to acquire those rights. The production and furnishing of hydroelectric energy by the State, particularly under the circumstances existing in New York, will work great injustice, Mr. Clinton said, to the general taxpayer, while in every instance the benefits will accrue to limited localities. There is no place upon the canals of New York State, Mr. Clinton added, where surplus water can be obtained and utilized without the expenditure of very large sums of money by the State, and there is no place east of Rochester where it is at all certain that there will be any surplus waters that can be utilized with any regularity for the production of electricity except at locks, where electricity sufficient for the use of the canal and nothing else can be produced.

## Annual Dinner of Commonwealth Edison Company Section

Perhaps the most prominent feature of the "get-together" activities of the Commonwealth Edison Company in Chicago is the annual dinner of the company section of the National Electric Light Association. The sixth gathering of this sort was held on the night of Nov. 6 at the Hotel Sherman and was attended by about 650 men. The occasion was notable by reason of the presence of a number of gentlemen connected with other public utilities of Chicago with which the Commonwealth Edison Company is now closely associated. Mr. W. L. Abbott, chief operating engineer of the Commonwealth Edison Company, presided at the dinner as the retiring president of the section.

Mr. Samuel Insull, in a serious address, made the point that the people own the corporations and that this widespread ownership is increasing. In this fact lies the hope that unfair attacks on corporations as such will cease. The electrical industries felt the effect of dear money during the last year less than other industries. Perhaps this was due to the facts that they are officered by young men, that they have seen the handwriting on the wall of public opinion as affecting corporations, and that they have to some extent made their arrangements to bow to public opinion. Mr. Insull remarked that the membership of the section is now 1750, which is more than 10 per cent of the membership of the National Electric Light Association and 40 per cent of the eligible employees of the Commonwealth Edison Company. He praised highly the work of the National Electric Light Association, told again what the service-annuity plan means to the employees of his company, dwelt on the importance of the employees' savings fund, and concluded with an earnest exposition of Commonwealth Edison service, which is represented by the service badge.

Mr. J. F. Meagher, president of the People's Gas Light & Coke Company, made a witty speech in which he mocked at the technical terms of the electric-service industry and the primary and secondary and even tertiary charges, which he cited as dazzling examples. Mr. Abbott made a report of the year's work of the section and introduced the new chairman, Mr. F. J. Arnold, of the engineering department, who spoke briefly. The other newly elected officers of the section are Mr. P. J. Smith, of the arc-lamp and sign department, vice-president, and Mr. T. J. Walsh, of the statistical department, secretary. Mr. William A. Fox has been re-elected as treasurer. During the evening the Commonwealth Edison Orchestra, under the leadership of Mr. M. L. Eastman, gave some high-class music. An excellent minstrel show was given by the Glee Club of the company under the management of Mr. Harold Wright.

## Varied Work of Electrical Inspectors

Mr. Victor H. Tousley, chief electrical inspector of the city of Chicago, gave a talk at the luncheon of the Chicago Jovian League on Nov. 10. Mr. E. H. Waddington presided. Mr. Tousley described in an interesting manner the work performed by the Bureau of Electrical Inspection of the Department of Electricity of the city of Chicago. By a recent city ordinance all electrical contractors must be registered before receiving a permit to do electrical construction work. This ordinance went into effect on Oct. 1, and since that date 548 contractors or electricians have registered themselves with the bureau. The inspection fees of the bureau this year will amount to about $200,000. The bureau has sixty-seven employees and it is operated at a profit to the city. However, it is planned to expend any surplus in bettering and extending the service. One interesting fact mentioned by the speaker in giving statistics of inspections was that the average rating of electric motors in the city of Chicago is about 9 hp.

## Concentration of Energy Production in Chicago

Practically all the energy requirements of the surface and elevated railway companies of Chicago are now supplied by the Commonwealth Edison Company. Recently three of the old elevated railway generating stations have been taken over by the central-station company—the Fullerton Avenue station of the Northwestern Elevated Railroad Company, the Loomis Street station of the Metropolitan West Side Elevated Railway Company and the Fortieth Street station of the South Side Elevated Railroad Company. The station-operating forces of the elevated-railway companies have been incorporated into the operating department of the Commonwealth Edison Company, including Mr. A. L. Hadin, operating engineer of the Chicago Elevated Railways. It is probable that eventually all of the railway generating stations will be shut down, although some of them, notably the South Side company's station, have an excellent record of economy. Five "straight railway" substations have been taken over by the substation department of the Commonwealth company.

As the Cosmopolitan Electric Company has been absorbed by the Commonwealth Edison Company, its modern Grove Street generating station and its two substations, one at the Stockyards and the other downtown, are now oper-

ated by the Edison organization, into which the 240 employees of the Cosmopolitan Company have been taken. It is of interest to note that when the two companies were consolidated and the papers were filed with the Secretary of State at Springfield, an incorporation fee, as though a new company had been incorporated, was required. This fee amounted to over $50,000.

The highest total-output maximum of the Commonwealth Edison Company up to Nov. 1, 1913, was 257,830 kw on Oct. 31, 1913. The highest peak of last Winter was 232,950 kw on Dec. 11, 1912. It is estimated that this winter's total-output maximum will be about 300,000 kw. The highest twenty-four-hour kilowatt-hour output up to Nov. 1 of this year was 3,365,900 kw-hr. and was recorded on Oct 30, 1913. It is probable that the maximum day's output for this winter will be 3,700,000 kw-hr. or over.

The number of employees on the pay-roll of the Commonwealth Edison Company on Nov. 6, 1913, was 4713. This large number is accounted for not only by the additions from the Cosmopolitan and Elevated Railway Companies but by the large amount of construction work the company is doing.

## Decision Upholding Emmet Patent for Sectional Blade-Tie for Steam Turbines

A decision has been handed down by Judge Hazel in the United States District Court for the Western District of New York, at Buffalo, upholding the validity of the Emmet patent, No. 924,546, issued June 8, 1909, for an improvement in steam turbines consisting of a sectional blade-tie riveted to the buckets by means of tenons integral therewith. The complainant was the General Electric Company, assignee of Mr. W. L. R. Emmet's patent just mentioned, and the defendants were the city of Dunkirk, N. Y., and the Board of Water Commissioners of that place, which had in use an alleged infringing turbine manufactured and installed by the Allis-Chalmers Company.

The construction of the Emmet sectional blade-cover is shown in Figs. 1 and 2, which are self-explanatory. The object was to overcome the excessive centrifugal stresses in prior covers or rings and to prevent leakage of steam, as well as to stiffen and strengthen the blades themselves. The defences advanced against the charge of infringement

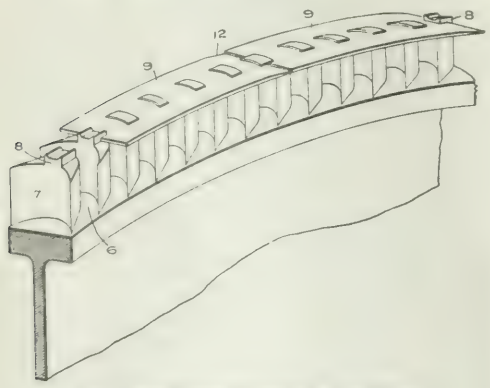



FIG. 1—SECTIONAL TURBINE BLADE COVER

were want of novelty and invention, anticipation, and non-infringement. While cover plates or rings were old, the opinion held that Emmet was the first to use tenons for rigidly fastening the cover plate to the vanes, and by a combination of old and new elements advanced the art. The tie blades and the rings or shrouds of the prior art were difficult of manufacture owing to their bore, their thinness, and their notches making connection with the blades. These continuous rings or shrouds were impracticable in high-power motors and lacked complete efficiency as a means for strengthening the blades.

According to the patent law, the inventive faculty resides in the reduction of an idea to practice as distinguished from merely making mechanical alterations, and whenever an

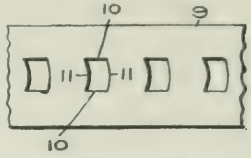



FIG. 2—DETAIL OF RING

old device is put to a new use and produces a new result, a question of fact arises over whether such older adaptation would occur to a person of ordinary mechanical skill.

The defendants introduced in evidence the file wrappers of the Fullager patents, No. 696,867, issued April 1, 1902, and No. 746,061, issued Dec. 8, 1903, and although numerous other patents were cited as disclosing the Emmet construction at earlier dates, the greatest emphasis was placed on these two patents mentioned. It was under these patents that the infringing turbine was manufactured. These patents were involved in complicated interference proceedings with Emmet's patent, since they involved claims for similar construction. Although the interference proceedings were all finally dissolved, conflicting views as to priority were held in the Patent Office and as to the exercise of diligence in reducing the Emmet invention to practice. The court stated that in view of the new testimony before it, the exercise of independent judgment became necessary. In short, the court held that Emmet exercised all necessary diligence in reducing his invention to practice, and this taken with his oath as to conception of invention before the Fullager filing date, in the court's judgment upheld him as the legal inventor. The complainant was therefore awarded a decree with costs.

## Chicago Electric-Vehicle Situation in 1913

At the meeting of the contract department of the Commonwealth Edison Company on Nov. 11 Mr. R. Macrae read a paper on the present electric-vehicle situation in Chicago, with which the author is thoroughly familiar. Few persons, he said, realize the rapid rate at which horses are disappearing from the streets of Chicago. Applications for energy to operate mercury-arc rectifiers are being received by the company at a rate that would call for the work of fifty or sixty horses a month. As only about 2 per cent of the electric vehicles in Chicago are charged from rectifier outfits, it is fair to assume that electric vehicles are now displacing horse-drawn vehicles at a monthly rate corresponding to the work of 300 or 400 horses.

Mr. Macrae, who is a man not given to over-confidence, predicted that vehicles operated by electricity will ultimately displace all other kinds of vehicles for city street traffic unless some very radical improvements are made in the other vehicles. He exempted touring and racing cars, referring to commercial and pleasure vehicles for city use. It is true that conditions are not now favorable in all cases in cities for the operation of electric vehicles but they are slowly becoming more favorable. On this point, referring specifically to the situation in Chicago, he said:

"With electric light streaming from every window and cars shooting by in every direction and picking up electric

power almost for nothing as they go, the electric truck has sometimes to travel 10 miles to get a little charge of electricity. We may, however, expect that a change for the better will soon be brought about in these conditions, now that everyone seems to be convinced that the electric vehicle has come back to stay."

Superlative claims of salesmen in relation to the simplicity of operating electric vehicles have probably been responsible for many electric-vehicle failures. An electric vehicle requires special attention which must be given to it by a person who not only knows what to do but also has the facilities for doing it. Mr. Macrae agreed with the statement that the wear and damage to an electric vehicle usually occur not on the streets but inside the four walls of a garage. In relation to the charging of batteries in unattended garages Mr. Macrae remarked that automatic apparatus is all right provided it is used under the supervision of some one who knows when it is working properly, but such devices can never take the place of intelligence on the part of the person who is looking after the vehicle. The expression "unattended garage" should be used with caution in discussing the electric-vehicle problem, because it may easily imply neglect.

Experience has shown that commercial electric vehicles operated in fleets are always a success; operated singly they are often a failure. In the one case they are properly cared for; in the other they are usually neglected. In advising its customers the central-station company should point out that the electric vehicle, to be a success, should be cared for intelligently and operated as an electric vehicle and not in the way a horse-drawn or gasoline vehicle is operated.

Following the reading of his paper Mr. Macrae exhibited a number of lantern-slide pictures. A composite load curve made up of the averages of six public garages showed that there was little consumption of energy from 8 a. m. until noon, almost none from noon until 8 p. m., and that the maximum occurred at 2 a. m. This is exactly the kind of load the central station needs. In relation to the mercury-arc rectifier used in vehicle battery charging Mr. Macrae described Chicago as a rectifier town. This no doubt is due to the fact that so large a proportion of the area of the city is served by alternating current. It is reported that the General Electric Company sells more rectifiers from its Chicago office than from all its other offices put together. The speaker reported that the operating company has had little trouble with rectifiers, particularly the smaller sizes. The tube is the best kind of a protective device. While it is buzzing away the vehicle owner or the garage proprietor may rest assured that everything in the charging process is going along all right. There are over 550 mercury-arc rectifiers on the circuits of the Commonwealth Edison Company, and Mr. Macrae has never heard of a serious complaint.

Figures were given to show that the average cost per mile of the electric delivery service of the Commonwealth Edison Company, considering the results obtained with a fleet of fifty vehicles, is 25.1 cents. Of this amount 9.3 cents is for operating and repairs and 2.4 cents for electrical energy used in charging the batteries. The cost of the energy is figured at 4 cents per kw-hr, which is twice as much as an outside consumer could buy it for under the most favorable conditions. The cost per mile for operating a corresponding horse-drawn vehicle in the Commonwealth Edison Company's service is 31.2 cents. A load curve was given showing that the average demand of twenty private garages was 142 kw-hr. per month. The speaker concluded by saying that better garaging facilities constitute the immediate need of the electric-vehicle situation in Chicago.

Mr. E. W. Lloyd presided at the meeting and he and Mr. George H. Jones spoke briefly. About 125 men attended the session.

## Ozone Machines and Public Health

"The Alleged Purification of Air by the Ozone Machine" is the title of a recent article in the *Journal of the American Medical Association* reporting experiments on the bacteriological and physiological effects of commercial ozone machines, conducted by the authors, Dr. W. A. Sawyer, director of the Hygienic Laboratory of the California State Board of Health, Berkeley; H. L. Beckwith and E. M. Skolfield.

Although the work of many careful investigators has discredited ozone for the purification of air, assert the authors, the purposeful adulteration of the air in public buildings by the use of ozone machines now threatens to become a public health problem. Ohlmüller showed that ozone was incapable of killing dry bacteria, and Erlandson and Schwartz demonstrated that the presence of ozone does not insure the absence of organic impurities, although for the time masking obnoxious odors. Filipow proved that ozone concentrated irritates the mucous membranes. Hill and Flack showed that one part per million irritates the respiratory tract, while two hours' exposure to fifteen or twenty parts per million might endanger life.

The experiments made by the authors utilized two well-known ozone machines and were conducted to show the relative killing power for animals and bacteria. A tight wooden cabinet, with a volume of 33 cu. ft., and a carefully closed room of 730 cu. ft. were used. Bacteria cultures were grown in meat broth and dried on sterile glass rods which were introduced into the ozone-filled cabinet. Guineapigs placed in the compartment died at intervals of one and one-half to four hours after the ozone machine had been started. Death was caused by marked edema of the lungs, which were found filled with foamy liquid. One guineapig, for example, showed labored breathing at the end of twenty minutes. Five minutes later it began rubbing its nose with its forefeet. At the end of forty-five minutes it was drowsy and at the end of one hour its eyes were watery and almost closed. Half an hour later its breathing was spasmodic and there were convulsions. In one hour and forty minutes after starting the ozone machine the animal was struggling for breath, and fifteen minutes later it died.

In all instances the streptococcus and staphylococcus cultures showed organisms of the characteristic morphology, and in every test in which guineapigs and bacteria were in the cabinet together the bacteria outlived the guineapigs. While working about the machines the experimenters declare that they themselves noticed a feeling of dryness or "tickling" in the nasopharynx accompanied by watering of the eyes and headache after prolonged exposure. From their experiments they conclude:

1. The products of the two well-known ozone machines examined are irritating to the respiratory tract and, in concentration, will produce edema of the lungs and death in guineapigs.

2. A concentration of the gaseous products sufficiently high to kill within a few hours such bacteria as typhoid bacilli, staphylococci and streptococci, dried on glass rods, will kill guineapigs in an even shorter time. Such products, therefore, have no value as bactericides in breathable air.

3. Because the products of the ozone machines are irritating to the mucous membranes and are probably injurious in other ways, the machines should not be allowed in schools, offices or other places in which people remain for considerable periods of time.

4. The ozone machines produce gases which mask disagreeable odors of moderate strength. In this way the machines can conceal faults in ventilation while not correcting them. Because the ozone machine covers unhygienic conditions in the air and at the same time produces new injurious substances, it cannot properly be classed as a hygienic device.

## Public Service Commission News

### Indiana Commission

The strike of employees of the Indianapolis Traction & Terminal Company, the impending difficulties of employees of the interurban railways, the strike of electrical linemen in Indiana and the strike of local carmen at Richmond, Ind., have thrown new burdens on the commission. Governor Ralston points out that the commission was called into the street railway difficulty only because a crisis had arisen and not with any intention of placing the additional burdens of labor troubles regularly upon the commission. That such a turn should be given the duties of the commission is preposterous, he said. Under the terms of the agreement, the employees and the company officials appeared before the commission at the expiration of five days after the agreement was signed with their differences over wages, hours, conditions of labor and other subjects and the commission began the task of arbitration. The decision of the commission, to be given in thirty days, was to be binding for three years on both parties. The present situation, in which the Public Service Commission is seen acting as a labor arbitration board, will be remedied, according to the Governor's statement, as soon as the Legislature can meet. Then an arbitration board probably will be created.

The Terre Haute Commercial Club has presented three petitions for an investigation of rates and valuation of the Terre Haute, Indianapolis & Eastern Traction Company, which supplies electric power and lighting and heat; the Citizens' Gas & Fuel Company and the Terre Haute Water Works Company. The petition in reference to the traction company declared that the schedule of rates filed with the commission by the company on July 29, 1913, showed excessive and unreasonable rates and discrimination. It also contended that certain regulations now in force by the company were in violation of the Indiana law. Among these regulations were one prohibiting customers of the heating plant from using other illumination than that supplied by the company, a provision that all electrical consumers shall pay a minimum meter charge, a provision that the maximum demand on which rates and charges are based shall be deemed to be the total connected load of the consumer's equipment, and a provision giving different rates to consumers who use the company's service exclusively. The petition also charged that the traction company does not maintain the voltage agreed upon or consistent with the equipment of consumers.

The commission may be forced to take some other course than to make physical valuations, because of the lack of the facilities for carrying on extensive work of this character, owing to the small engineering force and funds available.

### Massachusetts Commission

The Edison Electric Illuminating Company of Boston has filed an appeal with the Gas and Electric Light Commission against the Board of Aldermen of Chelsea, which recently granted a franchise to the firm of A. G. Walton & Company to erect wires along the streets in the vicinity of its factory for local electrical distribution.

The Massachusetts Gas and Electric Light Commission has issued its report for the calendar year 1912, including returns for the fiscal year ended June 30, 1912. The report is one of the longest ever issued by the board, covering 717 pages of material bearing upon legislation, decisions, special reports, accidents, meter testing, price cases, security issues, statistics and other related topics. Returns were made to the board from sixty-eight incorporated gas companies, fifty-six incorporated electric-light companies and twenty persons or associations making or selling electricity or gas. Thirty-two municipal plants also filed returns. Four new electric service companies were incorporated during the year. The work of the board in smoke abatement has proceeded steadily, and thus far but one formal hearing as a prerequisite for court proceedings for violation of the Massachusetts smoke law has been found necessary. The commission points out that the law can be enforced without hardship to plant owners and with increased economy of operation. A valuable feature of the appendix is a special report of the board upon demand meters which was made to the Legislature last year upon the request of the latter in connection with a proposition to regulate or prohibit the use of such instruments. As reviewed in these columns at the time, the report contains a large number of engineering data of interest and the conclusion of the board that its supervisory authority should be extended over apparatus of this character.

The commission's summary of financial conditions in the central-station industry of the State evidences continued rapid growth in the popularity and success of electric service. The total income of the private electric-service companies for the fiscal year 1912 was $13,580,031, compared with $12,353,109 in 1911. Income from the sale of energy for commercial lighting increased from $7,167,56[illegible] to $7,914,368, and income from its sale for industrial purposes from $2,677,425 to $3,023,512. Operating expenses, taxes and administrative costs were $7,976,348, compared with $7,251,118 in 1911, and dividends were $2,934,448 in 1912, compared with $2,662,703 in 1911. The companies' net profit for the year, after all fixed charges were deducted, came to $232,587 as against $166,966 in the previous year. The assets for 1912 were $56,824,843, compared with $51,327,024 in 1911, and the surplus for 1912 was $2,263,813, compared with $2,049,081 in 1911. The actual surplus is stated as 13.27 per cent of the capitalization for 1912, compared with 11.76 per cent for 1911.

### Illinois Commission

Mr. Richard Yates has been appointed a member of the Railroad and Warehouse Commission of Illinois. The board will go out of existence on Dec. 31, 1913, and will be succeeded by the Public Utilities Commission of Illinois. It is considered probable, therefore, that Mr. Yates will be appointed a member of the new commission. The law provides that not more than three of the five members of the new commission shall belong to any one political party. The present administration of Illinois is Democratic. Mr. Yates is a Republican and was Governor of Illinois from 1901 to 1905.

### Oregon Commission

The Railroad Commission of Oregon has issued a uniform classification of accounts for electric, gas and water utilities. The classification was adopted June 16, 1913, and became effective on July 1, 1913.

The instructions pertaining to the accounts define repairs which are to consist of ordinary and extraordinary repairs. Ordinary repairs are not required to be taken into account in fixing a rate of depreciation. Extraordinary repairs should be provided for by adequate charges to depreciation.

The instructions also state that utilities should include in operating expenses depreciation charges for the purpose of creating proper and adequate reserves to cover the expense of depreciation currently accruing in the tangible fixed capital. The amount charged as expense of depreciation should be based upon rules determined by the utility. Utilities should be prepared to give to the commission upon demand the rules and a sworn statement of the facts, experience, opinion and estimates upon which they are based. The rate of depreciation should be fixed so as to distribute, as nearly as may be, evenly throughout the life of the depreciating property the burden of extraordinary repairs and the cost of capital consumed in operations during a given month or year and should be based upon the average life of the units comprised in the respective classes of property.

In referring to "extraordinary casualties and unanticipated reconstruction" the instructions state that, if

authorized, upon application to the commission the utility to which such authority is granted may charge the amount named in the authorization to an expense account for the purpose of distributing over a limited period a loss of such a nature that it cannot be anticipated by the exercise of reasonable prudence.

For the purpose of the system of accounts the utilities are divided into three classes, those with gross annual revenues exceeding $100,000, those with revenues exceeding $25,000 but not more than $100,000, and those with $25,000 or less.

# Current News Notes

Comfort for Dumb Animals Provided Electrically.—The owner of a stable in Louisville, Ky., realizing the impossibility of obtaining good service from his horses when they were constantly annoyed by flies, placed a large electrically driven canvas paddle over each stall. All the fans were attached to a long shaft turned by a single electric motor.

* * *

Guide to National Electrical Code Changes.—The Philadelphia Fire Underwriters' Association has issued a guide to the changes in the National Electrical Code, edition of 1913. This pamphlet was prepared with a view of affording wiremen a ready means of ascertaining what changes and additions have been made to the old code. By this means it is believed electrical contractors will have little or no trouble in complying with the provisions of the present edition of the National Electrical Code.

* * *

Cost of Service Versus Value of Service.—In holding that a certain increase in freight rates was justified the Interstate Commerce Commission laid down on Oct. 28 the following general principle of great significance in rate making: "If, when viewed in the light of those considerations which enter into proper rate making, a particular rate is fair and just for the service performed, the price at which the shipper markets his product cannot be accepted as the controlling factor in fixing the rate."

* * *

Electric Search-Lamps in Colorado Strike.—As a result of the recent labor troubles in the Colorado mining districts, twenty-one electric search-lamps have been purchased by several mine owners and are being used for detecting hostile movements in the vicinity of the mine properties. Most of the lamps have 18-in. reflectors, although the largest is a 30-in. projector. All are of the pilot-house-control type, being mounted on top of, and controlled from, a sheet-steel cabinet in which the operator is stationed.

* * *

Los Angeles Municipal Lighting Plant Activities.—The city of Los Angeles, Cal., is now agitating the establishment of a municipal electric lighting plant and the operation of the lighting system from energy obtained from a plant built in connection with the new aqueduct system. The City Council recently appointed a board of engineers to advise the city as to the probable cost and probable earnings of a municipal distribution system. The members of this board are Dr. George L. Hoxie, of New York; Prof. C. L. Cory, of the University of California, and Mr. C. F. Koiner, of Pasadena.

* * *

Grand Junction, Col., Rejects Municipalization Plans.—Voters of Grand Junction, Col., rejected on Nov. 4 three separate proposals for municipalization of local public utilities. One question upon which a vote was taken was the purchase or construction of an electric plant, another involved the purchase or construction of a gas plant, and a third proposed the purchase of the gas, electric and railway properties of the Grand Junction & Grand River Valley Railway Company. The largest vote was recorded in opposition to the proposed municipalization of the Grand Junction & Grand River Valley Railway.

* * *

Free Lectures on Electrical Engineering.—A course of lectures on electrical engineering is being given by Mr. W. Wallace Ker, of the Hebrew Technical Institute, at St. Bartholomew's Lyceum Hall, 205 East Forty-second Street, New York, under the auspices of the New York Board of Education. The lectures, admission to which is free, are as follows: Nov. 15, "The Electric Storage Battery"; Nov. 22, "Alternating Currents of Electricity"; Nov. 29, "Development of Electricity and Its Use at Niagara Falls"; Dec. 6, "The Steam Turbine"; Dec. 13, "Primary Batteries."

* * *

Radio Stations of the United States.—A list of the land and ship radio stations of the United States has been printed by the Department of Commerce, Bureau of Navigation, Washington, D. C. The contents include a list of land stations arranged alphabetically by names, a list of all ship stations, and a list of all United States call signals arranged alphabetically, each followed by the name of the ship or land station to which the call has been assigned. In Part II is given a list of amateur stations licensed up to June 30, 1913, arranged according to radio districts, with the headquarters and territorial limits of each district. Copies of this publication may be procured from the Superintendent of Public Documents, Washington, D. C., at 15 cents each.

* * *

Foreign Weights and Measures.—The Foreign Trade Bureau of the Philadelphia Commercial Museum, Philadelphia, Pa., has issued a sixty-four-page pamphlet giving conversion tables of foreign weights, measures and money and also comparisons of prices per pound, yard, gallon or bushel in United States money with prices per kilo, meter, liter, hectoliter, etc., in foreign money. The pamphlet is compiled by the librarian and statistician of the museum, Mr. John J. Macfarlane. This publication will be found of value to manufacturers in the United States who have already established commercial relations with other countries, and it contains useful suggestions to those planning to enter into trade with foreign countries. Mr. Dudley Bartlett is chief of the Foreign Trade Bureau of the Philadelphia Commercial Museum.

* * *

Physical Research.—The investigations carried out by the Physical Laboratory of the National Electric Lamp Association, Cleveland, Ohio, the results of which have been presented before various scientific and technical societies of the United States, are published in the "Abstract-Bulletin," issued by the firm. In the first issue published abstracts are given of articles relating to every research carried out in the laboratory from its inception in 1908 to the summer of 1912. This publication contains papers by Dr. Edward P. Hyde, Dr. Herbert E. Ives, Mr. M. Luckiesh, Mr. F. E. Cady, Mr. A. G. Worthington and Dr. Percy E. Cobb. Some of the complete papers of which abstracts are made have been presented before the Illuminating Engineering Society and the American Physical Society, while others have appeared in the *Electrical World, Electrical Review and Western Electrician, Astrophysical Journal, American Journal of Physiology, Physical Review, Philosophical Magazine,* and *Illuminating Engineer.* The pamphlet contains 128 pages and is fully illustrated with photographs and drawings. The information given is valuable, and the abstracts, which have been prepared by the authors themselves, will serve their purpose well for all those who desire a general knowledge of the latest researches on the subjects treated.

Prussia to Develop Hydroelectric Energy.—A law has been enacted in Prussia to provide a sum of about $2,500,000 for the development of hydroelectric energy by the State from existing reservoirs built by the government, in connection with the Rhine-Hanover Canal, at Hemfort, on the River Ader, and at Helminghausen, on the River Diemel. It is proposed, further, to connect the plants to be erected at these points with a third station at Munden, on the Rivers Fulda and Werra. The total rating of the stations will be 41,000 kw. The area to be served includes thirteen counties in Prussia and three in Waldeck with a population of 600,000. The energy will be distributed to fifteen points in this area by a 40,000-volt system about 215 miles long, and at each point there will be a transformer station to reduce the voltage to 6000.

* * *

Water-Powers in New Quebec.—In bulletins published by the Department of Colonization of Mines and Fisheries in the District of Ungava, recently added to the Province of Quebec, under the name of the territory of New Quebec, a vast amount of information is obtainable respecting the water-powers of that territory. The interior of Ungava is a huge plateau which rises somewhat abruptly within a few miles of the coast line to a height of from 1500 ft. to 2500 ft. The various streams, therefore, afford numerous water-powers. On the Great Whale River within 20 miles of its mouth there are three falls of 150 ft., 230 ft. and 65 ft. respectively. On the South Branch of this same river a few miles from its mouth a fall of the river gives 136 ft. Nastapoka Falls, near the coast, is 170 ft. in height. Near Richmond Gulf the Wyachuan River Falls possess a head of 315 ft. A remarkable case of very high waterfalls in the interior is that of the Hamilton River. The Grand Falls of this river are situated about 300 miles from Rigolet. The falls themselves have a sheer drop of 302 ft., and for 12 miles above the falls the river rises rapidly so that in that distance the difference of level, including the falls proper, is 760 ft. The discharge is estimated at 50,000 cu. ft. per second, which would give approximately 1,500,000 hp at the fall proper and 3,660,000 hp for the 12 miles of falls of the river. These evidently are flood-water figures, since the Commission of Conservation gives the estimated horse-power of the falls at 120,000 hp, and of the total fall for a distance of 12 miles as 300,000 hp on low-water drainage.

* * *

## SOCIETY MEETINGS

Meeting of New York Sections of I. E. S. and N. E. L. A.—The regular monthly meeting of the New York Section of the Illuminating Engineering Society is to be held in conjunction with the New York Companies' Section of the National Electric Light Association at the Edison Auditorium on Nov. 17. Addresses will be made by Mr. S. G. Rhodes, of the New York Edison Company, on "Street Lighting Abroad," and by Mr. H. W. Jackson, of the General Electric Company, on "Recent Developments in Incandescent Electric Lamps." A feature of the evening will be the demonstration of neon tube lighting.

* * *

Convention of Southeastern Section, N. E. L. A.—The 1914 convention of the Southeastern Section of the National Electric Light Association is to be held Aug. 19 to 21, 1914, at the Isle of Palms, a popular beach resort 12 miles north of Charleston, S. C. At a meeting of the executive committee of the section at Charleston last week Mr. C. M. Benedict, treasurer of the Charleston Consolidated Railway & Lighting Company, was appointed chairman of the entertainment committee, the other members of which are Messrs. E. C. Deal, Augusta, Ga.; R. L. Lindsey, Durham, N. C., and W. W. Fuller, Charleston, N. C.

Chicago Section, I. E. S.—"Street Car Lighting" was the subject of a paper presented by Mr. L. C. Porter, of Harrison, N. J., before the Chicago Section of the Illuminating Engineering Society, Nov. 12. Preceding Mr. Porter's paper, Mr. W. A. Durgin, Chicago, gave a twenty-minute talk on "Fundamentals of Illumination." The next meeting of the Chicago Section, "ladies' night," will be held Dec. 10 at the residence of Mr. A. D. Curtis, 5528 East End Avenue, Chicago. Mr. Curtis will read a paper, "Five Years' Progress in the Indirect Lighting of the Home." At the session scheduled for Jan. 28 Mr. J. B. Jackson will present a paper on "Planning Lighting Installations."

* * *

Meeting of Yonkers Section, N. E. L. A.—The first monthly meeting of the N. E. L. A., Yonkers Section, was held on Nov. 10. Mr. J. P. Radcliff, who acted as temporary chairman, introduced Mr. W. I. Donshea, who explained in detail the workings of the new amendment to the constitution which provides for the local meetings of the different companies. Mr. Donshea also gave an interesting talk on the prizes to be awarded by the N. E. L. A. for the best papers submitted and urged the members not to be slow in the presentation and discussion of papers. Mr. G. B. Cornell, Jr., was elected permanent chairman for the coming year and Mr. E. J. Reilly was elected secretary. Mr. Cornell read a very interesting and instructive paper on "Electricity on the Farm," by Mr. E. P. Edwards, of the General Electric Company, illustrated with lantern slides. This is one of the lectures furnished by the lecture bureau of the N. E. L. A. The Rev. F. W. Cutler also delivered a very interesting talk, his subject being "Co-operation and Organization." A pleasing feature of the evening was the presentation of a silver loving cup by the employees of the Yonkers station to Mr. B. O. Fuller, who recently resigned as inspector to accept the position of superintendent of the Hollywood Inn.

* * *

Touring in the Electric Automobile.—At a well-attended meeting of the Chicago Section of the Electric Vehicle Association on Nov. 4 Col. E. W. M. Bailey, who recently toured from Boston to New York and thence to Chicago in a Bailey roadster, was the guest of honor. He gave an interesting description of his trip and there was an informal discussion by the representatives of manufacturers of electric vehicles and storage batteries as well as garage men and central-station men. Colonel Bailey said that too much stress should not be laid on making long runs on one battery charge. It is better to encourage the establishment of facilities for charging at frequent intervals along main-traveled highways. It is true, he said, that the Edison battery is best adapted for a trip such as he made inasmuch as it can be rapidly charged and discharged. Nevertheless, there is a large field for the lead battery in the equipment of city cars. Another point made by the speaker was that the average running speed of gasoline cars in touring trips is not more than 18 or 19 miles an hour. All present seemed to be much interested in the possibilities of electric automobile touring, and it was the general opinion that with suitable types of electric cars the possibilities of cross-country runs have been but little appreciated. Some of the storage-battery men said that with the existence of charging stations not too far apart, with the proper car and perhaps with some improvements in the battery itself, the lead battery will not be excluded from the equipment of electric touring automobiles. The opinion was expressed that all interested in the advancement of the electric passenger vehicle should take a greater personal interest in making touring trips in electric machine seeing to it that the public is acquainted with the results It was thought that the New York-Chicago trip of Colonel Bailey will be of distinct benefit to the industry.

# Hydroelectric Development on the Tennessee River

**Completion of Hales Bar station of Chattanooga & Tennessee River Power Company after nine years of work—Difficulty encountered in building dam**

ON Thursday of this week, Nov. 13, the largest single hydroelectric development in the South, that of the Chattanooga & Tennessee River Power Company at Hales Bar on the Tennessee River, 33 miles below Chattanooga, was formally started. The dam and lock were designed and constructed under the supervision of United States government engineers by the late Anthony N. Brady at a cost of approximately $9,000,000. The lock, which is situated on the west or right bank of the river, has the distinction of being the largest single lift in the world. It is built against a rock bluff, has a clear width of 60 ft., and is approximately 312 ft. long inside. The gates are of the mitering type, horizontally framed, built of steel and operated by electricity. These gates are somewhat remarkable for the head which they have to support, the difference in elevation between the two pools being about 40 ft. Each lift of the lower gates is 34 ft. long, 59 ft. high and weighs 129 tons. The lock chamber is filled by two culverts, 11 ft. by 6 ft., operated by stony sluice gates fitted for electrical operation. The dam itself is 1200 ft. long and extends from the lock on the west side of the river to the power house and transformer house on the east side. The crest of the dam is at an elevation of 635 ft. above the sea, and flashboards will bring the elevation of the crest 3 ft. higher. There is a passageway through the dam in which the electric conduits are carried from one side of the river to the other. The station is designed for 42,000 kw.

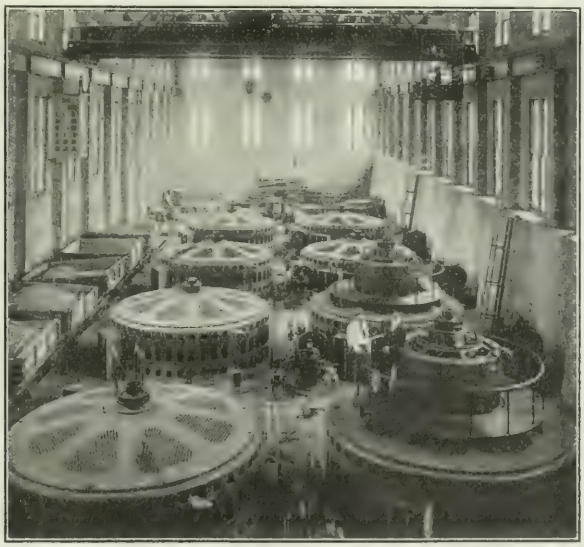


FIG. 1—HALES BAR STATION OF CHATTANOOGA & TENNESSEE RIVER POWER COMPANY

### Variation in Flow of River

The total length of navigable waterways formed by the Tennessee and its tributaries is about 1300 miles. At Riverton, Ala., and Muscle Shoals, Ala., the obstructions to navigation have been removed by a system of canals and locks so that a 5-ft. depth of water is available the entire year from Paducah, Ky., where the Tennessee joins the Ohio, to Muscle Shoals, a distance of nearly 300 miles. Between Muscle Shoals and Chattanooga the low-water navigation was limited to a draft of water not exceeding 2 ft., and at high water the river was practically unnavigable. A 5-ft. depth of water will now be available for navigation all the way to Chattanooga.

The general characteristics of the Tennessee River are those of a broad, tranquil stream with moderate current. Where the river passes through the mountains below Chattanooga navigation presents great difficulties at low water on account of the rapids and rock barriers and also at high water because of the excessive velocities of flow. At Williams Island, 10 miles below Chattanooga, where the river enters the mountain section, difficult navigation commences. The width of the river at high water through this section does not exceed 1500 ft. and varies from 700 ft. at certain locations to the first figure. The low-water flow of the river at zero reading on the Chattanooga gage is about 8000 cu. ft. per second. At the high-water reading, 58 ft. on the Chattanooga gage, the flow is about 700,000 cu. ft. per second. From this it will be seen that the task of damming or improving the river was very difficult. In fact, there is practically no other river in the world in which the variation of flow is so large and the available channel so small. The maximum velocity encountered in going through the mountain section at maximum discharge is about 19 ft. per second, while the maximum velocity at low water is approximately 1.7 ft. per second.

In 1904 the business men of Chattanooga secured an act of Congress granting permission to the city of Chattanooga to build and construct a lock and dam across the Tennessee River at Scott's Point for improving navigation and for power purposes. The city, however, did not take up this franchise and a further clause of the act prompted private parties to accept what the city had failed to take. Mr. C. E. James and the late J. C. Guild, of Chattanooga, took up the franchise and together with the late A. N. Brady organized the Chattanooga & Tennessee River Power Company, which entered into contract with the United States government for the construction and maintenance of the works. It was found on investigation that the location of the dam at Scott's Point would not give sufficient improvement to the river nor sufficient water-power, owing to the backing up of tail-water at the higher stages of flow. Authorization was finally obtained for locating the dam at Hales Bar, 33 miles below Chattanooga, where rock was available for the dam foundation and where the flood plane

widened to such an extent that a rapid rise of the tail-water would not be so disastrous to a water-power development.

The head on the turbines at this place would be about 39 ft. at low water, while at a 40-ft. stage the backing up of the tail-water would reduce this head to about 19 ft. The lock and dam were designed under the direction of Major H. C. Newcomer. The designs for the water-power plant were made by Mr. John Bogart, consulting engineer



FIG. 2—VIEW OF STATION AT LOW WATER STAGE

of the Chattanooga & Tennessee River Power Company, while the mechanical and electrical designs were perfected by Mr. Thomas E. Murray, consulting engineer for Mr. Brady. The hydraulic problem was the most difficult of solution as the variation of flow is extremely large, ranging from 5000 cu. ft. per second as a minimum to 320,000 ft. per second at occasional floods. As a general statement it may be said that for two months of the year the flow varies between 8000 and 16,000 cu. ft. per second; for about four months between 12,000 and 60,000 cu. ft. per second; for about four months between 16,000 and 60,000 cu. ft. per second, and for about two months between 20,000 and



FIG. 3—TOWERS AT RIVER CROSSING

100,000 cu. ft. per second. During the shorter periods, of course, the maximum flow exceeds these figures.

### Hydraulic Equipment

To secure uniformity of speed and regular output it was necessary to place three turbines on each shaft, the two lower ones operating during periods of high head and low flow, while the third turbine will be brought into play when there is more water but less available head. The lock and dam are built of concrete in which large stones up to 10 tons in weight have been embedded. Some reinforced concrete has also been used. The power house with its transformer house has been built of reinforced concrete. The latter is 66 ft. wide by 350 ft. long, comprising an operating building one story high and 220 ft. long and a switch and transformer house three stories high and 133 ft. long. The operating building consists of seven bays, each containing two turbine units, each unit consisting of three turbines mounted on a vertical shaft with a 3000-kw generator on its upper end. Under ordinary stages of the river only two of the turbines will be used for each unit. The two lower turbine wheels are 72 in. in diameter, and the upper wheel is 65 in. in diameter. The turbines run at 112.5 r.p.m., and each unit is capable of delivering 5250 hp under a head of 35 ft. The hydraulic machinery was built by the S. Morgan Smith Company, of York, Pa., and the governors by the Lombard Governor Company, of Ashland, Mass. An electric traveling crane of 50 tons rating is provided to handle the generators and turbines in the operating room and a

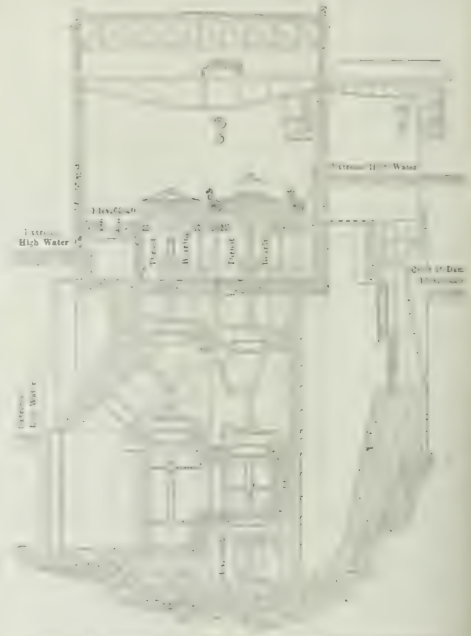


FIG. 4—CROSS-SECTION OF GENERATING STATION

gantry crane is placed on the upstream side of the operating building for handling the headgates.

### Difficulties Encountered in Erecting Dam

Although the transmission line, substation and power house have been completed for some time, work on the dam has only just been finished. The engineers experienced no end of difficulty in obtaining a firm foundation for the dam. In the two bays at the east end of the power house no trouble whatever was experienced with water, but in the rest of the excavation large quantities came up through the natural crevices in the rock. At first an attempt was made to pump the water out during the process of the work, but the amount increased so fast that something had to be done to stop it. The water coming mainly from the bottom, well drills were secured for putting down holes 6 in. in diameter to any depth. A number of holes were put down in the bottom where foundations in the crevices and fissures would be met. The holes were as deep as 50 ft

As the amount of water coming in increased and became too large to handle with pumps, the pit was allowed to flood with water to the level of the river. Pumps were then used to throw water into the pit so as to raise the level inside the cofferdam a little above that of the river. Before flooding, pipes were put into the well holes and carried up so as to be above the level of the water after flooding. These pipes were of the same size as the well holes and were bushed down on the top to 2 in. Cement grout was forced into the holes through the pipes by means of a small grouting machine and compressed air. Just enough pressure was used to force the grout out of the pipe and well into the hole. About 12,000 barrels of cement were used in the power-house foundation in this manner. After the foot of the power house had been excavated there was still trouble with the water coming up through the bottom whenever test holes were put down. In order to fill all openings and crevices in the rock immediately below the bottom of the power house, a large number of drill holes were made with the ordinary percussion drill. These holes, 2 in. in diamater, were filled with cement grout.

The dam on the east side of the river, covering about one-third of its length, was inclosed in a cofferdam divided into two sections by a cross cofferdam. The same trouble was met with here in connection with the bottom. At first well drills were used to stop the water by drilling and grouting as in the power house. Later, when the bottom was about secured, it was covered with small holes put down with ordinary percussion drills and then filled with grout. On the west side of the river about one-third of the width of the river was inclosed in one section of cofferdam. Before any material was excavated there well drills were put

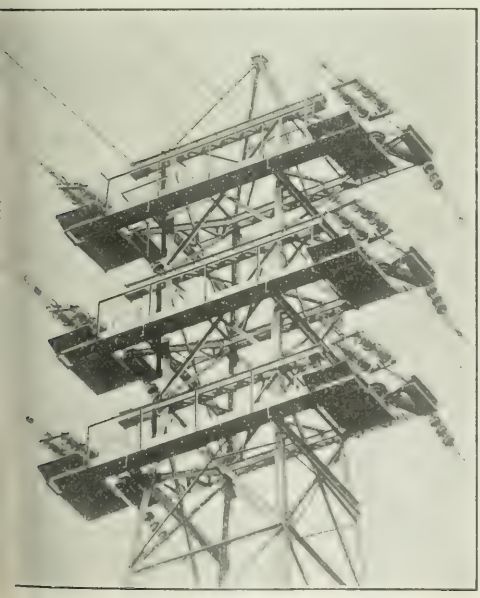


FIG. 5—WORKING PLATFORMS ON RIVER TOWER

at work over the entire bottom. A large proportion of the holes could not be driven as far as was desired owing to the fact that after the drill had passed the crevices sand and gravel would drop into the hole at the side of the drill. About 100 ft. of dam foundation was secured at the west side by the use of the holes for washing and filling the crevices as on the east side and in the power house. Then a new method was tried to get the bottom. The rest of the bottom inside the cofferdam was covered with fourteen caissons of different sizes, and these were sunk in the usual manner to good foundation rock. In building the dam gaps 20 ft. long were left so as to permit the water to pass through while the middle portion was cofferdammed.

### GENERATING EQUIPMENT

The generating station is laid out to accommodate four-

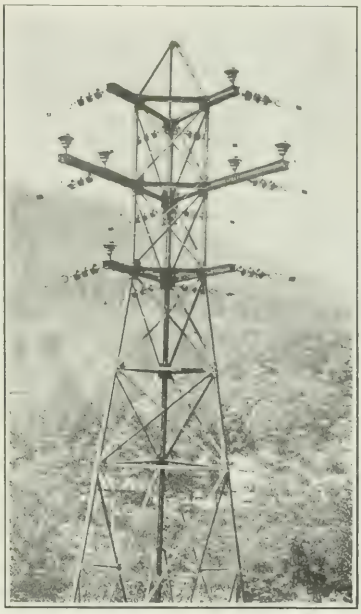


FIG. 6—STRAIN TOWER

teen three-phase, 60 cycle, 6600-volt generators, six exciters, one exciter switchboard, one alternating-current lamp and motor board, one alternating-current control board, fourteen alternating-current generator field rheostats, one storage battery, six step-down transformers, fifteen step-up transformers, twenty-nine 6600-volt motor-operated, oil circuit-breakers and buses, ten 45,000-volt, motor-operated, oil circuit-breakers and buses, three sets of multiplex lightning arresters and choke coils and three sets of electrolytic lightning arresters and horn-gaps. With the exception of the storage battery, all of the above apparatus was manufactured by the General Electric Company. The fourteen generators are located on the main floor of the operating room arranged in two rows, seven in each row. At present there are only ten installed, two of which have a 100-kw exciter mounted on the shaft.

On the main floor of the operating room near the switchboard are the other four exciters, each consisting of a 250-kw, 250-volt, 720 r.p.m. direct-current generator, driven by a 375-hp, 220-volt, 720-r.p.m., three-phase induction motor, both the generator and motor being mounted upon a common base and coupled together. On the same floor, close to the motor-driven exciters, are the exciter switchboard and the alternating-current lamp and motor board. At the extreme eastern end of the main floor of the operating room are six step-down, oil-cooled transformers each rated at 300 kw. three-phase, 60 cycles, 6600 to 230 volts. These transformers are located to the rear of the alternating-current lamp and motor board, but are separated therefrom by a fireproof inclosure. At present only five step-down transformers are installed, three of which furnish energy

to the exciter motors and two of which furnish energy for the lamps and motors throughout the station.

Above the exciter board and the step-down transformers is a gallery on which is located the main alternating-current 6600-volt and 44,000-volt control switchboard from which are also operated the alternating-current generator field rheostats. From each of the alternating-current gen-



FIG. 7—SUBSTATION AT CHATTANOOGA

erators three single-conductor cables are run in bituminized fiber conduits laid in concrete to the generator oil circuit-breakers and generator buses, which are located in the north part of the first floor of the transformer house and divided from the operating house by a 12-in. concrete wall. From the generator buses the energy is sent through oil circuit-breakers to the step-up transformers located on the first floor, which are also separated from the switch room by a 12-in. concrete wall.

The step-up transformers will be grouped in five sets, three transformers to each set and each transformer having a rating of 3133 kw, wound for 25,400 volts and 44,000 volts on the high-tension side and 6600 volts on the low-tension side. These transformers are water-cooled, and at present only three of the fifteen are installed. The 44,000-volt energy from the step-up transformers is transmitted through oil circuit-breakers to the 44,000-volt buses, which are located partly on the second and partly on the third floor in the transformer house. On the latter floor are also the 44,000-volt and multiplex lightning arresters.

### Transmission Line

The transmission lines leave the station at almost a right angle to the long side of the building and are carried to the substation in Chattanooga on 175 steel towers. The line follows for a great part of its route the tracks of the Nashville, Chattanooga & St. Louis Railroad Company, crossing them in six places, and in one instance crossing the tracks of the proposed route of the Southern Railroad Company quite close to the border of the State of Georgia. After going in an easterly direction about two-thirds of its total length, the line turns sharply north and continues in that direction until it reaches a point on the river near Moccasin Bend, where it turns northwest, crossing the Tennessee River at Moccasin Bend. Crossing the river for the second time, it enters the city of Chattanooga at the foot of Henry Street. From the foot of Henry Street the transmission line follows an easterly course parallel with Henry Street until it reaches the substation at the northwest corner of Henry and Carter Streets.

The two transmission lines are carried on single steel towers, each line consisting of three No. 000 bare copper cables, which are used in the whole distance of 17.5 miles with the exception of the two crossings over the Tennessee River, where 350,000-circ. mil bare copper cable is use On the top of the transmission towers, a steel groundi cable is clamped to the steel structures with cast-ir clamps and carried throughout the whole distance from t generating station to the substation. The steel towers va in height, 35-ft., 40-ft., 45-ft. and 60-ft. towers being us for ordinary spans and 150-ft. and 170-ft. towers being us for the river crossings. All the towers are erected on co crete foundations, and owing to the mountainous charact of the country the towers could not be erected at equ distances. The spans vary between 200 ft. and 700 ft., a over the Tennessee River they are 1400 ft. and 1500 respectively.

### Chattanooga Substation

The substation is a three-story and basement buildi laid out to accommodate two sets of electrolytic lightni arresters and horn-gaps, two sets of multiple lightning resters and choke coils, five 40,000-volt motor-operated circuit-breakers and buses, three 4000-volt motor-operat oil circuit-breakers and buses, one 40,000-volt control boa two 4000/2300-volt control boards, ten 2300-volt outgoi lighting feeders, fourteen 4000-volt outgoing motor feede one alternating-current station lamp and motor board, o motor-generator set, three 2300/115-volt oil-cooled st down transformers for station lamps and motors, one st age battery, and nine 40,000/4000-volt main step-do transformers. The principal arrangement of the apparat is similar to that in the generating station. At the pres

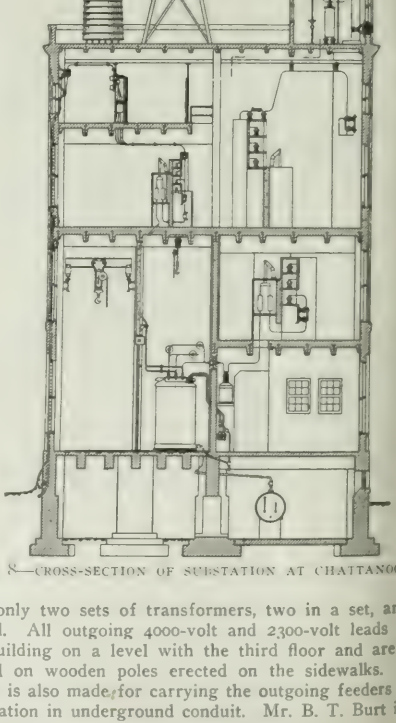


FIG. 8—CROSS-SECTION OF SUBSTATION AT CHATTANOO

time only two sets of transformers, two in a set, are i stalled. All outgoing 4000-volt and 2300-volt leads l the building on a level with the third floor and are s ported on wooden poles erected on the sidewalks. vision is also made for carrying the outgoing feeders u the station in underground conduit. Mr. B. T. Burt is resident engineer of the company at Chattanooga.

# Industrial Lighting by Incandescent Lamps

**Requirements of shop and factory illumination, methods of design and construction, and data on cost of operation of practical lighting systems. By Ward Harrison**

THAT good illumination in industrial plants is a factor in the cost of production is generally appreciated. It is the purpose of this article to scuss the requirements which must be met in the design a satisfactory lighting system, to point out methods of sign to be followed, and to show cost figures which will



FIG. 1—LIGHTING OF A BINDERY

of value to those contemplating the design of a practical ghting system.

There are four general requirements to be met—suffient light of the proper quality on the work; a moderate tensity over the adjacent area and on the walls; absence glare, and simplicity, reliability, ease of maintenance d low operating cost.

It is obvious that there must be sufficient light on the ork. Better lighting facilities, along with practically all her improvements in industrial plants, are installed for e purpose of ultimately decreasing the unit cost of proction. From an economic standpoint, however, it is very ficult, if not impossible, to determine the proper intensity r a given class of work. This intensity depends upon t cost of producing light, the number and wages of the ployees and the value of their output, as well as upon nature and fineness of the work and the possible reducn in spoilage. Owing to the difficulties encountered in luating these quantities, estimates of the intensity of mination required for any class of work have usually n based on other than economic considerations.

onsidered only from the standpoint of safety to emyees, 0.25 ft.-candle may, in most instances, be taken the lower limit of permissible intensity in an industrial nt. The upper limit of needful intensity may be conatively estimated at from 50 to 100 ft.-candles. Illumation of this order is sometimes required for operations olving fine detail, rapidly moving machinery and black aces, such, for example, as are common in the shoe stry. In this connection it must be borne in mind th after the apparent brightness of an object has reached rtain magnitude a further increase of intensity does not appreciably aid vision. The necessary volume of incident light will, of course, depend upon the coefficient of reflection of the object illuminated, but even for fine work on very dark goods intensities of the order of those stated above are considered satisfactory. Such intense illumination is usually required over but a limited area and, therefore, can best be supplied by the use of small lamps and reflectors placed close to the work.

While from 0.25 to 100 ft.-candles may be considered as the extreme range of intensity for artificial lighting in factories, the great majority of installations will fall within much narrower limits, between approximately 1 ft.-candle and 6 ft.-candles. Many tables have been published designating the proper intensity of illumination for various classes of work, but this necessary intensity depends so largely upon the nature and distribution of the lighting units and upon local conditions as well as on the work to be performed that such tables should be used only with the greatest caution. Furthermore, as stated above, such estimates are at best based merely on what is now considered good practice in plants where illumination tests have been conducted. There is no definite assurance that either a higher or lower intensity of light would not tend toward a more economical operation of the plant. As a matter of fact, the cost of adequate illumination for an industrial plant is so low in comparison with the value of the output dependent upon it that in many cases intensities considerably higher than those now supplied will be found profitable. At present an expenditure of 1 watt per square foot of floor area using an overhead system of tungsten-filament lamps and enameled steel reflectors is



FIG. 2—LIGHTING OF A COMPOSING ROOM

considered good practice for machine shops and other locations with similar lighting requirements. This will on the average correspond to an initial intensity somewhat in excess of 5 ft.-candles. Tables which give values of illumination recommended for various locations should be understood as merely an approximate guide. One of the most useful of these is given in the 1912 report of the

industrial lighting committee of the National Electric Light Association.

To insure a satisfactory intensity of light on the work from a general overhead system of lighting, it is in most cases essential to provide light from several directions so that all sides of the objects viewed may be properly illuminated and so that if one lamp burns out, or the light from the unit be intercepted either by the operator's body or by parts of machinery, the resulting decrease in intensity will not be serious. In an installation of a few large units shadows are likely to be pronounced. Furthermore, there is a very decided decrease in the illumination when one lamp is extinguished and consequently the time of many workmen may be lost. A smaller unit will affect a smaller area and this area to a lesser degree.

Again, with the lighting system in which a considerable number of units are used over an area, it is less difficult to produce uniform illumination. Where one class of work is performed in a given area, a uniform intensity of light over this area will obviously result in the most economical use of the total quantity of light supplied. With any of the artificial illuminants now available, it is impracticable even to approach uniformity of illumination where the distance between units is greater than twice their height above the work. One and one-half times this height is a more satisfactory ratio. For a given mounting height the allowable spacing of units is constant and independent of their candle-power. From the reasons outlined above, it follows that an installation of a considerable number of units of low intensity will usually prove more satisfactory and, in the end, more economical than a system involving a small number of high candle-power illuminants.

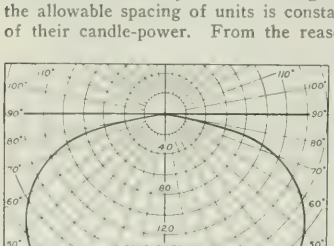
A requirement of even greater importance than sufficient quantity of light of uniform intensity of illumination is that the intensity shall be constant. A flickering light produces the same effect rapidly repeated as is experienced when one passes from a dark room into bright sunshine. The efforts of the iris to accommodate the eye to the rapid changes of intensity produce muscular fatigue and nervous reaction which cause discomfort and pain.

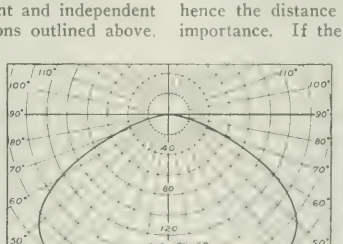
In addition to supplying the proper light on the work, a well-designed system of illumination should provide for some light on adjacent objects and on the shafting and belting, as well as on the walls and ceiling. In many shops the intensity, except at a few points, is so low that it is scarcely possible to see one's way about. Such lighting is not only inadequate from the standpoint of safety, but also strains the eye. If the work only is brilliantly lighted and the rest of the room is in comparative darkness, the uneven intensity encountered by the eye in shifting from the work has a tiring effect not unlike that of a flickering light source.

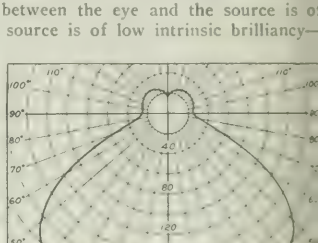
From the psychological standpoint, bright walls and ceiling lend an air of cheerfuness and wide-awakeness to a room which is wanting where the work only is illuminated. If, as in a cotton or a paper mill, the materials are of such a color that they will reflect a large proportion of the light incident upon them, the resulting illumination received on the walls and ceiling will be sufficient to obviate any appearance of gloom. If, on the other hand, the working surface is too dark to reflect much light in this manner it may become advisable either to choose an illuminant which directs some of its light toward the ceiling and side walls, or else to provide a few lamps especially for this purpose. Such units would ordinarily be placed close to the ceiling in diffusing envelopes. If the walls and ceiling are necessarily dark, as in a foundry, it is, of course, useless to throw any light upon them. Keeping the walls and ceiling well whitewashed adds materially to the appearance of a shop as well as to the efficiency of the lighting installation.

Glare must be avoided. Glare is commonly defined as "light out of place." To cause glare, the disturbing element need not necessarily be a light unit. Glare may as well be the result of specular reflection from some brightly illuminated surface not far from the line of vision, or even from some polished portion of the work itself from which the image of the light source is reflected to the eye.

Recent investigations indicate that the extent to which vision is for the time impaired by glare depends primarily upon the total quantity of light received by the eye directly from the source, rather than upon intrinsic brilliancy; hence the distance between the eye and the source is of importance. If the source is of low intrinsic brilliancy—that is, if its candle-power per unit of area is low—the effect of glare usually disappears very soon after the cause is removed. If, however, the source is one of high intrinsic brilliancy, such as the filament of a tungsten lamp or the crater of an arc, it may not only decrease the ability to see during its presence within the field of vision but will also tire or permanently injure the eye. The seriousness of this latter effect depends largely on the distance between the eye and the light source and also upon the brightness of the background against which the source is viewed.




FIGS. 3, 4, 5—DISTRIBUTION CURVES, LAMPS WITH DOME ENAMELED-STEEL, BOWL ENAMELED-STEEL AND GLASS REFLECTORS

TABLE I—UTILIZATION EFFICIENCIES

| Installation—Units Spaced 1.5 to 1.6 Times Height Above Work | Reflector: Enameled Steel Dome | Reflector: Enameled Steel or Glass Bowl |
|---|---|---|
| One unit | 28 | 24 |
| One row of five units | 42 | 36 |
| Two rows of two units | 48 | 41 |
| Two rows of three units | 52 | 44 |
| Three rows of three units | 56 | 47 |
| Three rows of four units | 60 | 49 |
| Four rows of four units | 63 | 51 |
| Four rows of eight units | 67 | 54 |
| Eight rows of eight units | 71 | 57 |

In order that a lighting system may not prove objection

able from the standpoint of glare, it should be designed with a view to the following requirements: First—No source of light of high intrinsic brilliancy should be so located that it can readily be seen, except at a considerable distance. In cases where it is impossible to screen the source entirely, the presence of a brightly lighted background, such as the surface of a reflector, will considerably diminish the harmful effect. Second—No considerable amount of light even from a well-diffused source should be allowed to enter the pupil of the eye directly when it is focused on the work. This usually requires that no light source, unless remote, be visible when the head is inclined toward the working surface. Third—It is desirable that the area within the field of vision be uniformly illuminated; at least, the brightness of any portion of this area should not be materially greater than that of the object under observation. Fourth—Specular reflection should be guarded against so far as possible. Where the position of objects worked upon is fixed and the greater portion of the work is in one plane, lamps can be so placed as to avoid specular reflection in the direction of the eye. In the majority of operations in industrial plants, however, such conditions do not exist, and one should direct his efforts toward producing conditions which will allow the operator readily to shift his position in such a manner that direct reflection cannot reach his eye.

lamps are spaced on 10-ft. centers, the 575 lumens will be spread over 100 sq. ft. and the resulting intensity will be 5.75 ft.-candles. This, of course, is a value for the initial intensity of light and, therefore, estimates relating thereto should be reduced by an amount sufficient to allow for the falling off in efficiency of the lamps and the accumulation of dust (see Figs. 6 and 7). If, in place of the dome reflectors, bowl enameled-steel or dense opal glass reflectors are used (Figs. 4 and 5), about 50 per cent of the total light, or 475 lumens, will be effective and the average intensity over the area of 100 sq. ft. will be 4.75 ft.-candles.

The foregoing data apply to a relatively large area free from obstructions, but no allowance has been made for light reflected from walls and ceiling. In a large room the increase in intensity resulting from such reflection will in most cases be negligible when steel reflectors are used. If the space to be illuminated is narrow in comparison with the desirable mounting height of units, so that not more than one or two rows of lamps can be installed, the efficiency of the system will be considerably less and will be dependent to a greater extent upon reflection from the walls. An extreme case of this nature is represented by an area 10 ft. square illuminated by a single unit placed about 6.5 ft. above the working plane, or approximately 9 ft. above the floor. Obviously, in this case, the illumination will not be uniform, and, unless the walls are light, the efficiency of the system will be less than one-half that obtained in a large installation. This low efficiency is due solely to the fact that a very large percentage of the light rays emitted by the unit must of necessity strike the inclosing walls before they can reach the working plane. If these walls are white, the percentage of light on the working plane may be increased from 30 to 60 per cent, depending upon the reflector employed. Table I gives values for the efficiency of utilization of a number of typical installations. Knowing the efficiency of utilization of a lighting system, one may obtain the average intensity of illumination as follows:

TABLE II—INTENSITY OF ILLUMINATION IN FOOT-CANDLES ON A HORIZONTAL PLANE PRODUCED BY A 1000-LUMEN SOURCE

Upper figures show intensity obtained with bowl enameled steel reflectors, lower figures, intensity with dome enameled steel reflectors

| Height of Unit above Plane, Feet | Horizontal Distance from Unit, Feet | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 4 | 8 89<br>11 00 | 8 75<br>10 50 | 7 61<br>9 08 | 5 74<br>6 29 | 3 92<br>4 08 | 2 50<br>2 62 | 1 51<br>1 74 | 0 879<br>1 170 | 0 512<br>0 805 | 0 327<br>0 570 | 0 208<br>0 410 | 0 136<br>0 299 | 0 091<br>0 222 | 0 064<br>0 165 | 0 044<br>0 129 | 0 028<br>0 095 | 0 021<br>0 072 | 0 016<br>0 057 | 0 013<br>0 046 | 0 010<br>0 035 | 0 008<br>0 028 |
| 5 | 5 70<br>7 11 | 5 67<br>6 79 | 5 25<br>6 37 | 4 42<br>5 12 | 3 40<br>3 70 | 2 46<br>2 60 | 1 75<br>1 81 | 1 210<br>1 310 | 0 767<br>0 955 | 0 503<br>0 696 | 0 327<br>0 515 | 0 243<br>0 394 | 0 152<br>0 301 | 0 111<br>0 230 | 0 083<br>0 180 | 0 058<br>0 141 | 0 044<br>0 110 | 0 034<br>0 090 | 0 025<br>0 073 | 0 017<br>0 059 | 0 013<br>0 048 |
| 6 | 3 94<br>4 92 | 3 95<br>4 77 | 3 80<br>4 55 | 3 38<br>4 04 | 2 82<br>3 22 | 2 27<br>2 42 | 1 74<br>1 81 | 1 300<br>1 360 | 0 950<br>1 020 | 0 665<br>0 773 | 0 465<br>0 590 | 0 324<br>0 460 | 0 228<br>0 358 | 0 176<br>0 288 | 0 128<br>0 226 | 0 093<br>0 182 | 0 072<br>0 145 | 0 054<br>0 118 | 0 041<br>0 099 | 0 032<br>0 079 | 0 025<br>0 066 |
| 7 | 2 90<br>3 58 | 2 92<br>3 53 | 2 82<br>3 38 | 2 64<br>3 18 | 2 33<br>2 72 | 1 96<br>2 20 | 1 60<br>1 71 | 1 280<br>1 330 | 1 000<br>1 040 | 0 768<br>0 815 | 0 580<br>0 640 | 0 418<br>0 506 | 0 301<br>0 405 | 0 227<br>0 327 | 0 168<br>0 264 | 0 132<br>0 216 | 0 103<br>0 177 | 0 080<br>0 147 | 0 061<br>0 122 | 0 047<br>0 102 | 0 039<br>0 086 |
| 8 | 2 22<br>2 72 | 2 24<br>2 72 | 2 18<br>2 63 | 2 08<br>2 52 | 1 91<br>2 27 | 1 68<br>1 92 | 1 43<br>1 58 | 1 200<br>1 270 | 0 985<br>1 020 | 0 790<br>0 820 | 0 625<br>0 655 | 0 496<br>0 535 | 0 376<br>0 436 | 0 279<br>0 358 | 0 220<br>0 292 | 0 168<br>0 243 | 0 131<br>0 202 | 0 104<br>0 169 | 0 084<br>0 147 | 0 066<br>0 121 | 0 052<br>0 103 |
| 9 | 1 76<br>2 20 | 1 76<br>2 16 | 1 74<br>2 09 | 1 66<br>2 02 | 1 57<br>1 90 | 1 42<br>1 68 | 1 25<br>1 43 | 1 090<br>1 190 | 0 923<br>0 980 | 0 775<br>0 805 | 0 636<br>0 666 | 0 522<br>0 559 | 0 423<br>0 475 | 0 342<br>0 376 | 0 265<br>0 316 | 0 207<br>0 262 | 0 164<br>0 222 | 0 127<br>0 186 | 0 101<br>0 159 | 0 083<br>0 136 | 0 072<br>0 119 |
| 10 | 1 42<br>1 78 | 1 43<br>1 75 | 1 42<br>1 70 | 1 37<br>1 65 | 1 31<br>1 59 | 1 22<br>1 45 | 1 10<br>1 28 | 0 990<br>1 110 | 0 852<br>0 923 | 0 735<br>0 781 | 0 628<br>0 652 | 0 525<br>0 550 | 0 442<br>0 464 | 0 367<br>0 389 | 0 302<br>0 328 | 0 242<br>0 279 | 0 192<br>0 238 | 0 155<br>0 203 | 0 126<br>0 175 | 0 103<br>0 149 | 0 083<br>0 128 |
| 11 | 1 17<br>1 47 | 1 18<br>1 45 | 1 17<br>1 42 | 1 14<br>1 38 | 1 11<br>1 34 | 1 05<br>1 25 | 0 96<br>1 13 | 0 873<br>1 000 | 0 778<br>0 870 | 0 685<br>0 743 | 0 597<br>0 634 | 0 520<br>0 540 | 0 441<br>0 460 | 0 376<br>0 393 | 0 316<br>0 336 | 0 270<br>0 288 | 0 222<br>0 246 | 0 180<br>0 213 | 0 145<br>0 185 | 0 122<br>0 161 | 0 102<br>0 139 |
| 12 | 0 986<br>1 230 | 0 990<br>1 220 | 0 988<br>1 200 | 0 974<br>1 170 | 0 950<br>1 140 | 0 905<br>1 090 | 0 845<br>1 010 | 0 781<br>0 909 | 0 713<br>0 815 | 0 633<br>0 705 | 0 564<br>0 605 | 0 496<br>0 525 | 0 436<br>0 453 | 0 375<br>0 392 | 0 325<br>0 338 | 0 277<br>0 292 | 0 237<br>0 254 | 0 202<br>0 221 | 0 169<br>0 195 | 0 140<br>0 170 | 0 116<br>0 147 |
| 13 | 0 841<br>1 050 | 0 845<br>1 040 | 0 845<br>1 020 | 0 832<br>0 995 | 0 812<br>0 978 | 0 780<br>0 945 | 0 734<br>0 902 | 0 695<br>0 820 | 0 645<br>0 740 | 0 586<br>0 659 | 0 527<br>0 579 | 0 472<br>0 505 | 0 421<br>0 442 | 0 374<br>0 385 | 0 324<br>0 338 | 0 284<br>0 296 | 0 245<br>0 258 | 0 215<br>0 228 | 0 183<br>0 200 | 0 156<br>0 174 | 0 131<br>0 155 |
| 14 | 0 725<br>0 905 | 0 728<br>0 895 | 0 728<br>0 885 | 0 720<br>0 863 | 0 710<br>0 850 | 0 681<br>0 820 | 0 638<br>0 791 | 0 621<br>0 740 | 0 581<br>0 678 | 0 535<br>0 615 | 0 490<br>0 550 | 0 445<br>0 486 | 0 402<br>0 432 | 0 360<br>0 378 | 0 319<br>0 332 | 0 281<br>0 293 | 0 250<br>0 260 | 0 217<br>0 229 | 0 191<br>0 203 | 0 168<br>0 180 | 0 144<br>0 159 |
| 15 | 0 630<br>0 787 | 0 636<br>0 782 | 0 645<br>0 775 | 0 631<br>0 755 | 0 619<br>0 743 | 0 604<br>0 730 | 0 585<br>0 705 | 0 560<br>0 669 | 0 525<br>0 619 | 0 491<br>0 567 | 0 450<br>0 515 | 0 415<br>0 462 | 0 381<br>0 414 | 0 345<br>0 369 | 0 310<br>0 327 | 0 279<br>0 289 | 0 246<br>0 258 | 0 222<br>0 241 | 0 195<br>0 206 | 0 174<br>0 183 | 0 152<br>0 163 |
| 16 | 0 555<br>0 695 | 0 557<br>0 687 | 0 558<br>0 680 | 0 557<br>0 666 | 0 550<br>0 656 | 0 542<br>0 645 | 0 529<br>0 630 | 0 498<br>0 602 | 0 476<br>0 566 | 0 450<br>0 523 | 0 419<br>0 481 | 0 388<br>0 439 | 0 358<br>0 393 | 0 329<br>0 355 | 0 300<br>0 319 | 0 269<br>0 286 | 0 245<br>0 251 | 0 219<br>0 229 | 0 198<br>0 207 | 0 177<br>0 185 | 0 156<br>0 164 |
| 17 | 0 492<br>0 615 | 0 494<br>0 610 | 0 492<br>0 605 | 0 491<br>0 595 | 0 485<br>0 585 | 0 478<br>0 575 | 0 464<br>0 563 | 0 450<br>0 546 | 0 433<br>0 517 | 0 411<br>0 485 | 0 387<br>0 451 | 0 361<br>0 415 | 0 335<br>0 378 | 0 312<br>0 341 | 0 286<br>0 307 | 0 262<br>0 277 | 0 238<br>0 252 | 0 216<br>0 224 | 0 194<br>0 204 | 0 177<br>0 186 | 0 158<br>0 166 |
| 18 | 0 439<br>0 549 | 0 438<br>0 544 | 0 440<br>0 540 | 0 439<br>0 530 | 0 434<br>0 522 | 0 426<br>0 514 | 0 420<br>0 507 | 0 408<br>0 493 | 0 393<br>0 475 | 0 376<br>0 447 | 0 354<br>0 418 | 0 338<br>0 389 | 0 314<br>0 358 | 0 294<br>0 329 | 0 271<br>0 298 | 0 251<br>0 263 | 0 231<br>0 245 | 0 212<br>0 224 | 0 193<br>0 201 | 0 173<br>0 182 | 0 158<br>0 166 |
| 19 | 0 394<br>0 492 | 0 394<br>0 489 | 0 395<br>0 485 | 0 396<br>0 476 | 0 392<br>0 471 | 0 387<br>0 465 | 0 378<br>0 456 | 0 371<br>0 450 | 0 360<br>0 434 | 0 347<br>0 415 | 0 329<br>0 396 | 0 316<br>0 366 | 0 294<br>0 339 | 0 275<br>0 314 | 0 256<br>0 288 | 0 248<br>0 262 | 0 223<br>0 238 | 0 206<br>0 219 | 0 188<br>0 199 | 0 174<br>0 180 | 0 157<br>0 165 |
| 20 | 0 355<br>0 445 | 0 356<br>0 440 | 0 354<br>0 436 | 0 358<br>0 433 | 0 356<br>0 425 | 0 349<br>0 420 | 0 342<br>0 412 | 0 336<br>0 408 | 0 328<br>0 397 | 0 320<br>0 382 | 0 304<br>0 363 | 0 289<br>0 341 | 0 277<br>0 320 | 0 259<br>0 297 | 0 243<br>0 274 | 0 228<br>0 252 | 0 214<br>0 231 | 0 199<br>0 213 | 0 185<br>0 196 | 0 169<br>0 178 | 0 156<br>0 162 |

Let $L$ = Total lumens per lamp.
$K$ = Utilization efficiency.
$A$ = Average number of square feet illuminated by each lamp.
$I$ = Average intensity in foot-candles.
Then $I = L K \div A$.

## Illumination Calculations

The recommendation has been made that for purposes of general illumination in factories lamps be spaced at intervals approximately 50 per cent greater than their height above the plane illuminated. This spacing of units will result in a sufficiently uniform illumination in all cases except where a markedly concentrating reflector is used. If this rule for spacing is followed, it is not difficult to estimate the average intensity of light over the working area. In an installation comprising three or more rows of units the estimate may be made with considerable accuracy. In such an installation using a tungsten-filament lamp and the best grade of dome reflector having a distribution similar to that shown in Fig. 3 a light flux approximating 60 to 70 per cent of the total quantity emitted by this bare lamp will reach the working plane. For example, a 100-watt lamp will produce initially 908 lumens and about 575 of these will be effective. If the

It is in most cases sufficiently accurate from a practical standpoint if the intensity of illumination is predetermined within from 5 to 10 per cent; hence, in making calculations, certain approximations as outlined above are permissible.

Another but rather laborious method of calculating illumination, in which the distribution curve of the unit is used, is known as the point-by-point method, tables of constants for which have been published from time to time. To determine the illumination in foot-candles of any point on a horizontal plane a given distance below the unit, the candle-power (taken from the distribution curve of the unit used) at the proper angle is multiplied by a corresponding constant. In practice, the accuracy with this method is but little greater than with the one previously considered, since individual curves of light distribution on lamps and reflectors of the same designation will be found to vary somewhat and curves on units of different sizes of the same type and manufacture are not exactly similar in shape or equal in efficiency.

The candle-power curve for a bowl enameled-steel reflector given in Fig. 4 represents the mean of tests on units

TABLE III—DISTRIBUTION OF LIGHT FLUX

| Zone, Degs. | Enameled Steel Dome | | Enameled Steel Bowl | | Dense Opal Bowl | |
|---|---|---|---|---|---|---|
| | Lumens in Zone | Summation of Lumens from 0 Deg. Nadir | Lumens in Zone | Summation of Lumens from 0 Deg. Nadir | Lumens in Zone | Summation of Lumens from 0 Deg. Nadir |
| 0– 10 | 17 | 17 | 14 | 14 | 15 | 15 |
| 10– 20 | 53 | 70 | 43 | 57 | 46 | 61 |
| 20– 30 | 94 | 164 | 78 | 135 | 80 | 141 |
| 30– 40 | 127 | 291 | 112 | 247 | 114 | 255 |
| 40– 50 | 143 | 434 | 138 | 385 | 138 | 393 |
| 50– 60 | 150 | 584 | 136 | 521 | 128 | 521 |
| 60– 70 | 141 | 725 | 86 | 607 | 84 | 605 |
| 70– 80 | 89 | 814 | 29 | 636 | 46 | 651 |
| 80– 90 | 6 | 820 | 3 | 639 | 29 | 680 |
| 90–180 | 0 | 820 | 0 | 639 | 164 | 844 |

of all sizes ranging from 40 watts to 250 watts. The average deviation of the individual curves from the mean value at various angles is 5 per cent and the average deviation in hemispherical flux values is only 2 per cent. The numerical values apply for clear tungsten-filament lamps operated in such a way as to produce a total of 1000 lumens. This corresponds to a 100-watt unit operated at 10 lumens per watt, or, very closely, 1 watt per horizontal candle-power Curves for dome enameled-steel and dense opal glass reflectors are given in Figs. 3 and 5. Plotting curves on this basis greatly facilitates the comparison of units in which the lamps are of different sizes and efficiencies. Illumination values may also be calculated most conveniently by

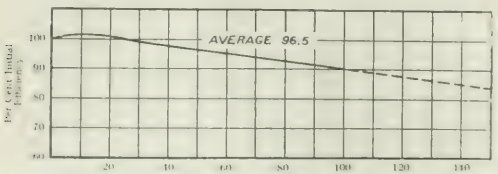



FIG. 6—VARIATION OF EFFICIENCY WITH LIFE

using such curves and correcting the final results by the ratio of the total lumens of the lamp chosen to 1000 lumens.

In Table II are given foot-candle values which have been calculated for various points under the units for which distribution curves are shown in Figs. 3 and 4. A single example will serve to illustrate the use of this table. It is required to determine the intensity of illumination at a point on a horizontal plane illuminated by three 60-watt tungsten-filament lamps equipped with dome reflectors when the units are suspended 7 ft. above the plane and their horizontal distances from the point are 2 ft., 7 ft. and 13 ft. respectively. From Table II it is found that at a point 7 ft. below the unit and 2 ft. out the horizontal illumination produced by the dome-shaped unit, the curve for

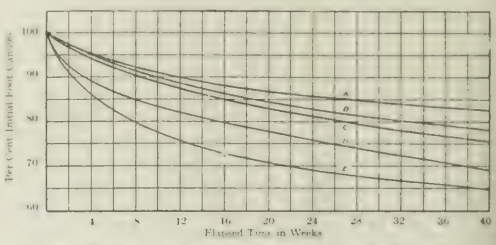



FIG. 7—VARIATION OF CANDLE-POWER WITH LIFE

which is given in Fig. 3, is 2.89 ft.-candles. The illumination for the other distances may be determined in a similar manner. The total becomes:

$$2.89 + 0.86 + 0.02 = 3.77 \text{ ft.-candles.}$$

This is the illumination produced by three units generating 1000 lumens each; hence, when using 60-watt units generating 526 lumens each, the intensity at the point designated will be:

$$0.526 \times 3.77 = 1.98 \text{ ft.-candles.}$$

While the usual distribution curve shows the average intensity of the light source in various zones, it does not indicate directly the distribution of the total volume of light. In order to obtain a better idea of the quantity or flux of light in the various zones, the values computed for the curves shown in Figs. 3, 4 and 5 are given in Table III. In the first column are values for lumens emitted within the successive 10-deg. zones beginning at a point directly

TABLE IV—ANALYSIS OF OPERATING COSTS—100-VOLT TO 130-VOLT TUNGSTEN UNITS

| | Size of Lamp, Rated Watts | | | | | | |
|---|---|---|---|---|---|---|---|
| | 40 | 60 | 100 | 150 | 250 | 400 | 500 |
| Cost of lamp, list | $0.350 | $0.450 | $0.800 | $1.200 | $2.000 | $3.600 | $4.000 |
| Cost of lamps, standard-package discount | 0.315 | 0.405 | 0.720 | 1.080 | 1.800 | 3.240 | 3.600 |
| Cost of reflector, standard-package discount | 1.155 | 1.292 | 1.566 | 1.653 | 1.653 | 2.617 | 2.617 |
| Cost of unit, standard-package discount | 1.470 | 1.697 | 2.286 | 2.733 | 3.453 | 5.857 | 6.217 |
| Annual Fixed Charges: | | | | | | | |
| Interest on total investment, 6 per cent | $0.088 | $0.102 | $0.137 | $0.164 | $0.207 | $0.351 | $0.373 |
| Depreciation on reflector, 12 1-2 per cent | 0.144 | 0.162 | 0.196 | 0.207 | 0.207 | 0.327 | 0.327 |
| Labor, monthly cleaning | 0.240 | 0.240 | 0.240 | 0.360 | 0.360 | 0.480 | 0.480 |
| Total | $0.472 | $0.504 | $0.573 | $0.731 | $0.774 | $1.158 | $1.180 |
| Maintenance Cost per 1000 Hours: | | | | | | | |
| Lamp renewals at standard-package discount | $0.315 | $0.405 | $0.720 | $1.080 | $1.800 | $3.240 | $3.600 |
| Lamp renewals at $150-contract discount | 0.291 | 0.374 | 0.664 | 0.996 | 1.660 | 2.988 | 3.320 |
| Lamp renewals at $1200-contract discount | 0.256 | 0.329 | 0.584 | 0.876 | 1.460 | 2.628 | 2.920 |
| Energy cost per 1000 hours at 1 cent per kw-hr | $0.400 | $0.600 | $1.000 | $1.500 | $2.500 | $4.000 | $5.000 |

below the lamp. In the second column is the summation of the lumens from 0 deg. (nadir) to the upper limit of each zone. The light within a certain zone is sometimes considered as "useful" when this quantity is available for the direct lighting of the working plane. The actual percentage of total light that can be directly utilized, and consequently the efficiency, depends upon the area lighted

and the number of rows of units. There is therefore a very direct connection between the figures given in Table I and those of Table III. The larger the number of rows, the greater the angle within which the light emitted from the unit may be efficiently utilized. In very large areas practically all of the flux within 70 deg. of the axis of the lamp can be used without the losses attending reflection from walls.

Since the intensity of illumination at any point on a plane varies inversely as the square of its distance from the light source, it is sometimes assumed that in a large building, such as a foundry, the efficiency of the lighting system is necessarily impaired when the lamps are hung high in order to clear the cranes. It should be borne in mind, however, that the height of the lamps in feet has itself no influence upon the efficiency of utilization, which depends solely on the number of units installed and the ratio of their height and spacing. For example, if there are two buildings, one 20 ft. by 50 ft. and 10 ft. in height and the other 40 ft. by 100 ft. and 20 ft. in height, it is clear from Fig. 8 that the effective angle, and hence the efficiencies of the lighting systems in the two buildings, will be the same. If the small building is illuminated by eight 100-watt lamps on 10-ft. centers and the large building by the same number of 400-watt lamps on 20-ft. centers, the

TABLE V—TOTAL ANNUAL OPERATING COSTS—100-VOLT TO 130-VOLT TUNGSTEN UNITS

| | Energy Cost, Cents | Size of Lamp, Rated Watts 40 | 60 | 100 | 150 | 250 | 400 | 500 |
|---|---|---|---|---|---|---|---|---|
| 1000 hours' operation per year. Lamps bought on $150 contract | 1 | $1 16 | $1.48 | $2 24 | $3 23 | $4.93 | $8.15 | $9 50 |
| | 2 | 1 56 | 2.08 | 3 24 | 4 73 | 7 43 | 12.15 | 14 50 |
| | 3 | 1 96 | 2 68 | 4 24 | 6.23 | 9.93 | 16 15 | 19 50 |
| | 4 | 2.36 | 3 28 | 5 24 | 7 73 | 12 43 | 20 15 | 24 50 |
| | 5 | 2.76 | 3.88 | 6.24 | 9.23 | 14.93 | 24.15 | 29.50 |
| | 6 | 3.16 | 4.48 | 7.24 | 10.73 | 17.43 | 28.15 | 34.50 |
| | 8 | 3.96 | 5.68 | 9.24 | 13.73 | 22.43 | 36.15 | 44.50 |
| | 10 | 4.76 | 6.88 | 11.24 | 16.73 | 27.43 | 44.15 | 54.50 |
| 1000 hours' operation per year. Lamps bought on $1,200 contract | 1 | 1.13 | 1.43 | 2.16 | 3.11 | 4.73 | 7.79 | 9.10 |
| | 2 | 1.53 | 2.03 | 3.16 | 4.61 | 7.23 | 11.79 | 14.10 |
| | 3 | 1.93 | 2.63 | 4.16 | 6.11 | 9.73 | 15.79 | 19.10 |
| | 4 | 2.33 | 3.23 | 5.16 | 7.61 | 12.23 | 19.79 | 24.10 |
| | 5 | 2.73 | 3.83 | 6.16 | 9.11 | 14.73 | 23.79 | 29.10 |
| | 6 | 3.13 | 4.43 | 7.16 | 10.61 | 17.23 | 27.79 | 34.10 |
| | 8 | 3.93 | 5.63 | 9.16 | 13.61 | 22.23 | 35.79 | 44.10 |
| | 10 | 4.73 | 6.83 | 11.16 | 16.61 | 27.23 | 43.79 | 54.10 |
| 4000 hours' operation per year. Lamps bought on $150 contract | 1 | 3.24 | 4.40 | 7 23 | 10 72 | 17 41 | 29.11 | 34.46 |
| | 1 1-2 | 4.04 | 5.60 | 9 23 | 13 72 | 22 41 | 37 11 | 44.46 |
| | 2 | 4.84 | 6.80 | 11 23 | 16 72 | 27 41 | 45 11 | 54.46 |
| | 3 | 6.44 | 9.20 | 15 23 | 22 72 | 37 41 | 61 11 | 74.46 |
| | 4 | 8.04 | 11.60 | 19 23 | 28 72 | 47 41 | 77 11 | 94.46 |
| 4000 hours' operation per year. Lamps bought on $1,200 contract | 1 | 3.10 | 4.22 | 6.91 | 10.24 | 16.61 | 27.67 | 32.86 |
| | 1 1-2 | 3.90 | 5.42 | 8.91 | 13.24 | 21.61 | 35.67 | 42.86 |
| | 2 | 4.70 | 6.62 | 10.91 | 16.24 | 26.61 | 43.67 | 52.86 |
| | 3 | 6.30 | 9.02 | 14.91 | 22.24 | 36.61 | 59.67 | 72.86 |
| | 4 | 7.90 | 11.42 | 18.91 | 28.24 | 46.61 | 75.67 | 92.86 |

average intensity of illumination will be the same, neglecting the difference in the efficiencies of the units, and its distribution will be similar.

## Cost Calculations

In determining the total operating cost of any system of lighting, three items must be considered:

First—Fixed charges, which include interest on the investment, depreciation of permanent parts and other expenses which are independent of the number of hours of use. Frequently this item forms the greater part of the total operating expense, yet it is only too often omitted from cost tables.

Second—Maintenance charges, which include renewal of parts, repairs, labor and all costs, except the cost of energy, which depend upon the hours of burning.

Third—The cost of energy, which depends upon the hours of burning and the rate per kilowatt-hour.

The life of a lighting system depends not only upon the wearing out of parts, but also upon obsolescence. There are no installations in this country which have been in use for a period of seven or eight years which are not already obsolete. Although the lamps may be in good operating condition, economy demands that they be replaced by more efficient illuminants. There is every indication that the next few years will see even greater progress in the development of lamps and the use of light. The rate of depreciation on all permanent parts is equal to at least 12.5 per cent. The investment required in the tungsten system of lighting is relatively very low.

A table which would show the total operating expense of tungsten lamps for all sizes, with every discount from the list prices, for all possible periods of burning per year, and under all cost of energy, would be so large as to be entirely impracticable. From Table V, however, the operating expense of units under any set of conditions may be found with little calculation.

The total investment includes the cost of lamps, reflectors, holders and sockets. The investment in permanent parts is the total investment minus the price of lamps. No depreciation is charged against the lamps inasmuch as they are regularly renewed. The labor item under fixed charges provides for the cleaning of all units once each month. For the smaller units with steel reflectors the cost of cleaning is taken as $0.02 per unit for each cleaning. Data obtained from installations where accurate cost records are kept show that this figure is conservative for labor at $0.20 per hour. The cost of cleaning other reflectors is taken in proportion to the amount of labor required. Some illuminants require attendance at regular intervals. The

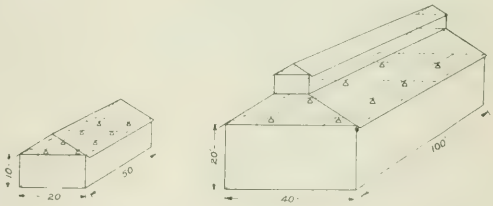



FIG. 8—BUILDINGS WITH IDENTICAL LIGHTING EFFICIENCIES

cleaning is done at the same time and is, therefore, included under the maintenance charge. For units which require no regular attendance the cleaning expense becomes a separate charge. It will be noted that the fixed charges form only a small part of the total operating cost for a lighting system.

The maintenance charge is given for a 1000-hour period of burning. To find the annual charge in any case, it is necessary to multiply by the ratio of the total hours of burning to 1000 hours. Where lamps are sold at other than the prices given, the proper correction should be applied. The renewal of lamps is the only maintenance expense.

The energy cost is given for a 1000-hour period with energy at $0.01 per kilowatt-hour.

An example will illustrate the use of Table IV. It is required to find the total operating expense per unit per year for lighting a mill with 250-watt tungsten-filament lamps. The lamps are burned a total of 4000 hours and are purchased at the discount obtained on a $150 contract. The cost of energy is $0.20 per kilowatt-hour.

From the table we obtain the following:

| | |
|---|---|
| (1) Fixed charges | $0.774 |
| (2) Maintenance, 4.000 × $1.800 | 7.200 |
| (3) Energy, 4.000 × 2 × $2.50 | 20.000 |
| Total | $27.974 |

In Table V are included annual operating costs which have been calculated for a number of cases frequently met in industrial plants.

# Effective Resistance and Reactance

**Graphic and algebraic treatment of the relations in alternating-current circuits surrounded by magnetic conducting material. By Waldo V. Lyon**

THE object of this paper is to give a simple discussion of an electric circuit with which is associated magnetic or non-magnetic conducting material in which energy is dissipated owing to hysteresis, to eddy currents or to both. In order to keep the discussion within the bounds of simplicity it will be necessary to make various assumptions. At the proper places these assumptions will be stated so that the limitations of the conclusions may not be lost sight of. It is assumed initially that the current and voltages are simple harmonic functions of the time, and whenever this is contrary to fact the actual voltage and current are replaced by their equivalent harmonic values. The apparent resistance of an electric conductor to alternating current is greater than it is to direct current, owing to the fact that the varying magnetic field set up by the current causes a non-uniform distribution of the current over the cross-section of the conductor. But for conductors not larger than No. 0 and for frequencies not greater than 60 cycles the apparent resistance to alternating current is practically the same as the ordinary ohmic resistance.

When considering a simple impedance circuit, as, for example, a so-called reactor, or a transformer on open circuit, it is customary to regard the circuit as consisting of a resistance $R$ in series with a reactance $X$. The relations that fix the values of this resistance and reactance are expressed in the following equations:

$$R^2 + X^2 = \frac{E^2}{I^2} \qquad (1)$$

$$R = \frac{P}{I^2} \qquad (2)$$

$E$, $I$ and $P$ are respectively the impressed voltage, the current and the power supplied to the circuit. These relations do not in any way depend upon the magnitude, the form-factor or the frequency of the impressed voltage. It is only necessary that $E$ and $I$ should be the effective values of the voltage and current and $P$ the average watts supplied. Assuming that the actual voltage and current are replaced by their equivalent harmonic values, they can be represented by vectors as in Fig. 1. $E$ is the fall in potention through the circuit and $I$ is the current in the direction in which the fall is taken. $RI$ and $jXI$ are called the effective resistance and the effective reactance drops. Cos $\theta$ is the power factor.

It is often assumed that $R$ is constant and $X$ proportional to the inductance of the circuit and the frequency of the impressed voltage. In practice this is not generally so, for whenever the power supplied to the circuit includes hysteresis or eddy-current losses, the resistance $R$ may vary over a considerable range and the reactance $X$ is not proportional to the inductance and frequency alone. Even though there be no hysteresis or eddy-current losses, the reactance can be expressed by the simple formula $X = 2\pi fL$ only when the current is a simple harmonic function of the time. Whenever the current is a periodic non-sinusoidal function the equations for the effective resistance and the effective reactance become very complicated. In this case the expressions for the voltage, current and power are those which are embraced in the following forms:

$$E^2 = E_1^2 + E_3^2 + E_5^2 + \quad . \quad . \quad .$$

$$I^2 = \frac{E_1^2}{R_1^2 + X_1^2} + \frac{E_3^2}{R_3^2 + X_3^2} + \frac{E_5^2}{R_5^2 + X_5^2} + \quad . \quad . \quad .$$

$$P = \frac{E_1^2 R_1}{R_1^2 + X_1^2} + \frac{E_3^2 R_3}{R_3^2 + X_3^2} + \frac{E_5^2 R_5}{R_5^2 + X_5^2} + \quad . \quad . \quad .$$

$E_1$, $E_3$ and $E_5$ are the effective values of the fundamental and harmonic components of the impressed voltage. $R_1$, $R_3$ and $R_5$ are the effective resistances of the circuit at the respective frequencies of the fundamental and the successive harmonics. They are not equal. $X_1$, $X_3$ and $X_5$ are the effective reactances of the circuit at the respective frequencies of the fundamental and the successive harmonics. They are not proportional to the frequencies. These equations show the necessity for assuming that the voltage and current are simple harmonic functions.

The first and simplest case to consider is that of a coil of conducting material with which is associated no magnetic or other conducting material. In this case the magnetic flux is directly proportional to the current and there are no losses but the joule heating in the conductor itself. The magnetic flux and the current will be in time-phase and the generated voltage in the coil—namely, the reactance voltage—will be in time-quadrature with the flux and hence with the current. The vector diagram is given in Fig. 2. In this case only do the true resistances and reactance satisfy the equations (1) and (2). Thus:

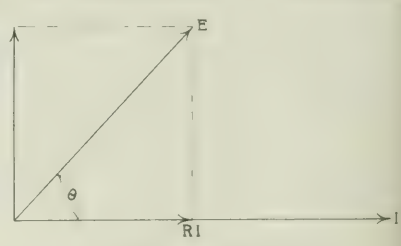



FIG. 1—SIMPLE VECTOR RELATIONS

$$\sqrt{r^2 + x^2} = \frac{E}{I}$$

$$r = \frac{P}{I^2}$$

The ohmic and reactance drops are in time-quadrature. The actual generated voltage lags behind the flux by 90 deg., and the component of the impressed voltage $E$ necessary to balance this is the true reactance drop ($jIx$).

The second case to be considered is one in which the electric circuit has associated with it non-magnetic conducting material in which eddy currents are produced. We will assume that the electromotive force which produces the eddy currents is in time-quadrature with the flux produced by the current in the electric circuit, and that this electr

motive force and the eddy currents are in time-phase. The vector digram is given in Fig. 3

The flux $\varphi$ produced by the magnetizing current $I_f$ generates in the electric circuit a voltage which is numerically equal to the true reactive drop $jI_fx$. This flux also generates in the associated conducting material an electromotive force which is in time-quadrature with it and which

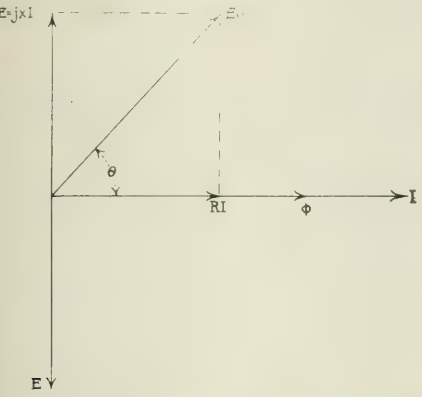



FIG. 2—VECTOR RELATIONS IN CIRCUIT WITHOUT MAGNETIC MATERIAL

produces the eddy currents. The eddy currents, which are represented by the vector $I_e'$, produce a demagnetizing effect on the magnetic circuit, to neutralize which a component current $I_e$ must be supplied to the electric circuit. The actual current $I$ existing in the electric circuit is the sum of these two components $I_f$ and $I_e$. The ohmic drop is in time-phase with this current. The impressed voltage is the sum of its two components, $jI_fx$ and $Ir$, and is shown in the diagram by the vector $E$. The reactive and resistance drops are no longer in time quadrature.

The third case to be considered is that of an electric circuit with which is associated non-conducting magnetic material. Such a material is not known, but the theoretical consideration of this case serves to separate the effects of eddy currents and hysteresis. In this case if the voltage generated in the electric circuit is a simple harmonic function of the time, the current will be distorted and will contain higher harmonics. There will also be energy dissipated in what is called hysteresis. As we are to assume simple harmonic functions, this actual current must be replaced by its equivalent sine value. The generated voltage and the current may then be represented by vectors, and the current will lead this voltage by an angle greater than 0 deg., since energy is dissipated. The vector diagram is given in Fig. 4.

The component $I_f$ of the equivalent sine current $I$, which is in time-phase with the flux $\varphi$, is the magnetizing component. The other component of the current, $I_h$, which is time-quadrature with the magnetizing current $I_f$ and in time-opposition to the generated voltage $E$ is the hysteresis component of the current. The angle $\eta$ by which the current $I$ leads the flux $\varphi$ is the angle of hysteretic advance.

The final case to consider is that of an electric circuit with which is associated magnetic and conducting material. The vector diagram is given in Fig. 5 and is a combination of those which represent the second and third cases. The current $I$ is divided into two components which are in time-quadrature—the magnetizing component $I_f$, which is in time-phase with the flux $\varphi$, and the core loss component $I_e$, which is in time-quadrature with the flux. The impressed voltage is divided into two components which are not in time-quadrature. The resistance drop is in time-phase with the actual current $I$, while the true reactive drop is in time-quadrature with the flux and hence with the magnetizing component of the current $I_f$.

As previously stated, it is customary to divide the impressed voltage into two components which are in time-quadrature. The first of these is the effective resistance drop and is in time-phase with the actual current. The second is the effective reactance drop and is in time-quadrature with the current. In Fig. 5 these are respectively $IR$ and $IX$. We can now find the relations that exist between the effective resistance and reactance and the actual resistance and reactance. It will be seen from Fig. 5 that:

$$IR = Ir + I_f \times \sin \alpha$$

but

$$I_f = I \cos \alpha$$

$$\therefore R = r + x \sin \alpha \cos \alpha \qquad (3)$$

Likewise

$$IX = I_f x \cos \alpha$$

and

$$X = x \cos^2 \alpha \qquad (4)$$

When the error would be slight we will assume that the resistance $r$ of the circuit is the same as it would be to direct current. If necessary, its actual value can be closely calculated by making suitable approximations. Equations (3) and (4) show that whenever there are core losses the effective resistance is always greater than the actual resistance and the effective reactance is always less than the actual reactance.

The solution of equations (3) and (4) for the actual reactance and the angle $\alpha$ will give:

$$x = X + \frac{(R-r)^2}{X} \qquad (5)$$

$$\tan \alpha = \frac{R-r}{X}$$

The values of $R$ and $X$ are determined by equations (1) and (2) and $r$ can be measured with direct current. If equation (5) is solved for the value of the effective reactance in terms of the effective resistance, the ohmic resistance and the actual reactance, we have

$$X = \frac{x \pm \sqrt{x^2 - 4(R-r)^2}}{2}$$

This shows that the greatest value that $(R-r)$ can have is $\frac{x}{2}$, otherwise the value of $X$ would be imaginary. But

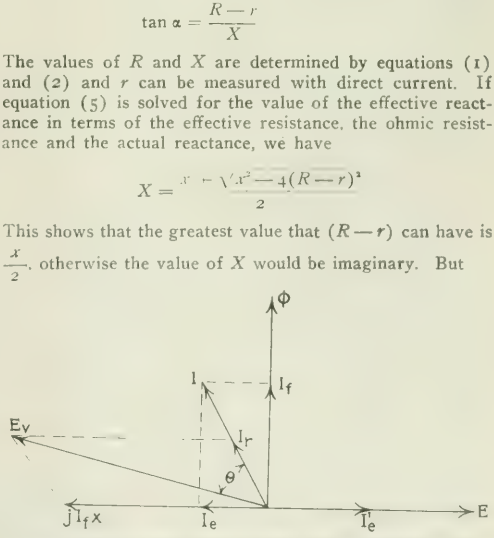



FIG. 3—VECTOR RELATIONS WHEN EDDY CURRENTS ARE PRESENT

$$(R-r) = x \sin \alpha \cos \alpha$$

Therefore the effective resistance $R$ has its greatest possible value when

$$\sin \alpha \cos \alpha = \frac{1}{2}$$

that is, when $\alpha = 45$ deg.

The value of the magnetizing component of the current, which it is often necessary to know, is found by substituting the value of cos α in the equation:

$$I_r = I\cos\alpha$$

$$I_r = \frac{X}{\sqrt{X^2 + (R-r)^2}}\, I \qquad (6)$$

It will now be shown how the effective resistance and the effective reactance vary with the impressed voltage and the frequency. In order to simplify the expressions as much as possible it will be necessary to assume that the actual reactance is proportional to the frequency alone, i.e., $x = fx_1$. This would not be so on account of saturation. The magnetizing current is equal to the generated electromotive force divided by the actual reactance.

$$I_f = \frac{E}{fx_1}$$

The core loss is given by the expression:

$$P_c = EI_c = K_1E^2 + K_2E\left(\frac{E}{f}\right)^{\eta - 1}$$

$\eta$ is the Steinmetz exponent. From this:

$$I_c = K_1E + K_2\left(\frac{E}{f}\right)^{\eta - 1}$$

$$\sin\alpha = \frac{I_c}{\sqrt{I^2 - I_c^2}}$$

$$\cos\alpha = \frac{I_r}{\sqrt{I_f^2 + I_r^2}}$$

Equations (3) and (4) may now be written in the following terms:

$$R - r = \frac{E\left(K_1E + K_2\left(\frac{E}{f}\right)^{\eta - 1}\right)}{\left(\frac{E}{fx_1}\right)^2 + \left[K_1E + K_2\left(\frac{E}{f}\right)^{\eta - 1}\right]^2}$$

$$X = \frac{fx_1\left(\frac{E}{fx_1}\right)^2}{\left(\frac{E}{fx_1}\right)^2 + \left[K_1E + K_2\left(\frac{E}{f}\right)^{\eta - 1}\right]^2}$$

$K_1$ and $K_2$ are constants determined by the division of the total core loss between eddy-current and hysteresis loss. $E$ is the generated voltage due to self-induction.

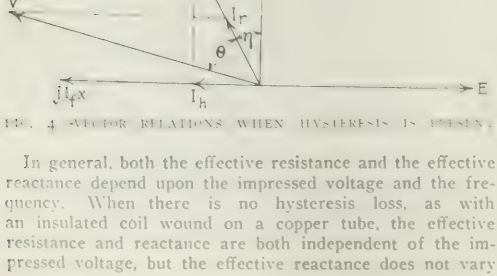



FIG. 4—VECTOR RELATIONS WHEN HYSTERESIS IS PRESENT

In general, both the effective resistance and the effective reactance depend upon the impressed voltage and the frequency. When there is no hysteresis loss, as with an insulated coil wound on a copper tube, the effective resistance and reactance are both independent of the impressed voltage, but the effective reactance does not vary directly with the frequency. If the eddy current loss should be so small as to be negligible and the generated voltage and frequency are kept in the same ratio—that is, the flux density is constant—the hysteresis resistance $R - r$ would vary directly with $E$ and the effective reactance $X$ would be directly proportional to the frequency but not equal to $2\pi fL$.

We are often interested in determining the flux that will

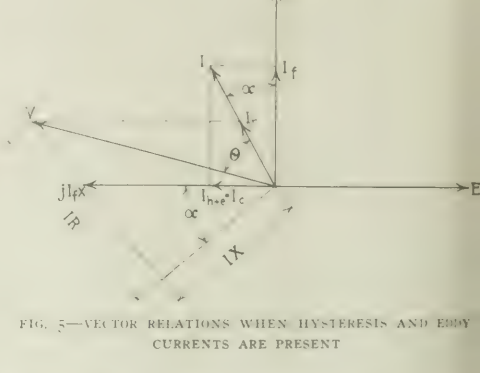



FIG. 5—VECTOR RELATIONS WHEN HYSTERESIS AND EDDY CURRENTS ARE PRESENT

be produced when 1 amp exists in the circuit and there are no core losses. The flux per ampere of magnetizing current, $\frac{\varphi}{I_f}$, is proportional to the actual reactance and is

$$\frac{\varphi}{I_f} = \frac{x}{2\pi fN} \cdot 10^{-8}$$

$N$ is the number of turns with which the flux $\varphi$ links. The flux per ampere is *not* equal *to the effective* reactance divided by $2\pi fN10^{-8}$.

For example, the following actual data are given:

$P = 345$ watts.
$I = 21.7$ amp.
$E = 25.7$ volts.
$r = 0.302$ ohms.

From this data:

$$R = \frac{345}{21.7^2} = 0.733$$

$$X = \sqrt{\left(\frac{25.7}{21.7}\right)^2 - (0.733)^2}$$

$$= 0.93.$$

From equation (5):

$$x = \frac{0.93 \cdot (0.733 - 0.302)^2}{0.93}$$

$$= 1.13$$

The actual reactance is about 22 per cent greater than the effective reactance in this case.

The magnetizing component of the current is given by equation (6).

$$I_f = 21.7\,\frac{0.93}{\sqrt{0.93^2 + (0.733 - 0.302)^2}} = 19.7$$

This is about 91 per cent of the actual current in the circuit.

It is perhaps interesting to know that the above data were taken when current was supplied to one phase of a three-phase alternator at standstill. This experiment is the basis for determining the reactance of the armature windings for various positions with respect to the field pole

# Electric Locomotives for Swiss Railway

**Single-phase, 15,000-volt, 15-cycle, 2500-hp units for use on the Loetschberg line operating through the Simplon Tunnel**

An outline of several experimental electrical locomotives for the Simplon Tunnel route of the Loetschberg Railway in Switzerland, together with a well-illustrated descriptive article relating to a 2000-hp, single-phase locomotive built by the Oerlikon company for this service, appeared in our issue dated July 29, 1911. As a result of the satisfactory operation of this locomotive the railway ordered thirteen additional locomotives of a similar type but somewhat larger for the Spiez-Brig high-speed passenger and freight service. On July 15, 1913, the electrical service was extended to Brig, and the new locomotives have been in satisfactory operation since that date.

Each locomotive is rated at 2500 hp, and at the normal speed of 31 miles per hour exerts a drawbar pull of 22,000 lb. It is provided with five intercoupled driving axles and two pony trucks.

In order to obtain flexibility on curves, the following axle arrangement has been adopted: The middle axle (driving axle) is given the extraordinary side-play of 0.98 in. (25 mm). The two adjacent axles are fitted without play into bearings fixed to the frame. The two end driving axles are said to have 1.57 in. (40 mm) side-play and are connected with the adjacent pony axles of the Krause-Winterthur pony trucks with sliding center pins and reaction springs. The pony axles therefore have even greater play, so that, notwithstanding the relatively great length of the locomotive, curves of 364-ft. radius may be taken without difficulty.

## Equipment of the Locomotive

The braking and signal equipment comprises Westinghouse automatic brakes, hand brakes, air sanders and air signal whistle. Compressed air is employed for the current collectors and for a part of the safety appliances such as door bolts and ladders. The compressed air is produced by two compressor sets with a common governor. A supplementary hand-operated air pump is provided for the initial lifting of the pantograph collectors.

The railway company required the electrical equipment to be divided into distinct duplicate sections, each half set being complete in itself. It is therefore possible to run with one-half of the equipment. Both equipments may also be run simultaneously either in series or in parallel. Moreover, the motors may be served individually by either of the two transformers. The locomotive is capable of developing full drawbar pull and speed continuously with one transformer, one controller and the two motors coupled in series.

Single-phase, 15-cycle alternating current at 15,000 volts is taken from the line by two pantograph collectors and conducted to the two halves of the electrical equipment through two protecting choke coils. The two high-tension switches are constructed as oil switches for distant and hand-operated control. They have maximum and minimum current cut-outs and are provided with rheostats to prevent heavy shocks when the transformers are switched into the circuit. The transformers are of the forced air-cooled type with the two high-tension coils connected in parallel. The coils of the low-tension side are connected in series and have twelve different steps of about 45 volts each for speed regulation from 90 volts to 520 volts. At full load with 420 volts at the terminals the motors take 2700 amp. The transformers supply current at 118 volts for the auxiliary motors and at 325 volts for the heating apparatus.

Each transformer carries integral therewith a voltage step switch, the contact points of which are directly connected with the low-tension taps of the transformer. In accordance with its position for the time being, the main cylinder connects two consecutive pressure taps with the two sides of an auto-transformer, the center of which is connected by way of its corresponding low-tension switch to one of the motor cables.

The step switches of the controller are constructed for distant and hand operation. They consist principally of a main cylinder, an auxiliary cylinder and driving gear. The main cylinder, which is connected with the voltage taps of the transformer, impresses the corresponding voltage on the auto-transformer. The auxiliary cylinder has a mag-



FIG. 1—GENERAL VIEW OF LOCOMOTIVE AND CATENARY CONDUCTOR SYSTEM

netic blow-out and effects the making or breaking of one or the other of the auto-transformer circuits so that the changing over of the circuit, which is effected by the main cylinder, may be carried out while the current is cut off.

The controllers and the low-tension oil switches are constructed for a maximum motor current of about 3600 amp.

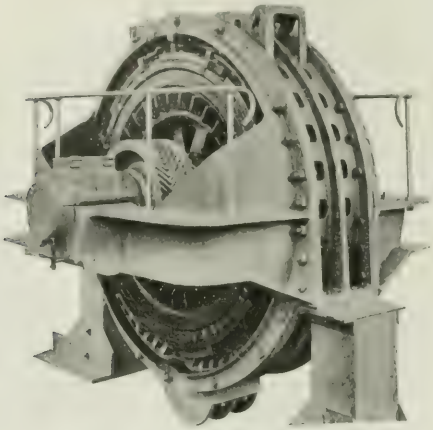


FIG. 2—1250-HP DRIVING MOTOR

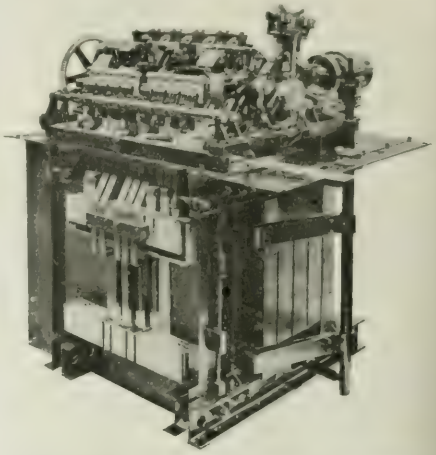


FIG. 3—TRANSFORMER AND CONTROL EQUIPMENT

They can be switched on or off by hand as well as electrically from the engineer's stands. Between each of the low-tension oil switches and the motors a shunt is inserted to feed the maximum cut-out of these switches and the ammeter of the motors.

The two motors, which are rated at 1250 hp each on a one-and-one-half-hour basis, are of the compensated-series type with interpoles. Their weight, including the gearing, is 14 tons each. By means of a double helical cut gear of 1:2.23 ratio the motor drives a counterbalanced jack-shaft. The cranks on both ends of these jack-shafts are coupled to the cranks of the driving wheels by means of a triangular yoke. In this drive non-spring-mounted masses are almost entirely avoided. The vertical play between the jack-shafts and wheels is absorbed at the middle driving axle by a vertical sliding block or Scotch yoke.

The motors have sixteen poles and are of open construction so that they are practically self-ventilating. Their commutating fields give sparkless running even without resistances. The air-gap between armature and stator is 0.15 in. (3 mm). The motors are built for a maximum emf of 500 volts and take about 3000 amp at their maximum load. The motor room is ventilated by a ceiling fan which is placed above the motors. This fan drives the discharged air through the commutating-pole shunt resistors, which are likewise built into the roof in order to cool them thoroughly by constant air circulation.

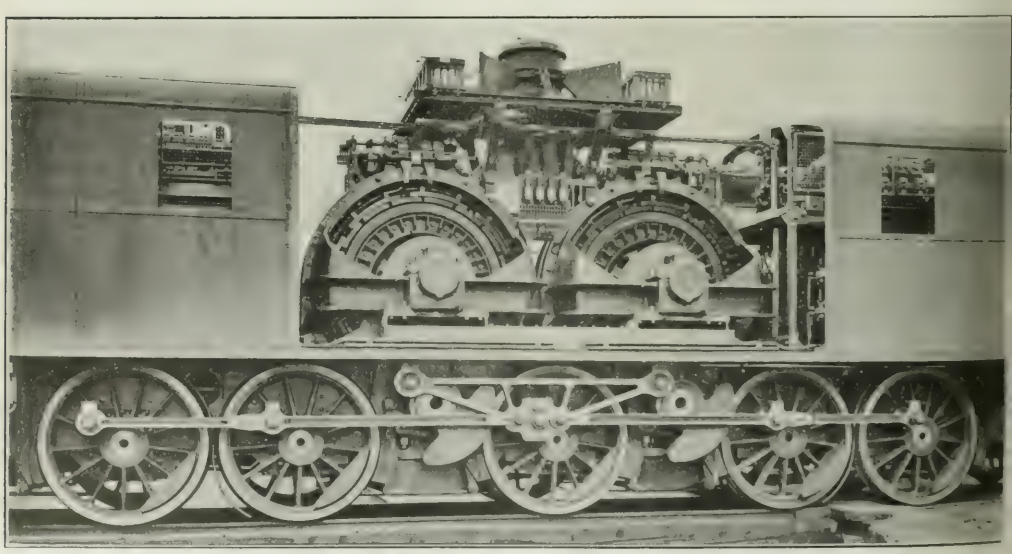


FIG. 4—VIEW OF DRIVING MECHANISM AND MOTOR MOUNTINGS

The normal speed of the locomotive is obtained at four times the synchronous motor speed. The tractive effor

l speed of the motor also ranges within wide limits inde-ndent of the line voltage, for on one hand care has been en to compensate by suitable transformer taps any con-erable decrease of line voltage, while on the other hand motor can develop its full torque at a third of its nor-

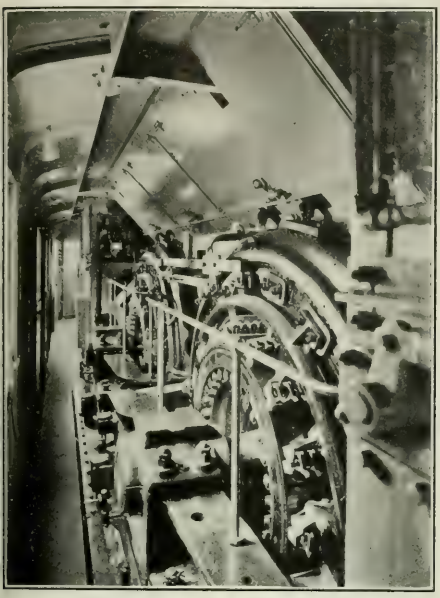


FIG. 5—INTERIOR OF LOCOMOTIVE CAB

l voltage. Owing to this fact the motors also possess an rmous overload range at normal voltage.

The power-factor of the motors at all normal speeds is ut 95 per cent. During trial runs the efficiency of the omotive proper (transformer, motor, gearing, etc.) up the wheel circumference has been found to be as high as per cent.

A motor-generator set jointly with four ordinary train-hting batteries supplies the direct current for remote ntrol and lighting. After the motor and generator itches have been cut in by the engineer, all further erations in the connections, such as paralleling with the teries, are made by an automatic starter.

### Motorman's Cabs, High-Tension Rooms, Etc.

The superstructure carries the two railway motors in center, and the transformers, control, etc., are placed ween the motors and the motorman's cab. For conveni-e in maintenance and repair, the roof over the motor m is fitted with two detachable trap doors, and the sides he section are also removable. End and side doors are t in as shown in the side view of a locomotive.

ach motorman's cab contains the air-valve mechanism perating the current collectors, two switches for oper-ig the high-tension and low-tension switches, main con-oller handle by means of which the step contacts are e pulated, reverser at the right of the controller, signal ns which show the engineer the running direction of the hinery, and two lamps which light up as soon as the ors stand in the zero position. All switches are so connected, either electrically or mechanically, that ng manipulations are impossible.

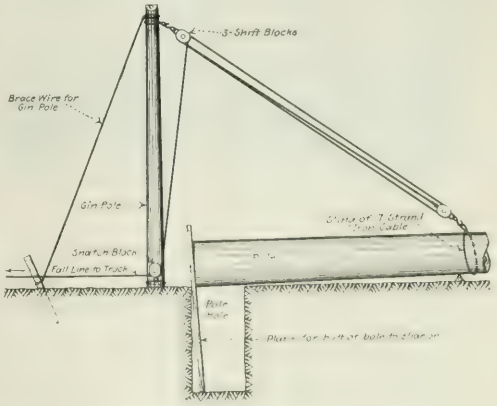
The two high-tension compartments in the motor room re hut off by doors of wire netting. These doors are so ked that prior to their being opened the high-tension conductor before and behind the high-tension oil switches must be grounded. The key which is necessary for the release of this lock is attached to the current collector valve conduit in such fashion that it can be taken off only when the collector valve is open, thus compelling the escape of any air in the conduit. With this key all the doors of the individual high-tension compartment can be unlocked, but it can be taken out of the lock only when all the doors are closed. This arrangement renders it impossible to open the high-tension compartment while the equipment is alive.

All of the mechanical parts of the thirteen locomotives were manufactured by the Schweizerische Locomotive & Maschinenfabrik, Winterthur. The contract stipulated that the electrical equipment of all locomotives should follow the plans and construction data of the Maschinenfabrik Oerlikon, regardless of the company which might be selected to assemble the locomotive. On this basis six of the equipments were made by Brown, Boveri & Company, Baden, and seven by the Oerlikon company.

## Motor Truck Reduces Cost of Erecting Poles

Among the many uses to which motor trucks of central stations are put that of raising poles is one of the most novel. As shown in the accompanying drawing, a gin pole, snatch block and tackle equipment are the only other prerequisites. The butt of the pole which is set over the hole impinges against a plank as shown. With the gin pole set up and anchored to a convenient fence post or other solid projection, the block and tackle are attached near the center of gravity of the pole. When the fall line of the blocks is run through the snatch block and tied to the rear axle of the truck it is only a minute's work for the truck to raise the pole and let it fall into the hole. Two men with short pikes are generally necessary to keep the pole from swinging sidewise as it is raised. In case the pole is being raised between the wires of an existing line, the movement of the truck can be controlled so that the men with the short pikes can direct the course of the pole through the overhead wires.

The method described above was used in erecting heavy poles with 8-in. tops for a 35,000-volt transmission line




RAISING POLES WITH AID OF MOTOR TRUCK

near Marion, Ind., with the result that 60 per cent of the cost of raising the poles was saved. The construction crews of the Marion (Ind.) Light & Heating Company now resort to the old method of "piking in" the poles only when it is impossible to reach the line with the motor truck.

# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## 37,000 Electric Vehicles

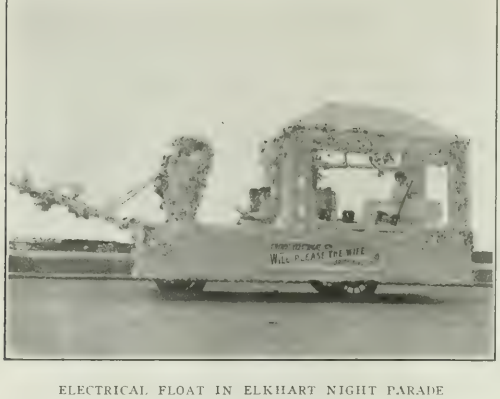
Thirty-seven thousand electric vehicles are in use in the United States, according to an estimate by Mr. Arthur Williams, president of the Electric Vehicle Association of America. Of this number 25,000 are probably pleasure cars and 12,000 are commercial wagons. Following are the numbers of electric vehicles in operation in some of the principal cities:

| | | | |
|---|---|---|---|
| Chicago | 2,850 | Denver | 887 |
| New York | 2,000 | Boston | 543 |
| Cleveland | 1,800 | St. Louis | 600 |
| Washington | 909 | Columbus, Ohio | 400 |

In Chicago electric trucking has increased 400 per cent in two years. In New York 40 per cent of the commercial power trucks are battery-driven. Nine of the New York hospitals use electric ambulances.

## Electric Float in Elkhart Parade

During the recent Merchants' Fall Festival in Elkhart, Ind., there was a night parade of illuminated automobiles.



ELECTRICAL FLOAT IN ELKHART NIGHT PARADE

One of the most striking floats shown, and the one which was awarded second prize, was that of the Brice H. Reid Company, a concern engaged in electrical contracting and the sale of electrical supplies. In front were two urns in which were seated two little girls under canopies. Doves were represented hovering over the "bowsprit" of the float with ribbons attached to them as though they were drawing the vehicle. The greater part of the display was devoted to a demonstration of domestic uses of electricity under a graceful pavilion. A housewife was seen seated at her ease in a rocking chair while an electric washing machine was at work. An electric flatiron was at hand to be used when needed. Other devices, such as a chafing dish, coffee percolator, electric fan and reading lamp, were shown. A collie dog at the lady's feet added to the domesticity of the scene.

The float was decorated in white and lavender, relieved with green vines. It was illuminated by 140 small fr incandescent lamps. There was a row of lamps aroun tops of the urns and the angles of the parasol canc Each of the six doves held a lamp in its beak. Elect energy was obtained from storage batteries. The float sented a beautiful apparance and was greeted with h applause along the line of march.

## A Sales Department's "Readiness to Serve"

Recently a severe electrical storm found the Detroit son Company with ten times the usual amount of tr waiting to be cleared. The telephone department was u to take the calls and the distribution force was inade in numbers and equipment to meet the situation.

The sales department thereupon tendered its assist Every available clerk in the sales department was put telephone or set to sorting and distributing trouble Every sales-department motor car was turned over to distribution forces, and soon every salesman was e driving a repair manor making repairs himself. was not outside of our regular work, as we recognize commented Miss S. I. Sheridan, sales manager of company, "for the sales department is responsible, than any other department, for good service to the pany's customers."

## Efficient Cost-Keeping Systems

One of the first principles of scientific managemen that of planning and dispatching. In this connection working out in advance of monthly requirements in the of supplies and checking the same against records of p ous use has been adopted by the Portland (Ore.) Rail Light & Power Company. From these monthly estim the purchasing agent is informed in advance of the req ments of all of the departments and can by lumping staples secure the benefit of quantity prices and disco The general storekeeper has thus an opportunity to c and replenish his stock if he has not on hand a suffic amount of the items estimated, or he does not need to o some item that is running low on the shelves as the mate shows no immediate need for it.

In the department of wires and conduits a job syste unit costs has been adopted. Before any work is sta an estimate covering the cost of such work is prepared if approved, the line foreman is notified. At the same the cost clerk of the department of wires and cond opens up a sheet in the line construction ledger that t care of all items and labor costs of installation or remo A daily segregated labor cost is obtained from the g foreman's daily report making it possible to analyze distribute the expenses on all jobs. This work is done the cost clerks. The timekeeper has a check on them makes all labor charges on jobs directly to a control account, covering the department of wires and condu this controlling account being on the books in the audi department. The total charges against the control account must balance with the distribution of the jobs turned in by the cost clerk. All items of labor, mate requisitions, either storeroom or purchase orders, c

memoranda for unused material and cartage costs are sent to the cost-keeping department and shown against each job separately. The same jobsystem applies in the meter department, the trouble department, the department of arc lamps and the electrical-construction department.

By this system it has been possible to gather a great deal of valuable cost data on nit costs, which have disclosed some very startling thingsn the way of efficiency possibilities.

It has been said that "reliable records are the best means of locating faults; without them rule-of-thumb methods must apply."

## Boston Edison House-Wiring Campaign

An active campaign forthe wiring of old residences has lately been inaugurated bythe Edison Electric Illuminating Company of Boston, Mass. The instalment plan is applied upon the basis of an initial payment of $2.35, followed by monthly payments of $2 each for a period of six months after the signing of the contract, and covering one outlet for a total of $14.35. Additional outlets are wired by accredited local contractors according to a carefully prepared schedule providing for various combinations as shown in the accompanying list. These prices apply only to "single apartments and dwellings and are based upon acceptance within thirty days from notation and upon the use of armored cable and first-class workmanship throughout and complete ready for use, excepting fixtures, where deductions for fixtures are made; and also excepting private property construction in excess of one stretch of wire over-




FIG. 1—FIXTURES OFFERED IN BOSTON EDISON HOUSE-WIRING CAMAIGN

head, or where undergroundservice is required in excess of 2 ft. inside the sidewalk lie."

The price list was developd particularly to enable every employee of the company to gure the cost of house wiring upon inquiry, without the dlay of securing an estimate from a contractor. The comany holds the opinion that a rate of 10 cents per kw-hr. mkes possible the conveniences of electricity in at least everyhome owned by its occupant, and to render the introduction of electric service still easier, the company offers to pay the contractor's bill in full, allowing the customer to meet the cost by the plan of instalment payments above outlined. The schedule of prices makes it possible for every employee to answer specifically just what it will cost to secure a partial or complete job, ready to use, in either case, including wiring, fixtures, shades, lamps and meter. No other information



FIG. 2—COPY OF LETTER USED IN BOSTON EDISON HOUSE-WIRING CAMPAIGN

is needed from the prospective consumer than an enumeration of the different rooms he wishes to have wired and the number of lighting outlets, switches and receptacles he plans to install. This offer is available only to prospective customers on existing commercial lines of the company or where extensions have been authorized, and all such contracts are passed upon by the credit clerk before being executed. Customers have the opportunity to extend their payments over periods to a maximum of twenty months in case their monthly payments exceed $5 maximum, shorter times being allowed for lower payments.

It is expected that very few contracts calling for but one outlet, at $14.35, will be made, and the effort of the employees is directed toward securing a complete wiring proposition by leading the applicant along step by step and showing him by detailed prices how much more can be secured by a little larger payment. Care is also taken to point out that the cost of a job is less if the whole number of outlets is installed at one and the same time.

### Example of Determining Wiring Cost

The following example shows the application of the schedule to the wiring of a third-story apartment requiring the following equipment: Kitchen—one receptacle, one center lamp on pull-socket, no switch; parlor—one three-lamp fixture with pull-socket, no switch; hall—one single-lamp fixture on switch, one baseboard receptacle, one single-lamp fixture in hall closet, no switch; dining-room—one four-lamp fixture on switch; bathroom—one single-lamp fixture on pull-socket, no switch; pantry—one single-lamp

with pull-sockets, no switch.

Applying the schedule:

| | |
|---|---|
| One No. 24 (hall-closet lighting) | 4.25 |
| One No. 24, less fixture, plus one No. 8 fixture (chamber lighting) | 7.50 |
| One No. 26 (hall-baseboard receptacle) | 4.00 |
| Two No. 28 (third-floor apartment) | 10.00 |
| Nine pull-sockets (kitchen, pantry, bathroom, parlor and chamber) | 2.25 |

This amount, $86.25, divided over eighteen months, would average payments of $4.79 per month and leave a balance of 3 cents due. The proper disposition of such an account would therefore be either a first payment of $5.50 and $4.75 per month for seventeen months, total $86.25, or $6.25 at signing of agreement and $5 per month for sixteen months, total $86.25.

To arouse the interest of prospective customers in the campaign, the company recently prepared and sent out individually addressed letters as reproduced herewith, showing what can be accomplished for the basic investment of $14.35. On the border of the page are reproduced ten photographs taken at the House of Edison Light, each view showing the service which may be secured from a single outlet with from one to three sockets. A card is inclosed with each letter to facilitate the customer's getting in touch with the company's representative.

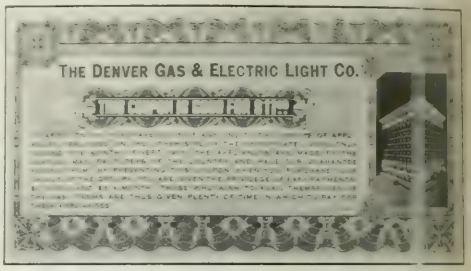
SCHEDULE OF WIRING PRICES

| | |
|---|---|
| No. 4—No. 1 and 2 outlet in hall with switch and fixture (three- | |
| No. 7—No. 1; No. 2; No. 4 | 28.00 |
| No. 8—No. 1; No. 2; No. 5 | 30.50 |
| No. 9—No. 1; No. 3; No. 4 | 31.00 |
| No. 11—No. 1; No. 4; No. 5 | 34.50 |
| No. 13—No. 1; No. 2; No. 3; No. 5 | 38.50 |
| No. 14—No. 1; No. 2; No. 4; No. 5 | 39.50 |
| No. 15—No. 1; No. 3; No. 4; No. 5 | 42.00 |
| No. 16—No. 1; No. 2; No. 3; No. 4; No. 5 | 47.50 |
| No. 18—Kitchen outlet with switch and fixture | 8.25 |
| No. 20—China-closet outlet and fixture | 4.25 |
| No. 21—Back porch outlet with switch and fixture | 8.00 |
| No. 22—Second-story hall outlet with two three-way switches and | |
| No. 23—Bathroom outlet with switch and fixture | 8.25 |
| No. 24—All other lighting outlets with fixtures each | 4.25 |
| For each additional floor above the first floor: | |
| running risers through additional floors). | |
| provide for controlling cellar lighting from the floor occupied by the user). | |
| Switches (exclusive of cellar switch), each | 3.00 |
| For fixtures if personal selection is desired: | |
| Nos. 18, 19, 20, 21, 22, 23, 24, each | 1.25 |
| Nos. 4 and 6, each | 2.00 |

## Results of Denver Group Appliance Sa

In the opening of the present year (as noted in the issue of June 21, page 1368), the Denver Gas & Electric Light Company inaugurated an appliance-sales campaign which proved very effective in adding load to its line, while at the same time reducing by two-thirds the usual sales cost of placing such devices. Coupons like that reproduced herewith were distributed among the company's household customers, each coupon entitling the recipient to $11 discount on his choice of any of the twelve fifty-dollar group of appliances offered. Each group comprised three appliances (such as vacuum cleaners, electric irons, toasters, curling irons, etc.) and would ordinarily have sold at $50. Besides the $11 discount represented by the coupon, the customer was allowed to pay the remaining $39 in monthly payments of $3 each, so that from the customer's standpoint the offer was an attractive one.

Approximately 1000 appliances were sold during this campaign—a record which exceeded that for any other month, although December is usually the best. The appliances thus put in service represent an additional load of




COUPON USED IN APPLIANCE SALES CAMPAIGN, DE

about 150 kw. which is distributed throughout the system. Similar sales were also conducted in June and September when gratifying results were again obtained. By the plan of grouping the appliances it was found that three devices could be sold with the effort ordinarily exerted in disposing of but one.

## Utilizing the Vacant Store Window

A novel use for vacant storerooms which accomplishes the triple result of "boosting" the local standard of window illumination, aiding central-station appliance sales and helping to rent the premises for the owner, has been discovered by the Joplin (Mo.) office of the Empire District Electric Company.

From real-estate dealers having charge of tantless business property permission is obtained for the central-station commercial department to equip the vacant show windows with displays of electrical appliances, each window being brilliantly lighted from the lines of the company. In a prominent position in each lighted window the agent's rental sign and address are also displayed on a large placard. Another legend used with success has been a card stating the cost per hour of the window lamps.

The real-estate man benefits, of course, from thoroughly lighted and attractive condition of his premises which draws the attention of many possible tenants who would otherwise pass without noticing his sign. Storerooms in which these electrical displays are installed do not remain tenantless long, which seems to be the only drawback to the plan, but as no expense is involved except that of decorating each new window in turn, the electric company profits by a wide margin from the publicity obtained. In a number of instances it has also disposed of the window installation outright to the new tenant.

# Illumination and Wiring

## Electric-Lighted House Number

The elctric-lighted house number shown in the illustraon waslevised by Mr. Charles M. Retts, a contractor of Tropico, al., and is in use on one of Tropico's bungalows, ts desin conforming to he Mision lines of the tructur In addition to howing the number of he hou both by day and y nigh the device serves lso as porch lamp.



ELECTRIC-LIGHTED HOUSE NUMBER

The fmework and roof f the amp housing are nade o lacquered brass, s are he figures, which re al it 5 in. high. Panes of frosted glass re plced inside this ramework on the sides, ront ad bottom, making th number equally isible y day and night. The bo portion is 10 in. ong ad 4.5 in. wide, while s height at the ront is6 in. and at the back is8 in. The brass oof hs an extension of .5 in. at the front and in. at he sides. A 16-cp lamp is used, although any size f unit night be employed, depending on the intensity of porch illmination desired.

## Lightng Protection in the Cripple Creek District

At th recent convention of the Colorado Electric Light, Power nd Railway Association Mr. Charles Neely, of the Arkans Valley Railway, Light & Power Company, read pape on "Lightning and Lightning Arresters in the Cripple Creek District." In that section one of the greatest prolems confronting the electric-service man is the severe ightning. It is not unusual to have sixty bad storms etween June 1 and Sept. 1. At an altitude of 10,000 . the lightning is very severe and direct strokes to he trasmission lines are not unusual. During one storm in the immer of 1913 there were fifty-six discharges over one se of aluminum arresters. This type of arrester is used qite extensively, but is rather expensive for general installaon on 6600-volt lines, so that considerable experimentin has been done with horn-gap arresters connected directl to ground. The gap of 1.25 in. formerly in use was fond to be too wide and a gap of 0.875 in. was substitute with excellent results. Mr. Neely reported that not a ngle piece of apparatus was lost during the summer of 191 on the 6600-volt service where horn-gaps set at 0.875 i. were used.

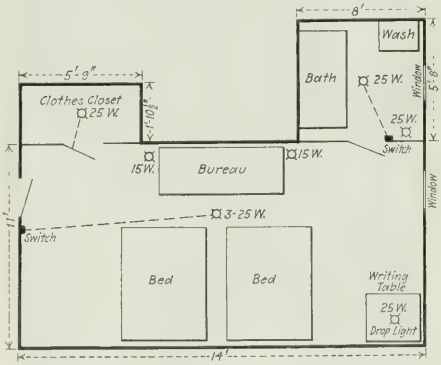
Abo Aug. 1 a set of horn-gaps with a 3-in. space was installd on a 20,000-volt circuit as an experiment. Each gap ws fused on the grounded side. The use of these protecors has resulted in but one interruption to service. Howe r, Mr. Neely does not believe that horn-gaps are practicble on 20,000-volt circuits except with the wide gap fr direct strokes to the line. For lower voltages, howevr, he thinks there is no doubt that the horn-gaps can beused very successfully. It has been found that the numbe of arresters in use on the 2300-volt circuits was much oo small and the same was true of the 500-volt servic In the case of 500-volt circuits it has been found that by installing the arrester at the motor with a choke coil, rather than placing it on the pole near the motor, better protection is secured.

## A Study of Hotel-Room Lighting

In view of the poor standards of illumination still in vogue in many hotels and the need of better service as a direct factor in patronage, the accompanying rough diagram of a first-class modern installation in a recently completed house is suggestive. The example selected is one of the lower priced rooms, which is taken for the reason that its lighting arrangement may be duplicated or paralleled elsewhere in older hostelries with less difficulty than had an expensive suite been taken.

The room is finished with light brown walls, the woodwork being of mahogany stain. The chamber proper is 14 ft. long by 11 ft. wide, with an adjoining bathroom 8 ft. long by 5 ft. 8 in. wide and a clothes closet 5 ft. 9 in. long by 1 ft. 10½ in. deep. The general illumination of the room is supplied by a cluster of three 25-watt tungsten lamps installed 18 in. below the ceiling, the latter being 10 ft. 6 in. high. These lamps are controlled by a push switch located inside the door. On each side of the bureau a 15-watt lamp is installed at a height of 5 ft. 6 in. above the floor, providing ample light for use at the mirror. In the further corner of the room a writing table is equipped with a screened drop lamp of 25 watts rating, supplied with energy from a baseboard outlet behind the table. The closet is automatically illuminated by a switch actuated by the door, a single 25-watt lamp on the ceiling being thrown into circuit when the door is opened. The walls of this closet are painted white and two shelves are provided running through its entire width.

The bathroom ceiling is 9 ft. 6 in. high. In a central position is installed a 25-watt lamp for general illumination, housed in a pear-shaped alabaster shade and carried 6 in. below the ceiling. The lamp is controlled from a push switch located inside the door. There is also a 25-watt bathroom side lamp at a height of 6 ft. above the floor, just inside the door and opposite a large mirror installed over the wash basin. This lamp is controlled by a




SCHEME OF HOTEL-ROOM LIGHTING

chain-pull switch. Although no illuminometer measurements are available, the lighting service furnished by this installation leaves little to be desired. With all lamps cut out except the drop lamp on the writing table it is possible to read or write in one corner of the room without the least disturbance to a guest occupying the further bed, and the placing of the utility lamps within reach of the hand has reduced the switch wiring cost materially below that which might be anticipated from the number of units installed.

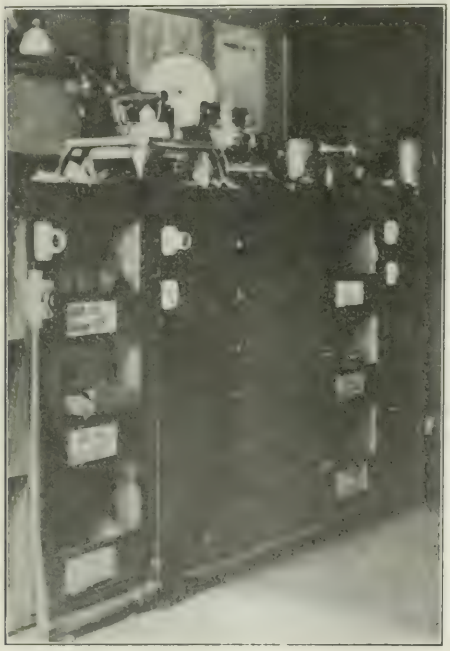
## Indirect Train Lighting to Be Supplemented for Readers' Use

The indirect lighting system of the Merchants' Limited, the New Haven Railroad's "crack" train between Boston and New York, is to be supplemented by the addition of direct tungsten units along the side beams of each car. This will increase the light available for reading purposes, concerning which there has been complaint.

The present equipment of this train (see *Electrical World*, April 26, page 888) was the first turned out by the Pullman company in which use was made of indirect lighting. When first installed each of the ten inverted fixtures suspended from the ceiling of the 72-ft. steel parlor cars contained one 100-watt tungsten lamp. By displacing each of these units with three 50-watt lamps an increase of 50 per cent in illumination was obtained, but even with this improvement some of the regular passengers complained of difficulty in reading in the soft light that pervades the cars, and the additional tungsten units have now been ordered installed.

## Wiring a Counter at Low Cost

To facilitate the testing of lamps and small energy-consuming appliances at the counter of its commercial department, the Manchester (N. H.) Traction, Light & Power Company has wired the rear of the counter in conduit as shown in the accompanying illustration, the outlets being in condulet fittings about 3 ft. 6 in. above the floor. In



CONDUIT WIRING FOR TEST OUTLETS

many central-station offices such counter wiring is of the open type run under a display counter or open shelf. The arrangement shown is by no means novel in principle, but it illustrates the compactness of conduit work in a location where every cubic inch of space is valuable and where projecting conductors would be objectionable. The location of these outlets directly behind the counter saves time in demonstration, avoids fire risk and enables about a dozen appliances to be tested at the same time. One of the outlets is connected with a Donkin "cent-hour" meter, so that the cost of operating any device can be determined at a moment's notice on either of the company's rate schedules, the meter dial being calibrated for two rates in red and black scale graduations.

## Private Street Lighting on North Clark Street, Chicago

The first installation of the new and artistic "Chicago" street-lighting posts for curb lighting has been put in service by the Commonwealth Edison Company on North Clark



FIG. 1 AND 2—"CHICAGO" LAMPS AND PRIVATE STREET LIGHTING ON NORTH CLARK STREET, CHICAGO, ILL.

Street, in the outlying district known as Summerdale. There are about eighty posts spaced 40 ft. apart on both sides of the street. The standard is of recent and handsome design and has been approved by the Department of Electricity of the city of Chicago and various other municipal bodies. The height over all is 14.5 ft. and the height from the ground to the center of the side lamps is 12 ft. The octagonal base has a diameter of 21 in. and the overall diameter of the ring of lamps is 27 in. This fixture is equipped with a 60-watt tungsten lamp in each globe. The top globe is 14 in. in diameter and the others are 10 in. in diameter.

## Experiments with Cheap Pole-Line Construction at Cleveland

The Cleveland (Ohio) Electric Illuminating Company will soon begin the construction of an experimental pole line for the purpose of determining accurate costs on distribution lines serving small customers. The officials of the Cleveland company have been deeply impressed by the data on inexpensive wiring and European methods of handling the small customer collected by Messrs. S. T. Doane and Hugo Eisenmenger, of Nela, near Cleveland, and the erection of the experimental distribution line is to be the first step in determining how practicable are these methods in solving Cleveland's problems.

According to present plans, the line will be rebuilt several times on property belonging to the company. From the different resulting costs it will then be possible to determine what type of construction is most inexpensive. If the least expensive equipment can be built at a price which will enable the company to serve the small customer in the outlying territory at a profit, this type of construction will be standardized for such lighting extensions.

### Recent Telephone Patents

A patent granted to Messrs. C. E. Egner and J. G. Holmstrom, of Sweden, relates to a transmitter designed to carry very heavy currents and provides means for keeping the transmitter cool by backing the microphone button with a vessel containing liquid for carrying off heat.

Mr. E. M. Schollenberger, of Chicago, has invented a telephone muffler consisting of a large double cone with abutting bases. The apex of one cone is drawn out into a lip-piece shaped to fit the contour of the face of the user, while the other incases snugly the transmitter mouthpiece.

## Letters to the Editors

### High-Frequency Generator

*To the Editors of the Electrical World:*

Sirs:—On page 913 of your issue dated Nov. 1 appears an abstract of an article by Mr. Ricardo Moretti on a new high-frequency generator for wireless work, in which is described a method which, aside from the details of the gap, is the same as one covered by United States patent No. 730,753, granted to Reginald A. Fessenden on June 9, 1903, a little over ten years ago. It may interest some of your readers to know the above in connection with this supposedly new development.

While there may be some advantage in the form of gap employed by Mr. Moretti, in that he may work at larger power, and possibly with greater regularity, still it should be noted that the method of operation is identically that disclosed in the above-mentioned patent.

S. M. Kintner,
*Pittsburgh, Pa.* *National Electric Signaling Company.*

### The Elevator as a Central-Station Load

*To the Editors of the Electrical World:*

Sirs:—When we look back upon the buildings of two or three decades ago—none of them more than a few stories in height—and then turn to the skyscrapers of to-day we marvel at the one thing that has made this great growth possible—the electric elevator.

Beginning with the installation of the first electrically operated elevator up through its various improvements until the present time, the electric elevator has set the pace in building construction. With each improvement of this type of elevator buildings have increased in height until now the skylines of our cities are marked by many massive structures each of them housing thousands of people and having an energy consumption equal to that of a small city. Without the elevator this enormous and intensified consumption of electric energy in limited territories would have been impossible.

To-day this subject is of special interest, in that in the highest building of the world passengers are transported directly in a single shaft to the fifty-fourth floor, a distance of 689 ft., a height a few years ago deemed impossible, while the latest type of electric elevator, embodying the traction principle, is capable of reaching any height the architect will essay.

In the distribution and movement of the congested population of a great city, especially in its business centers, vertical transportation now plays a most important part; for not only has the elevator made possible the skyscraper, but it is no less essential to the office, department store, warehouse, loft and apartment building of more modest height. As an example of the growth of elevator traffic, it has been estimated that the daily elevator traffic in the large cities outnumbers that of the traction companies nearly two to one, and while this work is widely distributed, yet the volume of traffic, if not the actual mileage, makes a most interesting transportation problem, which parallels that of the ordinary railway.

From the standpoint of the central station, however, the elevator is of vastly more importance than the railway, for while the latter derives its energy from its own generating plant, the former usually obtains its supply from the central station, and every electric elevator that is installed is a steady energy consumer—an ideal consumer in the fact that it operates chiefly during the daylight hours. In the last few years the number of electric elevator installations has increased surprisingly, owing to the increased economy and efficiency of operation of the electric-elevator machine.

The aggregate energy consumption assumes vast proportions when we consider the great number of electric elevators already installed as well as the almost unlimited field for future growth. Of equal importance to the central station, aside from the big possibilities for new business afforded by the electric elevator, is the vast saving brought about by the vertical building growth made possible by the electric elevator. Cities can expand in only two directions, horizontally and vertically. The elevator by enabling cities to grow upward has been the means of saving the central stations millions of dollars' investment in underground plant which would have been necessary in case of horizontal growth alone to secure the same business they enjoy to-day.

So much for the vertical elevator. There is another type of motor-driven elevator, known as the inclined elevator, which is being installed in factories of every type and description where, in the course of manufacture or shipment, the product must be moved from department to department or from floor to floor. This type of elevator, because of its economical and efficient handling of constantly increasing output, due to its continuity of motion—it is a continuous carrier, in the form of an endless moving chain—bids fair ultimately to find a place in every factory. The inclined elevator is also being used at docks to load and unload ships and in department stores to move packages from the shipping room in the basement to the sidewalk, ready for delivery. There are several types of the inclined elevator covering a wide range of applications, which makes it possible for this elevator to meet every condition of internal traffic service. The factories, department stores, docks and railroad terminals where the freight-handling expense can be reduced by the installation of a motor-driven inclined elevator are practically numberless.

The escalator, which operates on the same principle as the motor-driven inclined elevator but which is used for carrying passengers instead of freight, is another type of elevator which is fast gaining ground for use in public buildings. The escalator also covers a wide range of applications. It is being used in department stores, at elevated-railway stations, railway terminals, theaters, amusement parks and hotels for handling the passenger traffic. Installations have also been made in factories to move employees at morning, noon and evening.

In hilly districts the development of real estate with a subsequent increase in the consumption of electric energy is being greatly enhanced by the use of inclined railways for transportation of passengers and vehicles from one elevation to another.

The possibilities for new energy supply business through the installation of the above types of electric elevators merit the efforts of the central station to increase the number of electric elevators on its circuits.

With the co-operation of every central-station man in the educational and development work now being done to increase the use of electricity for domestic and industrial purposes, the elevator field is sure to attain the importance it deserves.

R. W. Charles,
*New York.* *Otis Elevator Company.*

# Field of the Operating Engineer

**A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers**

## Oil-Burning Furnaces—I

By R. T. Strohm

The arrangement of the furnace of a boiler that is to be fired with oil fuel varies according to the type of boiler and the location of the burner; also, it makes considerable difference whether the boiler setting is originally planned for the use of oil fuel or whether it is altered from the coal-burning type. Details of the arrangements will differ

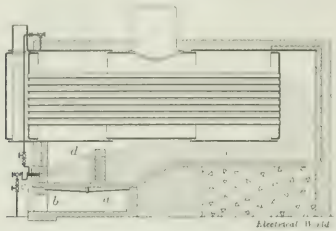


FIG. 1—RETURN-TUBULAR BOILER WITH KIRKWOOD OIL BURNER

because of the manner in which the air supply is allowed to enter. In view of these facts, it would manifestly be impossible to illustrate all of the many styles of furnaces, but several of them will be given to show their distinctive features.

A form of oil-burning furnace for a return-tubular boiler is shown in section and in plan in Fig. 3. There is a single fan-tailed burner *a* installed in the center of the fire-door. It projects well through the front wall and is surrounded by a short firebrick sleeve or arch *b*. The grates *c* are retained, and on them is laid a closely fitted layer *d* of firebrick that prevents air from rising through the grates except at the extreme rear end. On this layer of brick are placed a number of blocks that support another layer *e*, and this top layer forms a continuous floor from the arch *b* to the top of the bridge wall *f*. The air supply

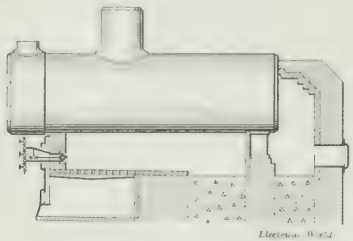


FIG. 2—RETURN-TUBULAR BOILER WITH BEST OIL BURNER

is admitted through the door *g* to the space beneath the grates, whence it flows to the rear, up through the grates, forward between the firebrick layers *d* and *e*, and then past the burner into the combustion chamber, as indicated by the small arrows. The arch *b* and the layer *e* of firebrick are kept at the point of incandescence by the flame from the burner, and the air in flowing along in contact with the hot brickwork becomes heated to a high temperature before it reaches the tip of the burner. This preheating of the air supply adds to the efficiency of the combustion. All joints or openings around the burner are carefully closed, so that no cold air can leak into the furnace. The entire air supply must therefore pass under the heated slabs *e*.

A return-tubular boiler arranged to use a Kirkwood burner is shown in section in Fig. 1. In this case the grate bars are retained but are covered with a closely laid floor *a* of firebrick that has a single slot *b* for the admission of air to the furnace from the ashpit. The burner *c* is set in firebrick in the fire-door opening and the slot *b* is just in front of it. The air on meeting the oil spray unites with it and the flames are thrown toward the rear, where they strike the firebrick pier *d* built on the grates. This pier is not solid, but forms a sort of checkerwork by which the burning gases are thoroughly diffused and mixed so

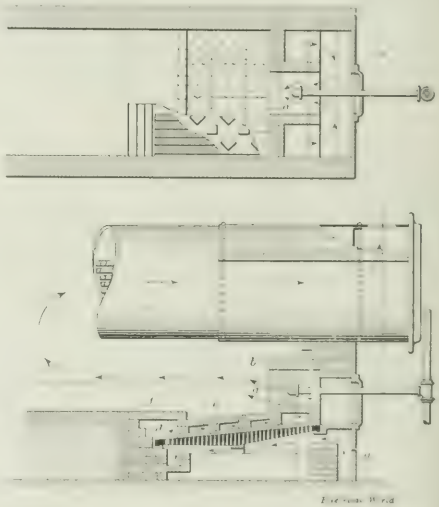


FIG. 3—RETURN-TUBULAR BOILER WITH SLOT OIL BURNER

as to prevent the possibility of incomplete combustion. Beyond the bridge wall the floor *e* is brought level with the top of the bridge wall, so that the hot products of combustion are kept in close contact with the boiler shell. With this arrangement the flames are directed against the firebrick on the grates and that forming the pier, but not against the boiler shell.

The arrangement suggested for a return-tubular boiler fitted with a Best burner is shown in Fig. 2. The bridge wall is torn down until its top is level with the surface of the grates. On this surface firebrick is laid flat, with air spaces about ½ in. wide in the part on the grates. The burner is inserted in an opening in the front wall of the setting, on the center line of the furnace. Its tip is about 8 in. above the firebrick on the grates and about 2 in. inside the front wall. The flame is thrown out parallel to

the grate surface and to the full width of the furnace. The air supply passes up through the openings in the brickwork covering the grates and mixes with the vaporized oil at all parts of the furnace.

The furnace arrangement shown in Fig. 5 is for a Babcock & Wilcox water-tube boiler. The grates are covered with a single layer of firebrick *a* laid close together except at the front, where a series of openings *b* are left. The burner *c*, which throws a fan-shaped flame, projects through the fire-door and its tip is just inside the front wall. Thus the flame from the burner is directly above the openings *b* in the brickwork. The air supply in this case is not preheated to any great extent, because it flows into the ashpit through the door *d* and passes immediately to the combustion chamber through the openings in the grates. The slot in the end of the burner is horizontal, and the sheet of flame thus produced is practically parallel to the surface of the grates.

The arrangement shown in Fig. 4 is also for a Babcock & Wilcox boiler. It differs markedly from that previously illustrated in that the burners are located at the back of the furnace, against the bridge wall, instead of at the front. The grates are removed completely and a firebrick floor *a* is built to cover the entire area from the front wall to the bridge wall. As may be seen in the plan view, this floor is carried by the side walls of the furnace and by the three sets of bearing bars *b* that rest on the side walls and on two longitudinal piers. The burners *c* are set in recesses in the front face of the bridge wall, just above the level of the floor, and are of the Hammel type. They direct fan-shaped flames forward over the flat floor *a*. The three passages formed beneath the bearing bars contain the oil and steam pipes leading to the burners and also serve as air ducts by which the air supply is led to

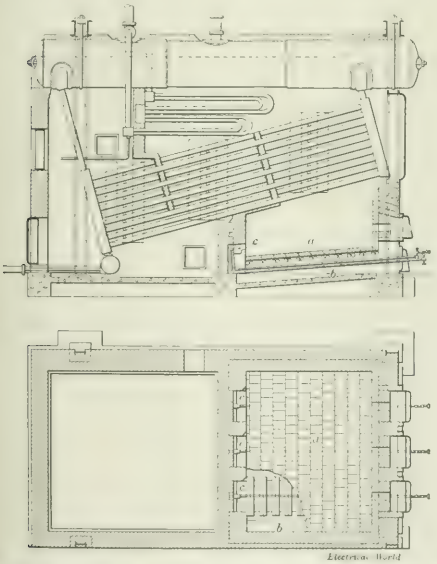



FIG. 4—BABCOCK & WILCOX BOILER WITH OIL BURNER AT BRIDGE WALL

the burners. Inasmuch as the floor *a* is kept incandescent, the air flowing along beneath it is heated highly before being allowed to flow upward past the burner into the furnace.

The three transverse rows of firebrick just in front of the burners are not laid end to end, but small spaces are left, in order that some of the air may rise directly through these openings and mingle with the oil vapor above the floor. This is done to prevent carbon from being deposited on the brickwork just below the tips of the burners. To the remainder of the floor *a* a coating of fireclay wash is given to fill up all joints and prevent air from flowing up through except as provided by the slots. The passage for each burner is separate from the others, and the

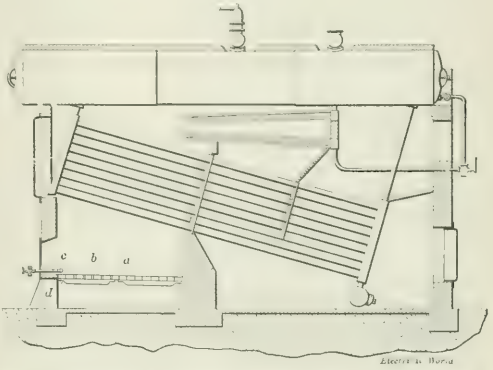



FIG. 5—BABCOCK & WILCOX BOILER WITH OIL BURNER IN FRONT

air supply to each burner can therefore be regulated by the ashpit door, independently of the others.

The object to be gained by placing the burners at the bridge wall and directing the flames forward is a better utilization of the combustion space. When the air and the gasified fuel unite and burn, the heat generated causes the temperature of the gases to rise, and they expand in volume as a consequence. By having them projected toward the front of the furnace, where the area of vertical cross-section is greater because of the upward slant of the tubes, the increased volume of the gases is accommodated by the increased space and the rate of flow of the products of combustion is thus rendered more nearly uniform. It will be observed that the front wall of the furnace is protected from the heat of the flames by a firebrick lining.

## Short-Circuited Slip-Rings

Induction motor rotors are either of the squirrel-cage or of the defined pole type. The former are bar-wound and the ends of the bars are soldered, bolted or electrically welded to end rings, while the latter have insulated windings through which the path of the induced current is well defined; hence the name. Motors of the squirrel-cage type do not admit of liberal speed control, because the winding circuits are closed and do not therefore permit of resistance changes while in operation. On motors of the defined pole type the ends of the rotor coils may be permanently connected to a resistor that rotates with the rotor or they may be connected to slip-rings on which bear the brushes that lead to an external resistor. In either case the rotor resistance can be varied by means of a suitable resistor that is cut out on the last controller notch or position.

An inspector was called in to locate the trouble on a slip-ring motor that ran at the same speed on all notches. Inspection showed that the rotor brush pigtail shunts of each brush-holder had impinged against the adjacent holder and had welded there. This permanently cut out the external resistor, which, therefore, had no effect upon the speed, the rotor operating as a plain squirrel-cage rotor, and as it was not designed to stand such operation, it was

eating more than it should. On a motor of the internal otating resistor type the same result obtains if the resistor nits become short-circuited, as in such a case the short-ircuiting shoe has no effect. Another advantage of the efined pole rotor is that it requires less current to pro-uce a given torque and, therefore, causes less disturbance n the line from which lamps may be supplied. For a iven rating a motor with a defined pole rotor will be arger than one with a squirrel-cage rotor, because more oom is required for insulation and for heat radiation.

## Hazard Due to Starting Diesel Engines with Compressed Oxygen

Widespread attention was attracted by the fatal explosion of a 50-hp Diesel engine at Bray, Ireland, in July f last year, while being started on compressed oxygen. n an analysis of the disaster by the British inspector of actories just issued some significant lessons are drawn oncerning this practice of starting Diesel engines.

The engine had previously been shut down and overauled, but when ready to resume operation it was found iat the charges of compressed air required for starting ad been lost from the three air vessels. It was therefore necessary to resort to some other compressed gas or starting, and following the instructions of the manuacturers to use "carbonic-acid gas or oxygen," a tank of xygen at 1800 lb. pressure was secured from a chemical anufacturer and connected to the compressor line of the ast vessel.

Meanwhile the fuel pump had been filled with kerosene, nd the operators proceeded to manipulate the valves in the sual method of starting. The engine had begun to move nd seemed to run quite satisfactorily when the chief engieer advanced the lever from the starting to the running osition. No firing stroke followed but air was heard caping with a hissing sound. At the next instant an xplosion occurred at the fuel valve on the cylinder and a ue flame was seen to travel along the blast pipe to the ast vessel, causing the latter to explode in turn with reat violence. The flying fragments caused the death of e head fitter and injured the chief engineer so badly that oth legs had to be amputated. The assistant engineer sustined severe burns, and considerable damage was done the station.

From his examination at the scene of the accident the ctory inspector concludes that the principal explosion was ue to ignition of the oily deposit in the interior of the blast ssel, its destructive power being increased by the large olume of compressed oxygen present. The oily deposit ferred to was probably derived from the lubricating oil ed on the compressor piston, which came over in the form vapor and was condensed in the blast vessel. The ssel at Bray had been in use two years and during all this me had never been scraped or cleaned. The metal was ed with a bituminous coating which probably contributed the explosion. The prime cause of ignition the inspector aces to the kerosene and its low igniting temperature pecially when in a finely divided condition. In the course the present inquiry he reports discovering at least two her cases where Diesel engines exploded while being arted on compressed oxygen.

The inspector advises that compressed oxygen or comstible gases like hydrogen should never be used for start-g Diesel engines, and that special warnings on these ints be issued by the makers of such engines. Traces of vapor should also be removed from the compressed air, far as possible, before it passes into the blast vessel. ch air vessels should be cleaned and examined internally least once a year, and also tested hydraulically once in ur years.

## Use of Fuller Board in Electrical Machiery

Is fuller board used in other electrical apparatus besides transformers? C. G.

Yes. Fuller board is the principal insulating material used in transformer manufacture. It is made up in sheets varying in thickness from a few mils to about one-eighth of an inch, although in large transformers it is generally not used in thicknesses of less than one-sixteenth of an inch. It is formed into the proper shapes and assembled with the coils so as to furnish the insulation among the various parts of the winding and between the windings and ground. Being of a fibrous nature it is absorbent and it is therefore necessary to use such means in operation as will prevent as much as possible the entrance of moisture into the transformer case.

## Removing Moisture from Oil

What is the best known method for removing moisture from transformer oil? S. T.

Various methods have been used from time to time for the removal of moisture from transformer oil, such as placing bags of dry lime in the oil, passing hot air through the oil, heating the oil so as to vaporize the moisture and drive it off, or passing it through some form of dehydrator. The latter is the most widely used, and the best form of this class of apparatus is known as the filter press. In this device the oil is pumped through several thicknesses of a specially prepared paper which permits the oil to pass through freely while at the same time retaining every bit of moisture until it becomes saturated. When the saturation point is approached the paper is removed and replaced by fresh dry paper.

## Solid Matter in Boiler Feed-Water

What is the source of solid deposits in boilers and how serious is the effect of such deposits on firing efficiency? G. N.

Many underground waters dissolve limestone, and when used as feed-water the resulting lime solution is carried into the boiler. Even though the actual percentage of solid material, measured in grains per gallon, is very small, the tremendous quantity of water evaporated during a year by the average steam boiler makes the total solids handled considerable. For example, a unit which evaporates 2000 lb. of water per hour will in a year of twelve-hour days have converted into steam about 8,750,000 lb. of water, which is the equivalent of 730,000 gal. If 1 gal. of this feed-water contains even 25 to 40 grains of mineral matter in solution, the total solids content of the feed supply for the year will be 1,830,000 to 2,920,000 grains. Expressed in more familiar units, the deposit of solids would thus aggregate 2630 lb. to 4190 lb. for the twelve months, were the blow-off unopened and the boiler uncleaned during the period of time.

Such figures give a more concrete idea of the tons of foreign matter which are involved in the slight quantities of dissolved solids in ordinary feed-water than is easily obtained in other ways.

In the past the deleterious effects of scale coatings have been generally overestimated by most textbook writers, for recent observations raise doubt whether the existence of even 0.125 in. of scale will increase to any very great extent the consumption of fuel beneath the boiler. But the principal disadvantage of scale lies in the resulting damage to the boiler parts and even in the explosion hazard it involves. Separating the water from the metal, the scale permits the latter to become overheated, resulting in "burning" or oxidizing, or even softening, of the metal, causing bulges or bags under the force exerted by the steam pressure.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*Principles of an "Electrostatic Motor."*—EUGENE BLOCH.—Abstract of a French Academy paper describing the principles of an electrostatic motor obtained by transforming the classical quadrant electrometer into a motor. If the needle of the electrometer is not suspended, but is simply supported freely on an axis, the electric torque developed will be no longer balanced by an opposite torque, and the needle will be driven into the interior of one of the pairs of quadrants. If at this moment, however, the sign of the charge on either the needle or the quadrants be reversed the needle will continue to revolve, and so on. The author accomplished the latter by providing a commutator for reversing the charge of the needle. The apparatus actually operated, but very irregularly on account of sparking at the commutator. Better results were obtained when, instead of direct current with a commutator, alternating-current excitation was employed. In one of the author's experiments the needle was maintained at 2900 volts by a storage battery, while the quadrants were charged to maximum alternating-current potentials of 5000 volts by a transformer operating from a 42-cycle source of supply. In this experiment a speed of 1260 r.p.m. was obtained. The capacity of such a motor is, however, very small greatly restricting its possible application.—*L'Industrie Elec.*, Aug. 10, 1913.

*Commutator Armature.*—ALFRED WINKLER.—A theoretical paper in the first part of which the author discusses the emfs induced in a commutator-type armature. The laws of these emfs, which are usually utilized in plotting vector diagrams for single-phase and polyphase commutator machines, are deduced here as a special case of the general theorem characterizing the action of the commutator. The author then discusses the subject of the ampere-turns of the commutator-type armature and the development of its torque.—*Elek. u. Masch.* (Vienna), Oct. 19, 1913.

*Three-Phase Series Commutator Motor.*—SCHERBIUS AND C. J. SONNENSCHEIN.—An article, illustrated by diagrams, on the self-excitation phenomena observed in a three-phase series commutator motor with six brushes. When driven as a motor this machine showed distinct self-excitation with unidirectional current. The phenomenon is due to the occurrence of higher harmonic fluxes and occurs only for certain positions of the brushes. Such self-excitation may occur when the machine is operated as a motor or as a generator, returning energy to the system, and may cause continuous losses.—*Elek. Zeit.*, Oct. 23, 1913.

*Oscillating Alternating-Current Machines.*—M. BOUCHEROT.—The conclusion of his long illustrated and mathematical serial on the calculation of alternating-current machines.—*L'Industrie Elec.*, Aug. 25, 1913. The former instalments of this serial appeared in *L'Industrie Elec.*, No. 10, 25, and Dec. 25, 1912, and Jan. 10, 25, Feb. 25, March 25, April 10, May 10 and 25 and July 10, 1913.

### Lamps and Lighting

*Electrodynamics of Arc and Spark Discharges.*—ARTHUR SZIVESSI.—A mathematical paper in which the author first gives an outline of the electrodynamics of arc and spark discharges and then derives the deductions that the current curve and the voltage curve of an alternating-current arc have no odd higher harmonics, and that a unstable direct-current arc can be made stable by connecting capacity in parallel with it.—*Elek. u. Masch.* (Vienna Oct. 12, 1913.

*Mercury-Arc Rectifier.*—F. PARKMAN COFFIN.—An article illustrated by diagrams giving an outline of the physical phenomena underlying the operation of the mercury-arc rectifier which can be clearly understood only when studied in connection with the general phenomena of gaseous conductivity. The author discusses the spark discharge, the arc, the Geissler discharge, the incandescent rectifier, the mercury-arc lamp and the physical phenomena in the mercury-arc rectifier.—*Gen. Elec. Review*, October 1913.

### Generation, Transmission and Distribution

*Rhone Power Transmission to Paris.*—There are at present two different projects for utilizing the water-power of the upper Rhone River for electric transmission to Paris. The first contemplates a single dam at Génissiat with a fall of 252 ft. The second calls for two dams at Bellegarde and Malpertius respectively, with falls each 108 ft. in height. The first plant will transmit most of its output directly to Paris. Most of the energy from the second project will be utilized in the districts surrounding the power plant, it being only recently that transmission to Paris has been taken into consideration. The first project is in charge of Messrs. Blondel, Harlé and Mähl, who propose to install 15 units each rated at 17,650 kw, making a total of 265,000 kw available. Energy would be generated at 12,000 volts and distributed at this pressure in the vicinity. For transmission to Paris it was originally intended to raise the potential to 120,000 volts, but now the plan is to use 150,000 volts. Formerly it was proposed to use the Thury direct-current series system, but more recently the three-phase system is receiving the preference. At Paris the pressure would be reduced to 12,000 volts. An extract is given of a recent report made by the head of the Paris lighting system favoring this project. The promoters of the second project propose to erect two power plants, at Bellegarde and Malpertius, the former with twelve 10,000-hp units and the latter with twelve 12,500-hp units. The two plants together would, therefore, have a capacity of 270,000 hp.—*Le Genie Civil*, Vol. 61, 1912, page 213; *Elek. Zeit.*, Oct. 23, 1913.

*Electricity in Mining.*—JROSLAV HAVLIACK.—A paper on the applications of electricity in the mines of Moravia Ostrau for driving mine ventilators, pumps, air compressors and hoisting machines. In the power houses of the coal mines both gas engines and steam turbines are in use. More recently the steam turbine seems to be favored on account of its lower first cost, lower attendance and lower cost of maintenance. But the matter is one that has not yet been definitely settled.—*Elek. Kraftbetr. u. Bahnen*, Oct. 4, 1913.

*Hydroelectric Plants in France.*—E. DU LONGUEVAL.—A review of hydroelectric plants erected or projected with special reference to large transmission and distribution systems.—*La Lumière Elec.*, Vol. 22, 1913, page 165; abstracted in *Elek. Zeit.*, Oct. 23, 1913.

*Mississippi Power Plant.*—M. NORDENSWAN AND C. W. SCHMIDT.—The conclusion of the illustrated description of the Keokuk hydroelectric plant.—*Elek. Zeit.*, Oct. 23, 191

### Traction

*London Traffic in 1912.*—A. J. Lawson.—A summary of the statistical figures of the number of passengers carried on the various transportation systems of London during the past year. These are as follows:

| | No. of Passengers, 1912 | Increase + or Decrease − |
|---|---|---|
| [illegible] | 436,192,548 | + 3,760,000 |
| [illegible] | 384,720,501 | − 6,171,427 |
| [illegible] | 796,997,724 | + 22,613,581 |
| [illegible] | 533,542,032 | + 13,961,848 |
| [illegible] | 65,023,120 | − 371,360 |
| Grand total | 2,185,775,925 | + 103,760,922 |
| [illegible] | | + 7,340,000 |
| [illegible] | | + 280,000 |

account is taken of the 5500 private automobiles and 00 motor cycles registered in the district.—London *Electrician*, Oct. 24, 1913.

### Installations, Systems and Appliances

*Calculation of Dangerous Rises of Voltage on Transmission Lines.*—P. M. Verhoeckx.—A long and highly thematical paper. The author points out that every ory of dangerous rises of voltage occurring on transsion lines must be based essentially on the electroagnetic-wave theory. The latter in its present form is nded on Heaviside's telegraph equation, which depends turn on Kirchhoff's mathematical theory presupposing ni-stationary conditions. Such conceptions are, however, really unapplicable in an exact wave theory. For s reason Heaviside's telegraph equation is by no means generally correct as has been supposed. Its validity is tricted to instances in which plane waves are propagated a certain direction. This is the case only for straight nsmission lines and not at all for wound coils. Even straight transmission lines Heaviside's equation is act only if the energy losses in the conductors are nitely small. To take into account the energy losses in conductors the author develops a more general teleph equation which represents the superposition of two n-distorted plane waves traveling with equal speeds in posite directions and being dampened according to the of geometric proportion. In certain theories of danous rises of voltages in transmission lines the traveling ves are assumed to be of rectangular wave form. hile such an assumption may permit of giving a general line of what happens, it is not exact and cannot be used numerical calculations.—*Elek. u. Masch.* (Vienna), t. 5, 12 and 19, 1913.

*Starting Rheostat.*—J. Saint-Germain.—A mathematical per, illustrated by diagrams, on the energy absorption in rting rheostats for direct-current motors and induction tors.—*L'Industrie Elec.*, Aug. 10, 1913.

### Wires, Wiring and Conduits

*Calculating Electric Networks.*—H. Frohman.—A mathetical paper illustrated by numerous diagrams giving he simple rules for the calculation of complicated netrks. Numerical examples are added.—*Elek. u. Masch.* ienna), Sept. 28, 1913.

### Electrophysics and Magnetism

*Occluded Gases in Geissler Tubes.*—R. W. Lawson.—William Ramsay has described experiments which he siders to prove the transmutation of elements. By sing electric discharges through hydrogen under low ssure, he believed he was able to produce helium. He thought he could produce synthetical neon from ium and oxygen. Sir J. J. Thomson, however, explained s result as being due to occluded gases. The present hor describes experiments which further support the ory of occlusion of gases in the electrodes or in the ss globes of the discharge tubes. His experiments make improbable that helium is produced by a discharge n under low pressure. They also render unlikely the synthesis of neon from helium and oxygen, because helium could be seen after all the neon had been expelled, and oxygen was observed only if the tube had been subjected to the discharge for several hours. The comparative abundance of the observed oxygen seems to exclude any assumption that this gas would be due to the decomposition of neon into helium and oxygen.—*Phys. Zeit.*, Oct. 1, 1913.

*Potential Theory.*—A. Korn.—A paper recommending an international agreement concerning important conceptions and notations in the theories of potential and of elasticity. —*Elek. u. Masch.* (Vienna), Oct. 12, 1913.

*Ferro-Cobalt for Magnets.*—Pierre Weiss.—An abstract of a French Academy paper on the magnetic fields obtained with an electromagnet having iron poles provided with special pole-pieces of ferro-cobalt. With a pole diameter of 3 mm, an air-gap of 1 mm and excitation amounting to 100,000 amp-turns, the field produced for iron alone was 52,580 gausses, and with ferro-cobalt 55,170 gausses. The proportion of ferro-cobalt present was 5 per cent.—*L'Industrie Elec.*, Sept. 10, 1913.

*Antimony Alloys.*—P. Leroux.—An abstract of a French Academy paper on the magnetic properties of lead-antimony and tin-antimony alloys.—*L'Industrie Elec.*, Aug. 25, 1913.

### Units, Measurements and Instruments

*Graphic Instruments.*—Kenelm Edgecumbe.—An illustrated article giving notes on graphic instruments. According to the method employed for tracing the record on the chart, three main groups of graphic instruments are distinguished: First, those in which the pen is attached directly to the measuring instrument, which has sufficient force to render pen friction negligible; second, those in which friction is eliminated altogether by keeping the "pen" out of contact with the paper chart; third, those instruments in which the pen is in contact with the chart in the ordinary way, but instead of being attached directly to the moving system, is controlled through a relay. Various instruments of these kinds are discussed, but chiefly those of the first type. The author gives details of the design of the pen and points out that a source of error which must be carefully guarded against in all moving-pen graphic instruments is the variation of the weight of the pen with the quantity of ink in it, a variation which necessarily affects the indications. The author describes an arrangement in which this source of error is avoided. He then gives details of methods of attaching and insulating the pen arm and describes the pin movement and friction drive of the chart.—London *Elec. Review*, Oct. 24, 1913.

*Alternator for Measuring Currents of Telephonic Frequency.*—A. Eberling.—An illustrated English translation of A. Franke's recent German article in which a description is given of the latest type of alternator constructed by the author. The machine is used for testing telephone lines and apparatus at such frequencies as occur in practical telephony. Its principle of operation, which remains unchanged, is briefly explained, together with the alterations made and the reasons for them. The author shows that measurements made with the latest type of machine have always given satisfactory results.—London *Electrician*, Oct. 24, 1913.

*Measurement of Air Velocity.*—H. Gerdien.—An illustrated description of an instrument for measuring air velocities, built by the Siemens & Halske Company. The air the velocity of which is to be measured is passed along two identical and symmetrically arranged sets of resistor wires. Reaching the first set, the air is heated and then passes along the second set, which is therefore less cooled than the first set of resistor wires. The difference of temperature of the two sets of wires is measured by a Wheatstone-bridge arrangement and gives a measure of the speed of the air.—*Elek. u. Masch.* (Vienna), Oct. 19, 1913.

*Electro-Kardiograph.*—J. RAUTENKRANTZ.—An illustrated scription of the latest form of the electro-kardiograph as ilt by the Siemens & Halske Company for use of physi- ns in observing and recording the beating of the heart a patient.—*Elek. u. Masch.* (Vienna), Oct. 5, 1913.

*Reading Optophone.*—E. E. FOURNIER D'ALBE.—An ap- ratus is described, depending on selenium for its opera- n, by which letters on a transparent ground can be cognized by the sounds that result in a telephone. In this y the blind are enabled to read matter suitably prepared listening through a telephone. The reading optophone sists essentially of a selenium preparation illuminated a line of light broken up into dots. The light of each t is intermittent, and each dot has a different frequency. us, in one apparatus actually constructed, the frequencies the eight dots composing a line 8 cm long are in the io of the numbers of the diatonic scale, viz., 24, 27, 30, 36, 40, 45 and 48. Large type printed on gelatine or ier transparent material, when interposed between the irce of light and the selenium, breaks up the line into ts, giving rise to notes differing in tone according to e shape of the letter. With a little practice the letters the alphabet are easily recognized and "read" by the r. The arrangement adopted is shown below. The line light is furnished by a 100-cp tungsten "linolite" lamp ose flux is concentrated by means of a cylindrical water s upon a revolving perforated brass disk provided with ght circles with the numbers of holes specified above. e disk is spun at about 20 or 30 r.p.m. by an electric otor. As it is not feasible to bring the transparency to

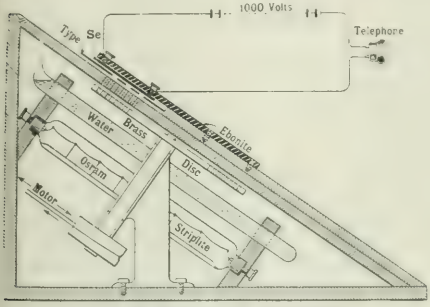



DIAGRAM OF READING OPTOPHONE

"read" into contact with the brass disk, the luminous ots are transferred to the upper side of a wooden parti- on by means of a set of glass rods with flat ends em- dded in the wood opposite the luminous dots. The flat ds of the rods are flush with the surface of the board, d the transparency can be safely and conveniently slid ross them. The selenium bridge *Se* is mounted above the ansparency with just sufficient clearance to allow free splacement. The luminous dots transmitted by the type other transparency impress their frequencies upon the lenium, and the latter gives a musical note correspond- g to each dot, even when the beams of light overlap on the same portion of the selenium. When that occurs with eighboring notes, "beats" are heard, just as when neigh- oring notes on the piano are struck together.—London *lectrician*, Oct. 24, 1913.

### Telegraphy, Telephony and Signals

*Insulation Conditions of Austrian Telephone Lines.*—R. OWOTNY.—The insulation requirements of the telegraph nd telephone lines along the seacoast of Austria are severe n account of the numerous fogs and occasional deposits f marine salt on the wires. Careful observations were ade on a recently installed line from Trieste to Zara, hich has a length of 307 km (184 miles), of which 58 km (35 miles) is in submarine cable having a practically constant and very high insulation resistance. For three months the insulation resistances of each of the two conductors of this line were measured with direct current, both from Trieste and from Zara. It was found that very distinct changes of the insulation resistance occurred even with a change of wind. Salt deposits also resulted in impaired insulation. In spite of the considerable fluctuations of the insulation resistance and in spite of the low values reached at times, there was no trouble with telephonic transmission. It is concluded, however, that provision of the line with Pupin coils would have been impracticable under these conditions.—*Elek. u. Masch.* (Vienna), Sept. 28, 1913.

*Energy Transmission in Wireless Telegraphy.*—M. REICH.—An account of quantitative measurements of the energy transmitted by electric waves. The results confirm the radiation theory of Hertz. In their order of magnitude the currents actually found in the receiver agree well with the theoretical values. Discrepancies noted are due to the fact that transmitter and receiver are not placed on a surface of infinitely good conductivity. Absorption of part of the energy accounts for other differences. The more mountains there are between transmitting and receiving stations the greater will be the absorption. Broad rivers, on the other hand, favor transmission. Weather also has an effect on absorption, which is higher after a heavy rain than in a dry atmosphere. During the night sudden fluctuations of the absorption occur which do not seem to follow any regular laws. On the basis of the figures in the article it is possible to predetermine pretty exactly the current in the receiving antenna for a distance of some hundred kilometers during the hours of the day if the condition of the country between the two stations is known—*Phys. Zeit.*, Oct. 1, 1913.

## Book Review

THE D'ESTE STEAM ENGINEERS' MANUAL. With electrical appendix by Charles Penrose. Boston, Mass.: Julian D'Este Company. 356 pages, illustrated. Price, $2.

With only 113 pages devoted to the steam department proper and the remainder of the 356 pages occupied by the voluminous "appendix," strict disciples of James Watt may accuse the compilers of this manual of rather letting the electrical tail wag the canine. But the error has been one of judgment in selecting the title only, for the contents of both sections contain much useful reference information. While the purpose of the book is described as being distinctly practical, an end that is certainly achieved, even the college graduate may consult its pages for freshening his recollections of integral calculus. Steam boilers, steam engines, refrigerating machines, indicators, steam meters and belting are some of the topics handled in terse discussions of essentials, the chapters being interspersed with familiar formulas which the more technical engineer will be glad to find collected in such handy form. Turning over to the preponderating electrical section, the subjects there treated include electrical units, measuring instruments, dynamo-electric machinery, transformers and connections, thermometers and pyrometers, photometric methods, and general principles of design of power-houses and systems. Liberal use has been made of circuit diagrams for showing connections of transformers, meters, switchboards, high-tension oil switches, etc. Manufacturers' catalogs and data have apparently contributed largely to the descriptive and illustrative matter in the book, and there is little presented that has not already been published elsewhere in the electrical press or trade bulletins. But as a compilation, collecting between its covers material drawn from scattered sources, the manual will doubtless fulfil its mission of convenience and service to the reader.

# New Apparatus and Appliances

## An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

### Porcelain Pull-Socket

A porcelain pull-socket recently placed on the market by the Arrow Electric Company, of Hartford, Conn., is illustrated herewith. Instead of being equipped with the ordinary ball chain, the socket is operated by a short piece of strong weatherproof cord to which is fastened the insulated chain. The cord slides easily through the opening in



PORCELAIN PULL-SOCKET

the porcelain shell, making an easy-acting socket, and it is claimed that the cord has been proved by tests to be even more durable than the ball chain on this type of socket.

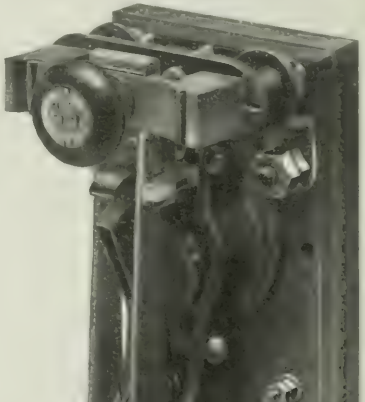
### Electric Self-Starters for Motorcycles

Electric starters for motorcycles have made their appearance, as demonstrated at the second national motorcycle, bicycle and accessory show, held at the Coliseum, Chicago, during the week ended Nov. 8. The exhibitor of the motorcycle with this "1914" improvement was the Hendee Manufacturing Company, of Springfield, Mass., the manufacturer of the "Indian" machine. All standard models of this type for 1914 are electrically equipped; that is, for electric self-starting and for electric lighting as well as electric signaling and electric ignition. The self-starting equipment consists of a set of storage batteries suspended in a casing underneath the saddle. By closing a switch the energy from this battery outfit operates a small motor which "cranks" the gasoline engine. When the machine is running at proper speed the motor acts as a dynamo to supply energy to charge the battery. The manufacturer says that the battery connected up in the charging position has a rating of 70 amp-hr. at 6 volts, and connected up in the starting position a rating of 35 amp-hr. at 12 volts. The motor has four poles and is said to develop about 1.5 hp. As a generator it begins to charge the battery at a speed of 12 miles per hour on high gear and 8 miles per hour on low gear. It reaches the maximum at 16 miles per hour on high gear and 12 miles per hour on low gear, the charging being controlled by a regulator attached to the generator. The system is protected by a magnetic cut-out contained in the case with the regulator. It is asserted that the electric starting equipment has been tested for eight months and ... operated satisfactorily despite the vibration of the machine. The batteries are sealed and apparently water-tight. The motorcycle is also equipped with small tungsten head-lamps and tail-lamps and an electrically operated signal horn. Under ordinary conditions the starting equipment will cause the gasoline engine to begin firing in a cold state in from twelve to fifteen seconds and when the engine is warm it will commence firing in from three to five seconds, it is declared.

### Shunt-Trip Circuit-Breaker for Battery-Charging Service

The general use of ampere-hour meters with storage batteries on electric vehicles and in other similar service has created a demand for a durable, rugged and simple type of circuit-breaker for operating in connection with such meters to cut off battery charge when the proper number of ampere-hours has been delivered to the cells. After experimenting with and using various types of circuit-breakers on the market for several years, the Sangamo Electric Company, Springfield, Ill., decided to build one especially designed for this service as shown herewith.

The operating mechanism of this shunt-type circuit-breaker is very simple and rugged. The breaker mechanism is supported on a cast-iron base attached to a suitable sub-base of slate or pressed insulating material. The iron base is hollowed out to receive the operating coil which



CIRCUIT-BREAKER FOR BATTERY-CHARGING SERVICE

is wound with a number of turns of fine wire suitable for the voltage across the charging circuit. The coil is the iron-clad, giving a very powerful magnetizing effect for a small exciting current. In front of the coil and pivoted to the iron base is an armature or clapper, which when attracted by the coil swings up sharply and strikes the latch lever above. The latch is strong and positive, ...

sting of a hardened-steel drop forging engaging with a ardened-steel plate riveted to the swinging arm of the rcuit-breaker just below the contact brushes.

When the latch lever receives the blow of the armature drops down, disengaging the arm, which is thrown out the ejector spring at the bottom of the base. This eaks the main circuit over the two main contact blocks the top of the circuit-breaker. At the same time auxary contact fingers behind the main arm, not shown in e illustration, open the trip-coil circuit, so that there is possibility of its being burned out nor of the contacts in e ampere-hour meter being burned through opening of e circuit at that point.

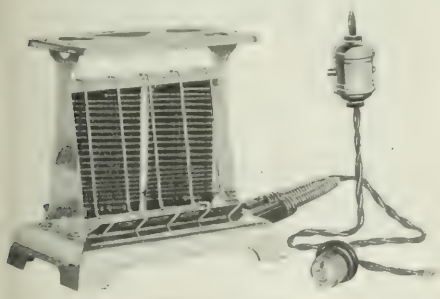
The circuit-breaker is easily and positively closed by essing down the knob attached to the swinging arm, and ry severe jarring and vibration is required to unlatch the eaker unless current passes through the trip coil. Curnt is carried from the contact blocks through heavy copr straps to the main load connections which are at the p of the circuit-breaker. The trip-coil contacts are made small binding posts at the bottom.

The standard breaker, as shown, is rated at 100 amp r circuits of 30 volts to 125 volts. It will, however, carry ntinuously currents of 150 amp and can be wound for volt operation. This type of breaker can also be used an overload or underload or no-voltage release by eans of suitable relays. The device is furnished either an insulated base as shown or with back-connecting ids for switchboard mounting.

## Vertical Electric Toaster

The Canadian Westinghouse Company, Hamilton, Onrio, has recently placed on the market a vertical electric aster. The device shown in the illustration herewith s been designed and finished for use on the dining-room ble, all parts being nickel-plated and highly polished. It asts two pieces of bread at once and has a place on the where the toast may be kept hot.

This device is very economical in operation. The power ed is 550 watts at 110 volts, and two pieces of toast can made in less than three minutes. The toaster has a cord of 6000 hours for toasting, which means that it can ake eight pieces of toast every day for almost 100 years. The heating element is practically indestructible, being ade of nichrome, a non-oxidizing and non-rusting alloy. ne efficiency of the toaster is increased by a reflector e base of which rests on an insulating asbestos board



ELECTRIC TOASTER

otecting the base from direct heat radiation or conducn. This construction enables the toaster to be used on uncovered table without damaging the finish of the od.

The toaster weighs slightly less than 2.5 lb. and is 7 in. height. It is furnished complete with a silk cord and attachment plug.

## 1914 Model Electric Passenger Vehicles

The Waverly 1914 model, four-chair brougham, illustrated herewith, has an unusual seating arrangement. Each passenger is provided with a separate Pullman chair, three of these chairs taking the place of the usual rear seat running the full width of the car. By placing the center chair slightly back of the other two a 9-in. width



FOUR-CHAIR BROUGHAM

of seating area is gained, giving 61 in. instead of 52 in The fourth passenger is accommodated in a "cozy-corner' seat at the right. With such an arrangement the driver is placed with the other occupants and not in front of them.

Other 1914 models of the same company are the "front-drive-four," a new car with "stream-line" body design and a four-passenger seating arrangement, all seats facing forward; the "rear-drive-four"; the "front-and-rear-drive" brougham with dual drive, which permits the operator to drive from either the front or the rear seat, and the five-passenger limousine. All seats of the five-passenger limousine face forward. Three passengers are carried on the rear seat. The driver has an individual seat and also a separate door for entering and leaving the car. The fifth passenger occupies the right-hand front seat

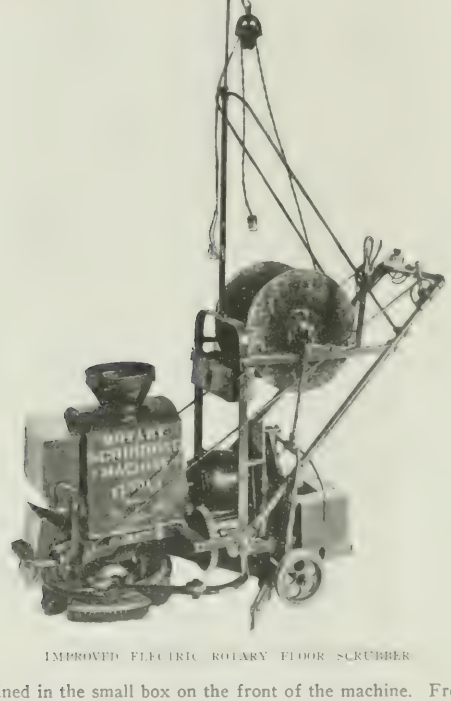
## Recent Developments in Lead Vehicle Batteries

In enumerating developments in batteries for the operation of electric vehicles at the recent Chicago convention of the Electric Vehicle Association, Mr. Bruce Ford, of the Electric Storage Battery Company, Philadelphia, Pa. said that in the past the life of the flat-plate type of cell has always been figured in terms of the life of the positive plate. In "iron-clad-exide" batteries, however, the positive plates have been designed to be one of the strongest elements in the combination. The problem of maintaining separation between the positive and negative plates has been the only real difficulty encountered. It has been found rather desirable to increase the free clearance space between the vertical tubes of the positive plates and the wood separators. This has been accomplished by a new design of negative grid with sufficient reduction in thickness to allow the desired addition to the separator and ribs on the positive plate. In the latest type of cell the frame of the positive plate is undercut and the negative plate instead of the positive is sheaved, overcoming difficulties incident to moss growths which formerly gave trouble. The exposed edges of the outside tubing are also reinforced by being left unslotted in the latest type of positive plate. To test the ability of various cells to withstand the abuse of overcharging, three sets of batteries of different types were connected in series and charged continuously at 10 amp twenty-four hours each day. While the other type of cells soon disintegrated, the "iron-clad" plates are still intact after sixteen months. The depth of sediment in this battery is at present about 0.125 in. In closing, the author recommended the boosting charge as an efficient means of increasing the daily capacity of a battery and gave methods for figuring boosting rates.

Messrs. Rabenalt, Conant, L. Demmert, Baker and others took part in the discussion. Mr. Demmert believed that better results can be obtained from a flat plate than from a thin one. Mr. Baker spoke of a 2-ton truck which was equipped with thin-plate batteries and the charge boosted at a high rate during the noon hour with good results. Mr. Ford said that even if used as a counter-cell the "iron-clad" battery seems to hold up under trying conditions.

## Electric Rotary Floor Scrubber

An improved type of electrically operated floor scrubber recently developed by the Finola Manufacturing Company, of Hannibal, Mo., is shown in the accompanying illustration. Small and medium-sized floors can be scrubbed at a lower rate per square foot with this machine, it is declared, than by the old manual method. The scrubber is driven by a 0.25-hp motor which is geared to the rotary brushes and to a reciprocating pump. Soap powder is contained in the small box on the front of the machine. From the larger tank behind the soap receptacle water is sprayed onto the floor in front of the rotary brush, mixing with the powder which is automatically sifted as the machine moves. Levers on the handle control the rate at which water and soap powder are delivered onto the floor, and also operate a squeegee which dries the scrubbed surface. The reciprocating pump previously mentioned sucks up the dirty water collected by the squeegee and transmits it to the removable tank at the rear of the outfit.



IMPROVED ELECTRIC ROTARY FLOOR SCRUBBER

Electricity is supplied to the motor through flexible cord which is wound on a retrieving reel. One end of this cable is connected to a plug receptacle and the other to slip-rings on the reel which lead to the motor. As the machine is pushed along the floor the flexible cable is unwound, being kept taut by a spring inside the reel. A switch on the handle controls the operation of the motor.

## Automatic Alternating-Current Controllers

An automatic controller for single-phase, two-phase three-phase induction motors used in driving printi presses and other machinery requiring adjustable spe has been put on the market by the Monitor Contro ler Company, Baltimore, Md. Starting, stopping, reve ing and jogging of the press can be done automatica

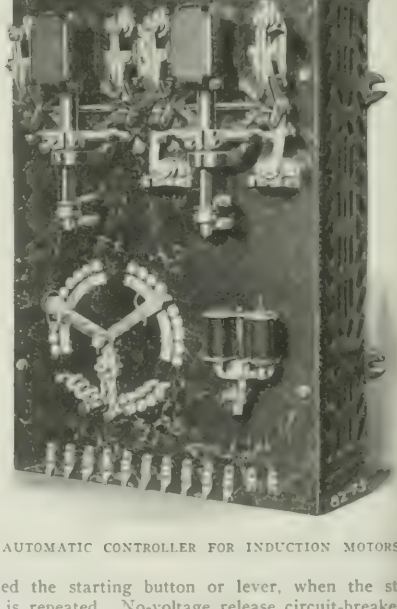


PUSH-BUTTON BLOCK

control being obtained from a simple station on the pre either by a push-button or by a safety lever.

The principal feature of this new controller is the aut matic insertion of a proper resistance in each phase of t motor, this resistance being the same regardless of t position of the regulating handle. After the motor h attained the proper speed the starting resistance is aut matically cut out, and the regulating resistance, which h been previously determined by setting the handle, is aut matically thrown in, bringing the motor promptly to t speed desired.

In case the supply of energy to the motor has been sh off suddenly and the motor therefore stops, the entire s tem is automatically cut out, and on the return of curr the motor will not start until the operator has ag



AUTOMATIC CONTROLLER FOR INDUCTION MOTORS

touched the starting button or lever, when the sta cycle is repeated. No-voltage release circuit-breaker a therefore unnecessary.

The Monitor controller is also useful in "inchin moving the bed any fractional part of its stroke, this an operation that must often be done by laboriously m the flywheel by hand.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**St. Gothard Railway in Switzerland to Be Electrified.**—Press reports during the past week state that the Swiss government has provided for the expenditure of $7,600,000 for the electrification of the St. Gothard Railway and that this is the first step toward electrification of the entire national railway system in Switzerland.

**Large Insulator Order Placed.**—The Los Angeles plant of the California Glass Insulator Company is to be increased in capacity by the addition of $40,000 worth of new machinery which is being installed to help take care of an order for 15,000,000 insulators placed with this concern by the Pacific States Electric Company. The contract involves an expenditure of $1,500,000 by the utility company, and it is a particularly large one for this class of apparatus.

**Activity in Byllesby Properties.**—The net gain in connected new business during the last week in October on all the electric properties operated by H. M. Byllesby & Company was 614 customers with 746 kw of lighting and 667 hp in motors. New contracts not yet connected amounted in the same period to 1162 customers with 682 kw of lighting and 446 hp in motors. On Oct. 24 the Minneapolis General Electric Company broke all its previous records by generating 347,930 kw-hr. of energy.

**Electric Equipment for Canadian Paper Mills.**—Two large orders for electric-drive equipment have recently been placed with the Canadian General Electric Company by paper-mill interests. The Donnaconna (Que.) Paper Company order embraces a number of motors of various ratings up to 150 hp and totaling 1330 hp. The Abitibi Pulp & Paper Company has ordered motors ranging from 400 hp downward and aggregating 2165 hp for installation in its new mills at Iroquois Falls, Ont.

**Booming Electrical Heating Devices.**—The American Electrical Heater Company, Detroit, Mich., is offering to dealers in electrical appliances the use of slides for moving-picture theater advertising of its heating devices as Christmas gifts. The company has also prepared some special Christmas advertisements on its various devices, electrotypes of which are offered to dealers for use in their local papers. Both of these advertising offers promise practical assistance to the dealer in educating his local clientele in the giving of electrical gifts for the home.

**Wire Manufacturers Not Thinking of Selling Out.**—Some rumors have been around lately concerning a proposed purchased by the Westinghouse Electric & Manufacturing Company of the Safety Insulated Wire & Cable Company, of New York. Interviewed in regard to this matter during the past week, C. E. Graham, vice-president of the wire concern, stated that the rumor was absolutely without foundation and that no offer preliminary to such a change in ownership had been made by either company or was anticipated, so far as he knew.

**Electrically Heated Water Sterilizers Sold.**—The Forbes Company, of Philadelphia, Pa., has recently sold through its New York agents, Westerberg & Williams, of 233 Broadway, three of its electrically heated water sterilizers to public utility companies in that city. The New York Edison Company has had one of these sterilizers in operation for some time at its Forty-second Street office and has ordered two more for installation at its generating stations. The United Light & Power Company, also of New York, has purchased one of these sterilizers.

**Jobbers' Sales in Pittsburgh District Remain Steady.**—Two prominent electrical jobbers supplying railroads and steel mills in the Pittsburgh district stated in a recent interview with a representative of the *Electrical World* that sales were increasing slightly from month to month throughout the busy season. In this territory the great railroad system are regarded as the most reliable thermometers of trad conditions. The purchases of these roads as indicated the general trend of the jobbers' business have been on par with those of previous average years. The representatives of the steel industry are also buying electrical supplie to complete preparations for the dark days of the comin winter.

**Association of Purchasing Agents Formed.**—During th past month there was formed in New York City, with hea quarters in the same place, an organization known as th National Association of Purchasing Agents, the main ol jects of which are to further mutual acquaintance amon purchasing agents in all lines, to standardize purchasin methods and routine, to investigate and certify new a pliances and materials, to arrange improved publici methods, and to standardize specifications. Sub-associa tions in different sections of the country will be forme to care for local interests. The temporary chairman the association is H. T. Leeming, of Thomas A. Ediso Inc., and the temporary secretary and treasurer is E. Hendricks, whose headquarters are at the Hotel McAlpi New York City.

**Electrically Driven Pumps Ordered for Panama.**—Th Isthmian Canal Commission has just awarded the contra to the Blackall-Baldwin Company, of 39 Cortlandt Stree New York, for furnishing extensive pumping equipment f the Panama water supply pumping stations at Ancon an Miraflores, Canal Zone. These centrifugal pumps, fourtee in number and ranging in capacity from 250 gal. to 5,0 gal. per minute, will be of the horizontal volute type of on two and three stages and will operate under heads of fro 70 ft. to 355 ft. They will be built by the Kingsford Fou dry & Machine Works. The motors for driving the pumps are to be directly connected to them and will b three-phase squirrel-cage induction motors, operating on cycles and voltages of 220 and 2200. The range in capaci of the motors is from 7½ hp to 345 hp, and they are to b supplied by the General Electric Company.

**Westinghouse Machine Company to Have Increased Manufacturing Facilities.**—At a recent meeting of the executiv committee of the Westinghouse Machine Company an a propriation of $125,000 was made to provide addition manufacturing facilities. The additional equipment is r quired to take care of the rapidly increasing business whi the Westinghouse Machine Company has been enjoying r cently, owing in a large measure to the new lines of pro ucts developed. Among these particular mention may b made of the impulse turbine, the reduction gear, the aut mobile rotary valve motor and the air-spring for automobi trucks. The first mentioned has found large use in centr stations and industrial plants and the second, in additio to a wide demand for marine installations, is finding larg application in direct-current generator design. The com pany contemplates devoting a portion of the above appr priation to securing additional machine tools, designed t use high-speed tool steel.

**Interlocking Directorate Plan Opposed.**—In connectio with the active debate which has been aroused by the pr posed extensive changes in the country's banking syste there has been given an added impulse to the agitatio against the interlocking directorate system which is s prominently and generally associated with corporate co trol. Through the workings of this system it is not unusu for the same individual or group to control in a give locality, both the banks and the companies using the service, a condition which often leads to unhealthy finance Also by the same system it is often possible for a minori

rest to control extensive operations in an industry, or in ral allied industries, for its own benefit. For some years e have been spasmodic attacks on this system in Con-s, and there is a feeling in some quarters that the pres-discussion of the currency question will precipitate a leg-ive attack upon the interlocking directorate system dur-the coming winter.

**use Manufacturer Arranges to Supply New Line Pending gation.**—On Oct. 28 the United States District Court for Eastern District of Pennsylvania granted a temporary nction to the Johns Pratt Company, of Hartford, Conn., raining the Economy Fuse & Manufacturing Company n the further sale of inclosed-type fuses of the kind said nfringe the patents of the first-mentioned concern. Fol-ng the decision the latter company has begun work on ew form of inclosed fuse which, while using the same e of terminals, casings and links as those in the former , is said by that company to fall without the scope of injunction. It is claimed that the tests on these new s show them to be fully as satisfactory as the older type, the company expects to be able shortly to supply all rs affected by the injunction.

**ransmission Towers Constructed.**—The Blaw Steel Con-ction Company, of Pittsburgh, Pa., has lately received racts to build a number of transmission towers for tric energy supply companies. The Pennsylvania Water ower Company, of Baltimore, Md., has ordered about standard towers and some special crossing towers for new 110,000-volt transmission line between Holtwood, and Baltimore, Md. A contract for 100 standard tow-and a number of special towers for a double-circuit 00-volt line has been awarded by the Penn Central Light ower Company, of Altoona, Pa. Other projects for h orders have recently been placed for similar equip-t are the Lake Shore Electric Viaduct, in Elyria, Ohio, the tower line at Riverside, N. J., in which R. D. mbs & Company, of New York, are interested.

## tement of the Copper Producers' Association for October

hile the stocks of copper on hand on Oct. 31 show a t increase over September figures, they are still lower ever before in the history of the association, with the ption of that month. As shown in the following sum-y, the export deliveries fell off in October.

| | October, pounds | | September, pounds | |
|---|---|---|---|---|
| on hand in the ited States on first month | | [illegible] | | 38,314,637 |
| duction | | 139,070,481 | | 131,401,229 |
| | | 168,863,575 | | 169,715,266 |
| stic deliveries | 68,173,720 | | 66,836,897 | |
| gn deliveries | 68,123,473 | | 73,085,275 | |
| | | 136,297,193 | | 139,922,172 |
| [illegible] | | 2,566,382 | | 29,793,094 |

### NEW YORK METAL MARKET PRICES

| | Nov. 3 Bid. | Nov. 3 Asked | Nov. 11 Bid. | Nov. 11 Asked |
|---|---|---|---|---|
| ndard, spot* | Selling Prices | | Selling Prices | |
| | £ s d | | £ s d | |
| don, standard, spot* | 71 10 0 | | 68 7 6 | |
| ne Lake | 16 87½ | | 16.00 | to 16.25 |
| ctrolytic | 16 87½ | | 15.75 | |
| ing | 16.00 | | 15.50 | |
| ter wire, [illegible] | 17.50 | to 17.75 | 17.00 | |
| | 4.35 | | 4.35 | |
| | 40.00 | to 45.00 | 40.00 | to 45.00 |
| zinc, f.o.b. smelter | 7.50 | | 7.50 | |
| r, spot | 5.37½ | | 5.30 | to 5.40 |
| spot | 39.70 | to 40.00 | 39.15 | to 39.35 |
| mium | | | | |
| ept delivery | 19.75 | | 19.50 | to 19.75 |
| | 19.50 | to 19.62½ | 19.25 | to 19.50 |

### *OLD METALS

| | | |
|---|---|---|
| copper and [illegible] | 15.00 | 14.50 |
| | 9.75 | 9.50 |
| | 8.50 | 8.25 |
| [illegible] | 4.20 | 4.20 |
| | 4.37½ | 4.37 |

### *COPPER EXPORTS

tons to Nov. 11 ..... 10,547

[illegible] the New York Metal Exchange

# Corporate and Financial

**Organization Changes in Kings County Electric Light & Power Company.**—At a meeting of the directors of the Kings County Electric Light & Power Company on Nov. 5 N. F. Brady was elected president, to succeed the late A. N. Brady, and J. C. Brady was elected vice-president and director. The directors also declared the regular quarterly dividend of 2 per cent on the outstanding capital stock, payable on Dec. 1.

**St. Louis Suburban Utilities.**—The new officers of the Electric Company of Missouri doing business in the suburban area surrounding St. Louis are: President, J. D. Mortimer; vice-president, C. S. Ruffner and A. C. Einstein; secretary, J. F. Fogarty; treasurer, Robert Sealy; assistant secretary, S. H. Wallace; assistant treasurer, P. F. Schroers. The St. Louis County Gas Company has practically the same officers. The two companies work in harmony with the Union Electric Light & Power Company, of St. Louis.

**United Light & Railways Company Adds to Transfer Agencies.**—Changes have been made recently by the United Light and Railways Company in its arrangements for the transferring of stock certificates. Since Nov. 1 these have been transferred in New York by the Guarantee Trust Company and registered by the Bankers' Trust Company, in Chicago they have been transferred by the Continental and Commercial Trust and Savings Bank and registered by the Illinois Trust and Savings Bank, and in Grand Rapids the certificates have been transferred by the company itself and registered by the Michigan Trust Company. It is claimed that the large distribution of the company's stock has made necessary the three transfer agencies.

**Bangor Power Company's Dam Completed.**—The new dam of the Bangor Power Company at Veazie, Maine, was recently completed, according to an announcement made by E. W. Clark & Company, of Philadelphia, Pa., who control the Bangor Railway & Electric Company, of which it is a subsidiary. This new dam is located on the Penobscot River about 3 miles above Bangor, and its construction adds 1000 hp to the company's generating capacity, giving it a total capacity of 18,750 hp. The old Veazie dam, built of timber about sixty years ago, was one of the earliest hydroelectric developments in the United States. The Bangor Railway & Electric Company has recently secured the extension of several of its franchises for street-railway operation.

**Washington Utility Plans Expansion.**—The Skagit Power Company, which is under the management of the Stone & Webster Management Association, of Boston, Mass., has received a permit to develop two large hydroelectric power sites on the Skagit and Cascade Rivers in the western part of the State of Washington. These sites, it is expected, can be developed on a large scale economically, so that it will be possible to furnish power from them at very low rates. The company, which has its headquarters in Seattle, has established an industrial department with W. E. Herring in charge and is endeavoring to get manufacturing plants located in the vicinity. In its development of the project the company plans to keep ahead of the power requirements so that reserve power will always be available.

**Illinois Traction Company Absorbs Western Railways & Light Company.**—Announcement is made that the Illinois Traction Company, of Champaign and Peoria, Ill., is about to absorb the Western Railways & Light Company. The proposed merger is to be accomplished through the purchase of the common stock of the Western company by issuing one share of Illinois Traction common stock in exchange for two shares of the Western company's common stock. Both companies are McKinley properties and have practically identical management and principal ownership. Mr. W. B. McKinley, of Champaign, Ill., is president of both companies, and Mr. H. E. Chubbuck, of Peoria, Ill., is vice-president executive in each case. The plan has been in contemplation for some time and is being put into effect to bring about the economies which will result. The Western Railways & Light Company controls the Galesburg (Ill.) Railway & Light Company, Illinois Valley Railway Company, Chicago, Ottawa & Peoria Railway Company, Quincy (Ill.) Railway Company, Citizens' Lighting Company of La

lle and Peru, Ill., Northern Illinois Light & Traction Com-ıy, Cairo (Ill.) Railway & Light System, Consolidated ater & Light Company, Marseilles, Ill., Mound City (Ill.) ght & Water Company, Abington (Ill.) Light & Power mpany, Wichita (Kan.) Railroad & Light Company, chison (Kan.) Railway, Light & Power Company and Jef-son City (Mo.) Light, Heat & Power Company. The au-orized capital stock of the Illinois Traction Company is ,000,000, half common and half 6 per cent preferred.

**New Assessment on Stock of the Philadelphia Electric mpany.**—The directors of the Philadelphia Electric Com-ıy have placed an assessment of $5 per share on the stock that company payable Dec. 1. This new assessment kes the stock $22.50 paid. An extra stock dividend of 50 per share has also been declared by the directors pay-e on the same date as the assessment. In connection h this assessment on the stock of the company a state-nt has been made concerning its plans for expansion in near future, for which the assessment will provide. An dition of 37,000 hp has lately been made to the com-ıy's generating capacity and a similar increase is nned for next year. In addition to a large prospective d, the street railway system in Philadelphia is making ıstantly larger demands for electric power for operat-its lines.

**Initial Installation at Big Creek, Cal.**—Through the office C. E. Graham, vice-president and director of the Pacific ght & Power Corporation, 25 Broad Street, New York, it learned that during the past week the first electric energy pply from that company's hydroelectric development at g Creek, Cal., was furnished to the city of Los Angeles, l. The present generating capacity is about 60,000 hp, d there is a transmission line 165 miles in length between generating station and Los Angeles, where the principal mand is at present centered. The energy is used for the eet railways in the above city largely, also for municipal d general lighting service. An ultimate capacity of 350,000 is claimed for the Big Creek development, and this will used as fast as the demand for electrical energy in that tion requires. The Stone & Webster Construction Com-ıy, of Boston, Mass., is the engineer and contractor on s work.

**Southern California Edison Financing.**—It is reported t the Southern California Edison Company is planning offer shortly to its stockholders, at 85, two-thirds of $3,000,000 common stock recently authorized by the lifornia Railroad Commission. This offering is prelim-ry to the sale of the stock to a syndicate which has been med to underwrite the issue. Previous to the issue of s new common stock the company had a capitalization $8,400,000 common and $4,000,000 of 6 per cent pre-red stock, and $10,717,000 of the company's bonds are standing. The proceeds of the new issue are to be used the payment of $1,010,000 of floating debt and the rest the retiring of debentures and the part payment of the ts of improvements on the company properties. The nings of the company are reported to be showing large reases, and it is thought possible that the dividend on common stock may be increased from 5 per cent to er cent during the first quarter of 1914.

**Toledo Traction, Light & Power Company Matters.**—e Toledo Traction, Light & Power Company's preferred ck becomes cumulative at 6 per cent on Jan. 1, 1914, and net earnings are expected to increase largely in the ır future, warranting an initial dividend on this stock April 1. This company owns all of the bonds and other urities of the Toledo Railways & Light Company and subsidiaries, excepting $4,191,000 underlying bonds and mall amount of stock not deposited at the time of the rganization last January. The gross earnings of the er company for the fiscal year ended Aug. 31 were 194,987, and its net earnings were $1,347,768. A large ount of money is being spent at present on rehabilita-n of the company's properties, and when this work is mpleted, as it is expected to be in the near future, an rease in the net earnings should be shown. In its light-and power departments the company is making a rapid n in business, and a considerable outlay has been neces-y for additions to its generating capacity and extension its transmission and distribution facilities.

# Business Notes

**E. W. Clark & Company,** investment bankers, of Philadelphia, Pa., have recently established a department of their business for the dissemination of news matter on the various public utility properties under their control or management. These utilities are scattered from Maine to Oregon and from Tennessee to Michigan, and their combined annual gross income is said to be in the neighborhood of $31,000,000.

**The Automatic Cable Clamp Company,** of Donora, Pa., announces the following firms as its representatives in various sections of the country: The Pettingell-Andrews Company, Boston, Mass., for the New England States; the Bressan-Young Company, 27 Thames Street, New York, for eastern Pennsylvania, New York, and the Southeastern States; the Union Electric Company, Pittsburgh, Pa., for the Pittsburgh district and West Virginia, and the I. A. Bennett Company, 565 West Van Buren Street, Chicago, for the Western and Southwestern States.

**The Roffy-Grace Corporation,** of 1926 Broadway, New York, is preparing to market the products of the Ak-ray Corporation, of the same address. At the present time the latter concern is largely occupied in the development of a new electric automobile headlight which is claimed to possess marked advantages over the usual type of lamp. The officers of the two companies are identical. S. P. Grace, president, has been until recently superintendent and chief engineer for the Bell Telephone Company in Pittsburgh, Pa., and J. T. Roffy, vice-president and secretary of the companies, has been connected with the Westinghouse enterprises for a number of years and has perfected a number of special illumination devices.

# New Industrial Companies

**The Federal Hardware & Electric Company,** of Boston, Mass., has been incorporated with a capital stock of $10,000 by John F. Chevalier and Stephen S. Grady.

**The Carl Electric Vehicle Company,** of Toledo, Ohio, has been incorporated with a capital stock of $300,000 by L. M. Henders, M. G. McAleenan and B. E. Roberts.

**The Northwestern Pacific Callophone Company,** of Seattle, Wash., has been incorporated with a capital stock of $100,000 by M. M. Block, J. H. Claridan and others.

**The Wright-Howard Electric Company,** of Los Angeles, Cal., has been incorporated with a capital stock of $10,000. The directors are G. C. Wright, W. F. Wright and W. D Smith.

**The Buffalo Electric Vehicle Company of the Pacific Coast,** of Los Angeles, Cal., has been incorporated with a capital stock of $500,000 by J. R. Avery, A. D. Avery and N. A. Boile.

**The Kemoo Electric Manufacturing Company,** of Cleveland, Ohio, has been granted a charter with a capital stock of $100,000. The incorporators are Wallace I. Knight, C. G. Roades and Herbert Matthews.

**The General Electric Utilities Company** has filed articles of incorporation with a capital stock of $100,000 under the laws of the State of Delaware. The incorporators are H. Roys, J. W. Heaney and R. I. Guthman, of New York, N. Y.

**The McIntosh Richards Company,** of Grand Rapids, Mich., has been incorporated with a capital stock of $10,000 to manufacture gas, electric and combination fixtures. The incorporators are William L. G. McIntosh, Fred W. Richards and William McIntosh.

**The Wallace & Tiernan Company,** of New York, N. Y., has been incorporated by Joseph Maucuse, C. A. Simpson and M. A. Lynch, 165 Broadway, New York, N. Y. The company is capitalized at $25,000 and proposes to manufacture sanitary and electrical equipment.

**The Alliance Electric Company,** of Hornell, N. Y., has been incorporated with a capital stock of $10,000 by A. W. Dalton, Charles F. Kistinger and Stephen C. Reville, 705 West 144th Street, New York, N. Y. The company proposes to do an electrical contracting business.

## Trade Publications

**Trolley Omnibus.**—A small booklet recently sent out by the Field Omnibus Company, of New York, gives some interesting information on its double trolley bus for passenger service.

**Conduits and Fittings.**—The "Austin Post" is the title of a trade pamphlet issued monthly by M. B. Austin & Company, of Chicago, Ill., to keep the world informed on its various products.

**Ball Bearings.**—The single annular type of F. & S. ball bearings is shown in a pamphlet lately issued by the J. S. Bretz Company, of 250 West Fifty-fourth Street, New York, sole importer of this German product.

**Pyrometers.**—Catalog No. 1400 of the Bristol Company, Waterbury, Conn., refers to the Bristol electric pyrometer for measuring temperatures up to 2000 deg. Fahr. A list comprising seven pages gives the names of a partial number of users of this instrument.

**Busbar Supports.**—The Delta-Star Electric Company, Chicago, has issued a bulletin devoted to high-tension busbar and wiring supports. With the standard units listed, over 7000 combinations are possible, thus greatly simplifying high-tension station and switchboard wiring.

**Aluminum for Automobile Parts.**—The British Aluminum Company, Ltd., of 109 Queen Victoria Street, London, England, has put out a catalog showing the advantages of aluminum for automobile fittings and illustrating the standard shapes in which it is obtainable for such service.

**Electric Vehicles.**—Issue No. 17 of *Small Motors*, published monthly by the Westinghouse Electric & Manufacturing Company, is devoted to the subject of electric vehicles. Vehicle equipments are fully described. Characteristic curves of vehicle motors are given, as well as halftone views and cross-sections of the different motors.

**Terminals.**—The Standard Underground Cable Company, Pittsburgh, Pa., has issued Bulletin No. 710-1, devoted to indoor cable terminals. The terminals described are said to represent an improvement on earlier forms of potheads, end bells, etc. They are designed for indoor use. The bulletin shows a large variety of these terminals to cover practically every need of the cable user.

**Soot Cleaner.**—A forty-eight-page pamphlet bearing the title "Economical Steam Production" has recently been issued by G. L. Simonds & Company, Chicago, Ill. It is an exhaustive treatise on the subject of soot in relation to boiler efficiency and contains useful engineering data on soot cleaning as applied to all types of water-tube and firetube boilers, referring especially to the Vulcan system.

**Diesel Engines.**—The Consolidated Diesel Engine Manufacturers, Ltd., has recently put out an attractive pamphlet describing the Diesel engine pumping station at Gladstone Dock, Liverpool, England, which is said to be the largest installation of this class of internal-combustion engines yet completed. W. R. Haynie, American representative of the company, with offices at 30 Church Street, New York, can supply these pamphlets to interested parties.

**Globes and Reflectors.**—The Lighting Studios Company, Madison Avenue, corner Thirty-first Street, New York, has recently issued an attractive catalog under the title "A Handbook of Our Creations in Lighting Glassware and Specialties." It is printed in loose-leaf form, in a binder arranged to permit of future additions, and contains illustrations of artistic shades, reflectors, hemispheres, ball globes, dishes, urns and some recent installations.

**Electric Calendar.**—Miss Grace T. Hadley, 350 North Clark Street, Chicago, has designed an attractive electric calendar for 1914. This is a wall calendar, intended to portray the "home electrical." It consists of a cardboard sheet for every month, each page also containing recipes for electrical cooking, verses having to do with the use of electricity, or something of that sort. There is also an appropriate illustration on each sheet. The title page or cover is handsomely printed in black and gold on a tinted background. The calendar is designed particularly to interest women and may serve as a novelty or premium to be sent out by those interested in extending the sale of electricity or electrical appliances.

## Personal Mention

**Mr. A. V. Bemis** has succeeded Mr. N. A. Lee as superintendent of the municipal electric light and water plant at Hawley, Minn.

**Mr. J. E. Buss** has recently been appointed superintendent of the municipal electric light and water works at Hallettsville, Tex.

**Dr. Karl Georg Frank,** American representative of Siemens & Halske and associated companies, sails from New York on Nov. 15 to spend about two weeks in London and Berlin.

**Mr. F. McSweeney,** of the Citizens' Gas & Electric Company, of Waterloo, Ia., has been appointed superintendent of the company's Cedar Falls branch, as successor to Mr. J. P. Jones.

**Mr. E. L. Locke,** for several years superintendent of the Arlington (Mass.) Gas Light Company, has resigned to accept the superintendency of the Light, Heat & Power Corporation of Boston.

**Mr. A. B. Coryell,** of Lafayette, Ind., has been appointed superintendent of the electrical and tramway department of the Moncton (N. B.) Tramways, Electricity & Gas Company, Ltd., vice Mr. H. N. Price, resigned.

**Mr. J. P. Jones,** superintendent of the Citizens' Gas & Electric Company, Cedar Falls, Ia., has been appointed assistant general superintendent at Waterloo, his place at Cedar Falls being taken by Mr. F. McSweeney.

**Mr. B. J. Jones,** general manager of the Ohio Electric Railway Company, Cincinnati, Ohio, has been appointed general manager of the Tri-State Railway & Electric Company, East Liverpool, Ohio, as successor to Mr. W. R. Griffin.

**Mr. George F. Mitchell,** who has had charge of the commercial division of the Red Wing (Minn.) Gas Light & Power Company, has resigned in order to accept a position in the commercial department of the Jackson (Miss.) Light & Traction Company.

**Mr. L. K. Bingaman,** for many years connected with the old Edison Electric Illuminating Company, of Sunbury, has been appointed business manager of the Northumberland County Gas & Electric Company, of Sunbury, successor to Mr. S. G. Reque.

**Mr. S. G. Reque,** general superintendent of the Northumberland County Gas & Electric Company, of Sunbury, Pa., has been appointed engineer of generation and transmission of that company and to a like position with the Columbia & Montour Electric Railway Company.

**Mr. Heinrich J. Freyn,** formerly consulting engineer of the gas engine department of the Allis-Chalmers Manufacturing Company of Milwaukee, has recently joined the H. Koppers Company, of Chicago, designer and builder of by-product coke and gas-oven plants, in the capacity of third vice-president.

**Prof. C. Francis Harding,** head of the School of Electrical Engineering, Purdue University, Lafayette, Ind., acting as consulting electrical engineer for the recently established Public Service Commission of Indiana and in this capacity has recently completed the appraisal of two of the largest electrical public utility companies in the State, under the direction of Mr. H. O. Garman, formerly of Purdue University, who is chief engineer for the commission.

**Mr. A. N. Dutton,** who has been vice-president of the West Virginia Traction & Electric Company and manager of the City Railway, Wheeling, W. Va., has been elected president of the City Railway and the City & Suburban Gas Company, Wheeling. He succeeds Mr. H. R. Warth as president of the City Railway and succeeds Mr. J. P. Taylor with the City & Suburban Gas Company, Mr. Taylor becoming vice-president of the City & Suburban Gas Company.

**Mr. V. W. Bergenthal,** assistant sales manager of the Wagner Electric Manufacturing Company, has been appointed purchasing agent of the company. Mr. Bergenthal is a graduate of the University of Wisconsin. After graduation he joined the engineering staff of the Stanley Elec-

Manufacturing Company at Pittsfield, Mass., and later was sales engineer and assistant manager of the Western office of that company at Chicago, Ill. Since 1904 Mr. Bergenthal has occupied the position of assistant sales manager of the Wagner company.

**Mr. S. C. Pohe**, general superintendent of the Columbia Power, Light & Railways Company, of Bloomsburg, Pa., has been made general manager of the company, which controls the Columbia & Montour Electric Railway Company, the Danville & Bloomsburg Street Railway Company, the Standard Gas Company of Danville, the Standard Electric Company of Danville, the Irondale Electric Light, Heat & Power Company, the United Gas & Electric Company, the Berwick Electric Light Company and the Northumberland County Gas & Electric Company of Sunbury. Mr. Pohe is well known in the electric-lighting circles in Pennsylvania and is secretary of the Pennsylvania Electric Association.

**Sir Joseph Wilson Swan, F.R.S.**, inventor of the incandescent lamp bearing his name, celebrated his eighty-fifth birthday Oct. 31. He is still engaged in active scientific work. In addition to his well-known researches leading up to his electric-lighting inventions, Sir Joseph devised the autotype carbon process for making permanent photographs, discovered the means of making rapid dry plates which revolutionized the art of photography, and made many improvements in photo-mechanical printing and in electro-metallurgical deposition. The distinguished inventor has many honorary degrees and is a past-president of both the British Institution of Electrical Engineers and the Faraday Society.

**Mr. C. Nesbitt Duffy** has resigned as vice-president and controller of the Milwaukee (Wis.) Electric Railway & Light Company to become vice-president and general manager of the Manila (P. I.) Electric Railroad & Light Company. Mr. Duffy expects to leave Milwaukee about Nov. 15 for St. Louis and will go from there to San Francisco, whence he will sail on the *Manchuria* on Nov. 27, arriving in Manila on Christmas day. Mr. Duffy entered the employ of the Milwaukee Electric Railway & Light Company as controller on Oct. 1, 1906, succeeding Mr. A. C. Mackay. In May, 1912, he was also elected a vice-president of the company. The call to Manila comes as a recognition of Mr. Duffy's wide general knowledge of the industry and his experience and ability as an administrative official. In his new work he will find large opportunities for the use of the abilities which he has developed and for the broadening of those principles of enlightened public policy of which he has always been an exponent.



C. NESBITT DUFFY

## Obituary

**Edward Fleet Morse**, inventor of the Morse silent chain, died Nov. 11 at Ithaca, N. Y., aged fifty-six years. In addition to the Morse chain, Mr. Morse invented the Morse thermo-gage, an instrument for measuring the temperature of steam.

**Joseph Ernest Hodgson**, general manager of the Fulton County Gas & Electric Company, Gloversville, N. Y., died in that city on Oct. 26. Mr. Hodgson was born in Brooklyn, N. Y., May 27, 1873, and was a graduate of the Polytechnic Institute of Brooklyn and of Cornell University. After leaving Cornell in 1897 he entered the employ of the Brooklyn Rapid Transit Company and in 1902 joined the staff of the Westchester Lighting Company, Mount Vernon, N. Y., which at that time was under the direct control of the United Gas Improvement Company, of Philadelphia. When in 1907 the Westchester corporation became affiliated with the interests controlling the Consolidated Gas Company, Mr. Hodgson joined the home engineering corps of the United Gas Improvement Company in Philadelphia and was subsequently detailed to St. Augustine, Fla. He remained for only a short time in that position, going from there to Gloversville, N. Y., as engineer of the electric division of the United Gas Improvement interests in Gloversville and Johnstown. His success was so marked that when the position of general manager of the Fulton County Gas & Electric Company became vacant through the resignation of Mr. L. D. Spragle he received the appointment. This position he held until his death.

**Sir William Henry Preece**, former engineer in chief and electrician of the British Post Office, and one of the highest authorities on telegraphy and telephony, died in London, Nov. 6. Sir William Henry Preece was born Feb. 15, 1834, near Carnarvon, North Wales. He completed a full course at Kings College, London, and studied electricity under Faraday at the Royal Institution. He was actively engaged in telegraph work from 1852 until the time he resigned from active service as consulting engineer of the Post Office Department in 1904 For sixteen years he was an employee of the Electric Telegraph Company, which existed prior to 1870, in which year the government took over the telegraph control of the country. His connection with the Post Office Department lasted over twenty-seven years. In 1852 Sir William, then Mr., Preece entered the office of the late Edwin Clarke, who was then chief engineer of the Electric Telegraph Company. From 1854 to 1856 he acted as assistant to Latimer Clarke and in the latter year was made superintendent of the southern district. During the early part of his career Sir William took out patents of a duplex system. In 1860 he was appointed by the London & Southwestern Railroad to be superintendent of the electrical system, and in 1870 he entered the post office service as division engineer for the south of England. In 1877 Sir William visited the United States in company with Sir Henry Fisher. The result of their investigations was the introduction of "sound reading" into England. He also brought over to England the system of quadruplex telegraphy. In 1884 he again visited the United States and when he returned to England introduced the multiplex system of telegraphy. In 1884 Sir William began experimenting with wireless telegraphy and worked out an electromagnetic system which was for a long time before the Marconi system in England in practical operation between Larvernock, near Cardiff, and Flatholm, an island in the British Channel, a distance of 3.5 miles. Sir William was for some years president of the Institute of Civil Engineers; he was a past-president of the Institution of Electrical Engineers (then the Society of Telegraph Engineers), a fellow of the Royal Society, a member of the Physical Society, the Meteorological Society, the Royal Institution, the British Association, the Society of Arts and an honorary member of the American Institute of Electrical Engineers and of the New York Electrical Society. His inventions, which were many, dealt with the telephone, Wheatstone apparatus, duplex, quadruplex and multiplex telegraph, wireless telegraphy and the electrical devices for increasing the safety of railway travel. He was a co-author of works on telegraphy and telephony and was one of the most prolific writers of scientific papers in the British Empire. His remarkable gifts as a lecturer on science brought him prominently before the general public of England. The papers presented by him before the different societies show the singularly wide range of subjects which he mastered and which through his great ability as a lecturer he was enabled to present to the best advantage. He was knighted on May 24, 1899.



SIR WILLIAM H. PREECE

# Construction

## New England

[illegible] Stone & Co., owners of the local electric lighting plant, expect to purchase within the next 18 months one 50-kw generator and within the next six months they expect to purchase 300 new 12 incandescent lamps with brackets, etc. H. L. Thompson is manager. Post office address, Weybridge, R. F. D. Middlebury.

NORTH ATTLEBORO, MASS.—The North Attleboro Electric Light Department, Water Department expects to install within the next six months one 150-hp horizontal tubular boilers. William Plattner is manager.

LUNTON, MASS.—The finance committee of the Council has recommended that the manager of the municipal electric-lighting plant be authorized to purchase an additional water-tube boiler, to cost $5,200. C. Golden is manager.

[illegible] Oct. 27 the taxpayers voted to appropriate $14,000 to renew the equipment in the municipal electric power plant, changing the system from 140-cycle, 1100-volt, single-phase, to 60-cycle, 2300-volt, three-phase, with duplicate generating units of 300 kw each with necessary switchboard equipment and line changes. The entire plant is practically being rebuilt with the exception of boilers and improvements to the street-lighting system are in charge of a special improvement committee. J. Herbert Bailey is superintendent of the municipal electric-light plant.

BROAD BROOK, CONN.—The contract for street-lighting in Broad Brook, which is held by the Northern Connecticut Lt. & Pwr. Co., of Thompsonville, expired Nov. 11. In the new contract it is expected that a provision will be made for changing the present street lamps for 60-candle lamps.

## Middle Atlantic

BUFFALO, N. Y.—Bids will be received by Francis G. Ward, commissioner of public works, Room 5, Municipal Building, Buffalo, until Nov. 28 for furnishing, setting up and connecting the scientific and medical equipment required in the completion of the new Technical High School building, located on the Bennett Park site, between Eagle and Clinton Streets, as follows: Mechanical equipment: (b) motors and generators; (c) shafting and hangers; (d) woodworking machinery; (e) metal-working machinery; (f) forge-shop equipment; (g) foundry equipment; (h) engineering laboratories; (i) applied-arts equipment; (j) pottery equipment; (k) shavings-exhauster equipment; (l) small working tools; (m) small metal-working tools. Electrical work: (a) conduit and wiring. Science equipment: (n) science laboratories equipment; (o) domestic science and service-kitchen equipment. A separate and distinct proposal must be made for each division of the work under the different classifications. Plans and specifications are on file at the office of the deputy building commissioner, Room 6, Municipal Building, where blank forms of proposals and any desired information may be obtained.

NEW YORK, N. Y.—Bids will be received by the Department of Charities, foot of east Twenty-sixth Street, New York, until Nov. 17 for furnishing labor and materials for the installation of electric-wiring fixtures and gas piping at the city hospital building, Blackwell's Island. Bids may be submitted on the entire work. Blank forms and further information may be obtained at the office of Frank Sutton, 80 Broadway, New York, consulting engineer. Michael J. Drummond is commissioner.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, N. Y., until Nov. 17 for installing electric equipment in the addition to and alterations in Public School 71, Forest Avenue, borough of Queens; also for installing electric equipment in new Public School 22, corner of Washington and Columbus Avenues, borough of Richmond. Blank forms, plans and specifications may be obtained or seen at the office of the superintendent, hall of the Board of Education, Park Avenue and Fifty-ninth Street, New York; at branch offices, 69 Broadway, Flushing, borough of Queens, and Borough Hall, New Brighton, borough of Richmond.

ROCHESTER, N. Y.—The large power house of the Rochester & Sea Bay Ry. Co. at Ontario was recently destroyed by fire, causing a loss of about $40,000.

WATERTOWN, N. Y.—The Public Service Commission has granted the Northern New York Utilities Co. permission to construct and operate a hydroelectric plant on Beaver River near Belfort. The company is also authorized to issue bonds to the amount of $248,000, to be sold at not less than 85, and $93,300 in capital stock to be sold at not less than par.

WILKINSBORO, PA.—Among the improvements contemplated by the Northwestern Pennsylvania Ry. Co., of Meadville, is the erection of a combined electric railway station and a substation (46 ft. by 76 ft.) in Wilkinsboro. Niagara power will be used under the new system. In addition to furnishing energy to operate the street railway the new station will furnish electricity for lamps and motors.

PHILADELPHIA, PA.—Bids will be received at the office of George D. Porter, director Department of Public Safety, Room 215, City Hall, Philadelphia, Pa., until Nov. 21 for the following supplies for the Electrical Bureau: 2400 sq. ft., ¼-in. asbestos wood, J. M. Trasite, plain or equal; 48 one-lamp ceiling fixtures for first-floor corridor, City Hall; police telephone service and equipment for the use of the city of Philadelphia during the year 1914; Bell municipal telephone service and equipment for the use of the city of Philadelphia during the year 1914; Keystone municipal telephone service for the city of Philadelphia for 1914; one main distributing terminal and protector frame for fire-alarm circuits; 11,000 ft., 25 pair, No. 16 gage, paper-insulated, lead-incased cable, to be delivered at Thirty-first District police station, Twenty-sixth and York Streets; 10,500 ft., 25 pair, No. 16 gage, paper-insulated, lead-incased cable, to be delivered at Thirty-eighth District police station, Fifty-fifth and Pine Streets. Specifications for above may be obtained at the office of the Electrical Bureau, Room 618, City Hall.

ELLERSLIE, MD.—The Cooks Mills El. Lt. & Pwr. Co., of Ellerslie, expects to install within the next four or six months from 40 to 50 meters, and to purchase within the next four months electrical appliances and supplies, including wire, switches, lamps, etc. Daniel Deal is president.

NEW MARTINSVILLE, W. VA.—The Sistersville El. Lt. & Pwr. Co., of New Martinsville, is rebuilding the lighting system here and extending its distribution lines to suburbs. D. L. Evans is superintendent.

BLACKSBURG, VA.—The Virginia Polytechnic Institute hopes to purchase arc lamps and lamp-posts within the next year. D. O. Matthews is superintendent of the Heat and Power Department.

MANASSAS, VA.—Bids will be received by the town of Manassas until Dec. 5 for the installation of an electric-light plant, including poles, lines and wiring. Bids will also be received until Dec. 3 for furnishing materials and installing water-works and sewer systems. Copies of plans and specifications may be obtained upon receipt of $5, which will be refunded if plans are returned before Dec. 1. C. R. C. Johnson is chairman and N. Wilson Davis engineer.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 17, for an electrical apparatus and cable connecting the present plant of the Interior Department with the court of appeals and the old court house, Washington, D. C. Plans and specifications may be obtained upon application. Elliott Woods is superintendent of United States Capitol building and grounds.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Nov. 18, for furnishing at the various navy yards and naval stations the following supplies: Brooklyn, N. Y., Schedule 5975—50 detectors for radio receiving sets, one 5-kw radio transformer; Schedule 5981—81,000 ft. 0.102-in. diameter telegraph wire; Philadelphia, Pa., Schedule 5976—two switchboards and spare parts, 143 miscellaneous telephones and spare parts. Bids will also be received at the same place until Nov. 25 as follows: Mare Island, Cal., Schedule 5978—one electro-plating outfit; Schedule 5979—engine-room mechanical telegraph transmitters and indicators (two each); Brooklyn, N. Y., Schedule 5986—one combination electrically heated sterilizer, complete; Schedule 6006—130,000 ft. aerial, silicon bronze wire; Annapolis, Md., Schedule 5990—one oil-engine-driven, direct-current exciter unit. Applications for proposals should give the schedule desired by number.

## North Central

ALBION, MICH.—Property owners on South Division Street are asking for an extension of the ornamental street-lighting system on that thoroughfare.

BOYNE FALLS, MICH.—The local electric-light plant has been purchased by W. J. Pearson, who has organized a company, known as the Boyne Falls Pwr. Co. It is expected that electricity will soon be furnished for motors as well as lamps. D. H. Hinckley, of Brutus, is also interested in the company.

DETROIT, MICH.—The Edison El. Illg. Co., of Detroit, has started work on the construction of a power plant at Connors Creek, where 40,000 hp will ultimately be developed.

HONOR, MICH.—The Betsey River Lt. & Pwr. Co., of Honor, has applied to the Village Council for a franchise to furnish electricity here. The company has completed its dam and, it is understood, will soon be ready to furnish electrical service. The proposed plant will cost about $100,000 and will develop about 1200 hp. J. L. Barker, cashier of the Benzie County Bank, of Honor, is interested in the project.

MONROE, MICH.—Orders have been placed by the Monroe Bindery Board Co. with the Allis-Chalmers Co. for two turbo-alternators.

ROSCOMMON, MICH.—Bonds to the amount of $4,500 have been voted for improvements to the electric-light and water-works plant.

CLEVELAND, OHIO.—Bids will be received at the office of the secretary of the director of public service, 204 City Hall, Cleveland, until Nov. 22 for a direct-connected motor-driven centrifugal pump for the city water department. Proposals must be submitted on blanks furnished by the superintendent of the water department. W. J. Springborn is director of public service and W. H. Kirby is secretary.

MIDDLE POINT, OHIO.—The France Stone Co. is contemplating the installation of electrical equipment at its Middle Point quarries.

PORT CLINTON, OHIO.—At the election held Nov. 4 the proposition to issue bonds for the construction of a municipal electric-light plant was

carried. For further information address the clerk of Board of Public Affairs.

SHILOH, OHIO.—At an election held recently the proposal to levy additional tax for a period of five years for the installation of an electric-light plant was carried.

HARRODSBURG, KY.—The proposal to issue $12,000 in bonds to provide funds for improvements to the municipal electric-light plant was carried at the election held Nov. 4.

LEXINGTON, KY.—At the election held Nov. 4 the voters defeated the proposed bond issue of $200,000 for the purpose of establishing a municipal electric-light plant.

LOUISVILLE, KY.—The General Construction Co., of Louisville, will install an electric plant in an apartment house it is building. The equipment will consist of three 75-hp horizontal return tubular boilers, down-draft furnaces, one 55-hp and two 75-hp steam engines, one 35-kw and two 50-kw generators with switchboard equipment for an isolated plant, switchboard meters and apartment meters and approximately 1700 incandescent lamps. Contracts for equipment and machinery have not yet been placed. A. M. Cowherd is engineer in charge of the work.

PARIS, KY.—The city of Paris is considering the question of establishing a municipal electric-light plant.

VARILLA, KY.—The Kentucky Utilities Co., of Lexington, has taken over the local electric-light plant, which was originally built to serve the various mines of T. J. Asher, on his 38,000-acre coal tract. This will be used by the company for the central plant in this district. Electricity will be transmitted at 33,000 volts to the mines of the Bell and Bath fields, with reserve stations at Middlesboro and Pineville.

ALBION, IND.—The Board of Public Works expects to purchase within the next six months about 4000 ft. three No. 10 lead-covered cable for street lamps and about 30 ornamental lamp-posts. A. Holderman is superintendent.

HUNTINGTON, IND.—At an election held Nov. 4 the proposition to issue bonds for the installation of a municipal electric-light plant was carried. H. I. Young is city clerk.

DUQUOIN, ILL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 19, for the construction, complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Duquoin. Drawings and specifications may be obtained at the above office or from the custodian of site at Duquoin. O. Wenderoth is supervising architect.

GRANVILLE, ILL.—Sidney Whitaker, owner of the local electric-light plant, expects to purchase within the next 30 days one 60-hp oil engine and two hoods for street lamps.

LA HARPE, ILL.—The installation of an ornamental street-lighting system is under consideration by the merchants of the city, using 16 standards in three blocks.

MANITO, ILL.—The contract for the construction of the new power house for the municipal electric-light plant has been awarded to R. A. Hilling & Co. As yet no other arrangements have been made for improvements to the municipal electric-light plant. William T. S. Beebe is superintendent.

MONTICELLO, ILL.—The Monticello El. Lt. & Pwr. Co. expects to install within the next five months substation equipment to take the place of its present generating apparatus (133 cycles). The company is now erecting about 1 mile of pole line and has recenly installed 75 service meters. Electrical cooking appliances and heating devices, etc., are purchased as required. John A. Glover is general superintendent.

PEORIA, ILL.—The Association of Commerce has instructed Secretary Palding Slevin of the publicity committee to secure estimates on a large search-lamp for advertising purposes; also estimates for an electric sign "Welcome to Peoria," with letters 20 ft. high.

PEOTONE, ILL.—The Peotone El. Co. expects to purchase within the next six months series street-lighting equipment and 20 ornamental lamp-posts carrying five-lamp clusters. H. Fedde is manager.

SPRINGFIELD, ILL.—A committee of business men has submitted a plan to Willis J. Spaulding, city commissioner, for the extension of the ornamental street-lighting system in the business district when the city enters the commercial lighting field.

STERLING, ILL.—The Northwestern Barb Wire Co., of Sterling, expects to purchase a centrifugal pump for its electric power plant. P. W. Dillon is secretary.

STERLING, ILL.—The light committee of the City Council has engaged H. S. Green, general manager of the Rock River Lt. & Pwr. Co., of Sterling, to prepare plans for the new ornamental street-lighting system for the business district of the city. The plans provide for 14 blocks.

WARSAW, ILL.—The Keokuk El. Co. has submitted a proposal to the City Council for the installation of an ornamental street-lighting system in Warsaw. Three different plans have been submitted.

GRAND RAPIDS, WIS.—The Consol. Wtr. Pwr. & Paper Co. may possibly install in the near future one or more 60-cycle generating units, switchboard, transformers, motors, etc., and remodel some of the boilers. Nothing definite has yet been decided upon. C. L. Hayward is electrical engineer.

LA CROSSE, WIS.—The Wisconsin Ry., Lt. & Pwr. Co., of La Crosse, expects to erect within the next six months a new substation.

MADISON, WIS.—The Peninsular Pwr. Co., of Madison, expects to erect within the next six months an extension to its 66,000-volt transmission line and to purchase boilers and turbo-generators for an output of about 1000 hp.

MAUSTON, WIS.—The Mauston El. Ser. Co. expects to purchase within the next six months one 150-hp steam engine and boiler complete. J. E. Carroll is manager.

MINERAL POINT, WIS.—The Mineral Point Pub. Ser. Co. expects to install within the next 30 days a 1200-kw Westinghouse (Bluder type) generator, La Blanc condenser and stoker, cooling tower and another Heine boiler. F. C. Ludden is president.

MOSINEE, WIS.—The Mosinee El. Lt. & Pwr. Co. expects to purchase one transformer. W. A. Von Berg is treasurer.

MOUNT HOREB, WIS.—The Mount Horeb Ht., Lt. & Pwr. Co. expects to purchase within the next two months one 75-hp producer-gas engine and one 50-kw, three-phase, 60-cycle, 2200-volt generator, directly connected. M. Mathison is president.

OAKFIELD, WIS.—The Oakfield Lt. & Pwr. Co. expects to purchase within the next 20 months a 10-kw to 12-kw generator and engine.

BLACKDUCK, MINN.—The question of purchasing the local electric-light plant and telephone exchange, owned by the Blackduck El. & Tel. Co., to be owned and operated by the municipality, is under consideration. M. D. Stoner is president of the company.

CHISHOLM, MINN.—The controlling interest of the Chisholm El. Co. has been purchased by Knox-Heskett Co., of Chicago, Ill., and associates. It is understood that extensive improvements are contemplated to the plant and system. Among the new directors are: Neal Brown, of Wausau; R. M. Heskett, of Chicago, Ill., and Charles Meyers, of Wausau, Wis. Albert Sandt still retains his interest in the company.

SWANVILLE, MINN.—The Village Council has granted a franchise to Albert Mielke to construct and operate an electric-light plant in Swanville.

WATERTOWN, MINN.—Plans are being prepared for construction of an electric-power plant in Watertown. A company is being organized by Guy E. Halgren and James J. Donsford to operate same.

ANAMOSA, IA.—William G. Dows, Isaac B. Smith and John A. Reed, of Cedar Rapids, recently granted a franchise in Anamosa, contemplate the purchase of the old electric plant in Anamosa and to connect same with their Cedar Rapids plant and furnish electricity for lamps and motors here. L. J. Fisher is city clerk.

BLOOMFIELD, IA.—The Burlington El. Ry. Co. has submitted a proposal to the City Council offering to purchase the municipal electric-light plant.

DUBUQUE, IA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 1 for changes in plumbing, conduit and wiring system and lighting fixtures in the United States custom house and post office in Dubuque. For details see proposal columns. O. Wenderoth is supervising architect.

DUNKERTON, IA.—J. A. Renz has been granted a franchise to construct and operate an electric-light plant in Dunkerton.

GILBERTSVILLE, IA.—The Gilbertsville Ltg. Co., recently incorporated, is reported to be contemplating the construction of an electric-light plant in Gilbertsville. R. W. Allen is president.

LE MARS, IA.—At an election held recently the proposition to grant the Le Mars Wtr. & Lt. Co. a 25-year franchise to furnish water and light in Le Mars was defeated. The franchise expired Oct. 1.

PELLA, IA.—The city of Pella expects to purchase within the next two months cable for underground distribution in connection with the municipal electric-light plant. A. C. Kuyper is manager.

THORNTON, IA.—The question of installing an electric-light system in Thornton is under consideration.

NEW LONDON, MO.—Bids will be received by the North Missouri Lt. & Pwr. Co., of New London, until Nov. 21 for furnishing material and construction of approximately 35 miles of 33,000-volt, three-phase transmission lines. Plans and specifications may be obtained from J. D. Lane, of New London, or the Fuller-Coult Co., Chemical Building, St. Louis, Mo., engineers.

GRAND FORKS, N. D.—Bids will be received by the Board of County Commissioners of Grand Forks County, at the office of the County Auditor, Grand Forks, until Nov. 25 for conduits, electric light and power wiring and telephone conduits for the Grand Forks County court house, in Grand Forks, according to plans and specifications prepared by Buechner & Orth, architects. Hans Anderson is county auditor.

PLAZA, N. D.—Application has been made to the town of Plaza by B. C. French for a franchise to construct and operate an electric-light plant here.

BLUNT, S. D.—The Blunt Lt. & Pwr. Co. expects to purchase within the next six months a few vacuum cleaners, washing machines and wiring supplies. C. E. Gunsalus is engineer and manager.

WHITE, S. D.—Application has been made to the City Council for a franchise by George Baisley, of White, to install and operate an electric-light plant here.

FULLERTON, NEB.—If the application of the Fullerton El. Lt. & Pwr. Co. now pending before the board of irrigation is acted on favorably, the company will install new equipment in a water-power plant.

[illegible] the next 12 to 16 months.

COTTONWOOD FALLS, KAN.—The Home Lt. & Pwr. Co., of Cottonwood Falls, expects to install within the next four months one 100-hp (150-lb. pressure) tubular boiler. W. W. Austin is manager.

GOODLAND, KAN.—The Goodland Lt. & Pwr. Co. expects to install within the next two months one 75-kw, three-phase, 2300-volt generator belted to a 60-hp Muncie oil engine. William H. Frazier is manager.

GYPSUM, KAN.—The Gypsum Lt. & Pwr. Co. expects to purchase within the next four months a 25-hp or 30-hp oil engine, underground conduit for ornamental street-lighting system and ornamental lamp standards. It also will soon purchase heating and cooking apparatus, washing machines and electric irons. R. O. Keys is president.

HARPER, KAN.—Within the next six months the managers of the municipal light and water plant expect to purchase a motor and pump for the water plant. A. M. Carter is superintendent.

HAVEN, KAN.—The Haven El. & Ice Co. expects to enlarge its ice plant and to purchase a 5-ton ice vat. The ice plant is operated in connection with the electric plant.

HIAWATHA, KAN.—The Hiawatha El. Lt. Co. expects to build within the next two months a 15-ton ice plant, to be operated in connection with the electric-light plant. R. H. Love is secretary and manager.

OSAWATOMIE, KAN.—The Electric Light Commission expects to purchase within the next six months one ground detector, one synchronizer for parallel operation, and about 20,000 ft. No. 8 weather-proof wire. B. L. Prier is superintendent.

## Southern States

CHARLESTON, S. C.—The Charleston-Isle of Palms Trac. Co., of Charleston, expects to erect within the next two months a substation at Mount Pleasant, to be equipped with two 300-kw rotaries, 6600-volt primary, 600-volt secondary (railway). Arrangements have already been made for purchase of equipment. W. W. Fuller is chief engineer and general superintendent.

PUNTA GORDA, FLA.—At an election to be held Dec. 2 the proposition to issue $75,000 in bonds, the proceeds to be used for extensions to electric, water and sewers systems, will be submitted to the voters.

NASHVILLE, TENN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 25 for a new hoistway, an electric freight lift, etc., for the United States post office and custom house at Nashville, Tenn., in accordance with specifications, copies of which may be obtained at the above office. O. Wenderoth is supervising architect.

HUNTSVILLE, ALA.—The Alabama Pwr. Co., it is reported, has decided to establish one of its steam plants in Huntsville. The proposed plant will cost about $1,250,000 and will furnish electricity in Huntsville and throughout a large territory in Madison and adjoining counties.

MUSKOGEE, OKLA.—The Sequoyah Club is reported to have awarded a contract to Joseph Dickman to construct a concrete dam 6 ft. high across the Illinois River. Later the club contemplates the installation of a waterwheel and generator to furnish electricity for lighting the clubhouse, cottages and grounds.

EASTLAND, TEX.—The Eastland Lt. & Pwr. Co. expects to erect within the next two months a power house. The company has recently purchased an engine and generator. A. A. Abney is manager.

HALLETTSVILLE, TEX.—The city of Hallettsville expects to purchase within the next six months a street-lighting system and 100 ceiling and desk fans. T. J. Buchanan is city engineer and electrician.

JACKSONVILLE, TEX.—The Jacksonville Ice & El. Co. expects to install within the next few months a 200-kva, 60-cycle, 2200-volt generator directly connected to an oil engine, or possibly a steam engine, and also 600 hp in new boilers. The company recently installed a series street-lighting system throughout the entire town.

LAREDO, TEX.—The Laredo El. & Ry. Co. expects to purchase within the next few months either a steam turbine or oil engine and stoker for boiler room; also new incandescent street-lighting system. Frank E. Scoville is secretary and manager.

MIDLOTHIAN, TEX.—The Ice, Wtr. & Lt. Co., of Midlothian, expects to purchase within the next two months 20 meters, 2000-lb. weather-proof wire and 12 lightning arresters, and within the next 12 months it expects to purchase 50 electric irons, six electric fireless cookers, six vacuum cleaners and general wiring supplies to the amount of $2,000. The company has just purchased one carload of poles. Charles J. Muller is manager.

MOUNT PLEASANT, TEX.—The Mount Pleasant El. Co. expects to reconstruct its overhead system, install series lighting system, furnish electricity to pump the city water and rebuild its plant within the next three months. Charles A. Bergen is manager.

NAVASOTA, TEX.—The Navasota Lt. & Pwr. Co. expects to purchase within the next four months a coal-conveying system to carry coal from car to boiler house, a distance of about 100 ft. R. W. Horlock is treasurer.

POST CITY, TEX.—The Post Pwr. Co. may decide to establish a complete lighting system for the town. As yet nothing definite has been decided upon. H. W. Fairbanks is vice-president and general manager.

SAN SABA, TEX.—The San Saba Lt. & Ice Co. expects to purchase within the next three months a 100 to 125-kw generating unit, consisting of engine and generator and generator switchboard panel for above generator. F. B. Hall is manager.

TOYAH, TEX.—The Toyah El. Lt. Co. expects to purchase within the next few months a 25-hp internal-combustion engine.

VERNON, TEX.—The Texas Public Service Co. expects to erect a short 2300-volt transmission line and to purchase an alternating-current, 2300-volt generator and engine; also usual line of electrical supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, etc. A. E. Gilman is business manager.

WALNUT SPRINGS, TEX.—The managers of the municipal electric-light plant expect to erect within the next two months a transmission line from Waco to Walnut Springs, to obtain electricity from the Waco plant; also to purchase the independent telephone line between Walnut Springs and Waco.

## Pacific States

HANFORD, WASH.—The Hanford Irrigation & Pwr. Co. expects to purchase medium quantities of lamps, heating devices and electrical wiring supplies. E. F. Benson is receiver of the company.

LEBAM, WASH.—Plans are being prepared by R. L. Fisher, of Raymond, for the installation of an electric-lighting system in Lebam. Electricity for operating the system will be supplied by the Lebam Mill & Timber Co.

MEDICAL LAKE, WASH.—The Okanogan Valley Pwr. & Lt. Co. expects to erect a small power house on the Methow River and to erect 30 miles of 22,000-volt transmission line, connecting Brewster and Okonogan, within the next six months; also to purchase within the next three months a 250-kw generator, switchboard panels, three 125-kva, 22,000-volt transformers, one pair of 35-in. waterwheels, exciter and waterwheel governor. Eugene Enlow, of Medical Lake, is president.

MONTESANO, WASH.—The City Council has authorized the installation of new street lamps on Kamilche, Church, Cedar and State Streets. Bids for the work, it is understood, will soon be asked for.

MORTON, WASH.—The City Council has granted a franchise to F. M. Broadbent to construct and operate an electric-light plant in Morton for a period of 49 years.

PROSSER, WASH.—Work will soon begin on the extension of the transmission lines of the Pacific Pwr. & Lt. Co. along the Model Orchard Road, a distance of several miles.

SEATTLE, WASH.—The Puget Sound Trac., Lt. & Pwr. Co., of Seattle, is contemplating the erection of a transmission line from Georgetown into the Black River district, to furnish electricity for lamps and motors to the ranchers in that vicinity.

SEATTLE, WASH.—The water-power rights on the Skagit and Cascade Rivers for which permits were recently granted by Secretary Houston of the Department of Agriculture to the Skagit Pwr. Co. have been purchased by the Stone & Webster Corpn., of Boston, Mass. It is understood that a hydroelectric plant to develop 50,000 hp will be erected at a cost of about $5,000,000. Electricity generated at the plant will be transmitted to Seattle.

TACOMA, WASH.—Plans have practically been completed by B. W. Collins, electrical superintendent, for the installation of an ornamental street-lighting system in the business district. An ordinance providing for creating an improvement district to install the lamps will soon be introduced in the City Council.

WASHOUGAL, WASH.—The Western Lt. & Pwr. Co., of Washougal, expects to install within the next 30 days one Woodward waterwheel governor. The company is rebuilding part of its distribution system and will make extensions of approximately 3 miles. C. W. Cottrell is president.

CORVALLIS, ORE.—The Oregon Pwr. Co. has submitted a proposal to the City Council offering to install 145 electric lamps of 100 cp in place of the 52 arc lamps now in use. The company offers to install the lamps at its own expense and maintain the lamps for the same amount that is now expended for street-lighting, provided a five or ten-year contract is signed.

LEBANON, ORE.—The Lebanon El. Lt. & Wtr. Co. expects to erect within the next three months 22 lamp standards, carrying five-lamp clusters, to be operated on 6.6-amp series system. Orders have been placed for posts and wire. S. I. Stewart is manager.

BURLINGAME, CAL.—Plans have been adopted by the Board of Trustees for the installation of a new street-lighting system in both the business and residence sections. Electroliers maintained by underground wires will be erected in the business district.

CALISTOGA, CAL.—The State Railroad Commission has granted the Napa Valley El. Co., of St. Helena, permission to purchase the property of the Calistoga El. Co. and to issue $20,500 in bonds, $15,300 in capital stock and $5,000 in notes, the proceeds to be used to take over the properties and to provide for extensions and improvements.

FILLMORE, CAL.—Surveys are being made by J. A. Heaston and Constant W. Booth, of Huntington Park, civil engineers, at Bradfield's

mp on the Big Sespe for the proposed hydroelectric power plant to be ilt by the Sespe Lt. & Pwr. Co., recently incorporated. The company has ed on 10,000 in. to be diverted from the stream. It is proposed to build veral dams across the stream and impound the floodwaters.

LOS ANGELES, CAL.—The City Council has adopted a report recmmending an appropriation of $1,500 to cover the cost of employing ree experts to report on the aqueduct bureau, which report is to be ven to the public before the coming bond election. George L. Hoxie, East Forty-first Street, New York, N. Y.; Prof. C. L. Corey, of the ate University, and C. W. Koiner, manager of the Pasadena municipal ectric plant, will report on the cost of a municipal electrical distribution stem for aqueduct power, cost of operating the system, etc. E. F. attergood, of the power bureau, will be required to submit an estimate the cost of a distributing system for street-lighting.

SAN DIEGO, CAL.—The State Railroad Commission has authorized e San Diego Consol. Gas & El. Co. to issue $27,000 in bonds, the oceeds to be used for additions and improvements to its plant.

SAN LUIS OBISPO, CAL.—The Midland Counties Pub. Ser. Corpn., San Luis Obispo, expects to install within the next three months one t of 66,000-volt lightning arresters. George L. Howard is district ent.

SANTA CRUZ, CAL.—The city of Santa Cruz expects to install a -ton incinerator in the old municipal power station, at a cost about $6,000. It also expects to purchase through the Coast Counties s & El. Co. an additional 50-lamp luminous-arc rectifying set together th lamps and cut-outs. J. C. Geyer is superintendent of Electric epartment.

MOSCOW, IDAHO.—Preliminary surveys are being made by the ashington Wtr. Pwr. Co., of Spokane, with a view of extending its ansmission lines immediately from Palouse, Wash., to Moscow. Small wns, including Troy and Kendrick, along the route of the transmission e will be furnished with electrical service.

CLIFTON, ARIZ.—The Arizona Copper Co., of Clifton, is now install- g transformers (625 kva) in the Clifton substation; equipment has eady been purchased. The company has recently completed a 6000- a generating plant and distribution lines to its mines and properties, d will need general line and construction material such as is used in wer and lighting installations. As yet nothing definite has been cided upon. Hammond Matthews is chief electrician.

DAYTON, WYO.—The town of Dayton expects to purchase within the xt six months incandescent lamps for the municipal electric-light sys- m. M. M. Owen is town clerk.

LA JUNTA, COL.—Bids will be received at the office of the supersing architect, Treasury Department, Washington, D. C., until Dec. 18 r construction, complete, including mechanical equipment, interior hting fixtures and approaches, of the United States post office at La nta. Drawings and specifications may be obtained at the above office from the custodian of site at La Junta. O. Wenderoth is supervising chitect.

## Canada

EDMONTON, ALTA.—R. H. Parsons, superintendent of the municipal ectric plant, has recommended the purchase of a 400-kw generator to be erated by a Belliss & Morcom engine, with condensing equipment.

HALIFAX, N. S.—The Halifax El. Tramways Co., Ltd., has been anted permission by the Public Utilities Commission to issue 6000 ares of capital stock at par, the proceeds to be used for extensions d retirement of bonds.

ELORA, ONT.—The by-law to contract with the Hydro-Electric Power ommission for 200 hp and authorizing an expenditure of $10,000 for e installation of a distribution system for same was carried.

FERGUS, ONT.—The by-law providing for power from the Hydro- lectric Commission and authorizing an expenditure of $16,000 for the stallation of a complete distribution system for the town was carried. he proposed transmission line will connect with the Prison Farm near uelph, and the substation will be located near the House of Industry roperty, about half way between Fergus and Elora.

FORT WILLIAM, ONT.—The City Council has deposited with the ublic Works Department plans for 500,000-circ mil, subaqueous armored ble for conveying electrical energy at 556 volts, direct current, from e power plant of the Kaministiquia Pwr. Co. across the Kaministiquia iver to Island 2, to furnish electricity for operating the extension of e municipal street railway.

IROQUOIS, ONT.—The Beach Hydro-Electric System has a customer r a second-hand 50-hp, 60-cycle, 2300-volt motor (must be in first-class ndition). M. W. Beach is manager.

LONDON, ONT.—The by-law authorizing an expenditure of $700,000 r equipping the London & Port Stanley railway for electrical operation as passed by the ratepayers on Oct. 22.

LONDON, ONT.—The city of London Hydro-Electric System expects o erect within the next three months an addition to the No. 1 substa- on (three stories high) to provide space for a 1500-kw rotary converter nd auxiliaries to furnish power for the street-railway system. E. V. uchanan is electrical engineer.

LONDON, ONT.—Negotiations have practically been completed be- ween the London Street Ry. Co. and the City of London Hydro-Electric System whereby the company will use hydroelectric power, the terms being that the company shall take a minimum of 1000 hp. In order to convert the energy from alternating current to direct current for street-railway use a rotary converter will have to be installed at a cost of about $20,000. The agreement is for a period of 12 years.

ST. CATHARINES, ONT.—The by-law authorizing an expenditure of $116,000 for the construction of substation and distribution system for the use of electricity to be supplied by the Hydro-Electric Power Commission of Ontario was passed on Oct. 30. The plans provide for a 2000-hp system. The transmission line will be erected by the Hydro-Electric Power Commission. W. P. Near is city engineer.

SMITHVILLE, ONT.—H. Gracey, of Smithville, is said to be con sidering the installation of a small electric plant driven by a gasoline engine, with storage battery auxiliary.

QUEBEC, QUE.—The Battlefields Park Commission has awarded the contract for lighting Battlefields Park to the Quebec Ry., Lt., Ht. & Pwr. Co.

YORKTON, SASK.—Tenders will be received by T. F. Acheson, secretary and treasurer of the town of Yorkton, until Dec. 22 for a 500-hp generating unit driven by a Diesel engine. For details see proposal columns. M. M. Inglis, of Yorkton, is electrical engineer.

## Miscellaneous

FAIRBANKS, ALASKA.—The Canadian-Klondike Mining Co., which owns a number of electric plants in this vicinity, is contemplating extending its transmission lines from Dawson to Fairbanks, via the Forty Mile, Eagle and Circle districts, plans for which are now being formulated.

JUNEAU, ALASKA.—W. L. Lass, superintendent, and R. P. Kennedy, assistant superintendent of the Treadwell Mines, of Treadwell, are contemplating organizing a company for the purpose of constructing a large hydroelectric power plant in the Long Lake and Speed River district, near Juneau.

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Nov. 24, for furnishing operating devices for monitor sashes, transformers, brass tubing, reinforcing steel bars, steel cable, steel wire, etc. Blank and general information pertaining to this circular (No. 807) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

# New Incorporations

SEBREE, KY.—The Warren Lt. & Pwr. Co. has been organized by G. H. Warren and others for the purpose of establishing an electric-light plant in connection with the plant of the Warren Milling Co.

FARMINGTON, MAINE.—The Franklin Lt. & Pwr. Co. has been incorporated with a capital stock of $750,000 to develop water-power plants, etc. The officers are: A. L. Fenderson, president, and C. O. Sturtevant, treasurer, of Farmington.

NEW PHILADELPHIA, OHIO.—The Ohio Ltg. Co. has been incorporated with a capital stock of $50,000 by W. A. Reiser, C. H. Slinghuff, M. Seibold, W. B. Gregson and William Schweitzer.

YOUNGSTOWN, OHIO.—The Mahoning County Lt. Co. has been granted a charter with a capital stock of $10,000. The incorporators are: Harry Engle, P. J. O'Neil, S. S. Conroy, L. A. Manchester and others. The company was recently granted a franchise in Youngstown on the condition that it would install a plant and have it in operation within two years.

KEIFER, OKLA.—The Keifer Lt. & Ice Co. has been incorporated by Charles H. Shone, Charles E. Petty, of Keifer, and D. W. Franchot, of Tulsa. The company is capitalized at $20,000.

AUBURN, PA.—The West Brunswick Lt., Ht. & Pwr. Co. has been chartered with a capital stock of $5,000 to operate in West Brunswick. The incorporators are: H. R. Carl, D. W. Nagle and B. K. Carl, of Auburn. The head office of the company will be located in Auburn.

PORT CLINTON, PA.—The Port Clinton Lt., Ht. & Pwr. Co. has been granted a charter with a capital stock of $5,000 to operate in Port Clinton. The incorporators are: H. R. Carl, D. W. Nagle and B. K. Carl. The offices of the company will be located in Auburn.

ROBSTOWN, TEX.—The Robstown Lt. Co. has been incorporated with a capital stock of $25,000 by R. R. McNeil, E. R. Sutherland and W. E. Pope.

TOLT, WASH.—The Tolt Wtr., Lt. & Pwr. Co. has been incorporated with a capital stock of $70,000 by R. B. McAdams and Robert McMurchie.

COOKSHIRE, QUE.—The Westbury El. Lt. & Pwr. Co. has been incorporated by Henry Alvin Worby, George W. Allard, Robert C. Cowling, Orin A. Osgood, Robert Bartholomew, Edward J. Planche and Cyrus M. MacRae. The company is capitalized at $75,000.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED NOV. 4, 1913.

[illegible] Assignor to Consolidated Stock Quotations Co., 16 Exchange Place, New York.

[illegible] PRINTING TELEGRAPH SYSTEM AND ALPHABET; D. S. Hulfish, W. J. Herdman and E. S. Lorimer, Toronto, Ontario, Canada. App. filed March 3, 1911. Employs simple manner of operating electromagnets and relatively larger number of printing types.

[illegible] CAPPING TOOL; D. M. Rossiter and L. Potter, Mount Vernon, Ohio. App. filed Feb. 8, 1913. For severing glass cylinders; has means for tensioning the heating wire which encircles the cylinder.

1,077,307. ELECTRIC HORN; R. R. Root, Cleveland, Ohio. App. filed March 31, 1913. Outstanding post on diaphragm is struck by armature which is supported on a spring tongue.

1,077,351. MEANS FOR CONTROLLING ELECTROMAGNETS AND SOLENOIDS; [illegible] Potter, Milwaukee, Wis. App. filed June 6, 1910. Prevents sticking of the plunger or armature of an electromagnet, particularly alternating-current, by inserting a resistance in parallel with the control switch.

1,077,355. ALTERNATING-CURRENT ELECTROMAGNETIC CONTROLLER; D. L. Hindquist, Yonkers, N. Y. App. filed March 3, 1911. Reduces volume of current required in starting, particularly for elevator work.

1,077,369. FUSE; E. E. Roberts, Hartford, Conn. App. filed Dec. 28, 1911. Inclosed type; relatively fine inner granular filling and a coarser outer granular filling which absorb and cool the gases evolved at fusing and vent the cooled gases.

1,077,372. ELECTRICALLY HEATED SADIRON; C. A. Shaler, Waupun, Wis. App. filed Feb. 12, 1912. Thermostat controls main and auxiliary heating coils without breaking the circuit.

1,077,374. DYNAMO-ELECTRIC MACHINE; C. E. Skinner and T. S. Scott, Wilkinsburg and Pittsburgh, Pa. App. filed Jan. 16, 1906. End portions of the armature winding which project from the core slots are supported in an annular bracket.

1,077,380. QUICK-BREAK SWITCHING MECHANISM; H. G. Wellman, Cleveland, Ohio. App. filed Feb. 5, 1912. Arcing at the contacts prevented by causing magnets temporarily to hold the switch levers closed until after the cams or other switch-closing devices have moved out of engagement with the levers.

1,077,395. MECHANICALLY OPERATED ACCELERATING MECHANISM; W. Deats, Yonkers, N. Y. App. filed Dec. 16, 1908. Particularly for alternating-current elevator motors; acceleration of motor effected by series of mechanically operated switches controlled by the motor itself.

1,077,398. ELECTRIC FOG-SIGNAL LIGHT; R. C. Douglas, San Francisco, Cal. App. filed Oct. 24, 1912. Slidable electrode holder with automatic means for feeding and retracting the same.

1,077,429. ELECTRICAL MEASURING INSTRUMENT; W. H. Pratt, Lynn, Mass. App. filed Aug. 14, 1911. Prevents the leakage flux from one element from affecting the other element of an instrument for measuring multi-circuit systems.

1,077,444. ELECTROLYTIC DIAPHRAGM; H. A. Wagner, New York, N. Y. App. filed May 3, 1912. Porous material containing metallic mercury in finely divided state and manganese dioxide.

1,077,451. ELECTRICAL CONTROLLING AND REGULATING APPARATUS; G. T. Ashley, Santa Monica, Cal. App. filed Dec. 13, 1909. Auto-starter which cannot be left in the "start" position or any other position except the "off" or "run" position.

1,077,479. DEVICE ADAPTED TO SHOW WHETHER AN ELECTRIC INCANDESCENT LAMP HAS BEEN IN USE; S. Klein, Berlin, Germany. App. filed March 17, 1910. Light-sensitive body incorporated in the lamp to indicate whether or not the lamp has ever been used.

1,077,503. AUTOMATIC VALVE; E. V. Anderson, Monesson, Pa. App. filed Oct. 18, 1911. Electrically controlled pilot valve controls flow of pressure to quick-operating supplementary valve.

1,077,507. ELECTRIC STORAGE DEVICE; H. P. Ball, Pittsfield, Mass. App. filed March 11, 1912. Has heat storage units which may readily be removed to the place where the heat is to be utilized.

1,077,539. BATTERY BOX; C. A. Mahla, New York, N. Y. App. filed March 6, 1913. Circuit-closing springs on the inside of the cover of the box eliminate need for any wiring connections.

1,077,558. TROLLEY-POLE RETRIEVER; C. B. Rodgers and J. A. Brennan, Bordentown, N. J. App. filed June 14, 1912. Pressure-operated device for depressing trolley pole when trolley wheel leaves the wire.

1,077,613. CONTROLLER FOR ELECTRIC MOTORS AND SIMILAR DEVICES; H. W. Leonard, Bronxville, N. Y. App. filed July 11, 1903. Motor starter, speed regulator and automatic protective devices are interlocked so that the several elements constituting the controller can be operated only in the proper sequence.

1,077,614 AND 1,077,615. CONTROLLER FOR ELECTRIC MOTORS AND SIMILAR DEVICES; H. W. Leonard, Bronxville, N. Y. App. filed July 11, 1903. Interlocking arrangement of starter, speed regulator and protective devices.

1,077,626. ALTERNATING-CURRENT APPARATUS; R. D. Mershon, New York, N. Y. App. filed April 27, 1910. Provides means whereby polyphase electrical apparatus may be operated on single-phase circuits.

1,077,627. ELECTROLYTIC CONDENSER; R. D. Mershon and J. S. Riddile, New York, N. Y. App. filed Dec. 14, 1910. Electrically connected collecting electrodes arranged at the ends of a series of side-by-side filmed electrodes.

1,077,628. ELECTROLYTIC CONDENSER; R. D. Mershon, New York, N. Y. App. filed Oct. 27, 1909. Transformer connected to the condenser electrodes, rectifier connected between the electrolyte and the transformer, and a battery in parallel with the rectifier.

1,077,635. ELECTRICAL RESISTANCE UNIT; E. J. Ovington, Los Angeles, Cal. App. filed March 3, 1911. Coiled resistance element screwed through perforations in a flat insulating sheet.

1,077,658. HEATING UNIT; F. M. Vogel, Pittsfield, Mass. App. filed June 12, 1913. For electric ranges; resistance element carried by cross strips loosely supported by angular side strips.

1,077,662. MOTOR-CONTROL SYSTEM; W. C. Yates, New [illegible] N. Y. App. filed July 2, 1912. Overload device inoperative d[illegible] starting of motor and an electromagnetic device inactive d[illegible] starting of motor and actuated by the motor current for rend[illegible] the overload device operative.

1,077,674. PRODUCTION OF REFRACTORY CONDUCTORS; W. [illegible] Coolidge, Schenectady, N. Y. App. filed Sept. 23, 1906. [illegible] tungsten filament by heating a shaped wire of tungsten powder [illegible] a binder of cadmium, mercury and bismuth in a current of g[illegible] remove exuded metal and prevent the formation of surface glo[illegible]

1,077,676. ELECTRIC HEATER; A. S. Cubitt, Pittsfield, Mass. [illegible] filed Sept. 21, 1910. Sectional heater made up of mechanically [illegible] nected channel supports each having a resistance suspended th[illegible] from the web member thereof and terminals extending up thr[illegible] the web member.

1,077,706. RANGE TRANSMITTER; J. L. Hall, Schenectady, N. [illegible] App. filed June 27, 1910. Embodies synchronously operating m[illegible] at sending and receiving stations with frictionally driven indi[illegible] at receiving station and electrically controlled latches for the [illegible]

1,077,711. HIGH-POTENTIAL INSULATOR; E. M. Hewlett, Sch[illegible] tady, N. Y. App. filed May 5, 1908. Insulator post with angu[illegible] adjustable metallic cap coupled to the end of the post.

1,077,717. MOTOR CONTROL; W. P. Jackson, Oakland, Cal. [illegible] filed June 18, 1912. In accelerating, when a certain predetermi[illegible] speed is reached the field strength is automatically reduced b[illegible] crease further the motor speed.

1,077,729. SYSTEM OF ELECTRIC METERING; K. Markau, Be[illegible] Germany. App. filed July 23, 1912. Metering system designe[illegible] induce consumers to use electricity freely for industrial and he[illegible] purposes during the period of light load but to discourage cons[illegible] tion of energy for such purposes during the period of peak load.

1,077,734. TERMINAL FOR METAL-SHEATHED WIRE; C. [illegible] Moore, Schenectady, N. Y. App. filed Jan. 18, 1913. End po[illegible] of the sheath is disconnected from the body of the sheath, and [illegible] inner working conductor is then connected to this disconnected t[illegible] nal portion of the sheath.

1,077,737. MOTOR-CONTROL SYSTEM; E. J. Murphy and J. [illegible] Probst, Schenectady, N. Y. App. filed June 20, 1912. Dyn[illegible] braking system for stopping motors quickly and safely.

1,077,739. TRAIN STOP; A. R. Mutton, Waterloo, Ia. App. [illegible] July 1, 1912. Cab-signal system with air-brake connections.

1,077,746. SNAP-SWITCH; J. G. Peterson, Hartford, Conn. App. [illegible] Sept. 22, 1911. Rotary snap-switch with special commutator a[illegible] blage and special support for the stationary switch blades.

1,077,749. MAXIMUM-DEMAND ELECTRIC METER; W. E. Po[illegible] Lynn, Mass. App. filed Feb. 19, 1910. Embodies a meter, a d[illegible] ential gear, a clockwork mechanism and a dial pointer.

1,077,792. VOLTAGE REGULATOR; W. S. Bralley, Schenectady, N[illegible] App. filed July 30, 1908. Includes an electrolytic cell of the al[illegible] num type in a circuit parallel to the circuit including the field w[illegible] ing of the generator.

1,077,802. MOTOR-CONTROL SYSTEM; F. E. Case, Schenect[illegible] N. Y. App. filed July 16, 1912. Obtains low voltage for co[illegible] circuit without use of a dynamotor by connecting a resistance a[illegible] the supply circuit and connecting the control circuit at some i[illegible] mediate point on the resistance.

1,077,817. STARTING DEVICE FOR ELECTRIC MOTORS; P. [illegible] ning, Schenectady, N. Y. App. filed June 27, 1911. Control sy[illegible] is automatically operated upon by the closing of a control circui[illegible] by means of a pressure gage or float switch.

1,077,829. CIRCUIT-BREAKER; A. Guerra, Celaya, Mexico. App. [illegible] Sept. 11, 1912. Includes a longitudinally expansible rod surrou[illegible] by a heating coil.

1,077,866. ELECTRICALLY HEATED COOKING DEVICE; H. [illegible] Ball, Pittsfield, Mass. App. filed June 8, 1912. Has a broiling c[illegible] ber with a heating unit in the top of the same and a cooking v[illegible] removably supported upon the heating unit.

1,077,877. CIRCUIT-CLOSING DEVICE FOR DOORS; W. H. F[illegible] Fort Worth, Texas. App. filed March 7, 1913. Includes a sp[illegible] pressed push rod and a pivoted abutment plate for the same, carrie[illegible] the door.

1,077,894. ELECTRODE; R. H. Stevens, Salt Lake City, Utah. [illegible] filed Sept. 29, 1911. Platinum-plated tungsten electrode for ligh[illegible] electroplating, batteries and electro-metallurgy.

1,077,895. SYSTEM FOR ELECTRICALLY CONTROLLING A[illegible] OPERATING RAILWAY-TRAFFIC-CONTROLLING DEVICES; [illegible] B. Taylor, Albany, N. Y. App. filed Aug. 12, 1910. Involves us[illegible] primary and secondary sources of energy of different potential.

1,077,913. HAMMER ACTION FOR MUSICAL INSTRUMENT; S[illegible] M. Keyte, Oakland, Cal. App. filed Oct. 8, 1912. Electro-pneum[illegible] cally operated and controlled.

1,077,914. COMMUTATOR; R. E. Noble, Chicago, Ill. App. filed [illegible] 2, 1910. Method of supporting the segments of an internal-con[illegible] commutator.

1,077,920. ELECTRODE; R. H. Stevens, Salt Lake City, Utah. [illegible] filed Jan. 27, 1913. Iridium-plated tungsten electrode for elec[illegible] plating electro-metallurgy and batteries.

1,077,937. TRAIN-CONTROLLING MECHANISM; R. T. and F. [illegible] Jones, Baltimore, Md. App. filed May 23, 1910. Ramp-rail syst[illegible] after automatic application of brakes, brakes cannot be released w[illegible] train is brought to full stop.

1,077,942. DYNAMO-ELECTRIC MACHINE; G. Sayre, Dayton, O[illegible] App. filed May 16, 1912. Self-regulating constant-current mac[illegible] which will maintain practically constant its own current output un[illegible] large variations of speed.

1,077,948. CIRCUIT-CLOSING DEVICE; W. W. Alexander (deceas[illegible] Denver, Col. App. filed Feb. 21, 1911. Contacts vibrated into [illegible] gagement with each other by the passing of a train.

1,077,953. METHOD OF AND APPARATUS FOR ELECTRIC WE[illegible] LNG; E. A. Faller, New York, N. Y. App. filed Feb. 13, 1913. C[illegible] bines in one organization electromagnetic holding means and elec[illegible] heating means.

# Electrical World

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**Concentration in Water-Powers**

At the conservation meeting in Washington this week figures were presented by Mr. Gifford Pinchot to show that concentration in ownership of water-powers is greater to-day than at the time of the last compilation on this subject under government auspices. Whether or not these figures are accurate they are of much less importance than some conservationists would have the public believe. The fact of the matter is that development of water-powers has made useful a large number of latent forces in the community which were doing no good to anybody. Undeveloped water-power made useful is an economic gain to the whole community. There must necessarily be also a monetary gain to those who advance the capital to create the enterprise and make it commercially successful. If no profits were likely, capital would not be forthcoming. If capital were not invested, the water-powers would remain undeveloped and conservation would be a fiasco. The largest possible use of energy generated by water-power means the largest possible measure of economy in coal. To the extent that the country prevents utilization of water-powers and delays the development of those mighty forces of industry, it depletes further the coal supply. If it encourages the greatest possible development of water-powers, it conserves the coal supply. The real issue is not whether one or ten large interests have made commercially successful many hydroelectric enterprises throughout the country, but what the effect of this has been, for good or harm, on the communities served. If those who propose to conserve the water-powers by leaving them to posterity for development will answer this question they will help and not hinder commercial progress.

**Utilization Versus Waste of Water**

A prominent example of the great economic mistake in allowing developed water-power to go to waste in a community where there is use for energy during light-load periods, and where steam plants are being operated to carry such light loads, is afforded by the hydroelectric installation of the Chicago Drainage Canal at Lockport. This plant supplies electric energy for the street lighting of Chicago to the extent of its permissible output during each night, but a large amount of energy goes to waste over the dam during daylight hours. At the same time, it appears that Chicago is about to be faced with a shortage of water-power for street-lighting purposes if electric street lighting is to be used over the whole city, because of the probable limit in the flow of the drainage canal. Leaving aside all petty politics, the obvious, sound, economic procedure in such a case is for the drainage canal plant to supply its cheap hydroelectric energy to the central-station systems of Chicago and surroundings during daylight hours and, in turn, to take the necessary surplus energy for operating the street-lighting system from the Chicago central-station systems at night. That such a plan might be opposed by cheap politicians on the one hand and by over-zealous and misinformed reformers on the other is probable, but the economic facts are as stated. The sooner the situation in Chicago and many similar situations can be straightened out along the lines indicated, the nearer will we be to true conservation of our natural resources.

**Electric Machinery on Automobiles**

An interesting trio of papers was presented last week before the American Institute of Electrical Engineers on the use of dynamo machines on automobiles. The first use of such machines was for ignition purposes. Next came small automobile generators for lighting the head-lamps, side-lamps, rear-lamps and inside lamps of the car, in conjunction with a storage battery. Later still came electric motors for starting the car engines by energy from the battery. It would manifestly be desirable to have one and the same small dynamo machine perform all of the three above-mentioned functions, not only on account of economy in first cost, but also on account of economy in space and weight carried. The difficulties in the way of such unification are, however, considerable owing to the fact that for lighting purposes the voltage delivered at the terminals of the ordinary lamp must be substantially constant, despite changes in the speed of the car. The result is that the electrical equipments thus far placed in service differ very widely in their details. Mr. Alexander Churchward, author of one of the papers, advocated a constant-speed generator coming into action at and above a car speed of, say, 8 miles per hour, with a slipping clutch such that at speeds above, say, 14 miles per hour the clutch will automatically permit of the right differential slip, so as to maintain constant generator speed. Such a plan would, of course, not be permissible if the generator had to supply a large amount of power, owing to the necessary low efficiency of the system at high car speeds. With the small amount of power actually demanded from the ordinary automobile generator, such slip-clutch, constant-speed generator-driving equipment becomes practicable and available until it can be superseded by an equipment equally effective and simple, but saving the energy lost in clutch-slip. The developments which have thus far taken place in automobile electric lighting are in many respects similar to those which formerly took place in the art of railroad-car electric lighting using axle-driven generators. The tendency there has been steadily toward simplification, but it must be remembered that while the railroad-car electric

equipment has to carry a much larger load than the automobile equipment, it is nevertheless freed from the demands for ignition and car starting.

### Suppressing Arcs at Switch Contacts

The method of suppressing sparking at interruptor contacts by shunting them with a condenser is well known and has long been used in connection with Ruhmkorf coils. The method has recently been studied by Dr. W. Burstyn, and detailed improvements suggested by the research have recently been published in *Elektrotechnische Zeitschrift*. The oscillatory-current circuit has received much attention during the last few years, in relation to radio-telegraphy. It is interesting to see the knowledge gained in that way reapplied to the proposed use of condenser circuits as shunts to alternating-current switch contacts. A properly designed oscillatory circuit, of a condenser and non-ferric inductance, is shunted across the opening contacts of an alternating-current circuit switch. On opening, an oscillation is set up in the branch circuit. By designing the switch contacts like those of a radio-transmitter quenched-spark interruptor, the oscillations extinguish themselves without arcing.

Whether the quenched-spark air interruptor can be brought into effective competition with the oil switch, in common use on high-tension circuits, seems very doubtful. Nevertheless, the details of the plan suggested are interesting and possibly may find application to oil switches themselves. It is evident that as the various branches of electrical engineering develop they are able to come to each other's aid in cases of difficulty in a manner which is sometimes surprising. The designer of a high-tension switch may have to familiarize himself with radio-transmission phenomena in order to eliminate certain difficulties with high-frequency oscillations.

### Measurements of Radio-Transmitted Energy

A very interesting article by Mr. M. Reich on some results of quantitative radio-transmission observations has appeared in *Physikalische Zeitschrift*. Measurements were made simultaneously of the current strength in an antenna at a sending station and in a tuned antenna at the receiving station. The ratio of received to sent current was measured at various wave-lengths, and also at various distances; that is, between different pairs of stations. Over a short distance (7 km) the observed received current was about 15 per cent short of the computed received current with 1-km waves, neglecting absorption, this loss being possibly attributable to imperfect ground conduction. With quarter-kilometer waves the loss increased to about 33 per cent. Over longer distances (a few hundred kilometers) the observed received current was only about half of the computed received current. The indicated loss was thus about 50 per cent. The loss was found to increase with drought and also with the frequency, the loss being greatest on short wave-lengths. Over hilly country the loss was greater than over flat alluvial soil. At night-time the loss was in general considerably less than in the daytime but was subject to greater fluctuations. About sunset the received current strength was found to undergo marked fluctuations. The particular sunset observations indicated two marked maxima, separated by about ten minutes of time. In this case both stations seem to have been approximately on the same meridian and the date seems to have been at the end of November. These two rapidly succeeding maxima, with a depression between them, might be explained by the solar shadow-wall theory. If so, the phenomenon of sunset double maximum should disappear at solstices, so far as concerns this particular pair of stations.

### Centralization of Energy Supply

A recent paper by Mr. C. Vernier before the British Institution of Electrical Engineers at Newcastle brings to the front the growing importance of concentrated supply. This is one of the points in which English practice is generally behind that in our own country. Mr. Vernier points out that, chiefly owing to the great number of small municipal undertakings maintained in isolation as a matter of local pride, the condition of the average British station as respects cost of production and load-factor is bad. When only some 2 per cent of the various undertakings show a works cost as low as 1 cent per kw-hr., even with British costs of fuel and labor, the need of reform is evident. The result is easily understood when one realizes that very few of the plants can boast of a load-factor as high as 25 per cent. This is one of the depressing effects of small municipal enterprises which do not appear on the surface but are very evident when a general view of the situation is taken. Contrasting this with the extraordinary results reached in some American systems, notably those about Chicago, one is impressed more strongly than ever with the economic value of the physical union of these scattered plants in a coherent and well-administered whole.

The difference between the trend of work here and that in England is still further emphasized by the fact that the density of population in England is more than twenty times that in the United States. If one stops to consider what this difference in density of service means, one plainly sees why it is that with relatively high costs of production the British stations are able to sell energy at a relatively low rate and yet present fairly creditable balance sheets. We know of no authoritative figures which plainly set forth the cost of distribution in American stations, but obviously, from the mere difference in density of population, it must be very much greater than in British systems, a fact which our commissions will do well to consider before trying to draw any parallel between rates here and abroad. The same difference bears directly upon the matter of overhead and underground distribution. Mr. Vernier feels keenly the disadvantages imposed on electrical distribution by throwing obstacles in the way of acquiring rights for overhead transmission lines, and notes how unfavorable is the situation of England in this respect compared with that of Italy and Switzerland, both of which countries have legislation compelling the granting of rights-of-way over private property. Once granted the right of eminent domain or its equivalent, it would be possible for the British

stations to be linked into great networks as is the practice here, which would greatly aid the economy of production and distribution and make it possible for the consumer to obtain energy at even lower prices than at present. At Newcastle some of these advantages are now being realized.

With respect to the introduction of such improvements in the case of municipal undertakings, Mr. Vernier very properly draws attention to the trend of work carried on in Germany, which is facing somewhat the same set of problems, and in particular mentions the co-operation of municipal and private undertakings in such work. Strasburg, for instance, owns a large block of stock in the company from which it and other cities obtain energy and several years ago was receiving more than $100,000 annually in clear profits from this investment for the relief of local taxation. The same co-operation between city and private investors is being tried in a number of other German cities with gratifying results. No stronger evidence of the soundness of the American practice of physical consolidation of small plants into a great system can be found than the contrast here furnished with British practice and the frank recognition of the value of the lesson thus enforced by American engineers.

## Combined Synchronous and Induction Motor Loads

The article which we print this week by Mr. H. L. Wallau clearly indicates the great commercial importance of the power-factor in distributing systems. It goes to show, for example, that the investment per kilowatt delivered, outside of land and buildings, is, roughly speaking, inversely as the power-factor, so that with a 50 per cent power-factor the investment per kilowatt sold is approximately double that at unit power-factor. Moreover, aside from the operating cost, the inconvenience and trouble in operating a system increases rapidly as the power-factor decreases. The author shows how much improvement may be effected in a low power-factor system by the judicious use of synchronous condensers.

The term "wattless" load used by the author might suggest that such a load of quadrature volt-amperes is devoid of watts or contains no power, thus giving a very false impression, because it is known that the quadrature load is just as "wattful" and imbued with true power as is the paying load. The active component of power carries the energy out of the circuit, mainly through the customers' meters, whereas the reactive component, or quadrature component, of power merely carries energy to and fro from one part of the circuit to another. If an express company having several offices in the same town engages in a delivery business for the sole purpose of carrying manufactured goods from its town offices to surrounding villages, it may constantly employ, say, 100 wagons, ninety of which are regularly occupied in the village-delivery work, from which the company's income is derived, while ten are regularly occupied in sorting and internally distributing the goods between the different offices in the town. The power-factor of such a system might be defined as 90 per cent, but the power of the wagons engaged in hauling goods to and fro inside the town, without any direct compensation, would be just as real power as that of the wagons engaged for paying load. Whenever energy is carried to and fro over a conductor, electric power exists and true watts exist, although such power may not win any commercial compensation and may be very wasteful economically. We purpose to publish a series of articles on the subject of synchronous apparatus applied to improving alternating-current circuit-operating conditions, and Mr. Wallau's article opens the subject from a very practical viewpoint. We believe that it will be of interest to all who are concerned with energy distribution, from either the scientific, the practical or the economic direction.

## Efficiency of Incandescent Lamps

In a recent letter to *The Electrician* of London, a writer criticises that journal for misuse of the term "efficiency" relating to tungsten lamps as expressed in watts per candle. The editor of *The Electrician*, in his reply, agrees with the writer but points out that his journal merely abstracted a paper recently read before the American Institute of Electrical Engineers, so that, by inference, he politely passes on the blame to the A. I. E. E. Of course, it is recognized as illogical to express the efficiency of an incandescent lamp in watts per candle, because the greater the efficiency thus numerically expressed the less the efficiency that the lamp must have. The Standardization Rules of the A. I. E. E. have long recognized this inconsistency, but unfortunately an attempt has been made to define the "efficiency" of a lamp first in "mean spherical candles per watt" and more recently in "lumens per watt" at the lamp terminals. This use of the term avoids the blunder of inversion, but is certainly far from correct, necessitating as it does a new and unwarranted change in the meaning of the word "efficiency" to cover this special case.

A writer employing "efficiency" in the sense of watts per candle ordinarily justifies himself on the score of extensive usage. He may, for example, persist in using a wrong term in his desire to avoid the appearance of pedantic chauvinism. We cannot help thinking, however, that no amount of usage can justify obvious misrepresentation. So long, for example, as a mile is a unit of length and an hour is a unit of time, it must be illogical to express speeds in "hours per mile." Such a practice, if it were actually followed, would be stultifying to the users, even though it were universally employed. It would be absurd and erroneous to express the efficiency of a motor in kilowatts per horse-power; it would be less absurd but equally erroneous to express it in horse-power per kilowatt, the only correct method being to allow the efficiency to represent the ratio of the output to input when expressed in the same units. Concerning the relation between watts and candle-power of incandescent lamps the best plan is obviously to speak of the watts per candle or watts per lumen as the "specific consumption" and the candles per watt or lumens per watt as the "specific output," and to allow the term "efficiency" to fall into innocuous desuetude. Some day, perhaps, when we are better acquainted with the laws of energy radiation than we are at present, we may return to the use of "efficiency," in relation to a lamp, in the same sense of a pure number, or the ratio of watts emitted luminously to total watts input at the terminals.

# The News of the Week

**Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.**

## Meeting of Public Policy Committee

The public policy committee of the National Electric Light Association met at the headquarters in the Engineering Societies Building, New York, on Nov. 17. The following were present: Messrs. Arthur Williams (chairman), Charles A. Stone, Henry L. Doherty, J. B. McCall, Samuel Scovil, Thomas E. Murray, W. W. Freeman, Herbert A. Wagner and Samuel Insull. A large part of the meeting was devoted to discussion of the subject of conservation and water-powers, which the committee has decided to study on the broad lines which characterize its consideration of large questions of public policy. This subject will be treated by the committee in a report. In connection with the discussion on this matter the following committee was appointed to attend the National Conservation Congress, which met in Washington this week: Messrs. W. W. Freeman, Herbert A. Wagner, H. G. Bradlee and Arthur Williams.

## Officers of Jovian Order in Baltimore

The Jovian Order of Baltimore has elected the following officers: Mr. William L. Wilson, president; Mr. J. W. Crowley, vice-president; Mr. Harry L. Lemmert, secretary; executive committee, Messrs. J. G. Johanneson, R. C. Fought, M. H. Jones, M. I. Dukehart, R. F. Bonsal and S. J. Blight.

The order plans to discuss the subject of electrification of railroad terminal property within the city limits of Baltimore. It is hoped that the first address on this topic will be presented before the order by Mayor Preston and that later a representative of the Pennsylvania Railroad Company will discuss the matter.

## Inauguration of Hales Bar Plant on Tennessee River

At Chattanooga, Tenn., Nov. 13 there was celebrated the opening of the 56,000-hp Hales Bar hydroelectric plant of the Chattanooga & Tennessee River Power Company described in an illustrated article in our last issue. Special trains carried to Chattanooga a large number of well-known financiers, engineers and public officials to take part in the ceremonies. Nearly 200 men of prominence were among the guests, the central figure being Mr. Nicholas F. Brady, son of the late Anthony N. Brady, who conceived and carried through the Hales Bar development.

To Miss Annie Gavit and Miss Jane Brady was given the honor of starting up the huge machine. Following this ceremony a buffet luncheon was served in the power house. With Mr. Paul J. Kruesi acting as chairman, addresses were made by Messrs. T. C. Thompson, Mayor of Chattanooga; B. T. Burt, general manager Chattanooga & Tennessee River Power Company; John A. Patten, president Tennessee River Improvement Association; Wilmer L. Moore, president Atlanta Chamber of Commerce; Newell Sanders, ex-United States Senator; T. E. Murray, vice-president New York Edison Company; C. J. Crowley, engineer for Jacobs & Davies, and Governor B. W. Hooper.

The party returned from the plant by special cars which conveyed them to Signal Point on Walden's Ridge, a place of great scenic interest. Here, at the Signal Point Inn, a dinner was served to the visitors by the Chattanooga Chamber of Commerce. Ex-Senator James B. Frazier acted as toastmaster and addresses were made by Col. John Bogart, Mr. E. B. Allman, speaker of the Alabama House of Representatives; Gov. B. W. Hooper, Mr. Thomas E. Murray, Mr. Adolph S. Ochs, publisher of the *New York Times;* Mr. Charles M. Jacobs and Mr. C. L. James.

## Vanderlip on the Society for Electrical Development

Mr. F. A. Vanderlip, president of the National City Bank, New York, has expressed in unmistakable terms his belief in the purposes of the Society for Electrical Development. In a recent letter relating thereto he stated that the society is founded on right principles and that it is constructive in every way. He says: "It is based upon the theory of broadening the scope of its members' activities and not of being in any way detrimental to one for the benefit of another. At the same time, its own success is so involved with good service to the public that mutual advantage must be derived from its activities. By the extension and the enlargement of central stations and the broader dissemination of electrical service much economy directly beneficial to the public can be effected. In the education of the public along the line of increasing electrical facilities, diverse load-factors can be obtained and service thus greatly cheapened. I believe the society, while based upon the natural desire for more business for its members, is at the same time doing real public service, and it should receive hearty support."

## A. I. E. E. Affairs

At a meeting of the board of directors of the American Institute of Electrical Engineers held in New York on Nov. 14 President C. O. Mailloux reported that the reorganization of the executive committee of the committee on organization of the International Electrical Congress of 1915 had been completed, as follows: Dr. Charles P. Steinmetz, honorary president; Dr. E. B. Rosa, honorary secretary; Mr. H. G. Stott, chairman; Mr. John W. Lieb, Jr., vice-chairman; Mr. C. O. Mailloux, chairman sub-committee on international relations; Dr. A. E. Kennelly, chairman sub-committee on program; Mr. Henry A. Lardner, chairman sub-committee on Pacific Coast relations; Mr. H. H. Barnes, Jr., chairman sub-committee on transportation; Prof. George F. Sever, chairman sub-committee on entertainment; Mr. Preston S. Millar, secretary-treasurer, and chairman sub-committee on publicity; Mr. F. L. Hutchinson, secretary A. I. E. E. (ex officio).

The board authorized the following meetings in addition to the New York monthly meetings and the midwinter and annual conventions: An Institute meeting in Washington, D. C., April 10, 1914, under the auspices of the electrophysics committee; an Institute meeting in Pittsburgh, Pa., April 23 and 24, 1914, under the auspices of the Pittsburgh Section and the committee on the use of electricity in mines; an Institute meeting in Pittsfield, Mass., May 29, 1914, under the auspices of the Pittsfield Section, and a Pacific Coast meeting in Spokane, Wash., September, 1914.

The president was authorized to appoint three representatives of the Institute upon the recently organized United States national committee of the International Illumination Commission, and $100 was appropriated as the Institute's one-third share of the United States national committee's contribution toward the expenses of the commission. The other bodies represented on the committee are the American Gas Institute and the Illuminating Engineering Society.

## Issue Between Public Service Commission and Company at Nevada, Mo.

Differences have arisen between the Public Service Commission of Missouri and the Nevada Water, Light & Traction Company, of Nevada, Mo., which will be taken to the courts. The commission holds that it has power to remove officials or employees of the company.

Mr. W. H. Hallett, attorney for the company, telegraphed to the *Electrical World* that the holding of the commission is in direct conflict with the decision of the Supreme Court of Missouri, to which the case will go on appeal by the company. The commission approved a rule requiring cash deposits to secure payment for meter service and also held that the consumer should be given the privilege of furnishing personal security in lieu of a cash deposit. The commission also held that it has power to change the rates fixed by franchise.

Upon inquiry by the *Electrical World* the commission telegraphed that citizens complained against the manager of the company, maintaining that his removal was for the benefit of the public. The commission states that the number of consumers had decreased. The commission holds that it has power to order a defendant corporation to remove a manager and secure the services of competent persons.

## Wakefield Municipal Plant to Purchase Energy

At a largely attended town meeting at Wakefield, Mass., Nov. 17 the citizens voted to discontinue electrical production at the local municipal lighting plant and to purchase energy from an outside source for a trial period of one year. The local lighting board announced at the meeting that outside energy can be secured at one-half the cost of operating the existing station. It was suggested that a reduction in rates from the present 15-cent to a 10-cent maximum would be possible under the new arrangement. At the meeting the fact was also brought out that municipal operation has cost the town about $240,000 more for street and commercial lighting than would have been the case had energy been secured at rates prevailing in the vicinity. The Malden Electric Company and other energy-supply organizations may be asked to offer competitive bids.

## The Electrical Contractor's Problems

At the meeting of the Kansas City Electric Club Nov. 11, Mr. J. G. Berrett, of the Holophane Works of the General Electric Company, and Mr. A. J. Burns, electrical contractor and secretary of the Electrical Contractors' Association of Missouri, both made addresses on the topic of the Society for Electrical Development. The aims and methods of the society were described, and members of the Kansas City Electric Club were urged to join in the national movement for popularizing electricity.

"I am looking forward to the time," said Mr. Burns in the course of his remarks, "when the contractor will have the same recognition as a business man that is accorded to the manufacturer and to the jobber. This can be accomplished only by educating the contractor in business methods and will be done to a great extent by the co-operative efforts of all the interests involved in the promotion of electrical consumption. At present the manufacturer and the jobber are setting too low a margin of profit for the contractor. They expect him to be able to make a profit on a margin of 10 per cent, although it costs him not less than 15 per cent and often 25 per cent to do business without a profit.

"The electrical construction work done by Kansas City contractors reaches above the half-million mark annually and is increasing every year, yet these contractors are not making money. It is to be hoped that central stations will in the near future be satisfied with the sale of electricity and allow the contractor to install and merchandise appliances at a profit."

## Supply Jobbers' Convention

*By Telegraph*

The November meeting of the Electrical Supply Jobbers' Association was held at the Homestead, Hot Springs, Va., on Tuesday, Wednesday and Thursday of this week. Sessions for members only were held on Tuesday afternoon and evening and on Wednesday and Thursday morning, with an open session on Wednesday evening. Routine work occupied the sessions on Tuesday, although some time was devoted to questions arising between the manufacturers and jobbers. The Wednesday morning session was addressed by Mr. Norman E. Webster, of Niles & Niles, certified public accountants, New York, and Mr. A. A. Gray, editor of the *Electrical Review and Western Electrician*, Chicago.

### Classification of Accounts

Mr. Webster spoke on sales analysis in the jobbing business. He emphasized the three principal points made in a paper read at the Chicago meeting last May as follows: First, that there should be such a classification and grouping of the expenses as would assist in ascertaining the cost of doing portions of the business separately from the other parts; second, that there should be such a classification of the sales as would disclose the profitable and unprofitable business, not alone on the basis of the percentage of gross profits but also on the basis of the percentage of net profit after deducting the expenses applicable to particular lines or classes of sales, and, third, that there should be a standard uniform classification for use by all jobbers, with the result that more valuable comparisons could then be secured.

Mr. Webster also said that the following conditions should be met. The accounting system should be such as to enable each jobber to be fully informed about his own business, even considering all its peculiar and varying conditions. It should be such that by comparisons of results on similar matters he can learn wherein his business is conducted more or less efficiently than others. It should be such that from the statistics of a number of houses average conditions can be ascertained and considered in their joint or individual dealings with those from whom they buy and to whom they sell, and that these average conditions may also be placed before other members whose methods are not in harmony with what are considered to be for the best interests of all. The accounting system should also be such that it will give this information promptly, much of it automatically, and also such that, in special matters, the information may be obtained before its usefulness is past. Finally, the accounting system should be one adapted to the conditions in small and large organizations, one in which the work may all be done in the ordinary way with pen or portions of it done by mechanical devices, and it should not be expensive.

Having previously suggested a classification of expenses, the author devoted most of his paper to the subject of sales

analysis, the following being a summary of the recommendations: First, that the sales, cost of sales and gross profits be classified broadly by lines of merchandise; second, by salesman's territory; third, by classes of customers; fourth, that sales be analyzed into stock and direct shipments and by classes as to the amount of the bills.

The entire matter is being put into a report by the accountants which will contain the definitions of the required accounts and forms for the monthly statements, and the association voted that the report be distributed to all its members.

### Economical Distribution of Supplies

Mr. Gray addressed the jobbers on the topic "The Electrical Jobbers as an Economic Factor in the Distribution of Supplies." According to Mr. Gray the electrical jobber is an economic factor in the distribution of supplies. His elimination or any movement in the direction of curtailing his usefulness would throw a burden upon the industry and increase the cost of energy-consuming devices to the ultimate consumer. This would retard the business and keep back the development of the industry. The jobber, however, will continue as an economic factor only so long as his organization renders easy the merchandising of supplies and co-ordinates his selling and service efforts with those of the manufacturer, so that material may pass from the latter to the consumer with the least degree of resistance and at the lowest possible expense in handling. As the demand for electrical material increases the demand will also increase for high-grade material at a reasonable price. The manufacturer of electrical apparatus has put a greater amount of skill, ability and courage into the production of his goods and has got less in return than the manufacturer in any other industry. The price of electrical goods is as low as is consistent with the production of standard material and an adequate return for the labor involved.

In this situation the supply jobber must so conduct his business that there shall be no additional burden thrust between the consumer and the producer.

### Society for Electrical Development

At the Wednesday night session Mr. H. H. Cudmore, of the Society for Electrical Development, outlined the aims and objects of that body in a convincing manner. His efforts were encouraged by Mr. E. W. Rockafellow, of the Western Electric Company, who read a letter from Mr. W. E. Robertson, who represents the Jobbers' Association in the Society for Electrical Development. Transmitted with the letter was a characteristic one from Mr. J. R. Crouse. Mr. W. N. Matthews, of St. Louis, the reigning Jupiter of the Jovian Order, also spoke in favor of the electrical development society, as did also Mr. A. A. Gray.

During an executive session Mr. A. D. Page, of the General Electric Company and representing the incandescent lamp manufacturers, addressed the body on the lamp-sale agreement existing between the jobbers, acting as agents, and the lamp manufacturers.

### Discounts in the Settlement of Accounts

At the closing session on Thursday morning the meeting was addressed by Mr. Frederic P. Vose, of Chicago, and Mr. H. R. Brand, of New York City. Speaking on the topic "Discounts in the Settlement of Accounts," Mr. Vose, who is secretary of the Electrical Credit Association of Chicago, said:

"Price terms and payment terms are of equal dignity in a bargain and sale. Yet payment terms mean something indefinite to the manufacturer, jobber and retailer, but something decidedly definite to the banker. The purchaser is inclined to think that 'cash discount' is added to the price of goods as a penalty to be suffered if he fails to pay within the discount period. Therefore, he concludes that he is entitled to deduct the 2 per cent at any time and thus bring the cost to him to the proper figure. Cash discount, however, is the premium offered for the use of ready money. If the seller does not get the use of the money, he should no more be charged for it than should the buyer be charged with goods that he does not receive. Terms of payment, it seems, have come to mean: thirty to sixty days, 'out of town'; ninety days, 'hard up,' and 120 days 'about to settle.'

### Protecting the Prompt-Paying Customer

"Every payment after maturity should be accompanied by the legal rate of interest. Regard it as a penalty when applied to a merchandise transaction, but it is the regular order for the banker. It is time the law merchant became equally positive in trade terms. Why should a prompt-paying customer be discriminated against? He pays according to the terms and his money helps to carry the slow customer who may be a trade pirate or an unfair competitor of the prompt-paying customer. Nothing but weakness on the part of the seller permits of the continuance of such unfair practices. Cash discounts insisted upon lessen the hazards of business. A customer should not be carried without interest from date due even to secure or to retain his business. To indulge him thus makes the manufacturer or jobber his banker without interest. Some buyers deliberately take unearned cash discounts and some sellers willingly extend the period. This is unfair competition and price cutting. The two main talking points in sales are, first, the goods (price, quality, efficiency and service) and, second, the terms upon which they may be obtained. Friction would be lessened if terms of payment were made plain at the outset."

Customers who cannot pay in thirty days should not look to the seller to carry them without interest. If the trade will not unite on insisting on interest on matured receivables, then, Mr. Vose insists, in fairness to the prompt-paying customer, the tardy-paying customer should pay an increased price. Another allied subject which he touched on was that of prompt and systematic collection methods, which not only benefit the seller but which tend to educate the buyer in handling the retailer or consumer. The customer should understand that the extension of uncertain credits ultimately works an increase in prices.

In conclusion, the author observed that if cash discounts for immediate payments cannot be done away with, then the jobbers' and the other active associations in the trade are big and strong enough to insist upon regarding sales contracts as being equally binding upon both vendor and vendee in law and morals. Anything short of that is unfair and lacks the primary elements of a square business deal.

### Daily Record of Net Profits

Mr. Brand outlined a system of accounting whereby net profits may be known daily. He likened his system to the steam gages, voltmeters, ammeters, etc., of the station engineer by the aid of which the latter knows exactly what his plant is doing every minute of the day. The author enumerated the various elements which combined make it possible to produce in any business a registration of business efficiency to such an extent that the manager can know from day to day the net worth of the business. The efficiency of both the producing and non-producing departments is also registered. The author is seeking to enlist the attention of trades associations in promoting his educational campaign so that he may bring about a universal condition whereby every business man will be fully protected against bad management. It is claimed that less bookkeeping and skill are required than with the ordinary system of accounting and that trial balances are eliminated.

The attendance at the Hot Springs sessions numbered about 260. The next meeting of the Jobbers' Association will be held at Washington, D. C., late in February. The 1915 convention is scheduled for San Francisco in May.

## Proceedings of the Fifth National Conservation Congress

The National Conservation Congress, which is the outgrowth of the conference of Governors of the states which met for the first time at the White House five years ago, held its fifth annual session at Washington on Nov. 18, 19 and 20, preceded on Nov. 17 by the annual meeting of the National Association of Conservation Commissioners and of the forestry section of the congress. The 1913 congress was devoted to forestry and water-power. Of these two subjects the latter occupied the principal attention of the congress, because of the situation in this country, in which the development of water-power resources has, in the opinion of many students, been greatly retarded.

Mr. Franklin K. Lane, Secretary of the Interior, who made the first address, urged co-operation between the states and the federal government. He said that the great difference among conservationists lies in the conflicting opinions as to state rights. It has been said that the United States is divided in opinion among Hamiltonians and Jeffersonians, between those who believe in a strong federal government and those who believe in a government more decentralized, between the federalists and the state rights men, but the truth is that in government the test is that of efficiency.

Mr. Lane added that the government is not wedded to any particular theory. It is wedded to the idea of practical tests which may work out something to better the country. It is indifferent to the agency employed. The states and the central government can co-operate, and manifestly there can be no success unless there is such co-operation.

The report of the committee on water-power was presented by Prof. George F. Swain, the chairman. The other members of this committee are Messrs Gifford Pinchot, Henry L. Stimson, ex-Secretary of War; Lewis B. Stillwell, of New York; A. F. Lever, Congressman from South Carolina; Charles R. Van Hise, of Madison, Wis.; M. O. Leighton, of Washington, D. C.; E. S. Webster, of Boston; B. M. Hall, of Atlanta, and Joseph N. Teal, of Portland, Ore.

### Majority Report of Water-Power Committee

Separate reports were presented by the majority and the minority members of the committee on water-power. The full committee, however, joined in making definite recommendations.

The report of the majority, presented by Prof. George F. Swain, chairman, was concurred in by Messrs. Lewis B. Stillwell, M. O. Leighton, Edwin S. Webster and B. M. Hall. This report states that there are three essentials of a sound water-power policy: (1) prompt development, (2) prevention of unregulated monopoly, (3) good service and fair charge to the consumer. The regulation of service and charge is usually a state or local function. It should be exercised by the nation only in interstate industry and possibly when the failure of other agencies might result in abuses.

The majority of the committee refers to three kinds of natural material resources, those which are not renewable, those which are self-renewing, and water-power which, if not utilized, is immediately wasted with no good results to anybody. The utilization of water-power for a purpose for which steam power, or some other form requiring the use of fuel, would be employed is not only the utilization of a freely given resource which would otherwise be wasted but it involves the saving of a corresponding amount of one of the non-renewable resources. The conservation of water-power, therefore, is a double conservation.

In conserving the non-renewable and slowly renewable resources, the avoidance of waste, maximum economy and economical and restricted use should be the guiding principles. In the case of water-power, however, a point of view almost the opposite of this condition, within proper limits, would seem to be the true one. Any proper use is better than no use at all.

The majority says that there would seem to be no form of individual enterprise more worthy of encouragement or which in the interest of true conservation should be made more tempting to the investment of capital than the development of water-powers. Laws and regulations governing the development of water-power should properly be made so that an adequate rate of return to the investor might reasonably be anticipated. While sometimes a water-power may be developed at slight expense, in many cases, if not in most cases, especially in the case of the largest water-powers, a very large investment of capital is necessary. Moreover, the risks attending this investment are often serious.

The majority says that three things are essential to induce the investment of private capital in water-power enterprises, as follows: definiteness in the contract, the prospect of a sufficiently attractive return commensurate with the risk involved, and the protection of the courts in case of disputes. Notwithstanding the fact that electricity is playing every day a more important part in social and industrial economy and the fact that the development of hydroelectric properties should be proceeding rapidly, there seems no doubt that present federal laws and the permits hitherto issued under them have brought about a condition of relatively slow development of water-power. The committee approves of the indeterminate form of franchise.

In conclusion, the majority says that because of the large first cost of water-power developments the risk of loss in case of failure of the enterprise is correspondingly large. Capital, therefore, does not need water-power enterprises, and it will not take them up to any considerable degree, unless fully protected.

### Minority Report of Water-Power Committee

The report of the minority, presented by Messrs. Henry L. Stimson, Joseph N. Teal and Gifford Pinchot, discusses the subject of concentration and development, stating that in the last two years the great power interests have increased their control of power held undeveloped more than twice as fast as they have increased their control of developed power. It declares that no right to use a public water-power should ever be granted, unless the grantee can show that it controls no water-power not developed or in process of development, or that there are sound reasons from the public viewpoint for leaving such controlled power undeveloped and asking for a further grant.

In conclusion, the minority says that while the effort to secure the passage of sound and needed water-power legislation has not yet succeeded, the passage of bad legislation has become increasingly difficult.

### Unanimous Recommendations of Water-Power Committee

The unanimous recommendations of the committee are in brief that the following principles should govern the privilege to use a water-power. For a definite period, sufficient to be financially attractive to investors, the privilege should be irrevocable except for cause reviewable by the courts. Thereafter the privilege should continue subject to revocation in the discretion of the government upon payment of the value of the physical property and improvements. After the expiration of the definite period, at recurring intervals of not more than ten years the amount of compensation and all terms and conditions during the next period of not more than ten years should be determined by the government. The privilege should be unassignable except by approval of the government. The privilege should be granted only on condition of development of the whole capacity of the site and as rapidly as the granting officer may require, giving due consideration to reasonable market demands and also on condition of continuous operation,

subject to such demands. The right to receive compensation for the value of the privilege, varying according to the conditions of each case, shall be reserved to the state or federal government from which the privilege comes. The government shall have the right to prescribe accounting methods. Upon revocation of a privilege by the government, the grantee shall be paid the fair value of the property exclusive of franchise and consequential damages. This shall cover necessary appurtenances for operation of the water-power and the transmission of electricity therefrom, but shall not include such properties as railroads, lighting systems, factories, etc., which are separate industries.

### Address of Gifford Pinchot

Mr. Pinchot said that the greatest necessity in the water-power situation and the next great step in conservation is immediate water-power development on terms fair to the public. Figures compiled by the United States Bureau of Corporations and brought up to date by the National Conservation Association show beyond question, Mr. Pinchot added, that the central fact in the water-power situation is concentration of control. Concentration in water-power has nearly doubled in the last two years. The ten greatest groups of water-power interests to-day control nearly twice as much water-power as the ten greatest groups of two years ago controlled then. The ten greatest groups of to-day control 65 per cent of all the developed water-power in the United States, and a single group, composed of the General Electric interests, controls 40 per cent of all the developed commercial water-power in the United States.

Mr. Pinchot declared that in the last five years the concentration of control in the ten greatest groups has increased about seven times faster than the total of all water-power development in the United States. The ten greatest groups have increased their control of undeveloped power in the last two years more than twice as fast as their control of developed power. In ten states one company and in seven States two companies control from 42 to 96 per cent of all the developed commercial water-power, and in fifteen of these seventeen States each of these companies was organized or reorganized within the last three years.

It is argued that concentration of water-power control is increasing faster than power development because high risks and low returns keep capital away. But, according to the figures published by one of the ten greatest groups of power interests, in the last ten years the net earnings of the gas and electric companies of the United States have never dropped below 8 per cent, as against 4.25 per cent for railroads and 7.79 per cent for industrial corporations. As shown by the annual amount of securities in receivers' hand per $100 of outstanding securities, the water-power interests are nearly five times safer investments than railroads, more than five times safer than industrial corporations, and about as safe as national banks.

Water-power as a natural monopoly is peculiarly subject to industrial monopolization and offers peculiar inducement to monopolistic control, Mr. Pinchot said. Since it costs less to produce than steam power while the price at which it can be sold is substantially determined by the competitive cost of steam, water-power is extremely profitable, as the eagerness to get possession of it sufficiently proves. The control of any source of mechanical power—coal, oil, natural gas, water-power—carries with it control over the industries which require the power, as the rapidly increasing domination of water-power interests over electric light and street-railway companies well illustrates.

Continuing, Mr. Pinchot said that under these circumstances the control of the water-power business, like the control of oil, meat and anthracite coal, is passing into a few strong hands. Like coal, meat and oil, mechanical power from falling water is a necessity of modern life. Control over a necessity of life is control over the people who must have that necessity. Private monopolization of any necessity of life means private control over the people without responsibility to the people. It means also the power to increase the cost of the necessaries of life, and therefore the cost of living, without regard to the public interest, up to whatever point will yield the largest profit.

Mr. Pinchot argued that the commonest and most plausible argument of certain water-power interests is that full protection to the public interest will check development, while the conclusive answer should be that in actual practice it does not.

Under regulations of the Forest Service, which include also the provisions objected to by certain power interests as sure to hamper development, there were in the national forests on Oct. 1, 1913, according to Mr. Pinchot, seventy-eight water-powers developed, thirty under construction and no less than seventy-six, capable of developing 728,300 hp at low water, for which permits had been taken out within the past two years, under conditions requiring prompt development. The total rating of all these powers is about 1,090,000 hp reckoned on minimum stream flow, or not less than twice that amount in actual fact. The speaker quoted these figures as finally and completely disproving the claim so often heard that proper government regulations check development.

In concluding, Mr. Pinchot said that since water-power first became a public question the friends of conservation have done their best at every session of every Congress to get consideration for legislation fair to both sides. At every session certain water-power interests which would be satisfied with nothing less than all checked the movement or killed the legislation. Year by year, nevertheless, it has grown more certain not only that the public must have some consideration but actually that the public rights come first. Some fair-minded water-power men have seen this all along. When their influence predominates with the water-power interests, as it soon will do, the speaker declared, a better day may be expected.

Declaring that the cause of conservation is to face this winter in Washington the most serious fight in its history, Mr. Charles Lathrop Pack, the retiring president of the congress, said that perpetuation of resources could be best achieved by present use along scientific lines.

Describing the work of the Canadian Commission of Conservation, James White, Deputy Commissioner, said that an investigation of the water-powers of British Columbia and the prairie provinces has been carried on during the last three years. Recommendations have been made to the various governments urging the leasing of water-powers for a definite period on condition of prompt development and compensation to the crown and control of rates. These principles have been adopted for water-powers in Ontario, Manitoba, Alberta, Saskatchewan and in a modified form, in British Columbia. The other provinces will probably introduce similar legislation soon.

The congress adopted the principles on which the members of the committee agreed unanimously. In connection with the discussion of the report, however, acute differences on the subject of federal and state rights developed. The delegations from Arkansas and Washington left the convention, charging that the congress was filled with employees of the Government Forest Service and former employees of the government. The issue on the question of federal or state rights was raised by the presentation of the two reports on the subject of water-power, the majority report favoring the regulation of service and charges by the state or local government and the exercise of such a function by the nation only in interstate industry and possibly when failure of other agencies might cause abuse, while the minority report favored federal regulation. Dr. Charles R. Van Hise did not sign either report.

## Electrical Equipment of Gasoline Automobiles

At the 288th meeting of the American Institute of Electrical Engineers, held at New York, Nov. 14, the general subjects of electric lighting and self-starting of gasoline motor cars were discussed in papers presented by Messrs. Alfred E. Waller, Alexander Churchward and Frank Conrad.

The design of motor-car lighting apparatus, said Mr. Waller in his paper, entitled "Dynamo Electric Lighting for Motor Cars," should begin with the choice of satisfactory lamp equipment. This fixes the power required and indicates the generator rating needed. For head-lamp purposes the 21-cp, 6-volt tungsten lamp with a 10-in. parabolic reflector has been chosen as most satisfactory. For the side and rear lamps 4-cp and 2-cp units give ample light, the limiting size being only the strength of filament necessary to withstand the motion of the car.

Much of the mileage covered by the average motorist is traversed at a speed of 18 miles an hour or less, so that the generator must come into operation at low rates of car travel. Provision must also be made for protecting the generator at very high car speeds. Among the methods of regulation employed are slipping clutches, governor-controlled resistances, use of high armature reaction, bucking field windings, iron-wire armature coils, auxiliary poles excited by cross magnetization, ballast-type feeder circuits and cam-opened brushes. The author recommended the two-wire system of distribution, pointing out that the single-wire scheme with car-frame return may bring about ignition complications. He also urged that manufacturers of car-lighting systems cut all wires and connections to length and have them properly marked so that mistakes by unskilled installers will be avoided.

### Clutch-Type Generators

Mr. Alexander Churchward discussed the "Advantages of Clutch-Type Generators and Separate Starting and Lighting Units for Motor Cars." The advantages of constant-speed dynamos for automobile lighting were enumerated by the author as follows: The battery is charged with a current roughly inversely proportional to its own condition of charge. The generator runs at low speed, avoiding wear and adjustment. Its efficiency even with much slipping of the clutch is higher than with certain schemes of electrical control. It can be geared to cut in at very low car speeds.

For cranking purposes all traction experience has shown the advantage of the series-type motor with steep torque characteristics. The author therefore recommended the use of a double-unit system comprising a shunt-wound dynamo for battery charging and a series motor for self-starting. Such a 6-volt double-unit set, he insisted, is as light and cheap as a single-unit equipment and will be more efficient per pound than any system designed for a higher voltage.

### Proper Ignition with Car-Speed Variations

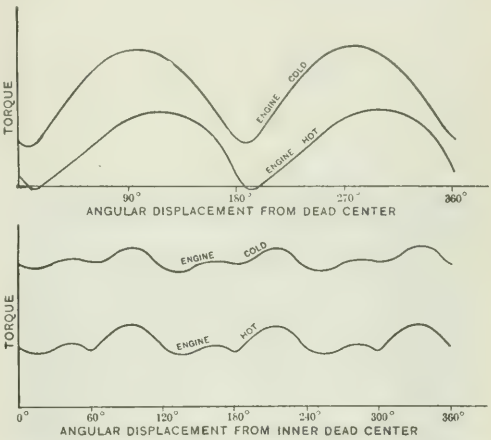
Mr. Frank Conrad, author of the paper on "The Electrical Equipment of Gasoline Automobiles," discussed first the relative merits of various ignition systems, advocating as best the use of an induction coil operating from a constant-potential circuit in connection with a device that will limit the current at low speeds. By means of a mechanism comprising two centrifugal cams which change their position with change in car speed, the contact device can be held closed for a constant period of time, regardless of the car speed. Incidentally the instant of break is advanced with increase of speed, to allow for the time required for the cylinder mixture to explode. The lighting generator chosen, said Mr. Conrad, should be able to supply the ampere demand of the lamps with the car running at 15 miles per hour. The author advocated the use of a demagnetizing series coil in the battery circuit as a means for maintaining constant charging current. He also advocated use of a separate starting motor in order to avoid complication.

In opening the discussion Mr. John M. Hipple, who, as chairman of the industrial power committee, was appointed by President C. O. Mailloux to preside at the evening's technical discussion, made the comment that the design of electrical equipment for gasoline automobiles is still in its early development and that certain of the unfit equipments now on the market must be eliminated in order to preserve the good name of electric-lighting and self-starting devices.

### Requirements of Car-Lighting Systems

Mr. H. Ward Leonard recounted his own early work in the train-lighting field and outlined briefly as follows the nine requirements of an electric generating system designed to be driven from a varying-speed source: (1) limiting of dynamo current, (2) automatic removal of battery sulphate, (3) avoidance of auxiliary devices and supplies, (4) freedom from wear and adjustment, (5) independence of temperature changes, (6) close control of regulating devices, (7) automatic control of overcharge, (8) automatic indication of battery charge, (9) supply of lamps from the dynamo alone in case of accident to the battery system.

Mr. Leonard Kebler questioned Mr. Churchward's claims for the high efficiency of the slipping-clutch generator and declared that large losses are produced by friction at the clutch. Such clutch mechanism, added the speaker, involves rapid wear and consequent adjustment.




TURN-OVER TORQUE OF FOUR-CYLINDER AND SIX-CYLINDER AUTOMOBILE ENGINES

Mr. Almon W. Copley also challenged Mr. Churchward's claims for clutch-type operation and declared that the wear of the chains and gears and the adjustment of the clutch must be considered. Mr. Copley expressed himself as an advocate of the single-wire grounded system of connections, which he declared permits better insulation, occupies less room and simplifies the insulation problems of sockets, lamps and fixtures.

### Two-Wire Versus Single-Wire Systems

Mr. A. D. T. Libby referred to the 6-volt limitation early put upon the automobile lighting industry and advocated the use of higher pressures, suggesting 12 volts for automobile use. An accidental ground on a single-wire system, he declared, may put all the electrical circuits on the car out of commission.

Mr. Harold Goodwin, Jr., pointed out that in a two-wire system one side often becomes grounded without attention being called to the fact, so that while being operated in this condition a second ground would completely disable the electrical equipment. For this reason he advocated the use of a single-wire system in the first place.

In a written discussion Mr. C. L. Wilson described tests made on a clutch-type generator and presented curves for comparison with those in Mr. Churchward's paper.

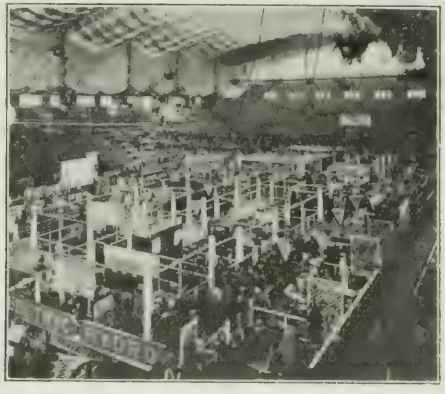
Mr. B. F. Bailey in a written discussion described the mercury type of switch devised by him for controlling a differentially compounded generator. He also questioned Mr. Churchward's assertions concerning slipping-clutch efficiencies. For lighting, starting and ignition purposes the writer recommended the use of a single generating set.

Mr. Kingston Forbes discussed the subjects of lighting and starting from the automobile engineer's standpoint. He referred to single-wire and two-wire systems of distribution and single, double and three-unit electrical equipments, concluding by recommending a combination ignition and lighting generator, with a separate series motor for cranking.

## Electrical Shows at Toronto and Montreal

At Montreal, Que., from Nov. 1 to Nov. 8 an electrical show was held in the local Arena, while from Nov. 10 to Nov. 15 a similar exhibition was given at Toronto, Ont. Both shows were devoted largely to electric household appliances and devices for popularizing the use of electricity.

At the Montreal exposition the Montreal Light, Heat & Power Company was the chief exhibitor. Its large booth displayed heating and cooking appliances, lamps, motors, etc. Another attractive display of general interest was that of the Montreal Electrical Society, which showed samples of cables, wires, cords, materials, telephone apparatus, storage-battery parts, etc., of historical and educational interest. Several Canadian-built electric vehicles were also on exhibition by a Walkerville (Ont.) manufacturer.



TORONTO ELECTRICAL SHOW

The Toronto electrical exhibition, which was held in the Arena Gardens, was opened Nov. 10 by Mr. P. W. Ellis, chairman of the Toronto Hydro-Electric Commission. The speaker described the development of Niagara water-power and said that as the result of the provincial distribution scheme electricity has been brought into 20,000 homes in Toronto. The Toronto Hydro-Electric Commission exhibited a model house equipped with electrically operated laundry machinery, sewing machines, etc., and also displayed a model machine shop and office. Electricity on the farm was the subject of the display made by the Hydro-Electric Power Commission of Ontario. Four cows were milked nightly by an electrically operated vacuum apparatus, while motor-driven ensilage and straw cutters, cream separators and butter rollers were in continuous operation.

## Illumination of Street-Railway Cars

Messrs. L. C. Porter and V. L. Staley, of the General Electric Lamp Works, at Harrison, N. J., presented a paper on "The Illumination of Street Railway Cars" at the meeting of the Chicago Section of the Illuminating Engineering Society Nov. 12. For car lighting, compared with carbon lamps, declared the authors, tungsten units produce better illumination at a saving in lighting expense. Where tungsten lamps are used it is desirable to install efficient reflecting devices, and in all cases a light interior car finishing is to be desired. The tungsten lamp for car lighting has reached a life of 2000 hours in laboratory test and from 1200 to 1500 hours under service conditions. The strength of the lamp is such that it withstands surprisingly bad operating conditions. It has practically superseded the tantalum lamp for car illumination.

The results of a study of car lighting made by Mr. G. H. Stickney, of the General Electric Company, with the cooperation of Mr. E. W. Holst, of the Bay State Street Railway Company, were given. Two methods of placing the lighting units were tried, one being the use of a single row of fixtures down the center line of the car and known as center-deck lighting. The other provides a double row of lighting units, one under each half-deck. There is little to choose between these two methods in efficiency, but the center-deck system is somewhat simpler and easier to install and maintain. With the center-deck system two circuits of 56-watt lamps, or one of 94-watt lamps, are used, and with the half-deck lighting 23-watt or 36-watt lamps are usually employed. It has been found that from 2.5 to 3 ft.-candles is desirable on the reading plane of passengers. This plane is considered to have an angle of 45 deg. 3 ft. above the floor. With either the center or half-deck lighting where efficient intensive-type reflectors are used approximately 82 lumens per running foot of car body will supply this illumination. This corresponds to about 10 watts per running foot, or 1.25 watts per square foot of floor area.

Tests have shown that with the common dark-yellow finish of street cars the efficiency of light utilization is approximately 15 per cent where no reflectors are used and 30 per cent with a good direct reflector system. On one cars where the finish of walls and ceiling was white, a utilization efficiency as high as 60 per cent was obtained. One pronounced advantage of the tungsten lamp over the carbon unit for car lighting is that the candle-power changes less on fluctuating voltages. Mr. Porter, who read the paper, gave a demonstration to illustrate this fact. Four tungsten lamps have been especially developed for railway service, rated at 23, 36, 56 and 94 watts respectively. The efficiency of the two smaller sizes is 1.34 watts per candle, and of the two larger sizes 1.20 watts per candle. Figures were given to show the economy of tungsten lamps compared with carbon lamps. The ultimate saving will warrant the re-wiring of old cars to enable tungsten lamps and reflectors to be used.

### *Discussion*

Dr. M. G. Lloyd, chairman of the section, presided and spoke of the practical importance of the subject. Mr. J. R. Cravath, of Chicago, suggested that the railways prepare their own designs for reflectors, which should be simple and easily cleaned. Glassware should be heavy enough to withstand railway service. Suitable reflectors double the efficiency of lamps for car lighting. For the eye-comfort of passengers bowls should be deep.

Mr. A. J. Sweet, of Milwaukee, told of the work he has done in studying the lighting of steam-railroad day coaches. He favors the center-deck arrangement of lamps, particularly on steam roads where seating arrangements are standardized. Mirror reflectors are, of course, the most efficient, but almost any reflector is better than the bare lamp. The design of the reflector should be mainly of the

intensive type but should also have some features of the extensive-reflection type to provide light at the sides of the car.

Mr. H. H. Adams, of the Chicago Railways Company, said that the recent arched-roof cars on his company's system had originally an interior finish of a pea-green color. Bare lamps are used and the speaker made experiments to see what improvement could be effected in changing the color of the car ceilings and walls. A light buff was finally selected and this made an improvement of 50 per cent in illumination. Reflectors are no doubt valuable, but in using them the appearance of the car should be taken into consideration.

Mr. Porter referred to tests made by a steam railroad where modern prismatic reflectors and shade-holders were installed in an old box car. This car was subjected to impact from a locomotive going first at the rate of 5 miles an hour, then at 10 miles an hour, and so on. A speed of 40 miles an hour, Mr. Porter said, was necessary before the collision shattered the reflectors in the box car. Mr. Sweet had said that he thought the center line of fixtures objectionable where longitudinal seats are used, but Mr. Porter said that the angles of reflection are such that this objection is not a serious one. As to the life of tungsten lamps used in car lighting, Mr. Staley remarked that it is hard to get actual figures. The Bay State Street Railway Company of Massachusetts has been getting an average life of 1500 hours, including breakage, stealing and all the incidents of service. Under laboratory conditions the tests show a life of 2200 hours for street-railway tungsten lamps.

An interesting feature of the meeting was a small but good collection of reflectors, car-lighting fixtures and conduits shown by the Holophane Works of the General Electric Company, Macbeth-Evans Glass Company, National X-Ray Reflector Company, Adams & Westlake Company, Safety Car Lighting & Heating Company, Appleton Electric Company and the Crouse-Hinds Company.

## Franchise Report Before Municipal League

A report of the committee on franchises was presented at a meeting of the National Municipal League held at Toronto on Nov. 15. The committee expresses the view that at present there is a tendency toward too great centralization in the control of public utilities and says that under some of the forms of public utility laws the powers of municipalities to control local utilities are being curtailed seriously or taken away entirely.

The judgment of the committee is that the league should inquire carefully into the significance of the movement for exclusive state control in the matter of public utilities. Certain features of exclusive state regulation tend to make the municipalization of utilities more difficult. The committee is of the opinion that in most cases regulation cannot be either logical or effective without the active cooperation of both state and local authorities. One of the arguments advanced is that a city must have control of its streets. At the same time it is clear that in the country and in small towns public authorities are wholly lacking in equipment for the regulation and control of public utility corporations. For this reason the committee concludes that it appears desirable that a state commission shall have general jurisdiction over public utilities throughout the State so that no companies may escape adequate regulation.

The report declares that every city of sufficient importance to enjoy the powers of home rule and the framing of its charter should have the right to establish a separate department, bureau or commission for supervision of utilities operating within its limits to such extent as may be necessary for the protection of distinctively local interests. Even in the larger cities, however, the State should still have jurisdiction over certain important matters. These matters are mentioned in the report as the regulation of security issues, the adoption of a uniform system of accounts, and the determination of certain fundamental questions which relate to stability of the investment. The committee is inclined to the opinion that rate-making should be recognized as a function in which local and state authorities may properly co-operate.

The committee believes that it is essential to proper development of the utilities of any city and to full realization of the principles of public control that in all cases where outstanding franchises run in perpetuity or for unreasonably long periods the city should definitely set about devising means for recapturing them. The report is signed by Messrs. Delos F. Wilcox (chairman), Robert Treat Paine, James W. S. Peters, Abraham E. Pinanski, Charles Richardson and Clinton Rogers Woodruff.

Prof. Edward W. Bemis did not sign the report. He adds a note saying that, while he agrees in the main with the views presented, he doubts the wisdom at the present time of lodging in any state commission any control of the capitalization or rates of public utilities in the larger cities, especially west of New York State.

## European and American Lamps and Lighting

At a joint meeting of the New York Sections of the Illuminating Engineering Society and the National Electric Light Association held on Nov. 17 recent developments in lighting and European lighting practice were described in papers by Messrs. H. W. Jackson, of the General Electric Company's laboratories at Harrison, N. J.; Alexander Maxwell, chief of the laboratories of the New York Edison Company; S. G. Rhodes, engineer of meter testing for the New York Edison Company, and C. F. Lacombe, chief engineer of the light and power bureau of the Department of Water Supply, Gas and Electricity.

Mr. Jackson described and demonstrated the high-efficiency nitrogen-filled tungsten-filament lamp, the development of which is attributable to the research work of Dr. Irving Langmuir, Schenectady, N. Y.

Mr. Maxwell described and demonstrated the neon-vapor tube lamp developed by Mr. George Claude, of France.

Mr. Rhodes, who recently returned from a trip to Europe, where he made a study of existing street-lighting installations, described various features which differentiate European from American practice in this respect.

Among the various types of meters discussed particular attention was called by Dr. Rhodes to ampere-hour, maximum-demand, two-rate and clock units. Ampere-hour meters are employed extensively and seem to prove satisfactory largely by reason of their low cost. The circuit-opening type of demand-limiting device is utilized with good results with lighting loads, but is not highly satisfactory for use with heating and similar loads. Two-rate meters prove useful in numerous localities where the charge per kilowatt-hour depends upon the time of demand. These meters are usually arranged to give separate indications of the consumption during the low-rate and high-rate periods, the total charge for service being calculated from the two readings. Elaborate time switches have been devised and are being used for signs, street lamps and similar installations. In some cases the clocks close and open the circuit each night in accordance with the period of darkness, the time of opening being varied automatically with the seasons.

Mr. Rhodes stated that in comparison with American standards European wiring is cheap and perhaps unsatisfactory. He questioned, however, whether the American standard requirements are not too severe when the cost and risk are properly considered. The cheap wiring scheme

involving the use of a single, centrally placed insulated wire with an outer metallic-tube conductor protecting the insulation was described as one well worthy of introduction in this country.

Mr. Lacombe, who has also just returned from a European trip, spoke particularly of the street lighting in Europe, which he said is better on certain streets than that in America, although there are no actual "white ways" on the other side.

## Electric-Vehicle Salon at Boston

Under the auspices of the Electric Motor Car Club of Boston an electric-vehicle salon, said to be the first of its kind, was opened in the ballroom of the Copley-Plaza Hotel, Boston, on Nov. 17 and continued for three days. Twenty-nine of the latest pleasure-car models were exhibited amid tasteful floral decorations by makers of the following vehicles: Bailey, Baker, Buffalo-Babcock, Detroit, Ohio, Rauch & Lang, Standard, Waverley and Woods. Four types of batteries—the Edison, Exide, Harwood and Philadelphia—were also shown.

Special efforts were made to demonstrate the appeal of the electric passenger car to the ultra-fashionable element



ELECTRIC-VEHICLE SALON AT BOSTON

of society without the usual commercial accompaniments of an automobile show. Leaders in Boston social life were among the patrons of the salon, and there were about 10,000 invitations issued to persons of recognized social standing in eastern New England. A reception and tea were held on Monday afternoon, presided over by the wives of the chairmen of the various committees. All visitors were furnished with catalogs as in a picture salon, and an orchestra added to the attractions of the display. No booths or advertising signs were permitted. A special parking committee cared for the cars of visitors attending the salon, which aroused great interest in the electric automobile among people of means. New England central stations co-operated in the issuing of invitations.

At the formal opening of the salon on Monday night Past-president W. H. Blood, Jr., of the Electric Vehicle Association of America, addressed a large and representative gathering, reviewing the history of the electric pleasure car and contrasting the designs of early days with those exhibited. He emphasized the point that even the early cars gave reliable, though costly, service. Their underlying principles were correct, but the working out of these ideas was crude. The modern electric vehicle appears before the public as a perfected article in which simplicity, durability and beauty are the three points of special superiority. The coach builder's art has reached its climax in the design and construction of the modern electric coupé. The storage battery of to-day lasts twice as long as those of a few years ago, while electric motors are practically indestructible. Mr. Blood also touched upon the development of the commercial car, outlined the special field of the electric machine as supplementary to that driven by gasoline, and in closing pointed out the tendency toward lower costs of electrical service in contrast with rising prices for gasoline. He cited the benefits of the "salon de l'automobile" held regularly in Paris, and expressed the hope that "le salon de l'automobile électrique de Boston" might prove to be a pleasure to the public and a profit to the exhibitors.

During the salon attractive electric signs announcing the event were installed in the hotel. The Tenney companies, operating about thirty-one public utilities in various Eastern muncipalities, provided a woman demonstrator, who introduced prospective customers to the exhibitors and also explained her personal experience in electric automobile operation.

Superintendent W. H. Atkins, of the Boston Edison Company, gave a luncheon on Tuesday noon to a number of prominent electrical men identified with the central-station industry in eastern Massachusetts.

## Mr. Arnold on Chicago Terminal Electrification

At a meeting of the committee on railway terminals of the Chicago City Council, Nov. 18, Mr. B. J. Arnold made public his report on a plan of rearrangement and development of the steam-railroad terminals of Chicago. The report, which had been previously submitted to the citizens' terminal-plan committee, makes a book of 237 printed pages with many diagrams and maps and was prepared within sixty days. It is commented upon as being a remarkable document to have been compiled in such a comparatively short space of time.

In his report Mr. Arnold reviews the proposals of Mr. John F. Wallace on the subject of railway terminals, presented to the Council committee Oct. 20. Mr. Wallace had recommended that the plans of the Pennsylvania Railroad for a new union passenger terminal be adopted and that the same company's scheme for a freight terminal be accepted with some modifications. Mr. Arnold has gone into the same subject much more extensively, and instead of mild acceptance of the railroad companies' demands asks for their co-operation in the extension of terminal facilities along certain lines which he lays down. These provide among other things for the straightening of the South Branch of the Chicago River and for the placing of all tracks in covered subways beneath the street level in the district bounded by Lake Street, Halsted Street, Twelfth Street and Lake Michigan.

Long-distance passenger traffic, it is urged, should be concentrated into the fewest number of terminals practicable, and details of arrangement are suggested. The city plan of Chicago should be supported, continues Mr. Arnold, and the passenger terminal plans co-ordinated with the local street-railway facilities, including the proposed subways. The improvements suggested in the report would practically necessitate electrification of the tracks, nevertheless this view is not introduced as an attempt to force electrification, for Mr. Arnold says that nearly all progressive steam-railroad men recognize that electrification of terminals must come within a reasonable time. Electrification will enable the railroads to effect an enormous real-estate development of their terminal property.

The report will be considered further at a meeting of the railway terminals committee to be held Nov. 25. Mr. Wallace, Mr. Arnold and representatives of both the citizens' terminal-plan committee and the Chicago plan commission have been invited to sit with the committee. Certain employees of steam-railroad companies who have vigorously opposed the proposed electrification have been assured that they may also have representatives present when the subject of electrification comes up. Following Tuesday's meeting, many aldermen left for the East to study subways and terminals.

## Activities of E. V. A.

President Frank W. Smith of the Electric Vehicle Association of America addressed the New England Section of the organization and the Electric Motor Car Club of Boston, at a joint meeting at the Hotel Thorndike, Boston, on Nov. 14, about seventy-five members and guests being present. He emphasized his intention to lead the association to fields of larger influence during his coming administration, paid tributes to the pioneer work of Messrs. W. H. Blood, Jr., and C. L. Edgar, of Boston, in furthering the electric-vehicle cause, and commented upon the growth of membership, which now aggregates 500. Mr. Smith spoke in enthusiastic terms of the recent Chicago convention and pointed out that more than forty new members were added at that time. Since the convention a number of additional applications have been received, including an important central station not previously in membership, with four associate and several press members. The increase has been 57 per cent since the 1912 convention.

At the meeting of the organization on Nov. 25 in New York action will be taken upon the petition of the proposed Philadelphia section for formation. The proceedings of the convention, not including the ten papers read, cover 250 closely typewritten pages. Three thousand copies of the official report of the convention will be published for distribution to members and others interested, and the proceedings will be further reviewed at section meetings this winter. All suggestions made on the floor have been tabulated for early consideration, and work by committees is to be the keynote of the year's program of development, along the lines successful in the N. E. L. A. Mr. Joseph F. Becker, of the United Electric Light & Power Company, New York, has been appointed chairman of the committee on membership and formation of sections, his work as chairman of the membership committee of the Commercial Section of the N. E. L. A. and as New York statesman of the Jovian Order specially fitting him for the task. The slogan for the year will be "Double the membership in twelve months."

An important constructive suggestion was offered by President Smith in the recommended formation of a committee on central-station co-operation, whose function it will be to determine exactly to what degree central stations and manufacturers are working together and what is lacking in such endeavors in the electric-vehicle field. Such a committee would present at the next convention a report that would answer once and for all the question as to the extent of this co-operation and how the conditions had been improved or otherwise during the period. The speaker stated that, although the association is fortunate in the willingness of Secretary Harvey Robinson to serve another year, the problem of securing a paid secretary giving his entire time to the work with permanent headquarters must soon be faced. New committees are also desirable upon the subjects of traffic, good roads and relations with the Commercial Section of the N. E. L. A., the last-named in particular connection with publication of electric vehicle data in the "Salesman's Handbook." Closing, the president described the booklets on commercial and pleasure vehicles just issued by the association.

## New Chicago Requirements for the Mitigation of Electrolysis

As related in the *Electrical World* of Nov. 1, page 888, the local transportation committee of the City Council of Chicago, after an animated hearing, recommended an ordinance providing for the unified operation of the surface street-railway lines in Chicago, containing, among other things, a section materially modifying the existing ordinance intended to prevent electrolytic damage from grounded railway return circuits. The section was adopted by the City Council and agreed to by the company.

By the proposed ordinance the city would be divided into three zones—an inner or congested-traffic section, a middle zone taking in the thickly populated residence sections, and a third or outer zone bounded by the city limits. All uninsulated return circuits shall be of such current-carrying capacity and so arranged that the sustained maximum difference of potential between any two points shall not exceed 10 volts in the inner zone, 15 volts in the middle zone and 20 volts in the outer zone. Moreover, such differences in potential shall not exceed limits to be from time to time prescribed by the Board of Supervising Engineers, Chicago Traction, thus giving the board power to install a potential gradient. The board may also increase the limit in the outer zone to 25 volts where underground utilities are not fully developed.

The Board of Supervising Engineers is to make tests to determine whether the companies are complying with the ordinance, the companies installing the necessary apparatus. The rate of progress of the work of electrolysis prevention is prescribed by the section, and within two years from the date of passage of the ordinance its provisions shall have been complied with throughout their entire railway systems by the expenditure of $1,000,000 if deemed necessary by the Board of Supervising Engineers, or more if necessary to prevent electrolytic damage.

Fines of from $50 to $200 a day are provided for each day's operation contrary to the provisions of the ordinance. A "Board of Electrolysis Claims," to consist of the city electrician, the chairman of the Board of Supervising Engineers and an engineer to be appointed by the street-railway companies, will hear and determine all electrolysis claims. Decisions of this board will be final and binding on the companies and on the municipal corporations. Within thirty days after the board has rendered its decision on any claim the company causing electrolytic damage shall pay to the municipal corporations entitled thereto the amount fixed.

## Rate Revision Ordinance Now Pending in Chicago City Council

After the whole matter of revising the rates of the Commonwealth Edison Company was left in the air by the Chicago City Council committee on gas, oil and electric light on Nov. 10, as related last week, the committee held its next meeting on Nov. 12. It will be remembered that the committee by a vote of 3 to 8 refused to adopt Section I of the proposed ordinance containing the provisions for rates for general consumers. At the meeting of Nov. 12 the action taken was reconsidered and discussion of the section was resumed. Mr. William H. Arthur, counsel for the Commonwealth Edison Company, said that the company would not accept less than a five-year contract for rates lower than 10 cents primary, 5 cents secondary and 4 cents tertiary, to go into effect on Dec. 1, 1913, the tertiary rate to be reduced to 3 cents on March 1, 1914. Mr. Ray Palmer, the city electrician, dwelt on the importance of the proposed contract ordinance in enabling the city to extend its street-lighting service. The proposed ordinance is fair and reasonable, Mr. Palmer said, and he recommended it. Alderman Merriam renewed his objections, based largely

on the advice of Mr. E. W. Bemis, the public-utility expert. He said the city should have some concessions, either on the reduction of the primary rate or in reducing the term of the contract. Mr. W. J. Norton, speaking for the company in relation to the reduction of the primary charge from 10 cents to 9 cents, said that it is true that the company, in serving perhaps 20,000 of its small lighting customers, would do so at a loss at either rate. It might be assumed that the cost of supplying these small short-hour customers was about 15 cents per kw-hr., but the rate to be adopted between 15 cents and zero must be a reasonable one or it would not be upheld by the courts. The company contends that 10 cents is a reasonable maximum rate.

Alderman George H. Bradshaw moved that Section I of the ordinance be adopted with the addition of Alderman M. J. Healy's amendment providing that the company shall pay the established prevailing organized-labor scale of wages for any construction work that may be done by it in extending street-lighting service for the city. This motion prevailed by a vote of 8 to 7. After this there was comparatively clear sailing in the committee, and the ordinance was adopted section by section substantially as recommended by City Electrician Palmer and agreed to by the company. In relation to the Healy amendment Mr. Arthur said that he was not in position to say whether the company would accept it or not. Finally the whole ordinance, as amended, was recommended to the City Council for passage by a vote of seven to four.

The ordinance as recommended was introduced in the Council Nov. 13. It was ordered published and made a special order for the meeting of Nov. 24.

## Credits and Collections Discussed by Electrical Business Men

For the purpose of exchanging information in relation to the credit rating of customers, the Electrical Credit Association of Chicago is active the year round, its territory extending from Pittsburgh on the east to Denver on the west and from the Canadian line to the Gulf of Mexico. The work is effected through the office of the secretary, Mr. Frederic P. Vose, who has supervision of the actual work of the association under the guidance of the officers and executive committee. Once a year the association has a "round-up," held this year on Nov. 14. The attendance at the afternoon business meeting was about eighty, and for the first time women were present, one of them reading a paper before the association.

### Work on the Chicago Association

In his address the retiring president, Mr. S. E. Kennedy, Central Electric Company, Chicago, said that while nearly all the reputable jobbers and dealers are members of the association, a large opportunity still exists for securing new members among the manufacturers. Mr. F. M. Pierce, Manhattan Electrical Supply Company, Chicago, representative of the association on the board of the National Electrical Credit Association, next made a brief report.

Mr. Vose presented his report as secretary and treasurer. The Chicago association was organized in 1896 and has now 215 company members, about one-third of whom are in the city of Chicago. In 1913 there were 6723 claims of delinquent debtors reported to the association. The amount involved was $570,011.37. The number of claims settled through the incidental activities of the association (which is not a collection agency) was 4265, representing $355,525.08. The ratio of number of accounts settled to total number reported to the association was about 63 per cent. Since the organization of the association the estimated amount received in settlement of accounts as an incidental result of its activities is about $3,680,000.

### Election of Officers and Other Business

Mr. Henry Schwab, Monarch Electric & Wire Company, Chicago, reported as the chairman of the membership committee and offered a resolution, which was adopted, providing for the creation of territorial committees in trade centers.

On the recommendation of the nominating committee, of which Mr. J. N. MacAlister, Chicago, Simplex Wire & Cable Company, was chairman, the following officers were elected: President, Mr. A. O. Kuehmsted, Gregory Electric Company; vice-president, Mr. Henry Schwab, Monarch Electric & Wire Company; national representative, Mr. F. M. Pierce, Manhattan Electrical Supply Company; members of executive committee, Messrs. E. R. Gilmore, Western Electric Company, and S. E. Kennedy, Central Electric Company.

### Co-operation Between Sales and Credit Departments

Three papers were read on "Co-operation Between Sales and Credit Departments." Mr. A. J. Gaehr, Cleveland, George Worthington Company, said that each salesman should consider himself a member of the staff of the credit department. On the other hand, the credit man should take the salesman into his confidence and teach him how to analyze financial statements. Further, the credit man should be alert to help the customer. Miss Elizabeth M. Smith, Chicago, who is the credit manager of the Bryan-Marsh Electric Works of General Electric Company, read the next paper on this subject. She made the point that co-operation should not be all on the part of the salesman. The latter, however, should never apologize for letters from the credit department. A customer never gets a collection letter without reason. She argued also that the credit man and the salesman ought to be on the same basis of compensation. If, for instance, the salesman is paid a commission or a salary and bonus, the credit man should be paid in like manner. Every order placed before a credit manager should mean either a personal gain or loss to him. Mr. W. H. Fogarty, Chicago, H. W. Johns-Manville Company, read the last of the three papers, dwelling on the importance of team work.

### Elimination of Cash Discounts

A letter was read from Mr. Henry L. Walker, Detroit, Henry L. Walker Company, in which he made a plea for the elimination of the cash discount. All sales should be made net at thirty days. After the lapse of ninety days no more goods should be sold to the customer and the account should be considered delinquent. Mr. E. R. Gilmore said that cash discounts are a source of evil from start to finish. Mr. Charles G. Burton, Peru (Ind.) Electric Company, favored eliminating the cash discount. Mr. Frank Horton, Chicago, Moran & Hastings Manufacturing Company, urged the prompt reporting of delinquent accounts, and Secretary Vose at this point made a strong plea for reciprocity among members. On motion of Mr. Miner it was voted to be the sense of the meeting that cash discounts be eliminated. While this resolution was under debate Mr. A. O. Kuehmsted quoted Mr. Roger Babson, who has said that the "discount thief" is a public nuisance.

### Moral Risk Clubs

Mr. W. J. Burton, Frank Adam Electric Company, St. Louis, described the recently established Moral Risk Club in St. Louis. The club is patterned after the ones in Chicago and other cities. Where credit is based on the buyer's general reputation for honesty and business ability co-operation between sellers prevents them from being victimized by dishonest men. Mr. Burton recommended the formation of such a club in any city where six or eight members can be secured. The cost in St. Louis is only $6 a year to each of the twelve members. Mr. Thomas J. Creaghead, Cincinnati, Creaghead Engineering Company, said that two members could organize a moral risk club.

## Public Service Commission News

### Indiana Commission

Criticism that has arisen because of the unprecedented stand of the new Indiana Public Service Commission in acting as an arbitration board for the settlement of the strike difficulties on the lines of the Indianapolis Traction & Terminal Company and several interurban systems has been considered carefully by the Governor and members of the commission. They say they realize that they are treading on dangerous ground, but that the crisis which called for action was so imminent and the lack of an arbitration board was so apparent that eventually the question came to whether the commission should attempt to solve the difficulty as individual arbiters and not by any authority of law or with any attempt to enlarge the powers of the board or whether the Governor should call a special session of the Legislature to pass a law creating an arbitration board.

The latter step was practically impossible because of the depleted condition of the state treasury, and then it was decided that, with the greatest care to avoid establishing a precedent, the commission members should tender their services until the 1915 session of the Legislature could establish a proper board. Both the Governor and the members of the commission are resisting every attempt to make the action of the commission appear as other than an emergency position, and all agree that the commission has no place in arbitration.

Developments of the past few days show what a pressure is being brought on both sides of the controversy to compel a settlement of the differences without resort to the commission. For a time it appeared that all the grievances of the men would be taken care of by the companies without the aid of that body. Later it was said that one or two of the more serious contentions might be taken to the state body for solution. The Governor and his aids have been working strenuously to keep even these from going before the utility commission if possible.

### Missouri Commission

Testimony has been presented before the Missouri Public Service Commission in the case involving electric rates of the Springfield (Mo.) Gas & Electric Company. Engineers submitted reports on appraisals of the physical property for the commission and the company. Testimony was also offered in reference to other elements of value than the physical property. Mr. W. J. Squires, of Squires & Company, Kansas City, Mo., made a report for the commission showing a reproduction value of the physical property of $403,650. Mr. F. P. Woy, Albuquerque, N. M., submitted an estimate on behalf of the company showing a total cost of the property of $515,390. Mr. W. G. Woolfolk, of Sanderson & Porter, New York, showed a reproduction value of $508,675.

The direct issue involved in the case is that of the maximum rate for residence lighting. The company has been charging a maximum rate of 15 cents per kw-hr. less a discount of 10 per cent for prompt payment. Negotiations, however, have been under way in reference to rates and the company offered to reduce its maximum to 12 cents. Citizens who brought the case before the state commission have asked for a rate of 6 cents. The company has recently made a contract with the Ozark Power & Water Company for power. In view of this arrangement it uses its old steam plant only for reserve purposes. One of the questions arising in the hearing was over the value of the reserve steam plant. The company claimed that this plant was of great value for reserve purposes and was a necessary and material part of its investment.

Mr. E. M. Stephens, of Kansas City, Mo., representing the citizens who commenced the proceedings, testified regarding the cost of construction of an equivalent plant.

Mr. Henry Floy, of New York, checked up the values fixed by the engineers and, starting with a physical value of $500,000, added sums for preliminary organization and promotion expenses, going value and taxes and interest during construction. He declared that the operating expense charges were reasonable and emphasized the necessity of maintenance of the steam plant for reserve purposes. Mr. Floy presented a number of exhibits, including one giving a record of various causes of interruptions of service to two terminal houses of the Cataract Power & Conduit Company, Buffalo, N. Y., from Jan. 1, 1907, to Aug. 1, 1913. The total numbers of interruptions by years were as follows: In 1907, sixteen interruptions, 153 minutes; 1908, nine interruptions, 68 minutes; 1909, fourteen interruptions, 119 minutes; 1910, sixteen interruptions, 120 minutes; 1911, twenty-eight interruptions, 216 minutes; 1912, eighteen interruptions, 138 minutes; Jan. 1 to Aug. 1, 1913, nineteen interruptions, 177 minutes. The totals for this period were 120 interruptions and 991 minutes.

Mr. Edwin Gruhl, assistant to the president of the Milwaukee Electric Railway & Light Company, testified on going value and depreciation.

Mr. W. H. Blood, Jr., of Stone & Webster, testified that he had found going value to be about 25 per cent of the structural cost. He also discussed working capital.

Mr. A. C. Einstein, general manager Union Electric Light & Power Company, of St. Louis, in referring to the necessity for a reserve plant said that if he knew he could avoid interruptions of service at St. Louis for one minute he would not hesitate to spend $100,000 for that purpose.

Mr. Charles S. Ruffner, Electric Company of Missouri; Mr. L. C. Gerry, Federal Light & Traction Company; Mr. E. D. Smith, Mississippi River Power Distributing Company; Mr. Francis Blossom, of Sanderson & Porter; Mr. George D. Coaney, of A. G. Edwards & Company, bankers of St. Louis, and Mr. R. E. McDonnell, of Burns & McDonnell, Kansas City, Mo., also appeared as witnesses.

## Current News Notes

To Patrol Transmission Lines by Aeroplane.—From San Francisco comes an announcement that Robert Fowler, the aviator who recently completed a cross-continental flight, has arranged with a California transmission company to patrol its high-tension lines leading out of Oakland in an aeroplane. A lineman equipped with repair apparatus will ride with the aviator, and the pair will take trips twice a week. The headquarters of this novel inspection crew are to be established at Sacramento.

* * *

Chicago Subway Projects.—The City Council of Chicago has asked for bids on the construction of a system of comprehensive passenger railway subways. The Board of Harbor and Subway Commissioners has estimated the cost at about $130,000,000. According to the present plan, bids are to be received until Jan. 5, 1914, and then opened publicly. The comprehensive plan of subway construction, the Arnold plan of limited subway construction, and possibly others, will probably be submitted to the voters at the election in April so that they may indicate their preference.

* * *

Examination for Examiner, Public Service Commission.—The New York Public Service Commission, Second District, Albany, N. Y., has vacancies for an examiner at a salary of $1,801 to $2,400, with expenses when engaged in field work, and for an assistant examiner at a salary of from $1,501 to $1,800. Examination for both of these positions will be held the latter part of November. Practical experience in corporation accounting for steam railroads, street and electric railways, electrical corporations, gas companies or telephone and telegraph companies is necessary. Candidates must be between the ages of twenty-five

and forty-five. The examination is open to non-residents of New York State. For application blanks address State Civil Service Commission, Albany, N. Y.

* * *

Fessenden High-Frequency Patent Injunction.—Judge Rellstab in the Federal District Court at Trenton, N. J., on Nov. 17, issued an order enjoining the Marconi Wireless Telegraph Company of America against further infringement of the Fessenden high-frequency patents, but permitting the company to deliver radio apparatus to the United States Navy by giving suitable bond pending an appeal from the injunction. The Fessenden patents, which are owned by the National Electric Signaling Company, were described on page 939 of our issue of Nov. 8.

* * *

Booklets in Electric Vehicle Association's Publicity Campaign.—Two handsomely illustrated booklets—"The Story of the Electric Pleasure Vehicle" and "The Story of the Electric Commercial Car"—have been issued by the Electric Vehicle Association of America for use in its publicity campaign. Between striking colored covers, measuring 8 by 11 in. much interesting general information on electric-vehicle subjects is given in attractive popular form, detailing the advantages, costs, safety, simplicity and economy of their operation. No particular make of vehicle is emphasized in either booklet, but a number of cars of representative manufacturers are illustrated and described, the features of each being pointed out. The text pages are of heavy calendered paper and are profusely illustrated, with marginal designs in special tints. Data comparing the relative operating cost of horse and electric propulsion are a feature of the commercial-vehicle pamphlet. Central-station companies, accessory manufacturers, etc. are invited to order and use these booklets in their own publicity work. For the first issue the price will be 25 cents per copy, but with future orders it is likely that this cost will be reduced. The booklets are being sold at actual cost by the association. The headquarters of the publicity committee of the Electric Vehicle Association are at 1170 Broadway, New York City.

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## SOCIETY MEETINGS

American Museum of Safety.—In connection with its annual meeting in New York, the American Museum of Safety will serve a dinner at the Waldorf-Astoria on Dec. 12. Mr. George F. Kunz is chairman of the dinner committee, which includes also Messrs. George B. Cortelyou, Elbert H. Gary, James Speyer and William H. Tolman.

* * *

Colorado Electric Club.—At the weekly luncheon of the Colorado Electric Club held at the Albany Hotel, Denver, Nov. 13, Gov. E. M. Ammon addressed the club on the subject of "Conservation." For the following Thursday noon the speaker of the day was scheduled to be President Haldane of the Colorado School of Mines at Golden.

* * *

Electric Vehicle Association of America.—The regular monthly meeting of the Electric Vehicle Association of America will be held Tuesday evening, Nov. 25, in the Engineering Societies Building, New York City. "The Industrial Truck as a Factor in the Efficient Handling of Internal Freight" is the title of a paper to be presented by Mr. W. W. White, of the General Vehicle Company.

* * *

Detroit Contractors Dine.—In honor of President Ernest Freeman and Secretary G. H. Duffield of the National Electrical Contractors' Association, who came to Detroit to make arrangements for the national convention to be held there next June, the local members of the contractors' association gave a banquet Nov. 10 at the Hotel Cadillac. Mr. L. W. Eddy acted as toastmaster, and responses were made by Messrs. E. McCleary, W. Turner, J. N. Rabe and T. Templeton. The Michigan section of the contractors' association will hold a meeting at Saginaw Dec. 15, to select delegates for the Detroit convention.

* * *

Toledo Section, A. I. E. E.—The regular monthly meeting of the Toledo Section, American Institute of Electrical Engineers, was held Nov. 7 at the Commerce Club, Toledo, Ohio. Mr. H. R. Fowler, of the Fowler Electrical Supply Company, read a paper on "The Electrical Control of Bridges." The members then adjourned and in a body inspected the bascule lift of the Cherry Street bridge recently mentioned in these columns.

* * *

High-Tension Transmission.—Mr. P. H. Thomas, consulting engineer of New York City, delivered an address before the Yale Branch of the American Institute of Electrical Engineers at its regular meeting in the new electrical engineering laboratory of the Sheffield Scientific School on Nov. 12, 1913. The subject presented by Mr. Thomas was that of high-tension transmission, which was discussed in its various mechanical and electrical aspects.

* * *

Yonkers (N. Y.) Branch, N. E. L. A.—The Yonkers (N. Y.) Electric Light & Power Company Branch of the National Electric Light Association held its first meeting Nov. 10, and elected Mr. G. B. Cornell president and Mr. E. J. Reilly secretary. During the evening addresses were made by President-elect Cornell on "Electricity on the Farm," Rev. F. W. Cutler on "Co-operation and Organization," and Mr. W. Donshay on association matters.

* * *

Pittsburgh Section, A. I. E. E.—Mr. F. R. Phillips, superintendent of maintenance of the Pittsburgh Railways Company, read a paper on "Recent Developments in Cars and Equipment of the Pittsburgh Railways Company" before the last monthly meeting of the Pittsburgh Section of the American Institute of Electrical Engineers. Mr. J. W. Welsh, electrical engineer of the company, collaborated with Mr. Phillips in the preparation of the paper.

* * *

N. E. L. A. Committee on Wiring of Existing Buildings.—The National Electric Light Association's committee on the wiring of existing buildings, of which Mr. R. S. Hale, Boston, Mass., is chairman, met at New York Nov. 19 and formulated plans for furthering the collection of data on wiring and the compilation of commercial practices. Among the topics discussed during the all-day session were methods of handling the business of very small consumers by European central stations.

* * *

Professor Muensterberg on "Human Efficiency."—Dr. Hugo Muensterberg, of Harvard University, spoke before the students of the New York Edison Company's commercial school Nov. 19, on the subject "Applying Psychology to Business." The speaker emphasized the part played by suggestion in every-day affairs, particularly in the work of the salesman. He made a plea for better analysis of the student's fitness for his intended vocation and suggested direct methods for studying mental applicability.

* * *

Illumination Topic Before the Froebel Society.—At the regular monthly meeting of the Froebel Society of Brooklyn, N. Y., to be held at Pratt Institute Assembly Rooms, 215 Ryerson Street, Brooklyn, Tuesday, Nov. 25, at 2:30 p. m., Mrs. Preston S. Millar, wife of the past-president of the Illuminating Engineering Society, will present a paper on "The Illumination of the Home." The influence of light in conserving vision and in beautifying the home will be discussed, and the paper will be illustrated by means of miniature rooms illuminated according to the principles of good lighting.

# Operating Data of a Large Railway Power Plant

**Development of generating system of Twin City Rapid Transit Company, Minneapolis—Unit costs with water-power, steam engines and steam turbines—Increasing the efficiency**

FOR a long time the Twin City Rapid Transit Company, of Minneapolis and St. Paul, Minn., has been devoting careful study to its problems of power generation. The high price of coal in Minneapolis furnishes a special incentive for the introduction of efficient steam-plant apparatus, as well as for the utilization of the water-power available in the falls and rapids of the Mississippi River at this point. This hydraulic energy is not, however, sufficient to supply all of the power required by the system, for several local flour mills possess prior rights to a considerable part of the available falls. The generating system of the Twin City company therefore at present consists of three quite modern plants, one a steam station and the other two operated by water-power. The first-mentioned is now equipped with steam turbines practically throughout, and nearly ten years ago replaced the older plants with their slow-speed belted units.

That the efforts to reduce generating expenses have been successful is evident from the reduction in fuel cost from about 0.7 cent per kw-hr. in 1905 to about 0.4 cent in 1913. At the same time labor and superintendence costs were reduced from 0.09 cent to 0.06 cent, and the outlay for lubricants and waste from 0.01 cent to 0.001 cent per kw-hr. This reduction has been accomplished by gradual improvement of the present steam plant and by economy in its operation. Before 1905 conditions were even worse, as shown by the 1901 total operating cost, about 1.4 cents per kw-hr., of which fuel was the principal item. At this time several old-fashioned steam plants were in operation supplementing the output of one water-power station.

## Early Water-Power and Steam Plants

Before 1897 the old steam stations just referred to were the sole source of power, but in that year a water-power plant was built at St. Anthony Falls, in Minneapolis, by the Pillsbury-Washburn Company and later taken over by the St. Anthony Falls Water Power Company. It contains eight 700-kw, three-phase, 3450-volt waterwheel-generator units and two 700-kw, 650-volt direct-current units, besides two waterwheel-driven exciters. Under the same roof there is also a substation with four 600-kw rotary converters. The alternating-current output is stepped up to 13,200 volts for transmission. The full flow of the Mississippi River, varying from 3000 cu. ft. to 15,000 cu. ft. per second or more, is utilized in this plant, the load on which for a long period has averaged over 4000 kw during the entire

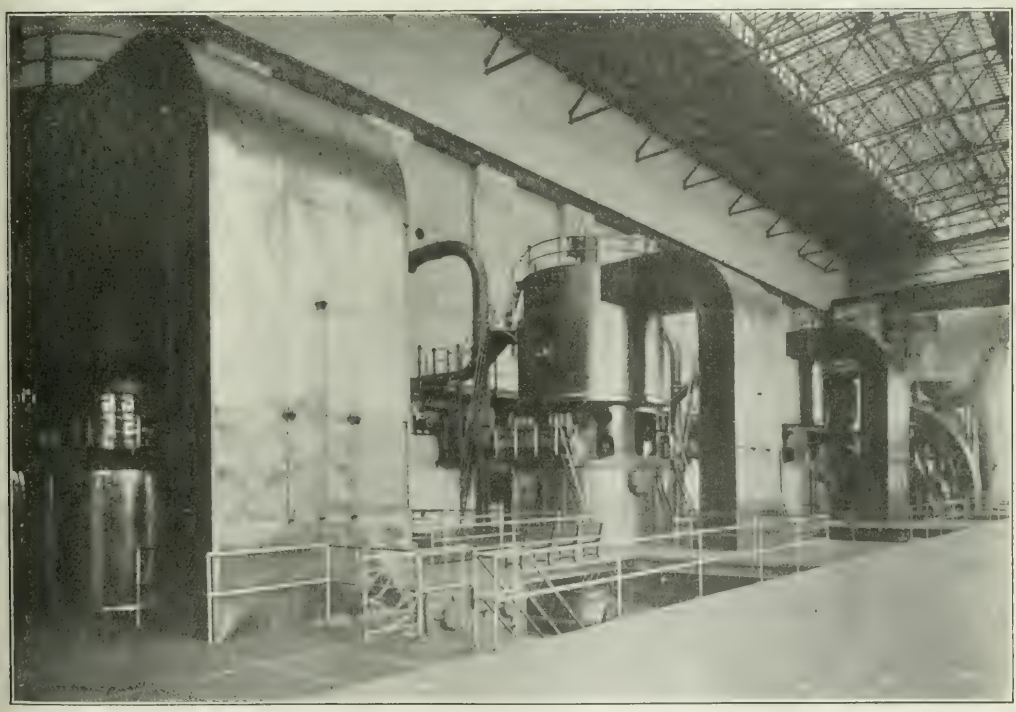


FIG. 1—INTERIOR OF TURBINE ROOM, TWIN CITY RAPID TRANSIT COMPANY'S PLANT, MINNEAPOLIS, MINN.

year. The station was for a time the main dependence of the Minneapolis traction system for its power supply.

Such good service was furnished by the "lower dam" station that a few years ago a second one was built at the "upper falls" to develop the extra power not required by earlier users. This development, known as the Hennepin Island plant, was inexpensively constructed, since the existing hydraulic works were utilized as far as possible and much of the required building material was found on the site. The cost was stated to be not over $26 per hp. The plant contains four 2250-kw, 13,200-volt, 35-cycle, three-phase generators and two 150-kw exciters, together with an entirely modern oil-switch and measuring equipment. The station was put into service in June, 1908, and has since utilized the surplus water to excellent advantage. While its output is necessarily very fluctuating and, unfortunately, does not reach its maximum when power is most needed, in the early summer, it carries about one-third of the entire load.

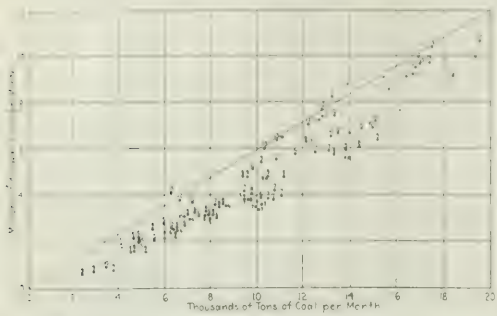



FIG. 2.—RELATION BETWEEN OUTPUT AND COAL CONSUMED

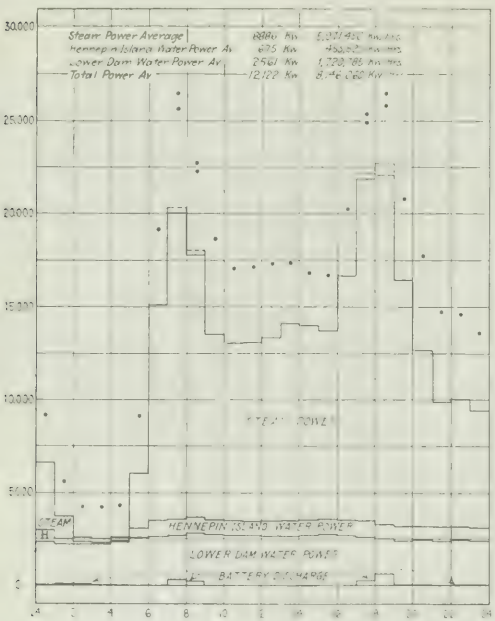



FIG. 3.—SYSTEM LOAD CURVE FOR FEBRUARY, 1909

Although the water-power plants are economical, they have limited capacity, and to an increasing extent in the future must steam be depended upon. Ten years ago a modern steam plant was projected for the site close to the lower-dam hydraulic plant. It was designed to contain ultimately five vertical, cross-compound Allis-Chalmers engines of 5000-hp capacity, direct-connected to three-phase, 13,200-volt, 35-cycle General Electric generators rated conservatively at 3500 kw, or, with the present standard temperature rise, 4000 kw. Three of these engines had been installed by 1905, giving the plant an actual rating of 12,000 kw.

The engines were supplied with steam from a boiler room containing eighteen Babcock & Wilcox boilers, each with 5560 sq. ft. of heating surface and a nominal rating of 556 boiler hp. These units were equipped with Roney stokers rated for continuous fuel supply at 825 hp, in order to develop 50 per cent overload on the boilers. Superheaters provided developed 120 deg. superheat at rated load. Draft was furnished by two Custodis radial-brick stacks, rising 225 ft. above the boiler-room floor.

There were four coal bunkers of I-beam and cinder-concrete construction located above the boilers and having an aggregate capacity of 2800 tons. These bunkers were supplied with coal by means of a complete conveyor system consisting of a receiving track for coal cars at one side of the building and a belt conveyor into which coal could be shoveled from the cars running between one wall of the building and the track. Driven by a 10-hp motor was a crusher fed from a hopper into which the belt conveyor discharged. An overlapping gravity-type bucket conveyor belted the boiler room transversely, and two distributing bucket conveyors above the row of bunkers belted the boiler room longitudinally. The lower runs of the last-named conveyors were also designed for ash removal, the ash hoppers discharging directly into them.



FIG. 4—STEAM STATION AND WATER-POWER DAM, MINNEAPOLIS, MINN.

### First Use of the Steam Turbine

Following the original plan, a fourth engine and eight more boilers were added in April, 1906. By this time, however, the steam turbine had been pronounced a success at Chicago and elsewhere, and in place of the fifth engine two 5000-kw Curtis vertical turbines were installed in February and July, 1907, respectively. The fact that this space accommodated in turbines three times its rating in engines is significant. No increase in boiler capacity was made at the time. A complete detailed account of the plant as it

existed in its earlier years was given in a paper presented by the mechanical and electrical engineer of the company, Mr. E. H. Scofield, before the Minnesota Branch, A. I. E. E., in December, 1906.

As already noted, the plan for the station was modified radically before it was completed. Hardly had the new turbines been installed when it was found possible to secure larger and more economical ones, and the process of replacing the engine units began. In the meantime experiments had been made with chain-grate stokers, and in January, 1909, two were installed; in July four others, and during the fall six more. To improve the capacity and efficiency of the chain-grate stokers better draft was required and one of the brick stacks was accordingly replaced in November, 1910, by two brick-lined steel ones mounted on structural-steel frames. These are 200 ft. high with flue diameter of 14 ft. The first 14,000-kw vertical Curtis turbine unit was put into service in February, 1911, and in July six more chain grates were installed. The space

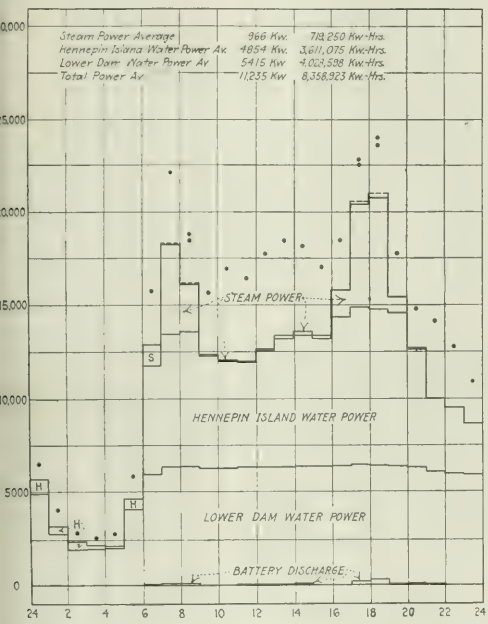



FIG. 5—SYSTEM LOAD CURVE FOR MAY, 1909

occupied by the masonry stack foundations was utilized for the installation of two additional boilers of 5000-sq. ft. heating surface, and the remaining furnaces were equipped with chain grates. The second brick stack was replaced with two steel ones in August, 1912. During the following month the first 15,000-kw turbine set displaced another engine. More steaming capacity being required, two more boilers were added in January, 1913, being installed in the space previously occupied by the foundation of the second brick stack. As this issue of the *Electrical World* goes to press the installation of the third large turbine has just been completed and but one engine of the original four remains.

The most conspicuous results of this evolution of the Twin City plants are seen in the increased station capacity in a given space and in reduced operating costs. As originally planned the capacity of the station was not over 20,000 kw. In the same space the present capacity is 60,000 kw, and it will be still further increased when the last engine unit is replaced. The effects of the changes in energy costs have already been touched upon but will be taken up in more detail. Fortunately the company keeps very accurate records, enough of which are reproduced in the accompanying figures to permit a study of the gradual cost reduction.

### Results of the Use of Economical Generating Units

In Fig. 2 are given the results of a study just completed by Mr. Scofield, engineer for the company, covering the

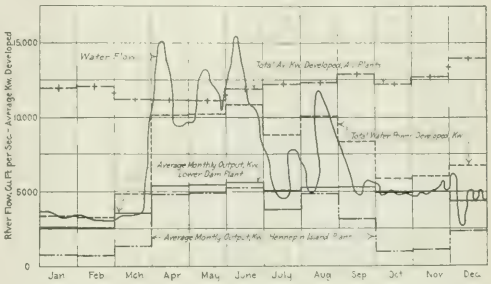



FIG. 6—RIVER FLOWAGE AND OUTPUT OF STATIONS DURING 1909

relation of the rate of coal consumption to the rate of energy production. A straight line drawn with a slope corresponding to 3.5 lb. of coal of an equivalent thermal value of 10,000 lb.-Fahr. heat units per lb. indicates the best average performance yet secured. The dots, numbered to correspond with the years from 1905 to date, indicate the monthly averages for the entire period of the station's existence. The remarkable effect of the newer units extends even to the small outputs, for which the load-factors are smaller as the size of the plant increases. Thus in 1913, with an output of but 4,125,000 kw-hr., the record of 3.03 lb. per kw-hr. was reached. In 1905 the same output was produced at the rate of 4.75 lb. per kw-hr.

It will be remarked that this same output required more coal in 1907 and 1908, but in these years the station was larger and therefore the same output represents a lower load-factor. In June, 1907, when the load-factor was a maximum for that year, the coal rate was 4.45 lb. per kw-hr. To comprehend fully the significance of this result it is necessary to study the steam-station load charts given

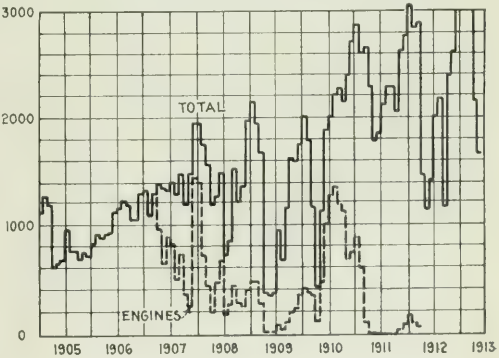



FIG. 7—CHART SHOWING ENGINE-HOURS AND TURBINE-HOURS

in the accompanying figures. In connection with them the water-power-plant charts are also of interest.

### Station Records

Fig. 6 shows the river flowage for the year 1909 and the corresponding outputs of the two water-power plants and of all of the plants together. The maximum monthly average load on the steam plant, 8886 kw, occurred in February

and the minimum, 966 kw, in May. Average daily load charts for these months are shown herewith in Figs. 3 and 5. The dots on these charts represent the maximum loads on the system and on the stations, without the battery.

The very instructive charts reproduced in the other accompanying curves contain a complete graphical record of the most important operating features of the Twin City Rapid Transit Company for the past eight and one-half years. Fig. 12 shows the great saving in cost due to the use

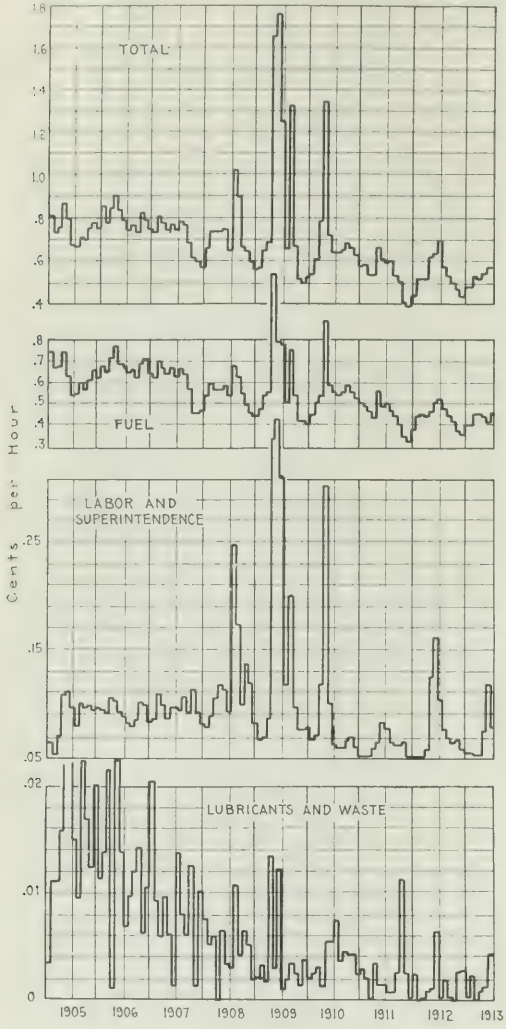



FIG. 8—TOTAL OPERATING COST PER KILOWATT-HOUR, WITH ANALYSIS

fluctuating nature of this load. The average monthly cost varies between 1.76 cents per kw-hr. in May, 1909, when the load was but 966 kw, and 0.4 cent in November, 1911, when it was 12,500 kw. There has been a steady decline in the average cost, amounting in nine years to nearly one-half. This is largely due to the saving in fuel, due in turn to the use of more economical generating units. The reduction in labor cost is not great, as the gradual increase in wages partly offsets the saving due to the smaller number of men required per unit of output. The remarkable reduction in cost of lubrication is also brought out in this

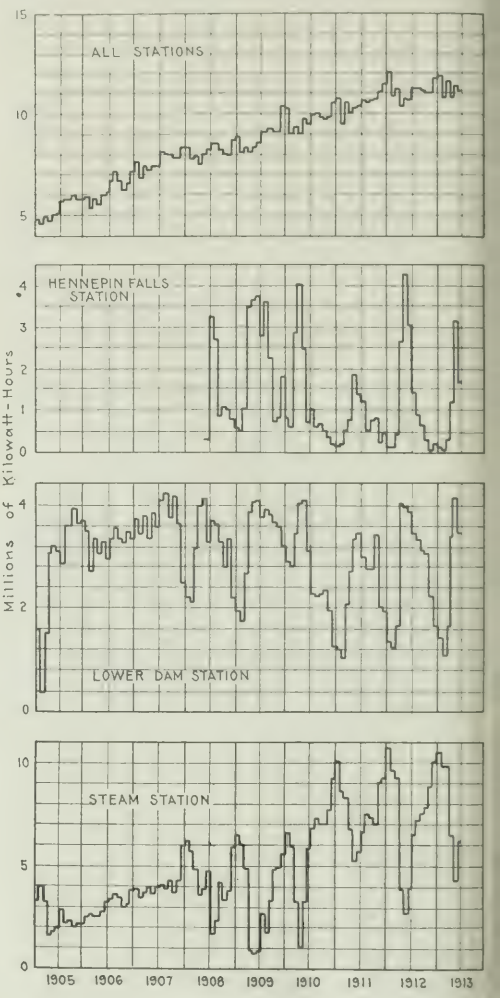



FIG. 9—CHART SHOWING OUTPUT OF STATIONS YEAR BY YEAR

of water-power, for when the cost of steam power is small, as shown in the lower part of the figure, indicating a good water supply, the total cost, as given in the upper graph, is also low, although the actual monthly energy output is practically constant. The steam-plant load is seen to be a very fluctuating one owing to its taking only the surplus demand.

Fig. 8 contains an analysis of the cost of operating the steam plant, which is of special value on account of the figure, since this outlay is practically nothing for the turbines. Fig. 7 is introduced to show how the output of the engines has become relatively less important until at present the remaining reciprocating unit is used practically not at all. There is a close relation between the engine hours and the cost of lubrication. In this graph the turbine hours are increased to engine-hour equivalents by multiplying the figures for the small turbines by 1.5 and those for the large ones by 3.

Fig. 9 shows the gradual increase in the load and how this demand is met by the three parts of the plant. This increase, it will be noted, conforms to those in car miles and in energy consumption per car, which are plotted in Fig. 10. The same figure also indicates a close relation between the load and the passenger receipts, both of which have doubled in the period covered. A rough average shows that the income is 6.3 cents per kw-hr. produced. In spite of the constant effort to build lighter cars the kilowatt-hour consumption per car-mile is on the increase, although lately it has been more stable than formerly. The present value is 4.8 kw-hr. per motor-car-mile.

Another chart (Fig. 11) shows the great increase in thermal efficiency of the steam plant and its dependence on the load factor. The best result was secured in May of this year, when but 30,000 heat units were required per kilowatt. This gives a thermodynamic efficiency for the station of 11.4 per cent. Assuming a boiler efficiency of 70 per cent, the corresponding engine-turbine-room efficiency is 16.3 per cent. The best corresponding figures for the engine plant alone, in June, 1905, were 8.1 per cent and 11.6 per cent respectively. In comparing these percentages with others it must be remembered that they cover the entire monthly input and output. In view of the excellent character of the former engine plant the saving obtained is remarkable.

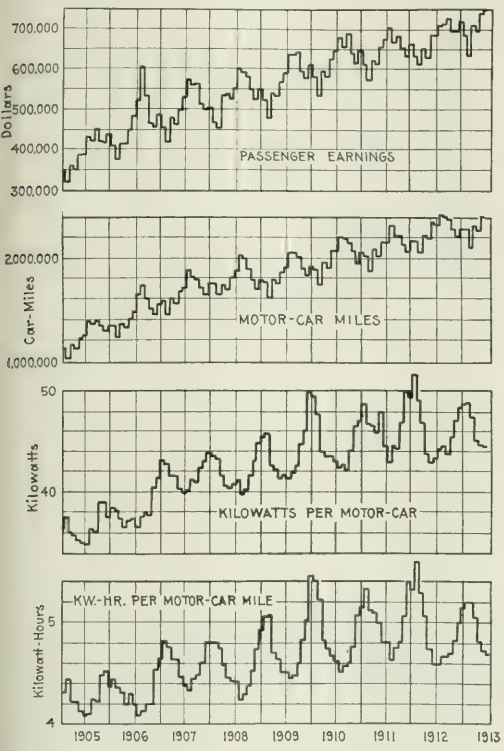



FIG. 10—GRAPHS OF SYSTEM OPERATING DATA

The sample records which have been reproduced in the illustrations accompanying this article are typical of a very large number regularly kept by the Minneapolis traction company. Most of them are plotted on loose-leaf notebook sheets, 5 in. by 8 in. in size, and suitable for blueprinting. The complete list of these graphical records comprises a very large number, and in addition there are numerous tables assembling the data. The important tables relate to the following items: Cost of power by months and years, total; operating cost of energy per kilowatt-hours (ranges between 0.678 cent and 0.52 cent); energy generated by months and years (shows increase in seven years from 64,296,424 kw-hr. to 133,227,996 kw-hr per year); operating energy per motor-car mile (varies from 4.29 kw to 4.99 kw); energy distributed in kilowatt-hours by months

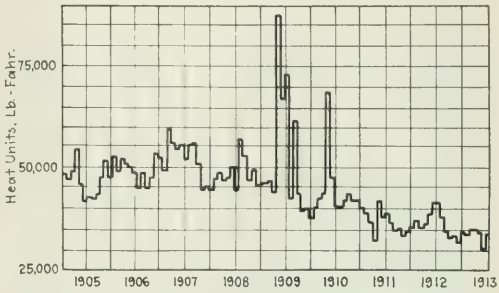



FIG. 11—HEAT UNITS CONSUMED PER KILOWATT-HOUR GENERATED

and years, and total and by divisions, last named also in per cent by divisions; energy consumption in kilowatt-hours per car-mile by divisions, by years and months, etc.

A monthly table is also made out for the estimated and actual energy secured from the water-power plants, the computed and actual costs of energy from the steam plants, etc. Other tables cover the average and maximum power developed by months, total, and for operation only; total motor-car miles made by years and months; total cost of power per motor-car mile, motor-car-hours, schedule speed (increased from 8.55 miles per hour in 1905 to 9.36 miles per hour in 1912); passenger earnings; cost of power

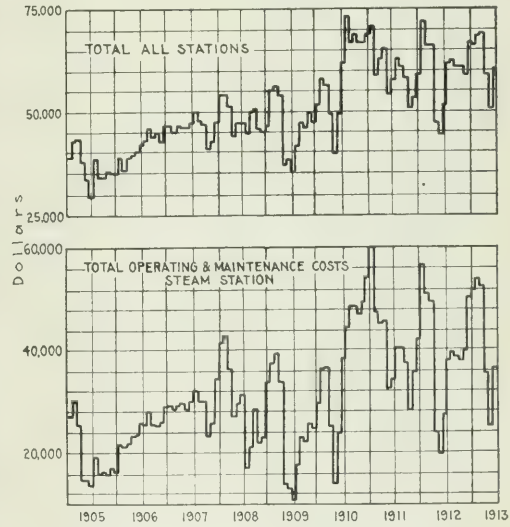



FIG. 12—CURVES SHOWING TOTAL COST OF POWER

in percentage of passenger earnings (varies up and down between 8.0 and 9.7); passenger earnings per motor-car-mile; passenger earnings per operating kilowatt-hour (has been gradually reduced from 7.32 to 6.09); kilowatts per motor car (has increased gradually from 36.7 to 45.7); power sold; cost of overhead maintenance; cost of track bonding, etc.

In the steam station the records are kept in great detail under the following headings: Kinds, amounts and qualities of coal received; cost of generating energy per kilowatt-hour, total and itemized under fuel, lubricants and waste, wages and superintendence, electrical maintenance, miscellaneous charges; average power generated; average fuel consumption per kilowatt-hour (3.39 lb. coal per kw-hr. is the general average); average heat value of fuel per pound and per kilowatt-hour (average value 34,680 heat units per kw-hr.); price of coal per 1,000,000 heat units (average value 12.58 cents); average kilowatts per boiler in service; total cost of operation and maintenance and itemized analysis of these; cost of handling coal per ton (runs from 8.8 cents to 7.2 cents); total cost of handling coal and cinders; price of coal per ton (averages about $2.577). Numerous other tables giving details of operation of boilers, engines, turbines, etc. The same system is carried out for line, substations and other parts of the system.

On account of the nature of these records and of the care which is taken in studying them the data given above will be useful for comparison with those of other plants. They show the results of consistent attention to essentials in the matter of power supply.

## Some Observations on European Electrical Topics

By Dr. Louis Bell

Were I asked what had made the deepest impression upon me during a recent trip to Europe in things general as well as electrical, I should unhesitatingly answer that it was the continual evidence of world organization for the control of trade. I encountered it directly and indirectly, positively and inferentially, at every turn.

Could any one lay bare the interlocking interests, the remote controls, the friendly alliances, the "gentlemen's agreements," in which the great commercial powers are involved, it would, I think, prove the most startling chapter in the world's industrial history. The law of supply and demand has ceased to have more than a casual bearing on international trading, for that law does not presuppose the existence of world-wide combinations, formal and informal, organized for the express purpose of defeating that free competition upon which the law depends.

In the electrical business we all know something of the nature of the international situation and of its general results, but we have little conception of the extent to which every branch of activity carrying on operations of great magnitude is involved in organization in restraint of trade. Frankly, I do not believe that one case in ten is known to the general public, or is openly admitted—but just casually talk "export" to the American market and then watch for signs of abating enthusiasm. I am not thinking now of electrical work or other things in which patent rights are concerned, but of the general situation in many lines. Everyone with whom one talks on business topics has a fresh instance to add. The question has particular importance now in view of the new tariff legislation and its results and is a factor which I think has not generally been taken into account in considering the probable balance of imports.

A curious feature of the whole matter is the indirection by which some of the results are achieved, almost unconsciously at times. For example, I know of concerns that might do a very large and profitable American business were it not for their unholy alliances with American agents whose chief interests are not in importations. Many a good European reputation has suffered from such indifference. Perhaps the thing works both ways, however, for more than ever before I have seen the universal American invasion. From tooth powders and soap to machine tools and burglar-proof safes my countrymen are in the game. I could have duplicated my shoes in nearly every city I have seen, could have bought Waltham watches in Geneva or American hardware in Birmingham. In fact, I might almost go so far as to say that if one cannot find any well-known American product in Europe, the probable reason is to be looked for in confidential terms with foreign competitors or in agencies that stand still.

In electrical matters, to pass from these general topics, one finds again the governing factors in differences of practice not at all on the surface, but in interrelated things not in immediate view. For example, the facts which I have more than once referred to as regards interior wiring in Europe turn on the question of building construction. Where fireproof and slow-burning constructions are almost universal and our native fire-trap is quite unknown, wiring rules do not need to be drastic, and were they to make such rules the fire underwriters would not have that moral support from the public which gives them the absolute power they enjoy. The same cause, I think, underlies the extremely large use of high-pressure three-wire systems, with 200 volts to 240 volts on a side. Likewise the universal use of multiple connection for street lighting is at the bottom of the choice of illuminants and of their particular application. It quite explains the rarity of alternating-current arc lamps and also the evolution of certain types which are extensively used but would be impracticable under American conditions of service and of import duties. It is only in the little differences of detail that national fashions appear, uninfluenced by these larger considerations.

Electrical distribution is greatly facilitated by the European habit of concentrating population in compact villages, instead of the wide scattering that is usual with us. This fact shows up not only in the possibility of lowered prices but also, in certain regions, by the organization of high-voltage networks which would not be justified if one had to deal with users widely scattered over the country instead of in groups. In England, especially, the problem of lighting the large isolated country house is commonly solved not by running a long line overhead but by an isolated plant, either electric or gas. I have seen some exceedingly neat little gasoline engine and dynamo sets which are being advocated for such service with considerable success. On the other hand, the large isolated plant in urban territory seems to be less common than with us owing to smaller buildings and the lower prices due to moderate distribution costs. Even the competition with gas is on a different basis and introduces new problems, some of which were hinted at in the recent British Association discussion in these columns.

In England, at least, the differences in popular habits and in climate result in particular features of load curve, and service generally, quite distinct from those found in American practice. In fact, it is very difficult to treat English electrical statistics so as to make them properly comparable with our own. One has to go to the roots of things before finding what the comparison really means. In general, I think we are inclined to attach undue importance to mere difference in wages and not enough to difference in conditions in dealing with all manufacturing matters. In England difference in governmental affairs makes now and then for remarkable effects. The British government is, in spite of its nominal form, for good or ill now the nearest approach to popular rule yet tried by any great power, and the results are sometimes striking. For instance, the street lighting in London has been wonderfully improved of late, thanks to parliamentary powers which enable the local authorities to place cross suspensions wherever they see fit. The act once passed, there is no method by which litigious individuals can go behind the returns, and the cross suspensions are installed. At every point one meets long trains of apparently casual consequences which one is very apt to misinterpret in judging them by American standards.

## Progress of Drum Development of Pacific Gas & Electric Company

By F. G. Mudgett

The Pacific Gas & Electric Company is completing 25,000 kw of its 112,500-kw hydroelectric development on the South Yuba and Bear Rivers at Drum power station, above Alta, in Placer County, Cal. The project was actively begun in July, 1912, and the only interruption to the work was the heavy snows common to the winters at such altitudes as are found in the various divisions of the job. Now, after practically a year of steady work on construction, the big generators will be ready by Nov. 27 to deliver 100,000 volts over 110 miles of transmission line to Cordelia substation, the load center of the Pacific Gas & Electric Company, where further distribution at 60,000 volts to the coast and central California cities will be made.

### Water Supply

The catchment area above Drum power house is 120 sq. miles in area, a watershed about at the summit of the Sierra Nevada Mountains, containing twenty-two smaller reservoirs all controlled to feed into the one large storage lake called Lake Spaulding. The capacity of Lake Spaulding, with the present 225-ft. dam, is 44,000 acre-ft., or about 14,000,000 gal. The ultimate dam will be 305 ft. from water surface and 320 ft. above bedrock, making it the highest dam in the world from water surface and comparable with the Arrow Rock dam, which is 260 ft. from water surface; the Roosevelt and Shoshone dams, both 240 ft. from water surface, and the Croton dam, but 160 ft. from water surface.

### Aqueducts

From storage the water is brought through a 4456-ft. tunnel in solid granite, 1100 ft. of which is concrete-lined, the finished size being 8 ft. 8 in. in diameter. An aqueduct 8.4 miles in length carries the water from the tunnel to Drum forebay, a large regulating reservoir having a capacity of 25 acre-ft., which insures continuous service at the power station by carrying the fluctuations between water supply and electrical load, as well as bridging any interruption in the canal system above.

### Pipe Line

The drop from the forebay to the nozzles of the impulse wheels is 1375 ft. A steel penstock or pressure pipe line (two lines eventually), 72 in. in diameter by ¼ in. thick at the forebay and tapering according to pressure to 52 in. in



FIG. 1—DRUM POWER STATION IN BEAR VALLEY GORGE

diameter by 1¼ in. thick at the power house, is the connecting link.

### Power House

The Drum power station is located in the Bear River gorge about 5 miles above Alta. To find a site for the power house it was necessary to sluice by means of the hydraulic monitor some 40,000 cu. yd. of hill slope, excavating finally by blasting into solid serpentine. The site is about 125 ft. by 500 ft. in size.

The erection of the building was begun in October, 1912, and the structural steel frame was completed in January, 1913, the work being terminated under unfavorable conditions in the winter. The building was designed under the direction of the civil engineer of the company for four

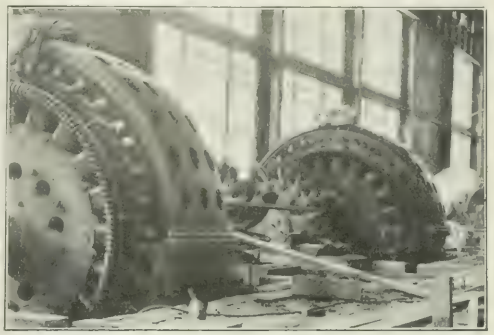


FIG. 2—TWO 12,500-KVA HYDROELECTRIC UNITS IN DRUM POWER PLANT

12,500-kw units, two of which are now installed. It is a reinforced-concrete and structural-steel structure, 77 ft. 6 in. wide by 208 ft. 8 in. long and 65 ft. high, and was completed in October, 1913.

### Equipment

The two 12,500-kva Westinghouse generators now in place are 6600-volt, three-phase, 60-cycle, twenty-pole machines. They are of the revolving-field type, horizontally divided. The armature is Y-connected. The generators are liberally rated and will carry their full load continuously with a moderate temperature rise, even under unfavorable climate conditions and low power-factors. The speed of the machines is 360 r.p.m.

The shafts of the armatures are horizontal, built with enlarged ends upset 2 in. for the reception of the overhung waterwheel runners, which are pressed on. At each end of the shaft a Pelton-Doble impulse wheel of 9000 maximum hp is overhung beyond the bearings. The shafts and bearings were made by the Westinghouse company. The maximum diameter of the shaft through the rotor is 26¼ in., and 18 in. at the bearings, which are 60 in. each in length. The over-all length of the shaft is 24 ft. 8¼ in. and its weight 26,420 lb. The diameter of the pitch circle of the waterwheel, which has seventeen double buckets attached thereto, is 85 in. The heaviest part weighs 10,000 lb. net, and all parts weigh approximately 75,000 lb. Each wheel is driven by a single deflecting jet. Its size is controlled with a needle valve, and the jet at maximum rating is 6⅞ in. in diameter.

### Governors

Governing is effected by a special oil-pressure-operated, relay-valve-type horizontal Lombard governor, which operates the deflecting nozzle directly. The body of the nozzle is 8½ in. inside diameter at the jet, opening and increasing to 26 in. at the ball joint. It is counterbalanced with a hydraulic piston.

The speed drop for gradual increase from no load to full load is adjustable from 0 per cent to 2 per cent. An electrical distance speed-control device operated from the switchboard by 125-volt direct current is provided. This enables the operator to vary the speed from 5 per cent above to 15 per cent below normal speed. A hand emergency control is mounted so as to revolve freely on a threaded piston rod, which can be connected with or disconnected from the piston rod by means of a split bronze

nut locked by suitable lever mechanism. An operator on the regular hand wheel can easily exert the full output of the governor, which is 20,000 ft.-lb. per stroke in three-quarters second with full port opening. This can be regulated to increase the time of action to any desired extent.

### Exciters and Transformers

The exciters to be used with the generating units are of 400-kw, 125-volt, 514-r.p.m. rating and are directly connected to single overhung 600-hp Pelton-Doble impulse waterwheels. Each unit is also equipped with a 600-hp, 2200-volt Westinghouse induction motor, which will serve to drive the exciter in the event of any accident to the waterwheel.

From the generators the energy is led through the low-tension switches to six 4250-kva, single-phase transformers, with an additional spare unit for energencies. When 6600 volts are impressed on the low-tension winding, which has several taps, line voltages from 110,000 volts to 125,000 volts will be obtained. All transformers will operate in parallel under any non-inductive or inductive load within their ratings. The line control at Drum power station is handled from the 125,000-volt switching gallery, which is equipped with oil and disconnecting switches.

All station switching is controlled from a switchboard of the benchboard type designed in such manner that the entire station with the four hydroelectric units and all auxiliaries may be completely controlled both hydraulically and electrically from it.

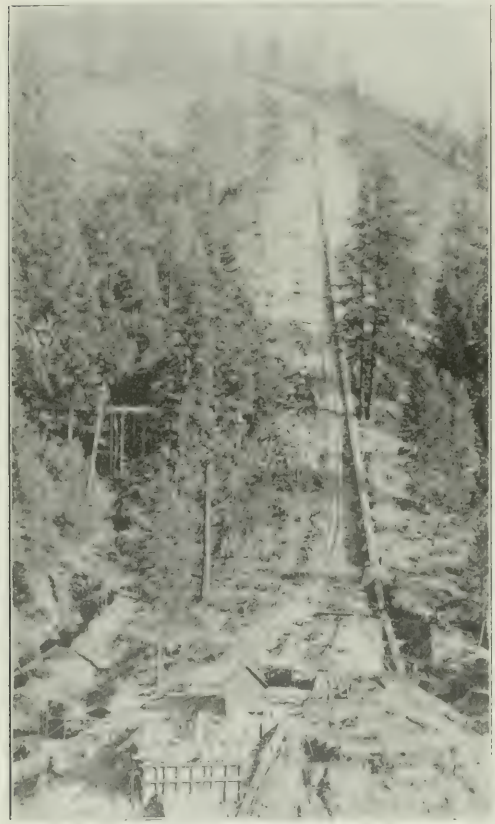


FIG. 3—DRUM PENSTOCK

### Transmission

The transmission line extends 110 miles westerly to Cordelia substation. The line towers are constructed to carry a double circuit, half of which is now completed. On account of the elevation at Drum power house the snowfall is as great as 25 ft. in a season, requiring the use of a special single-circuit steel "snow tower" over the first 13 miles. A double-circuit steel tower is employed on the remaining 97 miles and carries the wires in a vertical plane, the wires on the snow towers being carried in a horizontal plane. The towers are spaced about 800 ft. apart in the lowlands and as far apart as 2350 ft. in the mountains.

The use of both copper and aluminum conductors is exemplified in this line. The copper wire is No. 000 seven-strand (about 0.5 in. in diameter) and is used in the possible snow districts where sleet loads might be expected, as well as in the upper bay districts where sea fogs reach the line. The aluminum wire is No. 00000 nineteen-strand (about 0.625 in. in diameter) and spans 58 miles of the Sacramento Valley where snows and sea fogs are practically unknown.



FIG. 4—STEEL TOWER ON DRUM-CORDELIA TRANSMISSION LINE

The hydroelectric project is under the direction of Mr. F. G. Baum, chief engineer of the Pacific Gas & Electric Company. Assisting him are Mr. P. M. Downing, assistant chief engineer; Mr. J. P. Jollyman, electrical engineer; Mr. H. C. Vensano, civil engineer, and Mr. P. E. Magerstadt, resident engineer. Mr. F. G. Drum is president of the company, Mr. John A. Britton is vice-president and general manager, and Mr. A. F. Hockenbeamer is second vice-president and comptroller.

# Combined Synchronous and Induction Motor Loads

**Discussion of the advantages of utilizing synchronous motors and converters for improving the power-factor in alternating-current systems. By H. L. Wallau**

THE power-factor of induction motors is a subject that of late years has forced itself vigorously upon the attention of central-station engineers and managers, owing to the rapid strides made in the application of electricity to all classes of industrial activity. Many valuable papers have been written on the use of synchronous motors and condensers for the correction of "lagging" power-factors and the economics of the value of condensers have been touched upon.

It is not the author's intention to dwell at length on the causes of or the corrective measures required to overcome low power-factor, but merely to review certain basic principles and present some data gathered under actual operating conditions.

TABLE I—TESTS BEFORE INSTALLING SYNCHRONOUS CONDENSERS

| Designation of Feeder | Apparent Load, Kva. | True Load, Kw. | "Wattless" Load, Kva | Power-Factor in per Cent | Remarks |
|---|---|---|---|---|---|
| A..... | 375 | 270 | 259 | 72 | Single foundry, blowers, tumblers, grinders and machine tools. |
| B..... | 566 | 430 | 368 | 76 | Single factory, automatic screw machine and machine tools, group drive. |
| C..... | 533 | 320 | 426 | 60 | General motor service in small shops. |
| D..... | 250 | 140 | 210 | 56 | General motor service in small shops. |
| E..... | 135 | 80 | 108 | 59 | Machine tools and electric welders. |
| F..... | 175 | 100 | 143 | 57 | Drop hammers, grinders, etc. |
| Station... | 2,300 | 1,400 | 1,820 | 61 | ..... |

## General Considerations

Induction motors and other inductive apparatus draw from the line a current which is not in time-phase with the supply voltage. The current so drawn can be analyzed into two components, one in time-phase with the supply voltage and representing useful work, and the other in time-quadrature to it, representing "reactive" power. The wattless component of the current supplied reacts directly on the generator fields, demagnetizing them and increasing the excitation required to maintain the voltage. Moreover, the inductive effects of the lagging current in lines and transformers are far more serious than those produced by non-inductive loads. Motors, lines, transformers, generators, all have increased losses due to the excess current required with low power-factor, losses being increased by 23 per cent for 90 per cent power-factor, 56 per cent for 80 per cent power-factor, 104 per cent for 70 per cent power-factor, 178 per cent for 60 per cent power-factor and 300 per cent for 50 per cent power-factor.

The power-factor of the average induction motor operated on a circuit of rated voltage and frequency varies from 50 to 90 per cent, depending upon the size of the motor and the load carried. High power-factor can be maintained on induction motors only when carrying their full loads. Complex industrial conditions prevent this condition from being realized, and on the lines of supply systems are large numbers of lightly loaded induction motors operating at greatly reduced power-factors.

## Effect of Over-Voltage

While it is true that an induction motor will operate satisfactorily at from 10 to 15 per cent increase in normal voltage, gaining slightly in efficiency, pull-out and starting torque, it is nevertheless at a sacrifice in power-factor, which reacts to the disadvantage of the supply system. Central-station managers should, therefore, insist that consumers install motors designed to operate normally at, or very nearly at, the supply company's standard voltage. For example, a 220-volt motor and not a 200-volt motor should be installed by customers using energy from a 220-volt to 230-volt supply circuit.

The combination of under-load and over-voltage may lower the power-factor of motors under average operating conditions until the resultant line power-factor is from 50 to 60 per cent, with from 175 to 300 per cent increase in losses and from 60 to 100 per cent increase in total investment. The revenue derived is generally based on the hours' use of the demand in kilowatts, which rate takes no account of the increased investment accompanying low power-factor or of the greater losses caused thereby.

## Power-Factor of Commercial Circuits

Some years ago the effects of the low power-factor on the day load of a certain central station reached a critical point. It was impossible to maintain pressure without heavily over-exciting the generator fields, and to keep the engines from hunting the generators had to be kept well loaded with true power, resulting in enormous overloads in current and dangerous rises in temperature in all the windings.

Tests were made at one of the substations to determine what the actual line conditions were. The results of these

TABLE II—TESTS AFTER INSTALLING SYNCHRONOUS CONDENSERS

| Load on Distributing Lines | | | | Load on Condensers | | | | Load on Step-Down Transformers | | | | Voltage of Distributing Bus. | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Apparent Load, Kva. | True Load, Kw | "Wattless" Load, Kva. | Power-Factor per Cent | Apparent Load, Kva. | True Load, Kw. | "Wattless" Load, Kva. | Power-Factor, per Cent | Apparent Load, Kva. | True Load, Kw. | "Wattless" Load, Kva. | Power-Factor, per Cent | | |
| 2,370 | 1,700 | 1,635 | 72 | 1,440 | 100 | 1,435 | 6.9 | 1,820 | 1,800 | 200 | 99 | 2,300 | Mixed lighting and motor load. |
| 2,310 | 1,700 | 1,565 | 73.5 | 700 | 50 | 697 | 7.1 | 1,950 | 1,750 | 868 | 90 | 2,280 | Mixed lighting and motor load. |
| 3,350 | 2,500 | 2,920 | 65 | 1,315 | 100 | 1,310 | 7.5 | 3,060 | 2,600 | 1,610 | 85 | 2,240 | Motor load only. |

resulted in the installation of small synchronous condensers and motors on some of the consumers' premises and of large condensers at some of the substations.

The first series of tests gave the results indicated in

TABLE III—TESTS ON GENERAL MOTOR-SERVICE CIRCUITS

| | | | | | Remarks |
|---|---|---|---|---|---|
| A | 217 | 160 | 145 | 74 | Single foundry. |
| B | 842 | 740 | 400 | 88 | 200-kva condenser effect, single factory. |
| C | 668 | 500 | 453 | 74 | 80-kva condenser effect, general motor service. |
| D | 965 | 180 | 193 | 68 | General motor service, small shops. |
| E | 698 | 480 | 307 | 69 | Two factories employing welding extensively. |
| F | 187 | 130 | 88 | 83 | Mixed lighting and motor service. |
| G | 456 | 360 | 276 | 79 | 80-kva condenser effect, single shop. |
| H | 407 | 380 | 305 | 86 | Large foundry, blowers and machine tools. |
| I | 446 | 330 | 307 | 74 | General motor service. |
| J | 112 | 64 | 92 | 81 | General motor service. |
| K | 227 | 147 | 152 | 65 | General motor service. |
| L | 311 | 251 | 187 | 81 | 200-kva condenser effect. |
| M | 349 | 275 | 213 | 79 | Large paint-manufacturing company. |
| N | 100 | 88 | 48 | 88 | Clothing factory. |
| O | 187 | 111 | 151 | 89 | Two factories; motors carry about one-third load. |
| P | 191 | 157 | 109 | 82 | Lumber yards; motors carry about two-thirds load. |
| Q | 717 | 584 | 448 | 78 | 80-kva condenser effect. |
| R | 400 | 222 | 200 | 67 | Large automobile factory, motor load. |
| S | 575 | 425 | 380 | 65 | Large automobile factory, motor load. |
| T | 443 | 191 | 400 | 90 | Large automobile factory and general motor service, 200-kva condenser. |
| U | 450 | 237 | 380 | 85 | 80-kva condenser effect. |
| V | 93 | 42 | 80 | 86 | Lighting and motor service. |
| W | 780 | 577 | 500 | 67 | Large paint-manufacturing company and general motor load. |

Table I. The line power-factors varied from 56 to 76 per cent, and the average day load power-factor of the substation was 61 per cent.

After the installation of two 750-kva synchronous condensers at this substation the test results in Table II were obtained. These results bring out strongly the advantages to be derived from the use of power-factor corrective apparatus.

More recently another series of tests was made on the motor-service circuits, as shown in Table III. The first six feeders, designated by the letters A, B, C, etc., are identical with the feeders similarly lettered in Table I, the effect of the application of the local condenser on B and C and of increased loading of the motors on E being quite apparent.

Data were also collected on about sixty different instal-

TABLE V—TESTS OF RECEIVING CIRCUITS

| Receiving Circuit | Day Load | | Night Load | |
|---|---|---|---|---|
| | Load | Power-Factor | Load | Power-Factor |
| Transmission line | 1,400 | 61 | 3,425 | 89 |
| Transmission line | 2,200 | 97.5 | 2,050 | 99 |
| Transmission line | 3,920 | 81 | 2,150 | 77 |
| Transmission line | 1,770 | 87 | 2,150 | 83 |
| Motor-generators | 960 | 97 | 1,180 | 94 |
| Miscellaneous | 700 | | 145 | |
| Station load | 10,950 | 80 | 11,100 | 92 |

NOTE.—High power-factors on transmission lines are due to condensers or motor-generator sets becoming over-excited.

lations, comprising a variety of industries, some large and some small consumers. The power-factors of the installations are given in Tables IV and VI. It must be noted that the great majority of these tests represent average maximum-load conditions, and so the power-factors given are apt to be high rather than low. The highest power-factor noted is 95 per cent, the lowest 20 per cent. These values are averages over a period of three minutes. The general average of all average figures is about 69 per cent. Table V gives some data on the transmission lines and generating station for day and night load.

The approximate comparison given in Table VII may be of interest. Neglecting land and buildings, the investment per kilowatt of demand at the consumer's premises will be divided as shown in Table VII. Column A gives the investment for unity power-factor load, Column B the investment for 60 per cent power-factor load, Column C for 60

TABLE IV—TESTS OF GENERAL MOTOR-SERVICE CIRCUITS

| Character of Installation | Remarks | Kilowatt Demand | | | Power-Factor | | |
|---|---|---|---|---|---|---|---|
| | | Maximum | Minimum | Average | Maximum | Minimum | Average |
| Machine shop | Builders of machine tools | 23 | 11 | 17 | 92 | 72 | 79 |
| Machine shop | Builders of machine tools | 33 | 14 | 21 | 86 | 35 | 50 |
| Machine shop | Manufacturer of foundry supplies | 28 | 24 | 26 | 75 | 75 | 75 |
| Machine shop | Builders of machine tools | 46 | 38 | 42 | 82 | 72 | 75 |
| Machine shop | Builders of machine tools | 27 | 16 | 22 | 74 | 58 | 69 |
| Machine shop | Railroad repair shop | 72 | 50 | 60 | 66 | 63 | 65 |
| Machine shop | Tool manufacturers | 40 | 34 | 38 | 65 | 63 | 64 |
| Machine shop | Buffers and machine tools | 45 | 38 | 42 | 82 | 68 | 72 |
| Machine shop | Screw manufacturers | 100 | 90 | 95 | 79 | 74 | 75 |
| Machine shop | Safe manufacturers | 55 | 44 | 40 | 87 | 87 | 87 |
| Machine shop | Manufacturer of gas machinery | 13 | 4.5 | 6 | 50 | 20 | 35 |
| Machine shop | Manufacturer of children's toy wagons | 35 | 26 | 31 | 71 | 60 | 68 |
| Machine shop | Manufacturer of cap screws | 75 | 67 | 70 | 54 | 52 | 53 |
| Foundry | Blowers, tumblers, drill presses | 269 | 104 | 152 | 76 | 71 | 72 |
| Foundry | Blowers, tumblers, machine tools | 23 | 18 | 20 | 77 | 69 | 71 |
| Foundry | Blowers, tumblers, machine tools | 66 | 37 | 57 | 82 | 77 | 80 |
| Foundry | Blowers, tumblers, machine tools | 19 | 17 | 18 | 72 | 68 | 70 |
| Foundry | Blowers, tumblers, machine tools | 193 | 132 | 150 | 91 | 89 | 90 |
| Foundry | Blowers, tumblers, machine tools | 73 | 66 | 70 | 68 | 65 | 67 |
| Foundry | Blowers, synchronous motor-generator set | 103 | 65 | 82 | 92 | 88 | 90 |
| Foundry | Blowers and tumblers, etc. | 31 | 25 | 27 | 92 | 90 | 91 |
| Foundry | Blowers and tumblers, etc. | 108 | 42 | 52 | 75 | 59 | 61 |
| Automobile factory | | 139 | 106 | 125 | 75 | 64 | 68 |
| Automobile factory | Same when slack | | | | | | 52 |
| Automobile Factory | | | | 360 | | | 60 |
| Automobile Factory | | 22 | 10 | 13 | 72 | 63 | 70 |
| Forge shops | Drop hammers | 6 | 3 | 5.6 | 50 | 41 | 43 |
| Forge shops | Blowers only | 18 | 12 | 13 | 94 | 90 | 92 |
| Forge shops | Same shop, light load | 4 | 2 | 3 | 60 | 35 | 50 |
| Forge shops | Large shop | | | 400 | | | 90 |
| Forge shops | Hammers, light | 24 | 12 | 16 | 88 | 55 | 75 |

er cent power-factor load from consumer to substation nd 85 per cent power-factor from substation to generating tation, Column D for 85 per cent power-factor load at the onsumer's premises, condensers being installed ahead of ne consumer's meters.

The relative cost of small condensers has been taken at 2 and of large condensers at 4 per kilovolt-ampere in

Assuming a load-factor corresponding to 250 hours' use per month, the relative cost of energy in the above four cases (taking into account fixed charges on the equipment required and the running costs on the energy generated) will vary approximately as follows per kilowatt-hour: A = 100; B = 155; C = 133; D = 119.

It is apparent from the above data that it will pay cen-

TABLE VI—TESTS OF MISCELLANEOUS INDUSTRIAL INSTALLATIONS

| Character of Installation | Remarks | Kilowatt Demand | | | Power-Factor | | |
|---|---|---|---|---|---|---|---|
| | | Maximum | Minimum | Average | Maximum | Minimum | Average |
| efrigeration | Fish company | 20 | 16 | 17 | 78 | 70 | 73 |
| efrigeration | Same company under light load | 15 | 2 | 10 | 65 | 20 | 50 |
| efrigeration | Skating rink | 189 | 66 | | 77 | 73 | 75 |
| ir compressors | Average load light | | | 25 | | | 50 |
| rick yard | Mixers and presses | 32 | 21 | 27 | 79 | 64 | 75 |
| letal working | Presses and machine tools | 170 | 89 | 121 | 95 | 95 | 95 |
| tove works | Machine tools | 18 | 15 | 17 | 69 | 63 | 65 |
| tructural iron | Punches and shears | 20 | 4 | 12 | 82 | 37 | 60 |
| ilt extractors | Pumps | 158 | 54 | 73 | 59 | 52 | 55 |
| Voodworking | Sash and door work | 14 | 2 | 8 | 73 | 64 | 69 |
| Voodworking | Lumber yard | 50 | 22 | 33 | 91 | 75 | 88 |
| Voodworking | Counters and bar fixtures | 29 | 15 | 20 | 87 | 82 | 84 |
| Voodworking | Moldings | 108 | 59 | 80 | 68 | 63 | 65 |
| 'extile industries | Garment makers | 94 | 77 | 88 | 85 | 85 | 85 |
| 'extile industries | Knitting mill | 13 | 11 | 12 | 50 | 45 | 47 |
| 'extile industries | Garment makers | 16 | 10 | 12 | 67 | 62 | 65 |
| Elevators | Grain elevators | | | 11 | | | 87 |
| Elevators | Freight elevator | 5 | 1 | 3 | 75 | 59 | 66 |
| 'aint manufacturers | Grinders and mixers | 3 | 1 | 2 | 80 | 47 | 75 |
| 'aint manufacturers | Grinders and mixers | 24 | 6 | 18 | 88 | 68 | 85 |
| 'aint manufacturers | Grinders and mixers | 16 | 10 | 14 | 65 | 61 | 62 |
| 'aint manufacturers | Grinders and mixers | | | 275 | | | 79 |
| 'ood products | Meat curing | 32 | 10 | 15 | 80 | 75 | 77 |
| 'ood products | Abattoir | | | 18 | | | 69 |
| 'ood products | Noodle factory | 29 | 27 | 28 | 90 | 88 | 89 |
| Master factory | Grinders and mixers | 41 | 17 | 29 | 87 | 75 | 82 |
| | Manufacturer phonograph records | 7.5 | 4.5 | 6.3 | 78 | 72 | 72 |
| Electric welders | | | | | 65 | 30 | 50 |

erms of the total under Column A. It will be noted that here is only a slight decrease in investment where condensers are placed at the consumer's premises instead of at the substation, owing to the much higher cost of the smaller condensers. The difference in losses is, however, much more marked. Table VIII gives the relative energy

TABLE VII—INVESTMENT WITHOUT AND WITH POWER-FACTOR CORRECTION

| | Relative Investment per Kilowatt Delivered | | | |
|---|---|---|---|---|
| | A | B | C | D |
| Consumers' meters | 1.60 | 2.67 | 2.67 | 2.67 |
| Consumers' transformers | 5.00 | 8.35 | 8.35 | 5.88 |
| Distributing lines and switchboards | 10.00 | 16.70 | 16.70 | 11.78 |
| Step-down transformers | 2.40 | 4.00 | 2.82 | 2.82 |
| Transmission lines | 11.00 | 18.35 | 12.92 | 12.92 |
| Generating equipment | 70.00 | 116.80 | 82.40 | 82.40 |
| Condenser capacity | ..... | ..... | 2.86 | 8.60 |
| Total relative investment per kw | 100.00 | 166.87 | 128.72 | 127.07 |

losses per kilowatt of demand under the four conditions applying to Table VII.

In Table VIII the field losses have been computed on the basis of the ampere-turns of the generator armatures, being equal to 20 per cent of the ampere-turns of the generator field circuit.

Under the above conditions the kilowatt demand on the generating station per kilowatt of consumer's demand would be relatively as follows for the four cases enumerated: A = 100; B = 145; C = 138; D = 112, while the kilovolt-ampere demands would be A = 100; B = 242; C = 162; D = 132.

tral-station managers to study the loading of the induction motors on their circuits with a view to maintaining them at the highest possible average load.

In large installations one or more synchronous motors should be installed, if possible, where part of the load can to advantage be carried on a motor-generator set, as for example where adjustable-speed direct-current motors are

TABLE VIII—LOSSES WITHOUT AND WITH POWER-FACTOR CORRECTION

| | Relative Losses per Kilowatt Delivered | | | |
|---|---|---|---|---|
| | A | B | C | D |
| Consumers' transformers | 15.0 | 41.7 | 41.7 | 20.8 |
| Distributing lines | 60.0 | 167.0 | 167.0 | 83.2 |
| Step-down transformers | 4.0 | 11.1 | 5.5 | 5.5 |
| Transmission lines | 18.0 | 50.0 | 24.9 | 24.9 |
| Field excitation | 3.0 | 3.6 | 3.3 | 3.3 |
| Added for condensers | ..... | ..... | 1.8 | 8.0 |
| Total relative losses per kw | 100.0 | 273.4 | 244.2 | 145.7 |

required or where the motor can be allowed to accelerate without load. Local synchronous condensers should be used in the larger installations where no suitable load for synchronous motors is available.

Large synchronous condensers should be installed in exclusively alternating-current substations, and synchronous motor-generator sets in substations carrying a mixed alternating-current and direct-current load, to correct for the low power-factor on those feeders to which local correction cannot be applied.

Rate systems should provide the lowest kilowatt-hour charge to the load of unity power-factor.

# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Electric Regulations in Minneapolis

The Minneapolis General Electric Company has issued a booklet entitled "Regulations for Electric Service." The pamphlet is intended particularly for the use of contractors, architects, engineers and others who have to do with installations on the company's central-station service. Four classes of direct-current and alternating-current service available are listed, and contractors are requested, before beginning construction work or before making any changes in existing installations, to confer with the engineering department of the company. Plans and specifications for 2300-volt installations should in all cases be submitted to the engineering department for approval. The booklet contains in compact form much useful information about inspection, wiring, meters, standard meter boards, wiring for meters, motors and other apparatus that may be connected to the system, as electric signs, rectifiers, heating apparatus and the like. In addition there are given tables and useful information of general application. Altogether the pamphlet is valuable for reference. Messrs. H. M. Byllesby & Company, of Chicago, Ill., are the engineers and managers of the company.

## A Prize-Winning Central-Station Display

First premium was awarded to the display booth of the Titusville (Pa.) Light & Power Company at the recent Oil Creek Agricultural Fair, which is reproduced in the accompanying illustration. Various household and heating devices were exhibited, including electric machines, toasters,



CENTRAL-STATION BOOTH AT TITUSVILLE (PA.) FAIR

percolators, stoves, fans, cooking ranges, washing machines, vacuum cleaners, forge blowers, sewing-machines, etc. All of these devices were in actual operation. Striking use was made of tungsten lighting units of various sizes, and above the booth there hung the familiar slogan in large letters, "Do It Electrically." Mr. Eugene F. McCabe is vice-president and manager of the company.

## More Electric Vehicles for Louisville Company

The Louisville (Ky.) Gas & Electric Company, which has been employing a large fleet of electric vehicles for meter-reading, repair work and other purposes, has just added to its equipment two Urban trucks built by the Kentucky Wagon Manufacturing Company, of Louisville. These new electric cars will be used for the general work of the service department.

The electric company reports that from past experience its electric trucks have been found not only economical and satisfactory from an operating standpoint, but also an excellent advertisement for the electric vehicle and central-station service.

## Flash-Lamp Attachment on Portable Test Case

Portable meter-testing outfits used by the Brooklyn Edison company are being equipped with flash-lamp attachments to be used for lighting dark corners, attics, basements, etc., when searching for meters. A lens is fixed in one end of the test case like that in a box camera, and behind it is a miniature incandescent lamp which can be lighted by a small battery fastened under the lid. By pressing a button near the handle of the case and pointing the lens in the direction desired, light can be thrown on the object sought. With this attachment on the test set, the man carrying it does not need to carry a pocket flash-lamp, which is generally in an out-of-the-way pocket when wanted.

## Electrical Irrigation in California

Irrigation by motor drive already has an excellent start in its development in California, according to Mr. Samuel Kahn, vice-president and general manager of the Western States Gas & Electric Company, of Richmond, Cal. Every farmer who has electric service on his ranch acts as a new-business solicitor for the company, and now even the real-estate companies engaged in subdividing tracts of land for sale are offering a motor and a pump with each five-acre and ten-acre purchase. At the same time the real-estate man has the purchaser sign an application for motor service which is forwarded to the electric company.

Mr. Kahn adds that for irrigation work in his district three-phase, 60-cycle, 220-volt squirrel-cage motors have been found most satisfactory. Open-runner centrifugal pumps seem to be the most popular type of pump. Surface flooding is generally used, but sub-irrigation is rarely employed in the districts supplied with energy by this company. The water is generally pumped from wells, as a generous supply usually exists at depths varying from 30 ft. to 50 ft. The principal agricultural products of the Western States' territory are grapes, almonds, olives, apricots, peaches and cherries. Alfalfa is raised extensively while garden truck and some strawberries are grown.

The cost of farm labor varies from $1.50 to $2.50 a day. Electric-service rates for motors are as follows: First 1000 kw-hr. use per month, 3 cents per kw-hr.; second 1000 kw-hr., 2.5 cents; all excess over 2000 kw-hr., 2 cents. Energy for motors of 50 hp or larger is furnished at 1. cents per kw-hr. per month, the minimum charge per h

er year being $6. The lighting rate in irrigation districts 8 cents per kw-hr.

The first effort of the Western States Gas & Electric Company to obtain this kind of business was made in February, 1912. Since that time and up to Oct. 2, 1913, a total load of 4652 hp has been connected. A transmission line 50 miles long in the vicinity of Stockton and Lodi, Cal., furnishes energy for most of these irrigation projects. The Western States Gas & Electric Company is a Byllesby property.

## Small-Town Service in Colorado

Some rather interesting figures covering service in a community of less than 5000 population were given in a paper on "The Central Station in the Small Town" read at the recent convention of the Colorado Electric Light, Power & Railway Association. The author, Mr. H. L. Titus, said that in this place with only 451 residence connections his company had placed about 390 electric flatirons, 192 toaster stoves, 100 toasters and 42 heating plates, in addition to a number of electric cookers, washing machines and vacuum cleaners. These are all operated in residences at the regular lighting rate. In addition the company has placed fourteen private pumping plants of sufficient rating to care for the sprinkling of lawns, etc. From these the company receives from $1.50 to $4.50 a month on an 8-cent rate. A recent attempt was made to introduce the electric cooking range and the hot plate, and twenty-four units of this character are now in service. The rates for this class of service are 4 cents per kw-hr. for electric ranges with a minimum of $1.50 a month and 5 cents for hot plates with a minimum of $1 a month. With these rates the operating cost does not become excessive, ranging from $2 a month for the hot plates to perhaps $7.50 a month for the larger ranges.

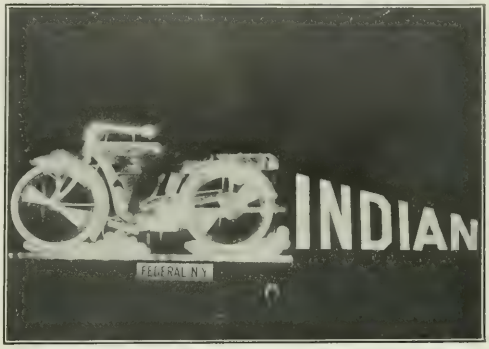
A close basis for estimating the cost of electric cooking when talking with a prospective range customer is to allow kw-hr. per day for each adult person in the household and about one-half of this where the hot plates are used.

## Worcester Factory Group Adopts Central-Station Service

The Worcester (Mass.) Electric Light Company has closed a contract for the supply of electric motor service to the Merrifield Building Trust, which owns one of the most notable factory groups in central New England. Forty-two three-phase, 440-volt motors will be installed, ranging in size from 0.5 hp to 75 hp and aggregating 418 hp connected load. The tenants are mainly engaged in woodworking, machine-shop practice, electroplating, laundry work and manufacturing on a small scale. Energy was formerly supplied to these buildings by line shafts driven through belts and gearing by a 450-hp single-cylinder condensing steam engine and four motors of from 35-hp to 75-hp rating were operated from a 150-kw belt-driven generator. The engineers' survey disclosed excessive friction losses in transmission between various floors and buildings, and a 35-hp motor was found to be carrying a load of but 5 hp under average conditions. Under the new conditions of central-station service, the main line shafting will be practically eliminated, all gearing will be discarded and the loading of individual motors will be closely proportioned to their rating. Separate meters will be installed for each tenant and the only fuses between the center of distribution and each tenant's motors will be located on each tenant's premises, a plan adopted to cut down interference and delays in operation. Nine hoists and elevators will be electrically equipped. The smaller motors will probably be wired for starting direct from the line without fuses, a double-throw, triple-pole spring switch being used for the purpose. A spring throws the switch out of the starting position if the handle is released.

## A Large Motor-Cycle Sign on Central-Station Service

A recent addition to the electric-sign installations on the system of the Boston Edison company is illustrated herewith, the sign being located on Massachusetts Avenue, Boston, on the roof of a building occupied in part by the agency for a well-known maker of motorcycles. The sign is 24 ft. over all and contains 376 2-cp lamps wired in multiple on a 110-volt direct-current circuit. The display represents a motorcycle in operation at full speed, the rider being made purposely inconspicuous. The flashing equipment provided produces a striking effect of revolving wheels




MOTOR-CYCLE SIGN ON CENTRAL-STATION SERVICE

and flying clouds of dust thrown out at the rear and carried away through the trade name of the manufacturer's product. The letters are reduced in size as they leave the wheel, and this heightens the effect of apparent high speed secured from the flasher. The motorcycle wheels are 4 ft. 6 in. in diameter and the sign is 12 ft. high. Its first cost was about $600, and the cost of operation on the Edison system is about $30 per month maximum, from dusk to midnight. The sign was built by the Federal Sign Company of New York according to the designs of Mr. G. H. S. Young, of the Boston Edison company.

## Motor Drive Reduced Oil-Pumping Costs 37 per Cent.

The United Oil Company has realized a reduction of 37.5 per cent in the cost of operating its property in the Midway oil fields, near San Joaquin, Cal., by substituting electricity for steam, this percentage of increase being based on a comparison of the actual outlay for the last two months of steam operation with that for the first two months of electric drive. Eight pumping motors have been installed on as many producing wells.

The accompanying table gives a detailed account of the expenses for September and October, 1912, the last two months of steam, and for January and February, 1913, the first two months of sole electric operation, showing a saving of $990.02, which is equivalent to the cost of 3300 barrels of oil at an average price of 30 cents a barrel. A study of these figures shows that a saving of 86.2 per cent has been made for water, 46.2 per cent for oils and grease, 13.5 per cent for fuel oil, and 8.6 per cent for labor. The need of boiler compound was eliminated entirely. Deterioration was not considered, although, on account of the heavy maintenance expenses

of wooden plants of steam lines, the comparison would prove electricity cheaper in this respect also.

Many other oil companies in California are awakening to the fact that electricity is more economical than steam.

COST COMPARISON OF OIL-WELL PUMPING BY STEAM AND ELECTRIC DRIVE

| STEAM EQUIPMENT | | | ELECTRICAL EQUIPMENT | | |
|---|---|---|---|---|---|
| | Nov. 1912 | Oct. 1912 | | Jan. 1913 | Feb. 1913 |
| Water | $[illegible] | $[illegible] | Water | $1[illegible] | $53.90 |
| Fuel | [illegible] | 305 50 | Fuel | [illegible] | 329 90 |
| Labor | 448 00 | 448 00 | [illegible] | [illegible] | 383.50 |
| Repairs, supplies, oil and grease | 30 00 | 30.00 | Oil and [illegible] | 17 50 | 1[illegible] 50 |
| Total | $[illegible] | $[illegible]241 | Total | $[illegible] | $764 80 |
| Daily [illegible] | | $2638 32 | Daily [illegible] | | $1648.30 |
| Average per month | | $1319.16 | Average per month | | $824.15 |

In the Midway fields alone there are now about thirty companies using a total of more than 300 pumping and drilling motors.

## Toledo's Customers' Department

An attractive "customers' department" has been established by the Toledo Railways & Light Company, of Toledo, Ohio, in a building adjoining its old headquarters. Hundreds of tungsten lamps are used to outline the structure, whose castellated cornice and tower make it prominent among all the other buildings on this much-traveled street. The ground floor is given over to a display room where




THE "CUSTOMERS' DEPARTMENT" OF THE TOLEDO COMPANY

electric cooking and heating appliances, lamps, domestic devices, etc., are on exhibition. A rest room for the convenience of women customers is also one of the evidences of the utility company's thoughtfulness toward its local public. The Toledo motto, "You will do better with electricity," has a prominent position on an electrically lighted transparent sign bordering the display window.

## Electricity on James J. Hill's Farm

The new hundred-and-fifty-thousand-dollar mansion which Mr. James J. Hill is having constructed on his 7000-acre farm at North Oaks, near White Bear, Minn., will be equipped to utilize electricity to the fullest extent. Electric motors will be used for various farming operations, the total connected load amounting to about 65 hp. Energy will be supplied to the North Oaks estate by the Stillwater division of the Consumers' Power Company, a Byllesby property.

Prior to signing a five-year contract with the Consumers' Power Company, Mr. Hill had experts investigate the advisability of an isolated power plant, but eventually he decided in favor of central-station service. Many inquiries are being received by the Stillwater division from farmers desirous of using electrical energy for both lighting and motor purposes, and a considerable increase in this class of business is expected next spring.

## Southern California Edison Company's Method of Disposing of Electric Appliances

By S. M. Kennedy

Any central-station man who has carefully and constantly watched the development of the electric appliance business from its inception to the present time, who has schemed and planned to arouse public interest and increase the number of appliance sales among his customers, must surely have established a theory on this subject which theory would gradually become a conviction. He will eventually conclude that there is some means or method by which every man or woman can be interested in any appliance of real merit and induced to install one in his or her home.

Advertising, whether newspaper, program, street car, billboard or circular, has a distinct advantage in attracting attention and awakening interest in an article, but advertising in itself does not obtain many signatures to agreements and orders. It must be followed up by personally presented proposals in order to make sales. Appliance-selling campaigns have developed many and varied plans to induce purchases, and each plan has been followed by more or less satisfactory results. Each successive scheme, if legitimate and properly presented, has brought into the fold some consumers who had hitherto held back, but it has left others out in the cold, awaiting some different proposal to warm their interest and make them feel that the ownership of the particular appliance presented is necessary to their comfort.

Of all the electrical appliances which have been produced for use in the home up to the present date, the electric flat-iron is the best beyond all question. It has passed through a dozen years of evolution until it has reached a degree of perfection which it will be difficult to exceed in type, efficiency or durability. The best evidence of this is that some of the leading manufacturers now give guarantees of ten years or longer on all the irons they are sending out. No other electric appliance consuming the same amount of energy is as constantly used in the home or gives as much satisfaction to the user when in operation. Nothing but enthusiastic indorsement is heard regarding its claim for comfort, convenience and utility. Other electrical devices for home use have appeared with recurring regularity, some to stay and others to go, but so far not one claims to rival the electric iron in importance, utility and popularity. The wonder is that throughout the length and breadth of the land every householder does not possess an electric flat iron, if he or she is within reach of an electric service. None is so rich that he can afford to overlook his need of this unique piece of apparatus, and none so poor that he would not find it real economy to make a sacrifice to own one. And still, perhaps through the carelessness or faul

the nearest central-station company, there are some ch, some middle-class and some poor persons who are rsuing old methods for ironing, using up their strength d wearing themselves out with unnecessary work, because e central-station company has not yet demonstrated to em what they need, what they are missing and how to t it.

The sales manager of a central station who says he has ld 10,000 electric flatirons to his company's customers ay have good reason to be proud of his achievement, but his company has 40,000 residence customers, that sales nager has still a lot of work ahead of him, because each d every one of those 40,000 consumers should possess an ctric iron. The same methods used in selling the first ,000 may not be successful in reaching the remaining ,000, but they all can be reached, and in time all should reached, and the sooner the better for the consumer and e electric company. The day will come when every resi- nce customer will require an electric iron for the kitchen uipment, just as much as electric lamps for the fixtures, d in some parts of the country this is close at hand.

The Southern California Edison Company has been gorously exploiting the lamp-socket appliance for eight ars and has placed with its customers through its own ganization during the past three years alone a total of ,000 appliances of approved types, whose consumption erages from 4 amp to 6 amp each. The total number in e on the company's system, with approximately 90,000 sidence consumers, exceeds the 100,000 mark.

This company recently estimated that more than 85 per nt of its residence customers were using electric flatirons, her purchased directly from the company or sold by deal- s. With a permanent force of appliance salesmen, mak- g house-to-house calls at regular intervals, the public had d plenty of opportunity through explanation and demon- ration to learn how the electric energy in their homes uld be utilized for good purposes other than lighting. ons had always been freely sold on straight cash sales. hey had also been put out on trial, sold on instalments, ned for limited periods, and in fact every effective ethod had been adopted to induce permanent use, except tually giving them away, and yet nearly 15 per cent of



G. 1—COFFEE POTS TAKEN IN PART PAYMENT FOR ELECTRIC PERCOLATORS

e company's customers were still holding back and using d methods and appliances for ironing. The 15 per cent ere still to be converted, but how?

It was found in many instances that the old irons which me consumers were using were blocking the sale of the w electric irons. In other words, many customers were iting for their old irons to break, wear out or be lost or stolen before they would invest in one of the modern electric contrivances. This created an opportunity, and the company has taken advantage of it. A campaign was inaugurated upon an exchange basis, the company taking the old iron no matter the make, size, type or condition, and accepting it as part payment on the purchase of a new electric iron. The retail price of standard makes of electric



FIG. 2—IRONS OF ALL SORTS TAKEN IN PART PAYMENT FOR ELECTRIC IRONS

irons is $3.50, and an allowance of 50 cents apiece was made for the old sadirons or other irons exchanged. The accompanying illustration (Fig. 2) demonstrates how well the plan worked. The stack shown contains 2700 irons altogether, including not only ordinary sadirons but also gas, gasoline and coke irons, and the total result of a three months' campaign will be more than 3000 additional irons put out. The company intends to keep at the promotion work on irons until every single one of its residence customers is supplied, even if the last and most stubborn of its customers must have the electric irons presented to them free, and a bonus paid them for the antiquated smoothers which they seem to love and cherish so pathetically.

In the opinion of many, the electric coffee percolator is next to the flatiron the best lamp-socket appliance from the central-station standpoint, and, of course, from the consumer's standpoint also. In almost all households in this country coffee is used once each day; in many it is used twice daily, and in not a few it is prepared three times every twenty-four hours. The electric percolator makes it easy to serve good coffee with the least amount of trouble and at a minimum amount of expense. That is where it pleases the consumer, and that is why it is always used after its advantages are understood. In the regular use of the percolator one or more times each day advantage comes to the central station and demonstrates the electric percolator to be of much greater importance than other appliances which are used irregularly or infrequently, even though the latter consume more energy while in operation.

With this in mind, the Southern California Edison Company has followed the iron exchange campaign with a coffee-pot exchange plan which has been in operation about two months and bids fair to reach considerable proportions. Fig. 1 shows a pile of more than 200 coffee pots of various makes and materials, each of which has been replaced by an electric percolator. In six weeks' time 600 of these exchanges have been made, and it is confidently expected that when all the territory has been covered the company will have taken in 1000 old coffee pots and have operating in their stead 1000 additional electric percolators. The retail price of the electric percolator is $6, and $1 is allowed for the old coffee pot when taken in exchange.

# Illumination and Wiring

## Noteworthy Lighting of a Factory at Cambridge, Mass.

One of the most striking examples of factory lighting from central-station mains in New England is illustrated herewith from a photograph recently taken at the new plant of Gray & Davis, Cambridge, Mass., manufacturers of




LIGHTING OF FACTORY BUILDING AT CAMBRIDGE, MASS.

automobile electric starting and lighting systems. The factory building is 360 ft. long, 60 ft. wide and five stories in height and fronts on the Charles River Basin, directly facing the outer Back Bay district of Boston, where it is in full view of important electric and steam-railway lines entering the city. The electric-lighting installation consists of 490 tungsten and ninety-five graphitized-filament lamps, and all of these were thrown into service when the photograph was taken. The ninety-five graphitized-filament lamps are of the 50-watt size, and the 490 tungsten lamps are divided among twenty-three 40-watt, twenty-four 60-watt, ninety-seven 100-watt and 346 150-watt units, all operated on a 110-220-volt distribution system.

The large sign bearing the name of the firm at the top of the factory is 100 ft. long, with letters 8 ft. high, and contains about 300 5-watt, 12-volt tungsten lamps. A search-lamp platform has been erected on one corner of the building for advertising purposes, the projector having a sweep of about 5 miles radius.

Inside the building the general lighting is effected by four 150-watt lamps per bay, there being nine bays, roughly 19 ft. square, on a standard floor on each side of the central aisle. Down these aisles single rows of lamps are run. Extensive use is also being made of three-phase induction motors operated from a 550-volt distribution system. The plant at present occupies 140,000 sq. ft. of floor area. It is of reinforced-concrete construction throughout. The entire electrical service is furnished by the Cambridge Electric Light Company.

## Registration of Contractors and Municipal Inspection

The Chicago ordinance requiring the registration of persons engaged in electrical construction went into effect on Oct. 1. The provisions of the ordinance were explained in the *Electrical World* of July 19. While the ordinance was passed primarily for the purpose of protecting the public against the work of so-called electrical contractors, it is expected that there will be a decided decrease in the average cost of inspections made by the electrical inspection department of the city. According to the report of the department of electricity of Chicago for the year 1912, there were 98,414 inspections made at a cost of $74,812.08, making the average cost per inspection about 76 cents. The inspections are charged for according to the number of lamp outlets or motors connected to the system. When the work of installing electrical equipment is done by an incompetent person, it frequently becomes necessary for the bureau to make several additional trips of inspection. On one occasion where a twelve-lamp installation was i spected it was necessary to make fifteen trips before t work was in condition to comply with what was considere good practice. As each one of these trips cost on t average 76 cents and the fee was only $1.20, it can be se that the elimination of the incompetent electrical work will considerably reduce the expenses of the electrical i spection bureau.

Heretofore it was the custom for the regular inspecto to report cases where no permit has been obtained, and was necessary for the chief inspector to obtain a witne to the regular inspector's statement regarding the evidenc and all three had to appear in court to prosecute the cas As the exact time at which the case would be brought t before court was never known beforehand, and as ea case was sometimes represented by a different inspecto the arrangement resulted in poor efficiency.

With the new arrangements, however, it will be the du of the special inspectors to receive notices of violation fro the regular inspectors and to obtain evidence and appe in court for these cases. During previous years the bure has spent several times as much as it gets through fines conduct the prosecutions.

There are two additional features which are of value the new ordinance. The inspection bureau is provided wi signatures of all men supervising electrical construction whom it can place the blame of poor workmanship execute under their care. The second feature is that the bure will be able to inform the contractors of any changes in t rules regarding electrical inspection. Not having had a definite mailing list previous to the passage of this ord nance, the bureau was unable to notify all of the contrac ors, and several who had been accosted for violation rules said that they were ignorant of the changes. Und the present arrangement all of the registered contracto will be on the mailing list, and others who may cla ignorance of the rules are violating the ordinance becau they have not registered.

## Illuminated Sky-Line Float in Dallas

Electrically illuminated floats in night parades alwa command attention, and if any particular novelty or i genuity is manifested in the design or effects produced the are sure to excite admiration also. Floats of this cha acter have won the plaudits of spectators in various fes vals in the Pacific Coast States and in St. Louis, Ne




ELECTRIC-LIGHTED FLOAT IN DALLAS JOVIAN PARADE

Orleans and elsewhere. A recent example was furnis by the night parade on Jovian and Electrical Day in Dall Tex., Oct. 31, to which reference has previously been ma This night parade was in charge of Mr. R. W. Van Valk burgh, grand marshal, and was formed in four divisi The second division included decorated floats. A no

Illuminated float in this division was that of the Southwest General Electric Company, illustrated herewith. It represented, in models of wood and cardboard made to scale, the buildings and sky-line of Dallas for a distance of two blocks, from the Adolphus Hotel on the left to the post office on the right. The windows of these building models were of oiled cloth and were electrically lighted. There were also miniature street lamps shown burning on the streets and models of street cars and automobiles. The legend on the float was "Modern Dallas Impossible Without Electricity." This attraction represented considerable work and ingenuity and was heartily greeted. Prizes were awarded to the Southwest General Electric Company and also the Abright Electric Company and the International Brotherhood of Electrical Workers for their floats. Fully 500 electrical men marched in the parade on foot.

## Ruling on the Service Requirements of the New York Electrical Code

As the result of conferences on evidence secured in the investigation of a number of electrical fires, Commissioner Henry S. Thompson of the Department of Water Supply, Gas and Electricity, New York City, has made the following ruling upon request of the conference, which represented the electrical inspection services of the Underwriters, the electric-light companies and the city.

It is understood that this interpretation involves no change in the Electrical Code and shall not be retroactive except in cases where dangerous conditions appear to exist.

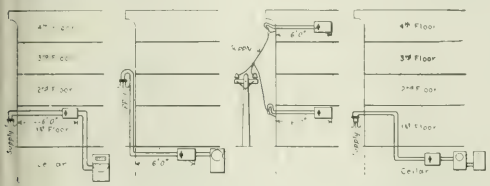



FIG. 1—SERVICE REQUIREMENTS OF NEW YORK CODE

1. Service conduits or metallic coverings protecting service wires must be electrically separated from the conduit system in the building.

This metallic pathway may be broken by the porcelain service switch or by insulating material, such as fiber or transite board, so installed as to provide a separation and insulation between the incoming service conduits or metallic coverings and the interior electric system.

It is suggested that a connection between the service conduit or metallic covering and the neutral wire of a grounded system on the street side of service switch be permitted if desired, and it was requested that, if adopted, the above would not be made retroactive but would apply to future installations only.

2. New-code conduit wire may be used for service connections provided the service conduit does not enter the building more than 6 ft. In case the conduit is concealed or is extended beyond the 6-ft. limit, it is recommended that the wire used in same be provided with an additional 1/64 in. of rubber or be protected by an additional 1/32 in. braid over each conductor or multiple conductor.

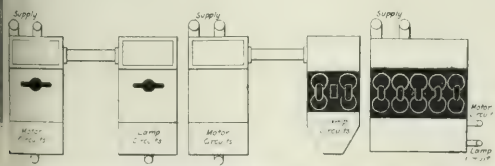



FIG. 2—APPROVED FITTINGS FOR COMBINATION CIRCUITS

3. All wires entering a building and constituting source of supply shall be carried through approved service devices. This will permit of all wires entering buildings being controlled either by one device having the requisite number of connections or by two or more approved devices so installed that when any one is operated the entire installation depending upon that circuit will be entirely disconnected.

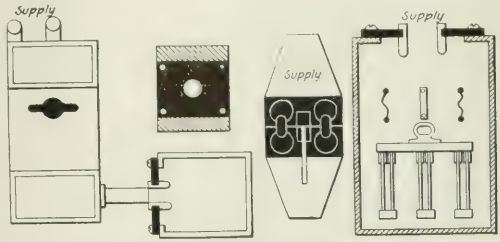



FIG. 3—FITTINGS APPROVED BY NEW YORK CODE

4. Fuse protection must be provided as called for in the rules of the National Electrical Code and the Electrical Code of the City of New York at a point where connection is made between all branches and main feeders, or as near thereto as possible. A neutral fuse will not be required at this point provided the circuits are fused on house side of meter, as called for in the codes.

5. Where two-wire meters are installed on three-wire circuits and the neutral system is grounded, the loop connecting the two outer wires must be on the meter side of the three-pole cut-out protecting the three-wire branch circuit.

In case the neutral is not grounded, a three-wire meter must be installed in order that all three wires of the final branch circuit shall be protected by proper fuses.

In cases where the final branch circuit is properly protected by the cut-out in the meter case, no additional cut-out on the house side of the meter will be required.

The accompanying diagrams illustrate some of the service conditions which were investigated.

## Elements of Cost in Street Lighting

At the convention of the Illinois State Electric Association held at Quincy, Ill., recently, Mr. S. B. Cushing, statistician of the Public Service Company of Northern Illinois, read a paper entitled "Cost of Operating and Rates to Municipalities for Series Street Lighting," in which he commented on present inconsistencies in street-lighting rates in Illinois, declaring it likely that some are as much too high as others are too low. Uniformity in rates becomes especially important where a company deals with several municipalities.

Incandescent street lighting is now coming to the front, following the introduction of a rugged type of tungsten lamp. In fixing proper rates to charge for this class of service items of expense should be studied in detail. Starting with the generating station, the annual cost per kilowatt of rating must be obtained and then applied to the wattage of the lamp or lamps installed at each location, making due allowance for the efficiency of the distribution system. This process should be repeated in case there is a substation. Due allowance should also be made for the fixed charges on special equipment for street lighting, like constant-current regulators or rectifying outfits. Fixed charges on pole-line investment can be obtained by considering the miles of wire devoted to street lighting, with the proportional part of the cross-arm space occupied. To physical items of cost must then be added,

Mr. Cushing said, invisible expenses, such as the cost of collecting bills from municipalities, time required in obtaining rights-of-way, and outlays for trimming or removing trees. Proper allowance should also be made for property and personal-injury claims caused by street-lighting circuits.

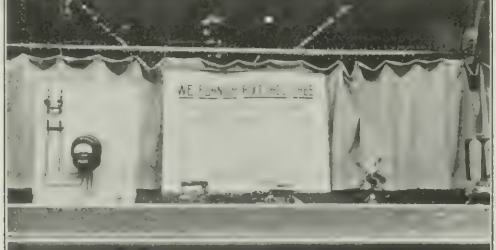
Tungsten lamps consume only small quantities of energy and if put on a kilowatt-hour basis the rate would be higher. After including the foregoing items the actual kilowatt-hours may be sold at the rate of 5 cents per unit until midnight for all street-lighting lamps up to 60 cp and below three-lamp clusters, and at 4 cents per kilowatt-hour after midnight for all three-lamp and four-lamp clusters in case the lamps are 60 cp or more in size. A rate of 3 cents per kw-hr. may be made for three-lamp and four-lamp clusters containing lamps of 60 cp or larger, the lamps burning from 2 a. m. to dawn. A rate as low as 5 cents per kw-hr. must not, however, be considered unless all of the items of cost mentioned—investment in lamps, lamp renewals, general expense, etc.—have been taken into account.

Mr. Cushing advocated abandoning the use of the moonlight schedule wherever possible. Such a schedule costs the municipality nearly as much as the every-night schedule, and is always a cause of controversy. It is advisable to have as few schedules as possible, and three are recommended: From dusk to midnight, from dusk to 2 a. m., and from dusk to dawn. Mr. Cushing's company has found that the expense of operating lamps from dusk to midnight is 80 per cent of the cost of operating them from dusk to dawn. Municipalities should spend the extra 20 per cent for police protection and to advertise the town. Lamps smaller than 60 cp should not be used for street illumination. Where more than one lamp is required a cluster of three 60-cp lamps may be used. If more than 180 cp is required at any location, three 80-cp lamps should be used, as it is recommended to increase the size of the lamps rather than the number in a cluster.

There should be no rebates for outages unless the lamp or lamps have failed to burn during two successive nights. This gives the company one day in which to remedy the trouble, and on the following night its inspectors are able to examine the work.

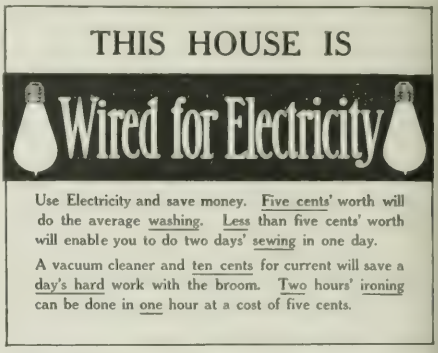
### Free Fixtures During House-Wiring Campaign

With the co-operation of local real-estate dealers and wiring contractors, the Manchester (N. H.) Traction,



WINDOW DISPLAY DURING MANCHESTER WIRING CAMPAIGN

Light & Power Company is pushing a successful house-lighting campaign this fall. Throughout the month of October the company furnished free fixtures for any house on its lines remaining unwired. Local contractors were also instructed to install new wiring on this basis, the company meeting the fixture cost. In each case the prospective user received a choice of several neat and attractive fixture styles. To all real-estate dealers and to the landlords of wired houses on the market the company furnished 11-in. by 13-in. placards as illustrated, emphasizing




WINDOW CARD USED AT MANCHESTER, N. H.

the economies and labor-saving capabilities of electric washers, motor-driven sewing-machines, vacuum cleaners and electric irons. The wiring campaign was also featured in the company's show window, where a residence-type meter, main switch and fuses were wired to various appliances in operation to show the prospective customer the simplicity of electric service.

## Letter to the Editors

### Rates for Electric Service

*To the Editors of the Electrical World:*

SIRS:—In his lengthy communication on the subject of "Rates for Electricity" in your issue dated Oct. 25, 1913 Mr. Percival R. Moses has stated a number of facts regarding existing conditions surrounding electric service but he pretends to ignore the reasons why some of the conditions are necessary. His criticism is of the destructive order rather than constructive. He would tear down methods which have been evolved from years of experience in a comparatively new business, and yet he suggests only a flimsy basis upon which to build what he probably deems an unassailable system.

A comparison is made between the simple method of charging for gas service, on the one hand, and the complex method of charging for electricity. Now, there are several reasons why there must be different methods of charge for these commodities, the principal reason pertaining to methods of generation. Gas may be manufactured at any suitable time of the day or night and stored until the consumer desires to use it. Electricity cannot be stored, except to a limited extent and at great expense, and consequently must be manufactured the instant it is required. The generating capacity of a gas plant may be much less than the "peak" of the load, but the generating capacity of an electric plant must always be at least equal to the "peak." We speak of supplying gas or electric service. "Service" refers not only to the commodity supplied, but also to the availability of the supply. The generating capacity of a gas plant does not bear the same relation to each consumer's demand as does the generating capacity of an electric plant. Gas may be conveniently stored and electricity cannot.

After referring to the simplicity of flat-rate systems of gas companies, Mr. Moses proceeds to attack the present

methods of charging for electric service. It is probable that no perfect method of charging for electric service has yet been developed. If one had been developed, so that each individual consumer would be charged for service in exact proportion to the cost of delivering the energy consumed, it is possible such a method would be found impracticable in operation.

A really scientific schedule of rates is supposed to follow the cost for each class of service, so that no class will be paying for any portion of service supplied to some other class. Mr. Moses has intimated that some of the largest consumers of electric energy are paying for service at such low rates that the loss must be made up by the smaller consumers who are paying the highest rates. As a matter of fact, the experience of the majority of companies is that the most unprofitable class of service is that supplied to the small consumers at the maximum rates, and if the cost were followed in all the schedules, some consumers would have to pay as high as 25 cents per kw-hr., because of the small consumption in proportion to the expense of delivering the service. However, rate-regulating bodies have more or less firmly intimated that the small consumer must be protected, and in fixing the maximum rates to be charged for service in any locality many regulating bodies have had in mind the idea of allowing the little fellow to get his service as cheaply as possible without putting too great a burden upon the electric company, which burden, of course, would have to be borne by the larger consumers. It is recognized by those interested in the electrical industry that the maximum rates are fixed with an eye more to expediency than to scientific regulation.

There are three fundamental factors which form a basis in charging for electric service, namely, quantity, demand and hours of use. The circumstances and conditions surrounding the supply of electric service differ more or less in the case of each individual consumer, though there are certain characteristics which are constant in all installations in which the uses of service are similar. For lighting service the quantity of energy consumed should not alone govern the rate per kilowatt-hour. The demand each consumer is liable to make upon the company is of equal importance, and the relation of kilowatt-hours used to the maximum demand is the most important factor in justifying variations in lighting rates. The sale of electric energy for motor service develops a greater number of variations in uses than for lighting. Experience has demonstrated that these variations in use may be summarized as follows:

First—Optional service: Service that the consumer may take at any time of the twenty-four hours according to his necessity and convenience.

Second—Daylight service: This service covers such industrial business as takes energy only through the ordinary working hours of the day, using no energy after 5 p. m.

Third—Twenty-hour service: Service used constantly except during the four hours of the evening peak.

Fourth—Continuous service: Service used every hour of the day, which means continuous use of a portion of the central-station plant's equipment.

Fifth—Valley service: Service which is used only between midnight and 6 a. m.

Sixth—Seasonal service: Service usually taken for a limited number of months during each year.

Seventh—Wholesale service: Motor service sold to other companies or to municipalities for re-sale.

Eighth—Emergency service: Service used as "standby" to private electric, steam or gasoline plants.

In these classifications no reference has been made to the factor of demand, which must be entered into when the question of rates is under consideration. With some companies there are other reasons which contribute to the necessity for deviations, such as proximity to point of generation, delivery of energy from high-tension lines, consumer paying for line extension and substation equipment, temporary contracts for surplus water-power, experimental work, and other special conditions differing from the characteristics of general service.

Mr. Moses has attempted to puncture almost every present method of charging for electric service. It would appear as if those who have honestly tried to frame just and equitable schedules have utterly failed, mostly through ignorance. Students and experts who have made a study of costs of generating and delivering energy have apparently miscalculated the expenses of distribution when framing schedules for various classes of service. And yet some of the electric companies and public utility commissions have in their employ what has been considered the best talent available. Theory and practice have been combined and the belief has prevailed that great progress has been made.

Rate-regulating bodies are agreed that there may be discrimination in charging for electric service as between the different classes of customers supplied, but that there shall be no discrimination between individual consumers of the same class. Public utility commissions have officially recognized that demand, load-factor, hours of use and quantity are conditions which justify variations in charging for service. Mr. Moses' statement to the contrary notwithstanding, some companies have attempted to determine the cost of supplying different classes of service and believe they have in a measure succeeded. The trouble with the line of contention adopted by Mr. Moses is that he would treat the selling of electric energy like ordinary merchandise. As a matter of fact, there is little resemblance between the two. Conditions of supply and demand between a company and its various customers show much variation, and there is a marked variation between the conditions under which different companies operate in different localities. Hence the impracticability of having the same rate schedules, lamp practices and service conditions in effect all over the country.

The majority of electric companies have in their employ engineers who can calculate the cost of delivering service under stated conditions. They can also tell the cost under average conditions, but in these days averages are not considered as proper bases for rates. The schedules must now follow the cost.

Apparently Mr. Moses' shafts are aimed principally at companies selling energy for motor service to large consumers at low prices, and he seems to think this practice is carried so far that frequently large consumers are supplied with service at less than actual cost. Those who have to do with rate fixing in most of the larger companies know the actual cost of delivering energy to any large consumer when the conditions of demand and consumption are clear. There may be exceptions, but as a rule large loads at comparatively low rates are not only profitable in themselves but such loads help to reduce average costs and enable a company to supply average consumers at rates lower than would prevail if the loads of larger consumers were not carried by the central station. And because of its lower costs of production, on account of the size and diversity of its load as a whole, the central station is in a position to deliver electric energy profitably to the larger consumer at a lower cost than the large consumer could in most cases make it from a plant of his own.

It would be folly for any electric company to supply service to a large consumer at less than cost just to get the business. The company would be loading itself down with an unnecessary burden. Moreover, any other consumer could lodge a complaint with the public utility commission regarding the rate charged for such a service, and the company would be required to justify the rate and demonstrate to the commission that the service is not supplied at a loss but is carrying with it a reasonable profit.

*Los Angeles, Cal.* S. M. Kennedy.

# Field of the Operating Engineer

**A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers**

## Unusual Substation Accident

A severe and rather remarkable accident happened at the Harding Avenue substation of the Commonwealth Edison Company during a recent noon hour. This substation is owned and operated by the electric-service company, but its output is sold exclusively to three elevated and surface railway companies. It is at present equipped with one 4000-kw Westinghouse rotary converter of the commutating-pole compound type, converting 25-cycle, 9000-volt alternating current into 600-volt direct current.

The substation switchboard is equipped with three busbars, one main bus, an auxiliary bus and one used for testing. The last-named affords a convenient means for testing the main recording wattmeters of the various railway companies and is often used for that purpose. At the time of the accident construction work was in progress to unite the two existing sections of this test bus with an intermediate section. Two or three men were engaged on this job, which was in progress partly on the first floor of the station and partly in the basement. Canvas was wrapped around the live parts of the busbar, and all the usual precautions were taken by experienced men.

Taking the piece of copper made ready for the connection, two of the men, Alfred A. Warner and Lawrence Giraffe, went back of the switchboard on the main floor to check up the measurements. While they were in there a loud explosion was heard and flames burst out with quantities of smoke. The two men ran out with their clothing on fire. They received immediate first aid and were removed to a hospital as soon as possible. Both men were badly burned. Mr. Warner died a few hours after the accident, but it is expected that the other man will recover.

In some way, it appears, a contact was made between the main lead from the rotary to the switchboard and the metallic work in the building structure. The resulting burn-out was very severe. The chief operator of the substation, Mr. James Milligan, was left to grapple with a very serious situation, while the other men who happened to be in the building took care of the injured men. The short-circuit on the machine lead was between the rotary and its switch and circuit-breaker. The trouble so reduced the voltage that the no-voltage release of the main circuit-breaker was tripped and thereby disconnected the rotary from the busbars. However, the draft of current was not sufficient to open the oil switch controlling the energy supply to the rotary converter, so that the machine ran on still pumping energy into the short-circuit. The operator diagnosed the trouble correctly and operated the control switch, thereby opening the oil switch of the rotary converter and cutting off the source of supply. This was done in a few seconds.

The strain on the insulators supporting the cable rack from the frame of the building was great, owing to the short-circuit, and some of them broke down, developing arcs between some of the section feeders and the framework supporting the cable rack. These were not heavy arcs and possibly they were due to molten metal. These arcs received the next attention of the operator and were extinguished. In the meantime a considerable fire, started by the burning canvas, was in progress. The operator next turned his attention to this and put out the flames with the fire-fighting equipment provided by the company in all stations and substations.

With the equipment under control, Mr. Milligan's next task was to examine the apparatus to see if it would be safe to put it back into service. At nearly the first moment of the accident he had notified the load dispatcher downtown by telephone, so that in turn the railway companies were advised to make temporary provision through the feeding network, should this be necessary. Things in his own substation were in pretty bad shape, but nevertheless the operator was satisfied that the machine would stand up to its work, and he had it back in service carrying its load within twenty minutes from the time of the explosion.

Mr. E. F. Smith, superintendent of substations of the Commonwealth Edison Company, says that Mr. Milligan's performance was one of the best displays of courage, combined with promptness, accuracy and well-directed activity, that have come to his attention since the establishment of the substation system. There was no interruption to the service of the railway companies.

## Oil-Burning Furnaces—II

By R. T. Strohm

A form of furnace construction used in connection with a Heine water-tube boiler is shown in Fig. 1. The bridge wall is torn out completely and the whole floor is brought to the level of the bottom of the ashpit. On this surface two layers of firebrick are placed, as at *a* and *b*, separated by bricks *c* laid on edge and so supported as to leave an air

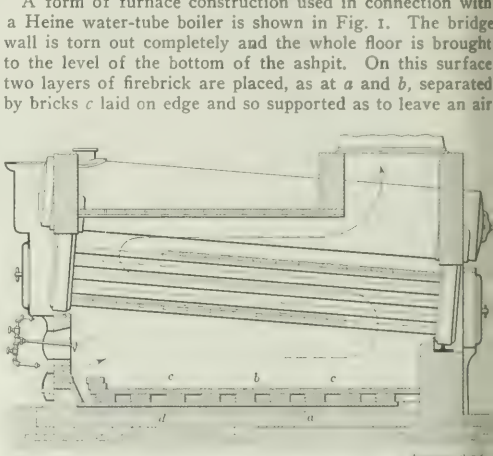



FIG. 1—HEINE BOILER WITH PREHEATING OF AIR SUPPLY

passage *d* underneath the lower layer. The air supply enters through the ashpit doors, flows to the back end of the boiler through the passage *d*, then forward between the layers *a* and *b*, and escapes, highly heated, into the furnace just beneath the burner *e*. The burner is of the slot type and throws a fan-shaped flame that spreads to the sides of the furnace. The inclination of the burner is such that the flame is about parallel to the rows of tubes.

The Stirling water-tube boiler arranged for burning oil with a Best burner is shown in sections in Fig. 2. The grates are removed and the sloping floor of the furnace is covered with firebrick laid flat in rows 9 in. from center to center. On top of this firebricks are laid on edge and 9 in. from center to center. The top layer of firebrick

d flat, with ¼-in. air spaces; thus the air supply is admitted over the whole bottom of the furnace after being heated by contact with the brickwork. The burner *a* is inserted through the front wall about 8 in. above the grate and parallel thereto, the tip extending into the furnace about 2 in. Over the tip is constructed a firebrick arch *b* forming an igniting chamber. The arch is brought to incandescence by the heat of the flame, and in case the action of the burner is momentarily interrupted, as by a slug of water carried over with the oil, the spray will be reignited by the hot brickwork when the burner continues its operation. The bridge wall is constructed with a firebrick facing and a flared top, so that the flames striking into the pocket thus formed are turned back on themselves. This is done to prevent the flames from striking directly against the tubes. An auxiliary air duct *c* is formed in the bridge wall. It connects with the passages beneath the furnace floor and admits air to the upper part of the flame when the fires are being forced. At such a time there is a tendency to form carbon monoxide at the top of the flame, and the air admitted through the duct *c* supplies the oxygen required to convert this to dioxide. The arch *d* is re-

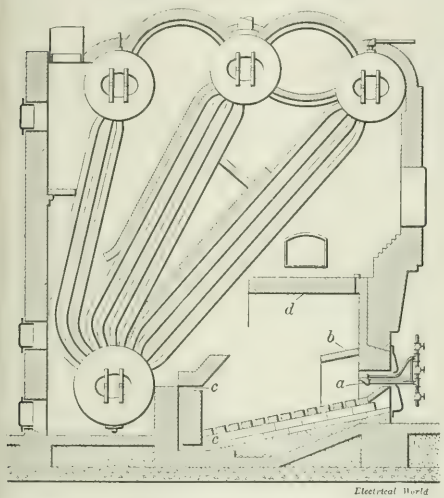



FIG. 2—STIRLING BOILER WITH AUXILIARY AIR DUCT

tained and serves to deflect the gases toward the front bank of tubes.

If desired, the burner can be put at the rear end of the furnace, as in Fig. 3. The arrangement in this case is like that for the Babcock & Wilcox boiler fired from the rear. The air ducts are formed beneath the floor, there being one for each burner, and the burners are protected somewhat by being set in recesses in the bridge wall. The arch over the furnace is omitted, and the front wall is heavily protected with firebrick.

One way of altering the usual furnace construction of the Stirling boiler so as to adapt it to the use of oil fuel is shown in Fig. 4. The rear half of the grate is removed and a brick pier *a* is substituted. A firebrick floor *b* is built over the top of the pier and the remainder of the grate surface, and air spaces from ¼ in. to ½ in. wide are left between the bricks on the grates. The arch usually found inside the furnace, above the firedoor, is removed entirely, because the burner *c* is installed at about the height of the top of this arch. The burner is of the slot type and is inclined so as to project the flames downward into the angle or pocket formed by the firebrick floor *b* and the bridge wall *d*. The flames thus are given a rebound before they enter the first pass among the tubes. The air enters through the space below the grates and flows up through the space in the brickwork into the furnace.

From an examination of the settings that have thus far been described the following conclusions may be drawn: The furnace of an oil-fired boiler, particularly in those parts against which the flames strike, must be lined with a

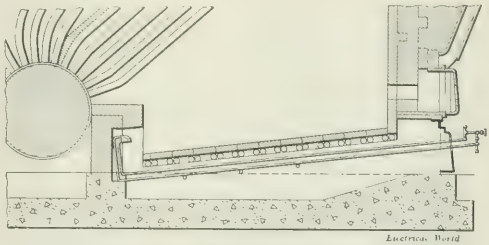



FIG. 3—STIRLING BOILER WITH BURNER AT BACK OF FURNACE

good quality of firebrick so as to protect the outer walls and the boiler and to resist the high temperatures produced. There should be a combustion chamber of ample size, in which the gases and the air may meet and commingle thoroughly, so that combustion may be complete before the resulting products of combustion are brought against the comparatively cool boiler surfaces. If combustion is not completed before the gases strike the metal parts of the boiler, the consequent chilling will prevent further combustion and cause smoke to be formed. If it seems likely that the flames will strike the boiler, baffles or arches should be set up to prevent direct contact. This is particularly necessary in the case of the blow-off pipe of a return-tubular boiler, when the blow-off is carried straight down through the gas passage at the rear end of the boiler. It is advisable to preheat the air supply before admitting it to the furnace.

Oil fuel is used as an auxiliary to coal in some cases. In one electric power station oil burners are installed with the idea of helping out on peak loads and for the purpose of banking the boilers. The arrangement of the furnace of one of the boilers is shown in Fig. 5. At the front there are the usual grates *a* on which coal fires are carried for the normal operation of the boilers. Behind the bridge wall *b* the burners are installed, as shown at *c*. The combustion chamber for the oil is formed by the baffle *d*, the floor *e*, the wall *f*, and the side walls of the setting. After combustion, the hot gases from the oil burner pass forward

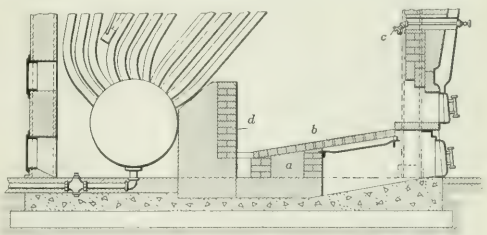



FIG. 4—STIRLING BOILER WITH OIL BURNER SET HIGH AT FRONT

over the bridge wall and travel along with the gases rising from the grates. The air supply to each burner is admitted through the passage *g* that contains the steam and oil pipes.

By this arrangement it is possible to fire the boiler at both ends, using coal and oil at the same time. The result is the same as would be obtained by increasing the

rate of combustion with coal alone; that is, the steaming capacity of the boiler is greatly increased. Of course, the oil burners are used to supply the additional steam demanded by a peak load. Under normal load the coal fires only are used; but as soon as a sudden increase of load comes on the oil burners are put in action, and in a very short time the capacity is equal to the increased demand.

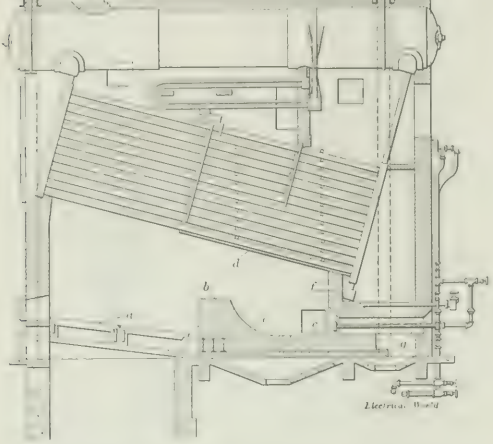


FIG. 5—OIL BURNERS USED AS AUXILIARIES TO COAL FIRING

This rapidity of response to sudden changes of load forms one of the strongest advantages of oil fuel. By adopting the scheme here outlined the boiler-horsepower may be increased two-thirds, without increasing the number of boilers.

During periods when the load is light oil is used to bank the boilers. There are four burners to each boiler, and one of these is connected so that it can be operated independently of the others when the boilers are to be banked. At this particular plant the oil costs more per heat unit than the coal; yet it is found more economical to use oil for banking, because the combustion is more efficient with the oil than with the slow coal fire.

## Thin Brushes

An inspector went 150 miles to stop sparking on a 20-hp, 125-volt, shunt-wound four-pole motor. The sparking was almost equally bad for all loads and for all brush positions within the range of the brush-holder rocker arm. The operator stated that the motor was idle for several months after its purchase and also that it had been a bad actor from the start. The commutator had been turned three times in two months and brushes had been consumed by the dozen. Investigation revealed that the motor had been purchased from a second-hand dealer who, presumably, had bought it from the original dissatisfied owner. The inspector put the motor through all of the usual tests to determine soundness of the commutator and the windings and to check the correctness of the brush setting and of the field polarity. All of these conditions proved to be normal. In testing for brush quality, however, the inspector happened to get hold of a set of brushes intended for a smaller motor. On starting and loading the faulty motor with these brushes installed commutation was perfect at all loads. Inspection showed the brushes to be 1/16 in. thinner than those for which the brush-holder boxes had been designed. On chamfering the ends of the original brushes they too gave perfect commutation. Before thinning the brushes the thickness of each spanned three commutator bars; after thinning the brushes each spanned only two commutator bars. It became evident then that the magnetic field had narrow neutrals that called for thin brushes. A motor with this fault could never have passed a running test.

## Safety Catches for Disconnecting Switches

Why need generator disconnecting switches be provided with locking catches when their blades are to be installed in such positions that they cannot possibly fall open by gravity? K. N. C.

Safety catches are provided for knife-type disconnecting switches to prevent their blades opening under the action of the self-generated strong magnetic fields which may result from heavy short-circuit currents through the switches. Such disconnecting switches are hand-operated and are intended to be opened only when no current exists. The forces acting to open the switch during heavy currents are due to the interaction of the field about the blade itself with those about other parts of the switch and adjacent circuits. Such disruptive forces may become very powerful, sometimes even tearing busbars and cables from their supports. The safety catch assures that under short-circuit conditions the switch will not fly open. Recent designs of disconnecting switches in which the path of the current is in a straight line through the switch reduce this tendency to self-opening.

## Repair of Heating Element

I have a 6-in. electrical hot-plate which has burned out. On taking it apart I found the heating element wound in a helix on a 3/16-in. arbor and the whole covered with something of the nature of cement. To replace the burned-out element I rewound a flatiron resistor on a new bedding it in calcine plaster. It burned out in about an hour. Then I tried a compound composed of asbestos (boiler covering), sand and Portland cement, but with the same result. Fireclay and sand were next tried, and again the wire rapidly corroded or oxidized until it finally burned in two. I cannot understand what there can be in the cements I used which would attack the wire. E. R. R.

The oxidation or corrosion of the wire observed is probably due to overheating caused by the cement covering used. Instead of providing good thermal conducting paths for the heat of the wire, compounds like the asbestos mixture mentioned are really thermal insulators. Such coverings, as the correspondent knows, are put on steam pipes and steam boilers to keep in the heat and prevent its loss by radiation. The same action results with this thermally insulated resistor wire. As its rate of heat generation remains practically unchanged, while escape of that heat is almost wholly prevented by the covering, the wire inside becomes hotter and hotter until it finally burns, or perhaps corrodes, with the help of corrosive chemicals distilled out of the inclosing cement. The general problem in heating-device design has always been to provide the best possible thermal conducting path from the resistor to the point of use of the heat. Such construction insures that the resistor temperature will not rise far above that of the outside of the appliance and also makes for the most efficient use of the heating energy. But since most of the good electrical insulators are poor thermal conductors especially those which retain their insulating qualities unimpaired at high temperatures, considerable ingenuity of mechanical design is often required to convey the heat properly from the wire where it is generated. But in the cases brought up by the correspondent the difficulty doubtless lies in the low thermal conductivity of the cement used and their inability to carry away fast enough the heat produced at the high rate at which the flatiron cement is worked.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*Alternating-Current Commutator Machines.* — F. Niethammer and E. Siegel.—A long mathematical paper on the operation of alternating-current commutator machines, taking into consideration all essential secondary influences. In the ordinary series motor the brush short-circuit currents improve the power-factor and at high speeds even produce phase compensation and leading current. In the double-fed series motors the brush short-circuit currents lower the power-factor when the speed is increased beyond the point of best commutation. The same is the case with all repulsion motors when the speed is increased beyond synchronism. All these statements hold when the machines are operating as motors. When they are running as generators the opposite is true. With respect to overload capacity repulsion motors, whether operated as motors or as generators, are inferior to ordinary series motors. The double-fed series motor behaves in general on overload like the ordinary series motor. Some notes are added on the possibility of braking with recuperation of energy.—*Elek. u. Masch.* (Vienna), Oct. 26 and Nov. 2, 1913.

*Noiseless Running of Electric Motors.*—S. Pontecorvo. —An illustrated translation in abstract of his recent German paper in which the different kinds of noise in electric motors are divided into three classes—noise due to magnetic causes, noise due to load and noise due to ventilation. Of these the first mentioned is the most troublesome. Means for reducing or suppressing the noise due to the various causes are described and criticised.—London *Electrician,* Oct. 31, 1913.

*No-Load Current of Transformers.*—M. Vidmar.—An article, illustrated by diagrams, in which the author gives a very simple and little known method of calculating the no-load current of transformers, taking into consideration the air-gap and any increase of the cross-section of the yoke. The formulas are applied to a practical example. For modern transformer-alloy steel sheets the curve of the no-load current coefficient as a function of the induction is given in a diagram.—*Elek. u. Masch.* (Vienna), Oct. 26, 1913.

*Resonance Transformer.*—O. Naumann.—An article outlining the theory of the resonance phenomena in a transformer having its secondary loaded with condensers. The theory is derived by means of the symbolic method and a number of simple diagrams are given. Some peculiarities due to the presence of iron in the transformer are explained by the results of tests.—*Elek. u. Masch.* (Vienna), Nov. 2, 1913.

### Lamps and Lighting

*Electric Street Lighting.*—L. Rosenbaum.—The author summarizes in some tables the statistics of street lighting of the Association of German and Austrian central stations. In 1909 the average connected load in incandescent lamps for street lighting in cities with less than 10,000 inhabitants was 14.5 kw per 10,000 inhabitants; in cities of 10,000 to 20,000, 8.4 kw; 20,000 to 50,000, 2.4 kw; 50,000 to 100,000, 1.8 kw, and in cities with more than 100,000 inhabitants, 0.6 kw per 10,000 inhabitants. In other words, the number of connections per inhabitant decreases rapidly with the size of the city. The connections of arc lamps for street lighting in kilowatts per 10,000 inhabitants were 6.6, 7, 3.6, 2.8 and 3.6, for the same sizes of cities respectively. They are less affected by the size of the city than the street lamps. Of considerable interest is the comparison of the figures for 1905 and 1909. In cities with more than 100,000 inhabitants the number of incandescent lamps for street lighting in 1911 was four times the number in 1905 and double the number in 1909, while the number of arc lamps remained constant from 1909 to 1911. The connected load in incandescent lamps increased by 65 per cent from 1909 to 1911, while that in arc lamps rose by only 1 per cent. In thirty-eight cities with fewer than 20,000 inhabitants the connected loads in incandescent lamps were 427 kw in 1909 and 524 kw in 1911, which is an increase of 23 per cent. The load in arc lamps in 1909 was 230 kw and in 1911 233 kw, which is an increase of 1 per cent. In Berlin, where there is competition with gas, the load in incandescent lamps for street lighting increased from 150 kw in 1909 to 187 kw in 1911, and the connections of arc lamps from 704 kw to 711 kw. In Vienna the connections of incandescent lamps for street lighting increased from 105 kw in 1909 to 122 kw in 1911, and the connections of arc lamps from 716 to 815 kw. Another table shows that carbon lamps amount hardly to 10 per cent of all incandescent lamps. The increase in the use of incandescent lamps for street lighting is, therefore, almost completely due to the development of the metallic-filament lamp. Figures are added giving the number of hours per year during which the lamps are used. In general the number of hours per year increases with the size of the city, but the consumption of kilowatt-hours per inhabitant decreases. *Elek. u. Masch.* (Vienna), Nov. 2, 1913.

*Rotations in the Iron Arc.*—W. G. Cady.—If in an arc between iron electrodes the anode is sufficiently oxidized so that a smooth molten globule of oxide is formed, the positive base of the arc tends to fall into a circular motion, producing the appearance of a minute ring of light at the anode. As the current is increased from about 1.5 amp to 2.5 amp four characteristic types of rotation may be observed in succession, the transition from one type to the next being marked by a distinct and sudden change in diameter and frequency of rotation. This is not the result of artificial conditions but the normal sequence of events in the iron arc as the current increases. The characteristic features of each type, including frequency, amplitude and appearance, are described, and photographic records of the movements at the anode, together with the accompanying fluctuations in voltage and current, are shown. Reasons are given for believing that these rotations owe their existence to a difference between the potential drop at the positive base of the arc and the similar drop in the surrounding region. At the positive base the oxide is more reduced and the potential drop is therefore greater; the high temperature probably enhances the effect still further. Observations with other metals and in other gases tend in the main to confirm the conclusions reached with the iron oxide. Oxides of nickel and cobalt show some evidence of forces similar to those in the iron arc.—*Phys. Review,* October, 1913.

*Tungsten for Drawn-Wire Lamps.*—A note on a recent British patent (No. 22,041, 1912) of H. Leiser. An intimate mixture of dry powders of the crystalline and amorphous modifications of the metal, in the proportion

of about 16 to 1, is pressed and heated to a temperature far below the melting point of the metal until the amorphous modification is changed into the crystalline.—London *Elec. Eng'ing*, Oct. 30, 1913.

*Tungsten Lamp.*—Anton Lederer.—An illustrated article giving a sketch of the development of the tungsten lamp.—*Elec. Journal*, November, 1913.

### Generation, Transmission and Distribution

*Water-Power Plant.*—E. Frey and O. Albrecht.—A continuation of their long illustrated description of the Wyhlen water-power plant of the Rheinfelden transmission system. In the present instalment figures of first cost are given together with details of the 45,000-volt and 25,000-volt transmission lines. The article is to be concluded.—*Elek. Zeit.*, Oct. 30, 1913.

*Utilizing the Power of the Tides.*—Some photographs showing a small experimental power plant erected by Pein to utilize the power of the tides for generation of electrical energy. The object is not the generation of large power but proof that uninterrupted operation is thereby possible. Direct current is generated at 110 volts.—*Elek. Zeit.*, Oct. 30, 1913.

### Traction

*Effect of Mining on Tramways.*—Nolden.—The first part of an illustrated article on the deleterious effects of mining operations on street railways and buildings due to sinking of the ground. Methods of avoiding such damage are discussed.—*Elek. Kraftbetr. u. Bahnen*, Oct. 4, 1913.

### Installations, Systems and Appliances

*Protective Ground.*—G. Ruppel.—The German regulations require that protective ground connections shall be made in such a way that in the surface of the soil surrounding the ground a safe and very gradual potential drop will be produced. From experiments on grounding with rods, plates, ribbons or rails the author concludes that the requirement of a very gradual potential drop can be fulfilled only with great difficulty. In order to eliminate danger the only safe way is, therefore, to make the resistance of the earth connection as small as possible so that in case of an accident either the line will be disconnected automatically or the voltage between the pole and the earth will be so small as to be free from danger. It is shown that by the use of long ribbons or wires or rails embedded in the earth, the resistance of the ground connection can be made as small as desired. This method is recommended for transmission lines in agricultural districts as well as for transformer stations.—*Elek. Zeit.*, Oct. 23, 1913.

*Electric Equipment of Building.*—An illustrated description of the electric lighting and power equipment of the recently finished new building of the British Institution of Civil Engineers in London.—London *Electrician*, Oct. 24, 1913.

*Parallel Running of Machinery with Different Characteristics.*—A note on a recent British patent (No. 27,069, 1912) of Brown, Boveri et Cie. Regulators are used which do not maintain constant the value of the quantity to be regulated over the whole range of regulation, but which vary it with the position of the regulating members within the regulating range in a definite sense. For generators working in parallel the main windings of the regulators are fed from the pressure to be regulated, and additional windings are fed by the total current of all the generators.—London *Elec. Eng'ing*, Oct. 30, 1913.

*Starting Rheostats.*—An anonymous article describing a method of calculating the design of a starting resistor in order to utilize to the utmost the resistor material. To estimate the suitability of a starting resistor knowledge of its cooling curve and continuous load are sufficient, and expensive experiments in intermittent operation are entirely superfluous.—*Elek. Zeit.*, Oct. 30, 1913.

*Circuit-Breakers.*—J. N. Mahoney.—An article in which the author points out that the breaking-capacity rating of oil circuit-breakers is usually based by the manufacturers on certain arbitrary assumptions and the nature of these assumptions must be known in order to apply the circuit breakers under different operating conditions.—*Elec. Journal*, November, 1913.

*Extinguishing the Arc on Breaking a Circuit.*—W. Burstyn.—To interrupt a direct-current arc of medium

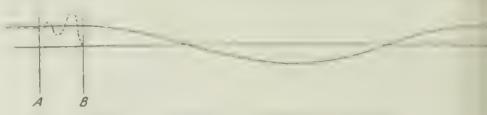



FIG. 1—WAVES ON BREAKING CIRCUIT

strength two methods are used. In the first the arc is extended to such a length and its resistance thereby so increased that it is extinguished automatically. The second method employs condensers. With an induction coil, for instance, the switch in the primary circuit is shunted by a condenser. The author shows that when the current is broken a high-frequency circuit is formed by the capacity of the condenser and the self-induction of the leads thereto. This high-frequency current is superposed over the current of the arc. The phenomenon is shown in Fig. 1, where *A* represents the moment of breaking the circuit. The superposed high-frequency current is shown by a dotted line. In the moment when this superposed current becomes equal and opposite to the main current the total flow becomes zero and the arc is broken. This is shown at the moment *B*, in Fig. 1. After that a slow oscillation starts. The conditions which render the extinction of the spark easy are that the contact surface should be metallic. Carbon electrodes are unsuitable. Platinum is not as good as silver. A hydrogen atmosphere gives improved results. Further, the wave-length of the high-frequency current should not be too short, because the shorter it is the shorter is the time during which the electrodes can cool off and the spark be extinguished. For instance, a condenser which is effective in extinguishing the spark with leads an inch or so in length will fail if the leads are made very short. It is, therefore, recommended that an iron-free coil of moderate self-induction be used in series with the condenser so as to get waves several miles in length. Further, the damping of the oscillation circuit should be as small as possible in order to permit the easy formation of the oscillations. For this reason alone a short wave is

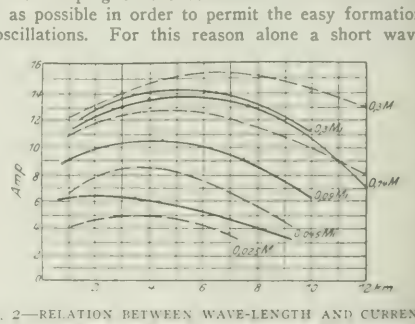



FIG. 2—RELATION BETWEEN WAVE-LENGTH AND CURRENT WHICH CAN BE INTERRUPTED

unfavorable, because with the same resistance it gives a high decrement. The rather complicated phenomena are well illustrated in Fig. 2. The dotted curves refer to silver contacts at 220 volts, the drawn-out curves to platinum contacts at 220 volts. At the right-hand end of each curve the capacity used is given in microfarads. The ordinates give those currents which can be interrupted if self-inductances of such size are used that the wave-lengths

ven as abscissas are obtained. The wave-lengths are ven in kilometers. Each curve clearly shows a maximum, eaning that for every capacity a certain wave-length can e found for which the current that can be interrupted is a aximum. A simple method based on this principle of tinguishing the arc at the contact is shown in Fig. 3, here *a* is the motor or bank of lamps, etc., to be discon-ected; *u* is the switch, *c* is a condenser, *l* the iron-free lf-induction coil, and *n* a very high resistance. Switch *u*

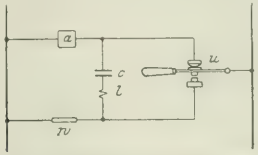
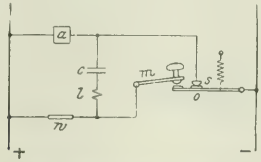



FIG. 3—SPARKLESS INTERRUPTER

so designed that the whole path through which it can ove is only 0.5 mm. If this switch is in the upper posi-on as shown in the illustration, the main circuit is closed nd the condenser *c* is charged. To break the circuit the vitch *u* is turned down so that it touches the lower contact nd the condenser discharges through the high-frequency rcuit *clu*. After one-quarter wave-length this high-fre-uency current reaches a maximum and its direction is pposite to the main current in the arc. The arc is then roken. It is also possible to break the circuit so that no ark is produced at all. For this purpose the high-fre-uency current is produced shortly before the circuit is roken, the circuit being broken at the instant when the tal current is zero. This method is theoretically ideal ut practically difficult, as it requires a very exact adjust-ent. In Fig. 4 if the handle *m* is pressed down on the andle *o*, the high-frequency circuit is closed, but imme-iately afterward the handle *o* breaks the circuit at con-act *s*. The small time difference must be just right and




IG. 4—INTERRUPTER WITH DEVICE FOR EXTINGUISHING THE SPARKS

an be adjusted by the spring which holds the handle *o*. he author finally shows that the same principles are pplicable to the extinction of the mercury arc. By com-ination a mechanical interrupter can also be obtained hich is suitable for induction coils and yields up to 1000 nterruptions per second.—*Elek. Zeit.*, Oct. 23, 1913.

*Motor Speed Regulation.*—A note on a recent British atent (No. 7896, 1913) of the Allgemeine Elektricitäts esellschaft. A booster with a series-field winding is con-ected to the driving motor. This winding has a com-ounding effect during positive boost and a different effect uring negative boost. Thus the motor speed is kept con-tant irrespective of the load.—London *Elec. Eng'ing*, Oct. 30, 1913.

*Bohemia and Moravia.*—KRASNY.—A paper on the com-mercial and legal conditions of electricity supply in Bohemia nd Moravia. The systematic erection of a complete sys-em of large power plants is advocated, with a combination of municipalities and private parties to invest the required apital.—*Elek. Zeit.*, Oct. 30, 1913.

### Electrophysics and Magnetism

*Positive Ionization from Heated Platinum.*—C. SHEARD AND D. A. WOODBURY.—An account of an experimental in-vestigation on temperature and surface conditions which affect the positive ionization from heated platinum. The chief results are as follows: Two sources capable of producing thermions are present as impurities in platinum. One source of ionization is more easily driven out by heating than the other. After continued heating and when investigated within the proper temperature region, two distinct types of current-time curves are obtained, one showing a decay with time from an initial maximum, the other giving rise to a maximum after two or three minutes' heating followed by the usual decay effects. The thermionic emission from a wire which has lost its power of producing ions may be enhanced and made comparable with the initial effects by (a) heating in a Bunsen flame, (b) heating electrically in hydrogen and (c) cleaning the wire with acid. The proposition is advanced that any change in the surface conditions of a wire or a salt will affect the subsequent ionization effects.—*Phys. Review*, October, 1913.

*Recoil Atoms from Thorium C and Actinium C.*—A. B. WOOD.—When an alpha particle is expelled from a radioactive atom the remainder of the atom recoils with the same momentum as the ejected alpha particle. The penetrating power of the recoil radiation in the case of the products of radium has been studied in detail by others. In the present paper the ranges of the recoil atoms from actinium C and thorium C are investigated with the object of throwing light on the arrangement of the products in these series. The results are as follows: The range of the recoil atom from actinium C is found to be the same by both the activity and ionization methods; on the other hand, the apparent range of recoil atoms from thorium C is markedly longer by the ionization method. These differences receive a satisfactory explanation by supposing that two distinct groups of recoil atoms are emitted during the transformation of thorium C. The shorter range group is radioactive, the other rayless. The order of disintegration of the thorium series is shown to agree with that suggested by Marsden and Darwin (by an entirely different method), viz., thorium D is the product resulting from the disintegration of thorium $C_1$ (emitting alpha particles of 4.8 cm range). The product recoiling from thorium $C_2$ (emitting alpha particles of 8.6 cm range) is probably rayless.—*Philos. Mag.*, October, 1913.

*Photoelectric Effect.*—K. T. COMPTON AND O. W. RICHARDSON.—There are two lines of experimental investigation which have been followed in the search for the ultimate explanation of the photoelectric effect from metals. Most of the work in this subject has had to do with the velocities of the emitted electrons or the relation of these velocities to the nature of the emitting metal and the frequency and intensity of the incident light. The second line of attack on the photoelectric problem is the investigation of the effect of the intensity of the light, the frequency of the light and the nature of the metal on the numbers of electrons emitted in unit time. Richardson's theory of electric action yields an expression connecting the frequency, nature of the metal and number of electrons emitted in unit time, as well as the expression for the initial kinetic energy. The equation following from this theory was made the subject of an experimental investigation which is described in the present paper. One consequence of the theory is that the rate of photoelectric emission must reach a maximum at some particular frequency, instead of increasing indefinitely with the frequency as was at first supposed. This is confirmed by the experiments. But the sensitiveness-frequency curve shows two maxima instead of one. The experimental results further indicate that the photoelectric sensitiveness is the same function of the frequency for all metals, the difference being that the curve is shifted bodily out to the region of short-wave length for the electronegative metals. —*Philos. Mag.*, October, 1913.

*Scattering and Absorption of the Gamma Rays of Radium.*—J. A. GRAY.—An account of an experimental in-

vestigation. The chief results obtained are as follows: When gamma rays are scattered there is a change in quality, the scattered rays being less penetrating the greater the angle of scattering. The change is gradual and small when the angle of scattering is small. A similar explanation must be given of the scattering of the X and gamma rays. There is probably very little direct scattering of X and gamma rays. The quality and quantity of the scattered radiation is approximately independent of the nature of the radiator. The softer the type of gamma rays, the greater the percentage scattered per unit mass. A discussion is given of the bearing of the results of absorption experiments, and it is shown why an exponential law signifies heterogeneity of the rays. In the case of X-rays scattering is in most cases so small compared with absorption that an exponential law probably signifies homogeneity.—*Philos. Mag.*, October, 1913.

**Units, Measurements and Instruments**

*Meter.*—An announcement of the Reichsanstalt admitting for calibration a direct-current mercury-motor meter and a meter with double counting device built by the Isaria company. The construction of these two meters is described and illustrated.—*Elek. Zeit.*, Oct. 23, 1913.

**Telegraphy, Telephony and Signals**

*Sine-Wave Transmission in Submarine Telegraph Cables.*—H. W. Malcolm.—A continuation of his long illustrated serial. In the present instalment the author deals with the attenuation of voltage throughout the cable and with the deformation of battery signals in transmission.—London *Electrician*, Oct. 31, 1913.

*Ionization and Oscillations.*—E. H. Barton and W. B. Kilby.—An account of an experimental investigation of the effect of ionization of air on electrical oscillations and its bearing on long-distance wireless telegraphy. The authors' results yield some experimental support to the theory of Eccles as to the propagation of electric waves round the curvature of the earth owing to the ionization of the upper atmosphere.—*Philos. Mag.*, October, 1913.

**Miscellaneous**

*Association of Austrian and Hungarian Central Stations.*—K. Perlewitz.—An account of the tenth annual convention of the Association of Austrian and Hungarian Central Stations held in Budapest from July 1 to 4, 1913. The association has 111 members, representing 127 central stations with a capital investment of $100,000,000. An Austrian section and a Hungarian section were formed, with separate officers, although the common president is Mr. H. Sauer. Reports on certain legal problems were made by Messrs. Harbich, L. Deutsch, R. Hiecke and Scheinig. Dr. Jellinek lectured on first aid in electrical accidents. He emphasized that the Sylvester method of artificial respiration recommended by the association was the only proper one and that all other methods, like the Schaefer method, should be avoided. Mr. Knoepfel read a paper on switch explosions and Mr. H. Kuhn spoke on fires caused by oil switches in large power plants. A. Kvetensky read a paper on flat tariff and apparatus for limiting the power demand on the premises of the consumers. The next meeting will be held in Cracow.—*Elek. Zeit.*, Oct. 30, 1913.

*Presidential Address.*—C. Vernier.—His presidential address to the Newcastle Section of the (British) Institution of Electrical Engineers. The author emphasizes that most generating stations in Great Britain are very far from what they ought to be. Some 40 per cent of these generating plants have ratings below 1000 kw and many supply small districts, with high capital charges, poor load-factors and heavy fuel and running costs. Less than 3 per cent of the stations can exceed even a 25 per cent load-factor. Out of 287 stations analyzed, less than 2 per cent have a manufacturing cost of 1 cent per kw-hr. or less. The first step toward improvement must be in the direction of the centralization of all coal-fired generating plants into large power stations supplying bulk energy over very large districts. The most important development of the future will be the electrification of railways, and there will be but one of two alternatives once the electrification of these railways begins in earnest. Either the existing central stations must then be in a position to undertake the supply of all the requirements of the railways or the railway companies will themselves build large generating stations and, at a certain stage of their electrification development, will inevitably seek to supply power customers in bulk. In either case the compelling agency will be that of larger outputs and the better load and diversity factors to be obtained by co-operation. The conditions in Great Britain are compared with those in Germany and especially with those in the United States. The objections to overhead wires and the delay in obtaining the right-of-way for overhead wires in Great Britain is pointed out as well as the discouraging features of the electric-lighting acts.—London *Electrician*, Oct. 31, 1913.

# Book Reviews

Sovratensioni negli Impianti Elettrici: Cause, Effeti, Protezioni By Ing. Emilio Piazzoli. Milan, Italy: Ulrico Hoepli. Cloth, 402 pages, 125 illus. Price, $1.10.

An excellent little textbook on the subject of surges, carefully prepared from the electrical engineer's standpoint with reference both to the theory of and practical protection from these objectionable visitors. The book is divided into two sections, dealing respectively with the phenomena of surge voltages and with protectors against surge voltages. The chapters are nine in number and treat of the following subjects: Introduction, over-voltages of internal origin, over-voltages due to lightning, phenomena and damping of over-voltages, systems of protection, preventive protectors, defensive protectors, selection of protectors, installation of protectors. The chapters on the applications of protectors to actual circuits are particularly good. The book will commend itself to transmission engineers having a reading knowledge of Italian who are interested in European lightning-protector practice.

Das Radium und die Radioaktivität By Dr. M. Centnerszwer. Leipzig and Berlin: B. G. Teubner. 96 pages, 33 illus. Price, 1.25 marks.

A very attractively written little book on radium and its properties. The literary style is unusually interesting in a book on physical science. The writer is not only a physicist but also a historian. The history of the discovery and development of radium in the laboratory of the Curies at Paris is very fascinatingly written. From the physical standpoint the book has the rare and marked merit of attaching units to its symbolic expressions. How often we see in books on physics expressions such as $e/m$, without being able to find what particular units attach to $e$ and $m$ respectively. After half an hour's search one may find it stated somewhere near the beginning of the book that $e$ is the electric charge in absolute units without any statement as to what particular absolute unit, electric or magnetic, is intended. This common habit is a standing disgrace to our scientific literature. It is so seldom that an author rises to the level of clearly indicating the units he employs that the exception in the book before us should be signalized with thanks and approbation. The book is divided into four sections, dealing respectively with the discovery of radium, the nature of its radiations, other radioactive substances, and applications of radiology. The volume has marked merit in various directions. It contains special information that is hard to find in the general literature on the subject.

# New Apparatus and Appliances

**An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers**

## Conduit Work in Concrete Construction

In a recent announcement the Chicago Fuse Manufacturing Company remarks that the great increase in the use of reinforced concrete as a building material has brought about some modifications in interior electrical fittings. The difficulty of making alterations after the walls or floors of a building have been poured renders it important that outlets be located exactly and held firmly in position during the pouring process. To meet this need there has been added recently to the "Union" line of conduit fittings made by the company named a new form of extension ring. It has ears on both sides, tapped and fitted with screws to accommodate any standard 4-in. cover or flat ceiling plate. The ring is fastened to the wooden form by nails through the lower ears; the bushings on the conduit are tightened and the cover or plate desired is put on. After the concrete has been poured and has hardened the form is removed and the box is ready to take any cover chosen. The regular depth of this extension ring is 1.625 in., but there is also a "deep ring" of 2.25 in. Greater depth can be easily obtained by building up two or more rings.



OUTLET BOX FOR CONCRETE CONSTRUCTION

## New Metal-Molding Fittings

The National Metal Molding Company, Pittsburgh, Pa., has recently developed and placed on the market a number of new and improved fittings, several of which are shown in the accompanying illustrations. Fig. 1 shows a key receptacle of the outlet-box type. Fig. 2 shows a chain-pull receptacle and Fig. 3 a snap switch, both of which are made "dead-end," being designed to be mounted on the molding. In Fig. 4 is shown a fitting used as a coupling where it is necessary to butt two elbows in breaking around a shallow obstruction.

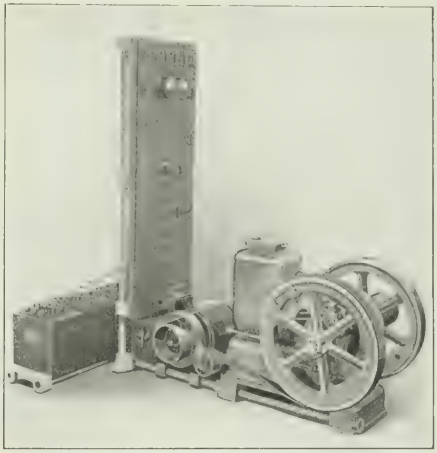


FIGS. 1, 2, 3 AND 4—KEY AND CHAIN RECEPTACLES, SNAP SWITCH AND COUPLING FITTING

The base plates of the fittings applicable directly to the molding have been standardized and are interchangeable. All of these fittings are "dead-end" and can be made continuous by twisting off the scored "blanking ear" on the base plates, thus eliminating the necessity of having contractors and dealers carry separate fittings for "dead-end" and continuous work. The molding is shipped nested with the capping separate. Cap-screws for the various fittings are slightly upset to prevent dropping out.

## Small Generating Plant for Farm Use

With the exception of its storage battery, the small electric-lighting plant illustrated herewith is mounted complete on a single sub-base made of steel and iron. Power is obtained from a gasoline engine which is belted to a generator equipped with a combined flywheel and pulley. A belt tightener which takes up automatically all belt stretch is operated by a heavy weight on a short arm. The standards for the switchboard are supported by heavy foot castings, and the panel is of slate, 1.5 in. thick. Two types of switchboard are used, one for full twenty-four-hour service and the other for service where battery may be charged while lights are not burning. The storage battery is mounted on a separate base and may be set in any position with reference to the generating plant, on the floor, on a shelf or in another room.



SMALL ISOLATED GENERATING PLANT FOR FARM USE

After the plant is tested at the factory the battery and generator wires are disconnected from the switchboard and the switchboard is lifted from the pockets in the sub-base and packed separately for shipment. The rest of the machinery is crated as it stands and is ready to run when the crate is taken off. The battery comes fully charged so that energy is available without waiting to charge the battery.

The rating of the gasoline engine ranges from 1 hp to 4 hp. This equipment is built by the Kewanee Water Supply Company, Kewanee, Ill.

## One-Piece Bushing

A one-piece bushing that does away with kinks in flexible tubing, allowing straight runs to be made into switch, loom, junction and cabinet boxes and thereby saving tubing and wire, is manufactured by the New Process Specialty Company, Milwaukee, Wis. This "Universal" bushing is tapered at both ends and can be pushed or pulled into place quickly without using any tools and without injuring the tubing or the box. It is made of steel and is brass-plated to prevent rusting. The bushing shown in Fig. 1 is used in switch and loom boxes and all 5/8-in. knockouts, and that in Fig. 2 in cabinets, junction boxes and all ½-in. conduit knockouts.



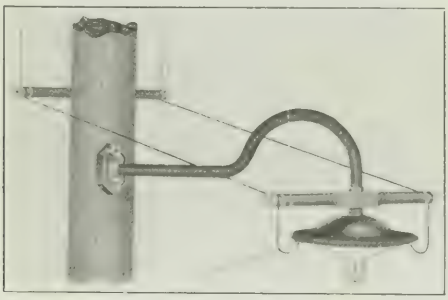
FIG. 1—ONE-PIECE BUSHING FOR 5/8-IN. KNOCKOUTS



FIG. 2—ONE-PIECE BUSHING FOR ½-IN. KNOCKOUTS

## New Reflecting Surface for Outdoor Fixtures

The Line Material Company, South Milwaukee, Wis., has prepared a new substance for the reflecting surfaces of outdoor or street-lighting fixtures which is considered superior to the coating of white japan heretofore used. This new material, which is called "Ky-ce-Lain," is put on the reflector surfaces by means of a secret process. The coating becomes hard and glossy, and its reflecting efficiency is high. Tests have shown that the surface is not affected by bending, although this quality is not necessary in reflector construction.

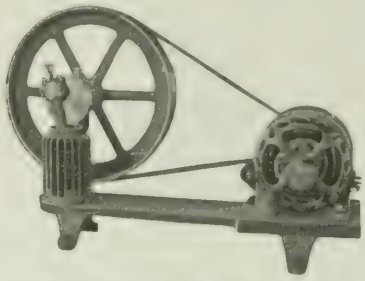


FIXTURE WITH "KY-CE-LAIN" REFLECTING SURFACE

The accompanying illustration shows a fixture manufactured by the Line Material Company furnished with this new reflecting surface. The upper surface is of bluish-black enamel covered with a special weatherproof coating such as used heretofore. The fluted reflectors are porcelain-enameled as before.

## Motor-Driven Garage Compressor

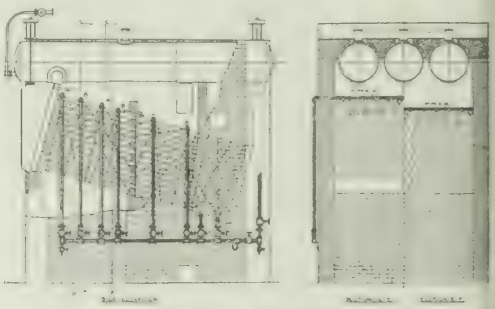
In the illustration herewith is shown a small single-cylinder compressor for garage use. It is mounted on a raised cast-iron sub-base and is belt-driven by a 5-hp motor. The raised sub-base permits of thorough cleaning of the floor around and under the machine and also of removing the valves of the compressor without dismounting the other parts. The apparatus is designed for permanent installation in connection with a storage tank. An automatic starting and stopping switch controls the pumping operation. The compressor is made by the Jacobsen Machine Manufacturing Company, Warren, Pa., and the motor by the Century Electric Company, St. Louis, Mo.



GARAGE COMPRESSOR WITH MOTOR DRIVE

## Soot Cleaner

Means for removing soot and ashes by the aid of a cleaner installed as part of the boiler equipment have been developed by the Vulcan Soot Cleaner Company, Chicago, Ill., as shown in the accompanying side elevation and section of a Babcock & Wilcox boiler. This cleaner discharges steam through perforated pipes and nozzles close to the tube surfaces. As a result the tubes in the center are reached as effectively as are those on the sides, and in the case of boilers set in batteries the tubes on the far side are cleaned with the same thoroughness as are those on the alley side.



SIDE ELEVATION OF BOILER WITH SOOT CLEANER

The operation of this Vulcan cleaner is very simple, as it is only necessary to open a set of valves one after another to blow the soot and ashes free from the surface. With this method blowing of the boiler tubes can be done fre-

quently, it being customary to blow them once every watch, which is oftener than is ever done by hand. No doors have to be opened with this kind of blowing, and there is therefore no infiltration of air which would reduce the boiler's efficiency.

In an effort to show that cleaning the boilers by hand is inefficient, a plant was equipped with recording instruments for comparison. Over a period of one month the average leaving temperature of the gases was found to be 517.8 deg., and the average $CO_2$ content 11.2 per cent. A second similar set of readings covering the same length of time, except that the boilers were blown daily with a Vulcan cleaner, gave an average leaving temperature of 391.8 deg. and a $CO_2$ average of 11.8 per cent. The $CO_2$ percentage is given to show that the efficiency of firing in both cases was practically the same. While using the cleaner, therefore, the stack temperature averaged 120 deg. lower, corresponding roughly to a saving of 6 per cent in fuel. Other tests have, it is reported, shown even greater savings with the use of these soot cleaners.

## Long-Burning Flame-Arc Lamps

The Allgemeine Elektricitäts Gesellschaft, of Berlin, Germany, has placed on the market a new long-burning



LONG-BURNING FLAME-ARC LAMP

flame-arc lamp for lighting large workshops. The unit, which is illustrated herewith, is known as the Flammeco lamp. It differs from the long-burning flame-arc lamps used for street lighting in the shape of its reflector, by means of which the intensity of the light below the lamp is made much greater. A new type of electrode is used, and it is said that a pair of these electrodes will burn from four to five times as long as a pair of the ordinary carbons now widely used for street lighting. This is an important point in its favor for use in modern factory workshops, where the large traveling cranes, which work continuously day and night, must be interrupted as little as possible by the lowering of the lamps for renewing carbons and cleaning purposes. The lamp is short and compactly built, thus being especially applicable where the suspension height available is limited by the distance between the lower edge of the roof ties and the upper part of the traveling crane.

A high candle-power output is necessary with Flammeco lamps on account of the height of suspension, which may be 65 ft. or more in many erecting shops. The candle-power of the direct-current lamps is sufficient for the purpose with the new electrodes used. The lighting output of the alternating-current lamps has been improved by raising the lamp voltage. These so-called high-voltage lamps operate at pressures ranging from 50 volts to 60 volts, according to the method of connecting them. The alternating-current lamp has a life of 80 hours to 100 hours between trims.

Fig. 2 shows a large workshop lighted by twenty-six alternating-current Flammeco lamps, the height of the arcs being approximately 65 ft. The lamps are hung in two rows, each row being 29.5 ft. from the center line of

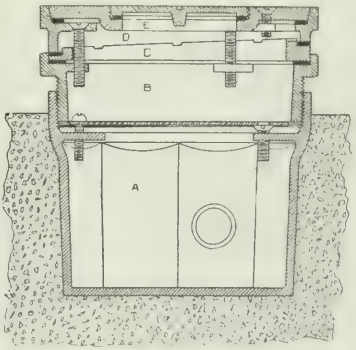


LONG-BURNING FLAME-ARC LAMPS IN LARGE WORKSHOP

the building and the lamps being spaced 32.8 ft. apart. Pairs of lamps are connected in series on a 190-volt supply, an inductive series resistance being used.

## Electrical Floor Box

An electrical floor receptacle and junction box for correcting faulty settings has been put on the market by the Lutz-Webster Engineering Company, Inc., Philadelphia, Pa. In the illustration the box *A* is shown carrying the threaded sleeve *B*, by which both circular adjustment through a full circle and vertical adjustment of over 0.5 in. can be obtained. Angular adjustment is made by means of the taper ring *C*, resting in the sleeve *B* and carrying the floor flange *D*. The bottom of the floor flange is provided

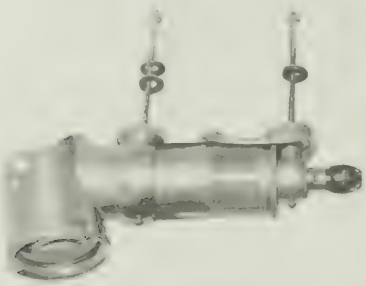



ELECTRICAL FLOOR RECEPTACLE

with a tapered flange corresponding with the taper ring *C*, which for leveling may be freely revolved from the inside with the fingers. The floor flange *D* is fastened by three screws to lugs on *B*, binding the taper ring and gaskets between them and forming water-tight joints. The box, threaded sleeve and taper rings are made of galvanized cast iron. Other parts are made of brass.

## Glareless Automobile Lamp

The Roffy Grace Corporation, 1926 Broadway, New York, is putting on the market an electric lamp for automobiles designed to produce a strong light and at the same time eliminate the glare common with so many automobile head-lamps. The light from the filament is passed through condensing lenses to a mirror and reflected back



ELECTRIC AUTOMOBILE LAMP

finally through a focusing lens which corrects all chromatic and spherical aberration, producing a white light on the roadway. The lamp is a small tubular device usually fastened to the radiator in an upright position. It is so focused that the rays of light follow the driver's line of vision.

## Electrically Operated Pontoon Cranes

Two 150-ton pontoon cranes have recently been built by the Wellman-Seaver-Morgan Company for the United States Navy Department. One of these large electrically driven hoists is to be placed in the Boston harbor and the other in Pearl harbor, Honolulu. Both will be used for transferring freight to lighters and for erecting or removing turrets, guns, boilers and other machinery or apparatus used on battleships.

In order to test the accuracy of the control equipment in landing a load, a heavy weight was lowered by the crane



PONTOON CRANE IN BOSTON HARBOR

to strike a block laid on top of an empty oil can. It was found possible to stop the load without injuring the oil can or deforming it. In order further to test this point, the weight was suspended about 2 in. above the block and then lowered to see how close it could be brought to that object without touching it. The distance was found to be 0.0625 in.

The controllers for both cranes are of the magnetic type and were furnished by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

## Bracketless Semi-Indirect Wall Fixtures

The H. W. Johns-Manville Company, New York, has put out a new bracketless wall fixture for semi-indirect

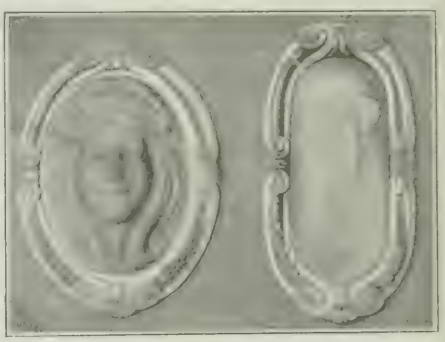


FIG. 1—SEMI-INDIRECT LIGHTING UNITS

lighting which is designed particularly to harmonize with surrounding objects. The bracket has been eliminated because the large amount of glassware in such a semi-indirect unit, if hung at a distance from the wall, would give the fixture an incongruous appearance. In Fig. 1 are shown two types of these new fixtures, each consisting of a socket equipment attached to the outlet box, a frame and the glassware.

The glassware mentioned comprises the molded glass cover and the silvered rippled-glass reflector which directs the light through the molded cover at the desired angle, thus eliminating spots directly under and above the frame. The molded piece may be tinted to suit the interior coloring.



FIG. 2—BRACKETLESS WALL FIXTURES IN A THEATER

The fixture is well adapted to low rooms, such as are found in yachts or bungalows where an extension bracket tends to exaggerate the lowness of the ceiling and to give a crowded effect to the room. Fig. 2 shows nineteen of these units installed in a theater, the glassware harmonizing with the interior decorations in both design and color, without a perceptible decrease in efficiency.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**H. M. Byllesby on the Outlook.**—Henry M. Byllesby, president of H. M. Byllesby & Company, recently returned to Chicago from a brief visit to England. In relation to industrial conditions, he said that while there is doubtless financial depression in the United States at the present time, it is his opinion that normal prosperity and easier money will prevail within a reasonable period. He voiced a feeling of confidence in the ultimate fair treatment of utilities and corporations throughout the United States by the various regulatory commissions having jurisdiction over them.

**Wireless Towers on the Isthmus.**—According to the *Canal Record*, the official organ of the Isthmian Canal Commission, the Penn Bridge Company, of Beaver Falls, Pa., which has the contract from the Navy Department for the fabrication and erection of the three 600-ft. towers for the proposed Darien radio station at Caimito, has let a subcontract to the Central American Construction Company, of Colon, to do the work of erection. Forces of the quartermaster's department of the Isthmian Canal Commission are engaged in the preliminary work of erecting the foundation piers of concrete for the towers.

**Special Cable Block Being Furnished.**—A special form of porcelain cable block, fitted with the Fahnestock quick connection spring clips, is being made for the Western Union Telegraph Company by the Fahnestock Electric Company, of 129 Patchen Avenue, Brooklyn, N. Y. The blocks are hollow and are fitted with clips for about a dozen leads. They are intended for use in locations where, for purposes of testing or other reasons, frequent changes in the cable connections are necessary. Aside from this work the company is experiencing the slight falling off in business usually encountered at this season.

**Belgian Agents for American Manufacturers of Engineering Equipment.**—The Association Technique, of 88 Rue de la Montagne, Brussels, Belgium, has been organized recently for the purpose of representing in Belgium and other parts of Europe the American manufacturers of machinery, appliances and materials for use in connection with railroads, public utilities, mines and other similar service. This concern will be prepared to represent firms manufacturing tramway track materials and allied lines. The association has very high personal recommendation and will be glad to hear directly from any American manufacturer in the above fields. Correspondence may be carried on in English.

**Pioneer Electric Locomotives in Alaska.**—What are said to be the first electric locomotives ever used in Alaska were placed in service within the past few months for mining operations by the Alaska Treadwell Gold Mining Company at Treadwell. The mine is an immense low-grade-ore property equipped with two mills, having an equipment of 540 stamps, power plants, foundry, cyanide plant, machine shop, sawmill and central hoisting and crushing plant, practically all of which are either operated by electric motor or being equipped for electric drive. The two initial 6-ton, 500-volt, direct-current locomotives were manufactured by the General Electric Company and are of the standard outside-frame type, in which the side frames are placed outside of the wheels.

**Motorcycle Accessories Shown.**—In view of the probability that the cycle car is soon to enjoy a larger popularity, it is of interest to note the progress that has been made toward adapting electric lighting and accessory equipment to the special demands on the smaller types of self-propelled vehicles. At the National Motorcycle, Bicycle and Accessory Show in Chicago, during the past week, there were shown a number of electrical equipments for lighting, ignition and horn operation on motorcycles. The Rex Battery Company, of Chicago, showed a lighting system consisting of a 6-volt generator with self-contained regulator and battery cut-out and a 6-volt storage battery, with switch, fixtures, head-lamp and tail-lamp. In operation the battery furnishes energy for the lamps when the motorcycle is standing still or when running at low speed. As the speed increases the generator furnishes an increasing part of the required energy until at 15 miles per hour the dynamo furnishes enough electricity to light both lamps.

**Drawback Allowances Made Under the New Tariff Law.**—In many cases, particularly in the machinery and allied industries, products made in this country contain parts or accessories of foreign manufacture, which have to be imported for this service. A good many of these products enjoy a large foreign sale and in order to avoid the injustice of making the builders pay duty on the parts which are imported for assembly and then sent out to the foreign market, there is provision in the tariff law for the payment by the government of drawback allowances on such parts at the time of export. Among the concerns which have recently taken advantage of this allowance are the Remy Electric Company, of Anderson, Ind., which uses imported ball bearings in its electric starting, lighting and ignition apparatus for automobiles, and the Timken-Detroit Axle Company, of Lansing, Mich., which uses imported worm gearing as part of its axle-drive equipment.

**Gas-Engine-Driven Generators for an Industrial Plant.**—Barnhart Brothers & Spindler, a branch of the American Type Founders' Company, are building a large and modern plant in Chicago, into which they expect to move shortly after the first of the year. In their present factory motor drive is used throughout, and its success there has been sufficiently apparent to warrant its use in their new factory. Here, however, there will be installed also a complete isolated power plant, which is to be furnished by the Alberger Gas Engine Company, of Buffalo, N. Y. The generating equipment to be installed will include one 75-kw and one 150-kw Alberger gas-engine-driven set and one 75-kw electric welding set. An electrically operated coal-handling system is to be installed also. The gas engines used in this installation will be duplicates in many respects and arranged so that parts are to a large extent interchangeable. They will have a substantial overload capacity in addition to the ratings mentioned. The Alberger Gas Engine Company reports the sale of gas engines of 50-hp rating and above, aggregating 1415 hp.

**Edison Storage Battery Company's New Factory Almost Completed.**—The new plant of the Edison Storage Battery Company at Orange, N. J., is practically completed and awaits only the installation of machinery in order to start making this product on the enlarged scale made necessary by the rapid development of storage-battery applications in electric trucks and pleasure cars, street-railway cars, train lighting, wireless telegraphy, railway, police and fire signaling, farm lighting and other similar uses. Owing to the facts that a modification of the present alkaline nickel-iron battery will shortly be put on the market by this company and that pending the arrival of new machinery more than 100 of its employees were recently laid off, temporarily, a rumor was spread to the effect that a large part of the producing force had been dropped and that the new type of battery was to displace the present type. R. A. Bachman, vice-president and general manager of the company, has issued a denial to this rumor, stating that by the latter part of December all new machinery will be installed, the present machinery rearranged in the new plant and 2000 new employees added to the production force. He says that the present type of battery is to be put out right along and announces that Lord & Taylor, in providing for the electric

delivery wagon fleet for their new store, have followed the lead of R. H. Macy & Company, Hearn, Loeser, Abraham & Straus and other large department stores in New York, by standardizing on Edison batteries.

**Chicago Seeking Private Capital for Subway Construction.**—The City Council of Chicago, Ill., has authorized an advertisement for proposals to construct a comprehensive system of passenger subways within the city limits that will be operated independently of existing surface and elevated transportation lines and that will ultimately be municipally owned, through the amortization of the construction debt out of earnings. This ordinance specifies certain routes approximating 57 miles in length, with about 135 miles of single track, for which the construction estimates approximate $96,000,000 for subway construction and $34,000,000 for equipment. In case any bid on this work is found acceptable, it is planned to incorporate it in detail in a second ordinance and submit this, together with two alternative plans, involving municipal construction and furnishing temporary relief in a limited section of the city, for a referendum vote at the municipal elections in April, 1914.

**York Manufacturing Company's Sales Increase.**—In the Nov. 8 issue of the *Electrical World* the statement was made that the sales of refrigerating machines by the York Manufacturing Company during October had fallen off about 50 per cent from the September figures. Information comes from that concern to the effect that this decrease was in the capacity of the machines installed during the period stated and that sales showed an increase of about the same proportion during that period. The peculiar relation existing between the company's sales and its installations is explained in the following abstract from a recent communication: "Our installations are heaviest during the summer months when sales are the lightest. Beginning with October, installations drop off and sales begin to increase. As a matter of fact, our sales for the month of October showed an increase over September of 50 per cent in the number of machines and an increase of over 125 per cent in the tonnage represented by these machines."

**Electric Truck Manufacture in Receiver's Hands.**—Creditors of the Atlantic Vehicle Company, of New York, recently filed an involuntary petition in bankruptcy against that company, and A. P. Osborn, of 14 Wall Street, New York, and H. L. Davisson, of the Edison Storage Battery Company, Orange, N. J., have been appointed receivers. This action was taken owing to the inability of the company to secure sufficient working capital to warrant its continuance in business at the present time. The liabilities of the company approximate $132,000, and it has nominal assets of about $110,000. The company has a number of partly built trucks on hand, and these the receivers propose to complete. They also propose to liquidate part of the assets of the company by the sale of Atlantic trucks, a number of which are now completed and ready for delivery. It is hoped that a reorganization of this company may be effected and that its business will be continued in a short time. The Atlantic electric truck has made an excellent trade record, and its users number some of the important breweries and express companies and other users of commercial vehicles.

**Electricity in Large Demand in the Pittsburgh Coal Fields.**—A considerable increase in the demand for electric service is being experienced in the coal region around Pittsburgh, Pa. For the week ended Nov. 1 the gain in motor-service business of the West Penn Traction & Water Power Company and its subsidiaries was 798 hp, and in addition to this there has been noticed a gain in the lighting and traction demand. Among the coal-mining companies which are finding electricity useful in their operations are the Pittsburgh Coal Company, which has 450 hp in motors at its Midland No. 1 mine and is planning for the electrification of a number of its other properties; the Pittsburgh-Buffalo Coal Company, which is said to anticipate the installation of 1500 hp in motors shortly; the Logansport Coal Company, with 150 hp, and the Meadowlands Coal Company, which plans to add 450 hp for operation of fans and hoists. In the new plant of the Latrobe Electric Steel Company the energy for operating the electric furnace is furnished by the West Penn company. In order to take care of this large amount of new business the latter company is now installing a new generator at its central station near Connellsville, Pa., and is rushing the work on its Cheat River hydroelectric development.

**Electricity Used in Zinc Mines.**—The Interstate Light & Power Company, one of the subsidiaries of the Consumers' Power Company, serves a large part of the southwestern Wisconsin zinc-mining fields with electric power. Since H. M. Byllesby & Company took over this property, late in 1910, the connected load has increased 81 per cent, and the energy output has increased to more than 225,000 kw-hr. per week. A large part of the electrical output is consumed in the zinc mines and reduction plants, the hilly character of the country and the isolated location of many of the mines rendering central-station electric power highly desirable to the zinc-mining industry. Prior to acquiring the property Byllesby & Company had acted in the capacity of consulting engineers for the previous owners and had designed and constructed a modern steam power station of 2750 kw rating. The growth of the business made it necessary in 1911 nearly to double the station rating by the addition of a 2000-kw turbine unit. There are now 103 miles of transmission lines serving the district, which includes the cities of Galena, Ill., and Platteville, Shullsburg, Darlington, Cuba City, Benton and Hazel Green, Wis. The population of these communities shows only a small growth, but recent prospecting has developed a number of new and large ore bodies and the outlook for additional business from this source is good.

**Electrical Equipment of Gasoline Automobiles.**—The three papers under this head delivered before the American Institute of Electrical Engineers in New York on Nov. 14 are significant in more than their actual contents. While many people are absolutely sure of the superiority of the electric vehicle over the gasoline car, there is generally speaking no such conviction. The gasoline automobile has many advocates, both for commercial and for pleasure use, who take no stock at all in electric drive. However, it is very evident that the use of electrical equipment for starting and lighting and the operation of automobile accessories has come to stay and has standing with the strongest advocates of gasoline-engine drive. And the applications of electricity on gasoline-driven machines are growing continually, some of the latest being electrically operated horns, electric gear shifters and electromagnetic brakes and clutches. There seems to be a wide difference of opinion as to the proper means for supplying this service, but trial will eliminate the inadequate and impracticable in a comparatively short time with so many investigators in the field. The question that seems very pertinent, however, in view of these tendencies, is whether or not it is economical to install this auxiliary electrical equipment and still continue to use the gasoline-engine drive, when the whole operation, including drive and accessories, can be handled with greater reliability and simplicity by electricity alone.

## NEW YORK METAL MARKET PRICES

| | Nov. 11 Bid. | Nov. 11 Asked. | Nov. 18 Bid. | Nov. 18 Asked. |
|---|---|---|---|---|
| Copper, | | | | |
| Standard, spot* | Selling Prices | | Selling Prices | |
| | £ s d | | £ s d | |
| London, standard, spot* | 68 7 6 | | 69 10 0 | |
| Prime Lake | 16 [illegible] | to 16.25 | | |
| Electrolytic | 15.75 | | 15.25 | to 15.37½ |
| Castings | 15.50 | | 15.00 | to 15.12½ |
| Copper wire base | 17.00 | | 16.37½ | to 16.50 |
| Lead | | 4.35 | | 4.35 |
| Nickel | 40.00 | to 45.00 | 40.00 | to 45.00 |
| Sheet zinc, f.o.b. smelter | | 7.50 | | 7.50 |
| Spelter, spot | 5.30 | to 5.40 | 5.30 | to 5.35 |
| Tin, spot | 39.15 | to 39.35 | 40.05 | to 40.50 |
| Antimony | | | | |
| Prompt delivery | 19.50 | to 19.75 | 19.37½ | to 19.62½ |
| Futures | 19.25 | to 19.50 | 19.00 | to 19.50 |

## *OLD METALS

| | | |
|---|---|---|
| Heavy copper and wire | 14.50 | 14.00 |
| Brass, heavy | 9.50 | 9.00 |
| Brass, light | 8.25 | 8.25 |
| Lead, heavy | 4.20 | 4.20 |
| Zinc, scrap | 4.37½ | 4.37½ |

## *COPPER EXPORTS

| | |
|---|---|
| Total exports to Nov. 18 | 16,698 |

*From daily transactions on the New York Metal Exchange.

# Corporate and Financial

**Bond Issue by the Hornell Electric Company.**—Authorization has been secured by the Hornell (N. Y.) Electric Company, from the Public Service Commission, for the execution of a mortgage to the Colonial Trust Company to secure $400,000 of first and refunding 5 per cent bonds. It is planned to issue $150,000 of these bonds shortly, exchanging $85,000 of them for the first mortgage bonds of the company and using the proceeds from the sale of the others to discharge current liabilities.

**People's Gas Company Increases Capital Stock.**—By a vote of the stockholders the People's Gas Light & Coke Company, Chicago, has increased its capital stock from $35,000,000 to $50,000,000. The present stockholders have the privilege of purchasing new stock in an amount equal to 10 per cent of their present holdings. The stockholders also authorized a new refunding mortgage. This is an open mortgage and will take care of all underlying liens and future needs of the company for construction and betterments. No amount is specialized in the mortgage. Samuel Insull is the president of the board of directors of the People's Gas Light & Coke Company.

**Scope of Middle West Utilities Company.**—The Middle West Utilities Company, of Chicago, now controls public-utility properties in eleven states. The principal subsidiary companies are the Twin State Gas & Electric Company, operating in Maine, New Hampshire, Vermont and New York; Kentucky Utilities Company, Marquette County Gas & Electric Company and Constantine Hydraulic Company, Michigan; Interstate Public Service Company, Indiana; United Gas & Electric Company and other properties in and near New Albany, Ind.; Illinois Northern Utilities Company; Tri-County Light & Power Company, Illinois; Central Illinois Utilities Company; Central Illinois Public Service Company; Missouri Gas & Electric Service Company, and the Public Service Company of Oklahoma.

**Western Union Telegraph Award Upheld.**—On Nov. 10 the United States Supreme Court handed down a decision denying the petition of the American Telephone & Telegraph Company for a new trial in the suit brought against it by the Western Union Telegraph Company in 1883. The suit was begun by the American Speaking Telephone Company to ascertain the amount owing to it by the Bell system under an agreement dating back to 1879 and concerning telephone royalties. In 1909 an award was made by E. W. Burdett, of $2,579,914 and 20,087 shares of stock of Bell subsidiaries. This judgment has been affirmed successively by the lower federal courts and the United States Circuit Court of Appeals, and this decision of the Supreme Court practically closes the case. Assuming a par value for the stock involved, the award amounts to approximately $4,500,000.

**Mount Whitney Power & Electric Company Improvements.**—Among the improvements in progress on the properties of the Mount Whitney Power & Electric Company are the building of a new reservoir with a capacity of 150,000,000 cu. ft., the enlargement of the Lindsay substation, the construction of a fifth hydroelectric plant on the Kaweah River, and the building of an addition to the auxiliary steam plant. The present capacity of the company's generating stations, 13,000 hp, is large enough to handle its business for some time, but an effort is being made to keep a good margin for reserve. The first mortgage bonds of the company can only be issued, for the purpose of carrying on extensions and improvements, after the money for such work has actually been paid out, and because of this limitation the company was forced early in the present year to issue some one-year notes. As the work progresses the bonds can be sold and the proceeds used for refunding these notes.

**Maine Utilities Combined.**—Announcement has been made by E. W. Clark & Company, of Philadelphia, Pa., that the Cumberland County Power & Light Company, of Portland, Maine, has obtained control of the York Light & Heat Company, which does an extensive electric light and power business in Biddeford, Saco, Kennebunk, Wells, York Harbor and other coast towns of that state. The first-mentioned utility owns and controls three hydroelectric stations, having a rating which totals 18,750 hp, and six steam generating plants, aggregating 13,800 hp in rating. It has recently obtained a five-year contract for the supplying of electric energy for light in the cities of Portland and South Portland, Maine. As soon as the proposed transmission lines can be completed it is stated to be the intention of the Cumberland County Power & Light Company to serve the territory formerly covered by the York Light & Heat Company from its own water-power stations, holding the steam stations of the latter concern in reserve.

**United Properties Company Reorganization Planned.**—A plan for the refinancing of the dozen or more public utility properties controlled by the United Properties Company of California has been placed before the trustees by R. G. Hanford and W. H. Tevis, vice-presidents and directors of the company. This plan will call for the expenditure of about $7,000,000, as the company's obligations include $2,500,000 due N. W. Halsey & Company on an issue of 6 per cent short-term notes which matured in June, 1913, and $1,150,000 of 6 per cent collateral trust notes, which matured in August of this year. In addition it is planned to pay $1,000,000 to F. M. Smith for his interest in the company, as well as to pay all the debts of the subsidiary companies. There is also a call for $750,000 with which to complete the projected improvements of the United Light & Power Company. The source from which these funds are to be obtained has not been made public and is being withheld until after action on the proposed plan has been taken.

**Portland Railway, Light & Power Company Matters.**—As a result of competitive bidding, the Portland (Ore.) Railway, Light & Power Company has secured the contract for lighting the streets of Portland for three years, beginning Jan. 1, 1914. With the 10,000-hp turbo-generator set recently installed, the company has a total generating capacity of 90,000 hp. which supplies a large part of the energy used in the electric railway, light and power lines in Portland, as well as in a number of the adjacent towns of Washington and Oregon. On Nov. 7 the City Commission of Portland passed an ordinance requiring the company to give six rides for 25 cents on its street-car lines. This ordinance is expected to go into effect thirty days after its passage. The directors of the company have recently declared a quarterly dividend of $1 per share, payable Dec. 1. This represents a reduction of 25 cents from the previous quarterly declaration. Following the completion of the extension work now in progress, the company is expected to show an increase in net earnings.

**Allis-Chalmers Manufacturing Company Report.**—The report of the Allis-Chalmers Manufacturing Company for the year Oct. 1, 1912, to Sept. 30, 1913, issued recently, covers the period from the former date to April 15, 1913, when the receivership terminated, and the subsequent period, following the reorganization, up to the latter date. The fiscal year of the company corresponds to the calendar year, and hence this report is not an annual one. Since the Bullock Electric Manufacturing Company is controlled and owned largely by the Allis-Chalmers Manufacturing Company, this report includes the balance sheet of that concern, together with that of the latter company. The total liabilities of the latter company as of Sept. 30, 1913, were $44,774,012, and during the year ended on that date the total sales amounted to $11,660,359, on which there was realized a net profit of $601,310. The former company's liabilities as of Sept. 30, 1913, were $4,859,652, and during the year covered by the report its total sales came to $2,597,474 and a net profit of $80,636 was obtained. On Oct. 1, 1913, the unfilled orders on hand were, for the Allis-Chalmers company $3,579,931 and for the Bullock company $658,575. According to the report, the volume of business handled between April 16 and Aug. 1, 1913, was very satisfactory, but since the latter date the volume of new business has fallen off in connection with what is thought to be a general slackening of business throughout the country. The manufacturing properties of both of the above-mentioned companies are stated to be in excellent condition, and the several departments in each company are well organized and working in thorough co-operation. With a normal volume of business it is expected that the Allis-Chalmers Manufacturing Company will show substantial net earnings.

## Business Notes

**F. W. Rose**, consulting engineer, has moved from the Palace Building to 470-475 Auditorium Building, Minneapolis, Minn.

**The Carbo Steel Post Company** announces that on and after Dec. 1 its main sales offices will be in the Rand-McNally Building, Chicago, Ill.

**The Union Metal Manufacturing Company,** formerly of 30 Church Street, has moved its New York office, in charge of W. L. Fairchild, to 110 West Fortieth Street.

**Clark Electric & Manufacturing Company.**—Charles J. Dempwolf has severed his connection with the Clark Electric & Manufacturing Company, New York City, and is now connected with the General Baking Company, 30 Church Street, New York.

**The J. & H. Electric Company, Inc.,** of 155 Clifford Street, Providence, R. I., is doing an electric repair and exchange business in motors and generators. Its officers are C. E. Harmon, president; W. M. Hodges, vice-president, and L. E. Whitehead, secretary and treasurer.

**The Goulds Manufacturing Company,** of Seneca Falls, N. Y., has appointed C. L. Newcomb, Jr., as its Western representative to succeed G. B. Turner. Mr. Newcomb's headquarters will be at 12 Chamber of Commerce, Denver, Col., and he will look after the company's interests in the Rocky Mountain and Northwestern territories.

**The National Electrical Specialty Company,** of Toledo, Ohio, has appointed H. E. Gifford, Jr., sales manager, with headquarters in Chicago. Mr. Gifford resigned as Western representative of the L. S. Brach Supply Company to accept this position, and he will now be largely interested in the marketing of the "Vac-M" lightning arresters, manufactured by the Ohio firm.

**The Star Advertising Company,** of Springfield, Ill., after completing a contract with the Illinois Traction Company which will require several months, is planning to take up the manufacture of electrical novelties and advertising devices. The headquarters of the company are in the Gaiety Theater Building, Springfield, Ill., and its president and general manager is H. J. Spurway.

## New Industrial Companies

**The Missouri Electrical Company,** of St. Louis, Mo., has been chartered with a capital stock of $2000 to do a general electrical business. The incorporators are Lester J. Harris, G. L. Camp and Arthur C. Eckert.

**The General Storage Battery Company,** of St. Louis, Mo., has been incorporated by Joseph Desloge, Firmin and Louis Desloge. The company is capitalized at $2000 and proposes to manufacture and deal in storage batteries.

**The Automatic Display Company,** of Chicago, Ill., has been incorporated by Charles R. Casler, George M. Bagley and Irma Labes. The company is capitalized at $100,000 and proposes to sell mechanical and electrical apparatus.

**The Nonpareil Lock Company,** of Chicago, Ill., has been incorporated with a capital stock of $40,000 to manufacture locks, hardware and electrical specialties. The incorporators are Matthew Borwick, C. F. Dusman and A. B. Cameron.

**The Metropolitan Appliance Company,** of Chicago, Ill., has been incorporated with a capital stock of $1,000 by George W. Levin, W. F. Cumming and W. J. Maher. The company proposes to manufacture and sell electrical and mechanical devices.

**The International Electric Pump Company** has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $250,000 and the incorporators are F. D. Buck, G. W. Dillman and B. M. Grawl, of Wilmington, Del.

**The Electric Contractors Company,** of New York, N. Y., has been chartered with a capital stock of $150,000 for the purpose of doing a general electrical contracting business. The incorporators are C. Metzer, of Brooklyn; R. E. Habel and A. S. Henry, of New York, N. Y.

## Trade Publications

**Storage Battery Locomotives.**—"Storage Battery Locomotives for Mine and Industrial Haulage" is the title of a booklet of the Electric Storage Battery Company describing the application of its product to service of that nature.

**Wiring Devices.**—A large post card is being mailed by the Metallic Seamless Tube Company, Ltd., Meta House, Corporation Street, Birmingham, England, reminding contractors of its "metallic" accessories, such as ceiling rosettes, cut-outs, wall plugs, wire, fittings, brackets and other material.

**Lighting the Home.**—An attractive booklet recently issued by Harvey Hubbell, Inc., Bridgeport, Conn., tells in an entertaining manner about "A Delightful Way to Light Your Home." The illustrations are very pleasing and are a fitting accompaniment to the text. Reference is made to the beauty, efficiency and convenience of Hubbell pull sockets on lamps all over the home.

**Porcelain Fixtures.**—A leaflet containing on one side illustrations of its white porcelain lighting fixtures and on the other side prices, sizes and descriptions, has been issued by Rush Brothers Company, 136 West Lake Street, Chicago, Ill. These fixtures, which are made of solid porcelain, are especially suitable for rooms with white woodwork, for sanitary restaurants, hospitals, schools and the like.

**Motors.**—The compensated type of polyphase motor is illustrated and fully described in Advance Bulletin No. 160, recently published by the Bell Electric Motor Company, Garwood, N. J. It is claimed for these motors that they will start their full load with about twice full-load current without extra starter, that they are automatic and foolproof and have a high power-factor and a high efficiency.

**Motor Drive in Textile Mills.**—Electrically driven pickers are the subject of a bulletin issued by the Westinghouse Electric & Manufacturing Company. Illustrations and descriptions are given of four methods of drive used for pickers. Detail views of the motors adapted to this service and the method of mounting them and a number of graphic meter curves illustrating the load on this type of machine are shown.

**Diesel Engines.**—A pamphlet issued recently by the American Krupp System, Diesel Engine Company, tells about the oil-engined ships in operation and projected by the East Asiatic Company, Ltd., and gives information on the formation of the American company to handle the rights of the German manufacturers in this country. Mr. J. L. Bogert is the engineer of the company, with headquarters at 165 Broadway, New York.

**Telephone Receivers.**—The "Other Ear" receiver, a device said to intensify the receiving qualities of any telephone, is made the subject of a leaflet recently issued by the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. This receiver is especially adapted for use in noisy shops and factories and for long-distance work. The company's 896 compact-type magneto telephone is illustrated and described in another leaflet.

**Isolated Low-Voltage Electric Plants.**—Electric energy for lighting, heating and motor service in places remote from a central supply station is discussed in a pamphlet recently issued by the Kewanee Water Supply Company, Kewanee, Ill. The advantages of isolated plants installed with Kewanee gasoline engines are clearly described. Information regarding the different parts of the outfit and full details are given as to the cost of plants of various ratings.

**Engineering Data.**—In a forty-four-page booklet with the title "Data for Electrical Engineers," the Metropolitan Engineering Company, Forty-second Street Building, New York, has assembled much useful information. A chapter on tampering leads logically to a reference to the complete line of protective devices manufactured by the company, of which a few illustrations and brief descriptions are given. Watt-hour-meter data, definitions of electrical units, a conduit and wire diagram, stranded conductors, and incandescent lamp information—a portion of the contents—suggest the character of the data presented. A good index would have increased the usefulness of the pamphlet.

# Personal Mention

**Mr. Arthur Brown** has been made manager for the Central Illinois Public Service Company at Edinburg, Ill.

**Mr. A. L. Utz** has succeeded Mr. M. C. Hunter as superintendent of the municipal electric-lighting plant at St. Joseph, Mo.

**Dr. Alexander Graham Bell** has been awarded the gold medal of the Royal Society of England in recognition of his inventions, notably that of the telephone.

**Mr. E. S. Fletcher,** manager of the Temple property of the Texas Power & Light Company, has been appointed district superintendent with headquarters at Temple.

**Mr. A. R. Norman** has been appointed manager of the Eugene (Ore.) branch of the Oregon Power Company. Mr. Norman was formerly manager of a group of utilities in Illinois.

**Mr. L. J. Hannah,** manager of the new-business department of the Louisville (Ky.) Gas & Electric Company, has resigned to become connected with a local mercantile firm which, it is understood, will be headed by Col. Robert E. Hughes, former president of the Kentucky Electric Company.

**Mr. Herbert L. Harries** has resigned his position as assistant general manager of the Louisville Gas & Electric Company to become connected with another Byllesby property. Mr. Harries was assistant to the president of the Louisville Lighting Company until its consolidation with the other gas and electric companies of the city, when he was made assistant general manager.

**Mr. Philip S. Dodd,** who has been manager of the *Electrical Review*, director of publicity of the National Electric Lamp Association, secretary of the Commercial Section of the National Electric Light Association, and one of the organizers and recently secretary-treasurer of the Society for Electrical Development, has allied himself with the Tucker Agency, Inc., advertising agent, of New York City.

**Mr. Allan G. Armstrong** has resigned as general auditor for W. S. Barstow & Company, Inc., New York City, managers for the General Gas & Electric Company and the Eastern Power & Light Corporation, to head an auditing company which will specialize in accounting for public-utility corporations. Mr. Armstrong has been connected with electric railways, gas and electric-light corporations for the last fifteen years.

**Mr. W. R. W. Griffin,** former manager of the Tri-State Railway & Electric Company, East Liverpool, Ohio, has been appointed general manager of the following properties, with offices in the Potters Savings & Loan Building, East Liverpool: Beaver County Light Company, Steubenville; Midland Electric Light & Power Company; Wellsburg Electric Light, Heat & Power Company; Wellsburg & Weirton Railway, and the Hancock County Electric Company.

**Mr. Edward N. Hurley,** president of the Hurley Machine Company, Chicago, is chairman of a committee of the Illinois Manufacturers' Association which is arranging a "foreign-trade cruise." A party of members of the association will sail from New York on Feb. 7 for Buenos Aires and will visit other South American trade centers. Mr. Hurley was recently appointed by Governor Dunne a delegate from Illinois to the National Conservation Congress in Washington during the present week.

**Mr. C. Peter Clark** has been appointed chief of the rate and tariff bureau of the Massachusetts Public Service Commission, with headquarters at Boston. Mr. Clark is a son of the late Charles P. Clark, former president of the New York, New Haven & Hartford Railroad, and is a native of Jamaica Plain, Mass. He has had a varied railroad experience, including service as general freight agent of the Old Colony Railroad and Fall River Line, general manager of the New York & New England Railroad and superintendent of the eastern division of the New York, New Haven & Hartford Railroad. Ten years ago he was appointed second vice-president and general manager of the Buffalo & Susquehanna Railroad and has since made his headquarters in Buffalo.

**Mr. Hugh McCloskey** has resigned as president of the New Orleans (La.) Railway & Light Company and has been elected chairman of the board of directors of the company and president of the American Cities Company, the common stock of which has been acquired by the United Gas & Electric Corporation. He will assume his new office Dec. 1. Mr. McCloskey first became identified with electric work in New Orleans in 1893 as a member of the board of directors of one of the subsidiary companies of the New Orleans Railway & Light Company. On Feb. 22, 1908, he was elected chairman of the board, and the following month he succeeded Mr. E. C. Foster as president of the company. The company under Mr. McCloskey's direction has made important improvements in the railway, electric-lighting and gas departments. Mr. McCloskey's connection with the New Orleans dock board was fraught with much service as the long lines of wharves and great steel sheds in that city show. He received recently the *Picayune's* loving cup for his public-spirited efforts in giving the city its wharves and sheds. Mr. McCloskey, besides being so prominently identified with the electric and railway development in the South, is first vice-president of the D. H. Holmes department store, vice-president of the Hibernia Bank & Trust Company and the Hibernia National Bank, and vice-president of the Hibernia Insurance Company. He was the founder of McCloskey Brothers, one of the largest wholesale grocery and produce firms in the South.

**Mr. A. O. Kuehmsted,** who was elected president of the Electrical Credit Association of Chicago at the annual meeting on Nov. 14, is the vice-president of the Gregory Electric Company of Chicago and has been active in electrical business circles in that city for a number of years. Mr. Kuehmsted was serving as vice-president of the Credit Association when promoted to the presidency. He has been connected with the Gregory Electric Company since 1895 and handles the business end of the concern. He is a native of Oshkosh, Wis., and was born in 1863. He went to school and obtained his early business training in Oshkosh and removed to Chicago in 1899 after he had been affiliated with the Gregory company for several years. Mr. Kuehmsted is an alert, active, intelligent man keenly interested in all forms of progress and advancement. He is a member of the Chicago Association of Commerce, the Illinois Manufacturers' Association, the Chicago Athletic Association, Electric Club of Chicago, Hinsdale Golf Club, LaGrange Country Club and other social and business organizations. His home is in Hinsdale, Ill., a suburb of Chicago. He has read papers before several business organizations and has contributed to the trade press. Last winter he was a delegate from the Illinois Manufacturers' Association to the convention of the National Association of Commerce at Washington. His straightforward, downright methods have made him popular among electrical men in Chicago.



A. O. KUEHMSTED

# Obituary

**Charles D. Robbins,** president of the Robbins Electric Company, of Pittsburgh, Pa., died Nov. 12 at his home in Pittsburgh, aged seventy-nine. Mr. Robbins was born in Philadelphia and went to Pittsburgh twenty years ago. One son, Mr. Harris Robbins, survives him.

**Charles W. Amory,** who died Nov. 5 at his home in Boston, Mass., was a director in many corporations, including the American Bell Telephone Company, the American Telephone & Telegraph Company, the Western Telephone & Telegraph Company, the Western Electric Company and the Edison Electric Illuminating Company of Boston.

# Construction

## New England

BIDDEFORD, ME.—The Cumberland County Pwr. & Lt. Co., of Portland, has secured control of the York Pwr. Co., which furnishes electricity in Biddeford, Saco, Kennebunk, Wells, York Harbor and other points along the York County coast. When the necessary transmission lines can be completed the company proposes to supply these places with energy from its hydroelectric plants, using the steam-power plant of the York Pwr. Co. for reserve only.

ELLSWORTH, MAINE.—The Bangor Ry. & El. Co., of Ellsworth, expects to purchase within the next two months three sets of aluminum lightning arresters. Edward M. Graham is assistant to president.

GREENVILLE, N. H.—The Greenville El. Ltg. Co. expects to purchase within the next three months a 3-kw to 5-kw marine set or a 3-kw to 5-kw turbine.

PLAISTOW, N. H.—The Plaistow El. Lt. & Pwr. Co. expects to purchase 15 transformers and 60 meters; also rectifiers, arc lamps and incandescent lamps (small amount). The company purchases energy from the Haverhill El. Co., of Haverhill, Mass. E. H. Landman is president.

SOUTH RYEGATE, VT.—The Ryegate Lt. & Pwr. Co., of South Ryegate, expects to purchase within the next ten months auxiliary equipment, including coal and ash-handling machinery, exciters, pumps, condensers, etc. M. F. Sargeant is president.

ATTLEBORO, MASS.—The Attleboro Steam & El. Co. has applied to the State Board of Gas and Electric Light Commissioners for permission to issue $80,000 in additional capital stock, the proceeds to be used to pay for additions and improvements now being made. Edgar Tregoning is manager.

CHELSEA, MASS.—New bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 29 for an underground electric transmission line from the navy yard, Boston, Mass., to the United States Naval Hospital, Chelsea, Mass., a distance of about 1 mile, according to Specification No. 2000.

SOUTH MANCHESTER, CONN.—Plans are being considered for the installation of an ornamental street-lighting system in the business section of the town. The present plans provide for 132 lamp standards carrying three-lamp clusters, to be maintained by underground wires. The South Manchester Lt., Pwr. & Tramway Co. has agreed to install the system, provided the town will enter into an agreement for a period of five years. The cost of the system is estimated at $5,000.

## Middle Atlantic

EAST ROCHESTER, N. Y.—The Despatch Ht., Lt. & Pwr. Co. expects to purchase a small supply of electrical appliances and suppplies, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, etc. For particulars address the company at 34 Clinton Avenue, Rochester. Royal Parkinson is general manager.

NEW YORK, N. Y.—The Public Service Commission has awarded the first construction contract for a section of the Interborough Seventh Avenue subway line to the Degnon Contracting Co., of New York, for $2,185,063. The contract was for Section 3, which extends under Varick Street, and the Seventh Avenue extension from Beach Street to Commerce Street.

ASHLAND, PA.—Notice has been filed that application will be made to Governor Tener for a charter for the Ashland El. Co. by Charles Elwood Hanna, Thomas Evans, Charles S. McGirr, J. A. McKee and William J. Montgomery. The company proposes to furnish electricity for lamps, heat and motors. Frederick M. Leonard, 119 South Fourth Street, Philadelphia, is solicitor.

ASPINWALL, PA.—Bids will be received by the borough of Aspinwall, addressed to S. R. Chase, borough clerk, 230 First Street, Aspinwall, until Nov. 24 for the following apparatus: Approximately 245 1-2-3-4 point brackets, 1000 insulators, 3750 lb. No. 6 copper wire, 180 fixtures complete for tungsten street-lighting system. Further information may be obtained from H. C. Lea, superintendent of public works.

GIRARD, PA.—Notice has been given that application will be made to Governor Tener for a charter for the Schuylkill El. Co. by Thomas Evans, Charles Elwood Hanna, Charles S. McGirr, J. A. McKee and William J. Montgomery. The company proposes to furnish electricity for lamps, heat and motors. Frederick M. Leonard, 119 South Fourth Street, Philadelphia, is solicitor.

NEWTOWN, PA.—Bids will be received by the Hanover Township School District until Nov. 28 for furnishing and installing gas and electric-light fixtures in the high school building at Newtown, in accordance with drawings and specifications prepared by Austin L. Reilly, architect, 58 Bennett Building, Wilkes-Barre, copies of which may be obtained upon application to the architect.

PITCAIRN, PA.—The Borough Council expects to purchase within the next six months street-lighting fixtures for 60 series tungsten street lamps. J. H. Travis is borough clerk.

SCRANTON, PA.—Plans are being prepared by the Watts Engineering Co. for the installation of an electric-light and power plant to be installed at the works of the Eureka Pwr. Co., of Scranton.

HARRISON, N. J.—The Hyatt Roller Bearing Co. is building a new power station for its manufacturing plant on Somerset Street.

JERSEY CITY, N. J.—Bids will be received by the Board of Education (committee on new school No. 24) until Dec. 4 for the construction of a school building, to be located on Virginia Avenue, near West Side Avenue, including complete electrical work, heating and ventilating apparatus. John T. Rowland, 98 Sip Avenue, is supervising architect.

PATERSON, N. J.—The Society for the Establishment of Useful Manufactures is contemplating the erection of a large steam generating plant in connection with the hydroelectric station it is now building at Passaic Falls, to be used as auxiliary to same. John W. Cooke, of Passaic, is hydraulic engineer.

TRENTON, N. J.—Contract has been awarded by the Pub. Ser. El. Co. for the construction of a new substation on Olden Avenue to serve the East Trenton district, to cost about $12,000.

BALTIMORE, MD.—Bids will be received at the office of the lighthouse inspector, Baltimore, Md., until Dec. 1, for furnishing storage batteries and charging panel. Blank proposals and particulars may be obtained by addressing the lighthouse inspector, Baltimore, Md.

BEAVER HOLE, W. VA.—The West Virginia Devel. Co. is reported to be contemplating a hydroelectric power development on the Cheat River at Beaver Hole, located about 13 miles from the Pennsylvania State line. The present plans provide for the construction of a dam about 1200 ft. long and 100 ft. high, power house to be built in and forming part of the proposed dam. It is estimated that 54,000 hp can be developed which will be distributed in West Virginia and southwestern Pennsylvania. No definite plans have been made for beginning construction work. F. W. Schneidenhelm, 503 Bank for Savings Building, Pittsburgh, Pa., is chief engineer. Beaver Hole has not a post office.

COEBURN, VA.—The Coeburn Lt. & Pwr. Co. expects to purchase within the next three months one ½-kw, two 1-kw and one 5-kw transformer and about 35 poles, six 5-amp meters and 2000 ft. No. 10 copper wire and 5000 ft. No. 14 copper wire. Claude H. Cox is manager.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until Nov. 29 for furnishing one common-battery lamp line, three-position switchboard, (total capacity, 600 common-battery lines, 40 magneto lines and 45 cord circuits), completely wired, but only equipped for 400 common-battery lines, 38 magneto lines, and 30 cord circuits, under Proposal No. 681. Further information may be obtained upon application to Major W. L. Clark, disbursing clerk.

## North Central

BAY VIEW, MICH.—The Bay View Camp Ground Association, electric-light department, expects to connect 50 to 75 cottages next season and will purchase meters for same, and probably about 25,000 ft. of wire; also necessary pins, insulators, etc. Electricity for operating the system is purchased from the Petosky municipal electric plant. Luther C. Mason is superintendent.

BLISSFIELD, MICH.—The taxpayers voted against a bond issue of $16,000 for repairs and extensions to the municipal electric-light plant which probably means the abandonment of municipal ownership of the plant. The Citizens' Lt. & Pwr. Co., of Adrian, has offered to purchase the local plant and furnish electricity for lamps and motors, giving a 24-hour service.

GAYLORD, MICH.—The Saginaw Wood Products Co., it is reported will remove its machinery to this city and later will install equipment for a power plant. Work will begin at once on the erection of a temporary building for power plant. R. K. Carr is general manager.

PORT HURON, MICH.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 8 for a conduit and wiring system, extension of gas-piping system and lighting fixtures at the United States court house and post office in Port Huron. For details see proposal columns.

QUINCY, MICH.—The Light and Water Works Department expects to install within the next 60 days one 10-in. by 18-in. by 10-in. compound engine directly connected to a 50-kw, two-phase, 60-cycle, 1200-volt generator and a four-panel switchboard. George J. Mickle is superintendent.

CINCINNATI, OHIO.—Bids will be received at the office of the Board of Hospital Commissioners, Burnett Avenue, Cincinnati, Ohio, until Dec. 9 for furnishing material and labor required for the erection of the new Tuberculosis Sanitorium and additions and alterations to porches on present ward building No. 2, in Lick Run, Hamilton County, in accordance with plans and specifications prepared for same and which are on file in the office of Tietig & Lee, architects, 716 Lyric Building, Cincinnati. Proposals will be received separate on each branch or any number of branches, or for the work complete, including all branches: Nos. 1 to 14 include excavation, masonry, general construction, etc.; (15) elevator work; (16) electrical work; (17) plumbing and gas fitting. Bids will also be received at the same time and place for labor and materials required in the heating and engineering work in the new Tuberculosis Sanitorium in Lick Run, in accordance with plans and specifications prepared for same and which are on file in the office of Walter G. Franz, consulting engineer, Union Trust Building, Cincinnati. Proposals will be received separately on each branch or any number

f branches, or on the work in aggregate, as follows: (1) boilers, tokers, smoke connection and coal cars, tracks and scales; (2) power iping, steam transmission lines and heating systems; (3) covering and nsulation; (4) temperature regulation; (5) electric transmission system; (6) refrigerating plant; (7) laundry equipment. Plans and specifications re also on file in the office of the Board of Hospital Commissioners. C. R. Holmes is permanent chairman and E. L. Kennedy is clerk.

CLEVELAND, OHIO.—An ordinance permitting the Cleveland El. Illg. Co. to extend its steam-heating system was passed at the recent election.

CLEVELAND, OHIO.—Bids will be received at the office of the secretary to the director of public service, No. 204 City Hall, Cleveland, until Dec. 4 for boiler-feed pumps for the municipal electric-light plant. W. J. Springborn is director of public service and W. H. Kirby is secretary.

CLEVELAND, OHIO.—The city of Cleveland expects to erect within the next six months three substations and to install 50,000 ft. of underground cable in connection with the municipal electric-light plant; also to purchase transformers of various sizes (about 18 of 500 kva and 50 or 75 of various sizes), steam turbine exciter set, two 150-hp induction motors, one 100-hp and one 75-hp induction motor, three 5000-kw turbo-generators (contract awarded to the Allis-Chalmers Co.); main switching equipment (Westinghouse Co.); six 1000-hp boilers (Stirling and Babcock & Wilcox); three boiler-feed pumps, one 11-panel distribution switchboard, two substation switchboards (sizes not yet determined); also oil switches, protective devices, etc. (not yet decided upon); lightning arresters, poles, insulators, meters, wire, etc., amount not yet determined. Within the next eight months the city will probably purchase tub transformers, probably 10 or 15, and arc lamps, probably 500 or more. F. W. Ballard, Jr., is constructing engineer.

HURON, OHIO.—Within the next two months the Board of Trustees expects to purchase one 110-kva and one 60-kva, 60-cycle, three-phase, 2200-volt generator, with switchboard complete, and panel for street-lighting; also either series direct-current arc-lamps and rectifier, or complete series tungsten equipment. J. C. Britton is superintendent of the municipal electric-light plant.

LANCASTER, OHIO.—The proposal to issue bonds to the amount of $135,000 for the installation of a municipal electric-light plant was defeated at the election held Nov 4.

LIMA, OHIO.—Bids will be received by the Board of County Commissioners of Allen County, Court House, Lima, until Dec. 8 for the necessary wiring at the Allen County Infirmary to distribute electricity from the switchboard to maintain 130 lamps at the main building and barn. Bids will also be received at the same time and place for the installation of an electric generating plant at the County Infirmary. The equipment is to include a prime mover, generator and storage battery, with all necessary accessories, to deliver 10 kw at the switchboard, which shall be included in the proposed installation at 110 volts, the storage battery to be capable of sustaining the voltage for 50 lamps of 16 cp for eight hours; also one 2-hp motor and 1-hp motor. H. J. Lawlor is clerk of board.

MARIETTA, OHIO.—The City Council has passed an ordinance providing for an issue of $2,825 in bonds for improvements to the municipal electric-lighting system. It is proposed to replace the present arc lamps, of which there are 218, with tungsten lamps, using 350 lamps. A portion of these will be placed in Norwood and Fairview Heights. In the business district 300-watt lamps will be used, which have already been purchased; 250-watt lamps will be used in the residence section.

MARYSVILLE, OHIO.—The Marysville Lt. & Wtr. Co. expects to complete its transmission lines to Milford Center within the next 30 days. Mayne Mackan is superintendent.

MINERAL CITY, OHIO.—The Board of Trustees of the municipal electric-light plant expects to purchase some vacuum cleaners. C. K. Limmer is superintendent.

MOUNT BLANCHARD, OHIO.—A franchise has been granted to Bert L. Marvin, of Findlay, to construct and operate an electric-light plant in Mount Blanchard. Mr. Marvin was also given a contract for street-lighting for a period of 10 years.

NELSONVILLE, OHIO.—The Hocking Pwr. Co., of Nelsonville, expects to erect within the next two months 3 miles of three-phase transmission lines. T. C. Hulbert is superintendent.

NEW WILMINGTON, OHIO.—Plans are being considered for extension of the street railway of the Mahoning & Shenango Valley R. R. & Lt. Co. from New Castle to New Wilmington.

NORWALK, OHIO.—We are informed that preliminary steps only have been taken toward the installation of a municipal electric-light plant. H. Whitford Jones & Co., of Cleveland, Ohio, have been engaged to take charge of the matter. A. W. Carpenter is director of public service.

NORWOOD, OHIO.—The power station of the municipal electric-light plant and water-works system was damaged by fire recently, causing a loss of about $50,000.

OAK HARBOR, OHIO.—Arrangements are being made for the installation of a municipal electric-light plant, bids for construction of which will be asked for about Jan. 1, 1914. The plans provide for a 125-hp steam generating plant and about 7 miles of distribution lines. George Champe, Nasby Building, Toledo, is engineer. Louis L. Cartersen is city clerk.

SALINEVILLE, OHIO.—Within the next two months the Salineville El. Lt., Ht. & Pwr. Co. expects to purchase a 150-kw to 180-kw, single-phase, 60-cycle, 1100-2200-volt (primary 7200 volts) alternator. P. S. Hart is superintendent.

HARRODSBURG, KY.—The town of Harrodsburg expects to purchase one boiler with stokers, one 150-kw direct-current generator and about 20,000 lb. of wire (from 0000 to 000000) within the next three months. Albert Riley is superintendent.

HENDERSON, KY.—Within the next 30 days the managers of the municipal electric-light plant expects to install a 400-hp Stirling boiler, Babcock & Wilcox chain grates, a 750-kw Westinghouse turbine, a Westinghouse surface condenser and an electrically driven river pumping plant for city waterworks; also to erect a 225-ft. by 11-ft. Heine radial brick stack. All equipment has been purchased and delivered. L. P. Hite is superintendent.

HORSE CAVE, KY.—The installation of an electric-light plant in Horse Cave is under consideration. P. T. Vaughn, it is reported, is interested in the project.

LOUISVILLE, KY.—The Louisville Gas & El. Co. has made arrangements to supply the Louisville & Southern Indiana Trac. Co., which operates a suburban service out of Louisville to New Albany and Jeffersonville, Ind., with energy to operate its cars. This will require a service of about 500 kw until March 1, 1914, and 1000 kw thereafter.

EVANSVILLE, IND.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 8 for a conduit and wiring system in the United States Marine Hospital, Evansville, Ind. For details see proposals columns.

ALEDO, ILL.—The Tri-County Lt. & Pwr. Co. has asked the City Council for permission to change its system from direct to alternating current, and that the city cause the dissolution of an injunction which it secured restraining it from bringing energy from outside sources and from changing the system from direct to alternating current.

CLINTON, ILL.—The property of the Clinton Gas & El. Co. is reported to have been purchased by the McKinley syndicate, of Champaign.

ELGIN, ILL.—New lamps, extensions of and rearrangements of the present lighting systems in Lord's and Wing Parks will be made next spring.

GALESBURG, ILL.—A resolution has been introduced in the City Council providing that investigations be made to secure an estimate of the equipment needed to enable the municipal electric plant to supply electricity for commercial purposes. The plant at present furnishes street-lighting service only. Alderman Charles Miller is interested in the project.

GALVA, ILL.—The Galva El. Lt. Co., recently incorporated with a capital stock of $150,000, has purchased electric plants in four towns and will build a large central power plant in Galva to furnish electricity in the towns of Altoona, Oneida, Galva, Lafayette and Cambridge, Ill. Equipment to be purchased by the company will include two boilers in batteries of one each, 250 hp and 300 hp respectively; rocking or self-dumping grates; one 250-kva to 300-kva, 2300-volt generating unit, with turbine or belted to Corliss engine, with switchboard equipment; transformers (standard voltages and sizes); eight transformers for substations, 2300 volts to 13,200 volts, 25 kva to 75 kva, with arresters, switches, fuses, supplying about 30 miles of three-phase pole lines, B. & S. No. 6 bare, hard-drawn wires; poles, cross-arms, insulators, anchors, meters (probably Westinghouse), and incandescent lamps. E. L. Brown is president and E. O. Brown is manager of the company.

HARVEL, ILL.—The Village Board has awarded a contract to the Southern Illinois Lt. & Pwr. Co. for lighting the streets of the village for a period of two years.

JACKSONVILLE, ILL.—At a recent meeting of the directors of the Chamber of Commerce the report of Prof. Bryant, of the University of Illinois, for the installation of a municipal electric plant was submitted. Two proposals were submitted as follows: (A) For a plant with sufficient output to maintain 180 arc lamps (450 watts), 90 kw; 184 Mazda lamps of 100 cp, 18.4 kw; 544 Mazda lamps of 60 cp, 40.8 kw, making a total of 149.2 kw; (B) 664 Mazda lamps of 100 cp. 66.4 kw; 136 Mazda lamps of 60 cp, 10.2 kw, making a total of 76.6 kw. The commercial load of the city, including that required for pumping, has a maximum of nearly 500 kw. The cost of a complete distribution system and power plant for street, residence and commercial lighting is estimated at $200,000; street-lighting system only and power plant to maintain same will cost about $60,000. The Jacksonville Ry. & Lt. Co. has submitted a new proposal for street-lighting, offering to install and maintain 60 three-lamp posts, 75 one-lamp posts and 545 one-lamp swing brackets, with an all-night service, for the sum of $15,000 per year. Unless the company gives the city better terms the Chamber of Commerce will favor the proposed bond issue.

KIRKLAND, ILL.—The Village Board has awarded the Illinois Northern Utilities Co., of Chicago, Ill., a contract for street-lighting and for furnishing electricity to operate the pumps at the water-works station for a period of ten years.

MOLINE, ILL.—The City Commission has approved the plan of Commissioner E. L. Eastman to install 111 new tungsten lamps at the street corners in the city.

MOLINE, ILL.—Improvements will be made to the lighting system of the southeast and southwest bluffs. The present arc lamps will be

[illegible] with tungsten lamps, the present plans providing for 200 additional [illegible]

STEWARD, ILL.—The Steward El. Lt. & Wtr. Co. expects within the [illegible] company has recently installed a new 25-hp Fairbanks & Morse engine [illegible]

STRASBURG, ILL.—The Central Illinois Public Ser. Co., of Mattoon, is negotiating with the village officials with a view of installing an electrical distributing system in Strasburg.

[illegible] plant of the Madison County Lt. & Pwr. Co. (a subsidiary of the Illi- [illegible] system), involving an expenditure of about $25,000, a large portion of which will be used for the installation of an additional water-pumping plant. New equipment will also be installed in the power station.

CORNELL, WIS.—At an election held Nov. 8 the proposal to construct a municipal electric-light plant was carried. L. G. Arnold, of Eau Claire, Wis., is consulting engineer. J. E. McArthur is village clerk.

NEW LISBON, WIS.—The Electric Light and Water Works Commission expects to purchase within the next six months a transformer, one meter for testing purposes; also to purchase electrical appliances and supplies, but as yet cannot give any definite amount. Theodore Wahl is superintendent.

WITTENBERG, WIS.—The Wittenberg El. Co. expects to purchase within the next six months one 23-in. waterwheel to operate under a 20-ft. head, one waterwheel governor for above wheel, 50 lightning arresters, 15,000 ft. of wire and wiring supplies; also within the next eight months it expects to purchase a number of small transformers for small motors and also some small motors, ranging from 1 hp to 5 hp. E. L. Debot is president and manager.

BREWSTER, MINN.—At an election held recently the proposal to install an electric-light system was carried. The City Council is authorized to proceed with the work and erect a transmission line from the city of Worthington to Brewster, the cost not to exceed $5,000.

SHAKOPEE, MINN.—The distribution lines of the municipal electric-light plant have recently been changed from the two-phase to the three-phase system. Within the next two months the town will purchase a 400-gal., 100-lb. pressure centrifugal pump, directly connected, and will also complete the installation of a series tungsten lamp street-lighting system. T. E. Harris is superintendent.

SPRING VALLEY, MINN.—The Southern Minnesota Pwr. Co., of Spring Valley, expects to erect 10 miles of 13,000-volt transmission line to Grand Meadow, a distance of 10 miles, and to change its system from direct to alternating current. Within the next eight months the company expects to purchase a small supply of electrical appliances and supplies, including small motors, vacuum cleaners, heating apparatus, etc. The company is now installing 20 ornamental lamp-posts (carrying five-lamp clusters) on Broadway. M. C. Brown is superintendent.

WINONA, MINN.—The Wisconsin Ry., Lt. & Pwr. Co. is contemplating the construction of a double transmission line between Hatfield and Winona erected on steel towers. Clement C. Smith, of Milwaukee, Wis., is president of the company.

APPLINGTON, IA.—C. J. Long, of Webster City, Ia., is engineer in charge of the construction of the proposed municipal electric-light plant, work on which is already under way. Henry Busse is clerk.

CEDAR RAPIDS, IA.—The City Council has passed a resolution to call an election on Dec. 15 to submit to the voters the proposal to issue $125,000 in bonds for the construction of a steel and concrete dam across the Cedar River at the site of the present dam. The contract which the city has with the Iowa Ry. & Lt. Co. provides that the city shall build the dam and lease fifty-nine-sixty-fourths of the water-power to the company at a yearly rental of 10 per cent of the cost of the dam. The contract is for a period of ten years.

EARLVILLE, IA.—A special election will be held on Dec. 9 to vote on the proposal to issue bonds for the construction of a municipal electric-light plant. William Hunt is clerk.

ELDORA, IA.—The Iowa River Lt. & Pwr. Co., of Eldora, expects to purchase about April 1, 1914, one waterwheel. The company is constantly purchasing electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners and washing machines. J. C. Lundy is manager.

KEOKUK, IA.—The Keokuk El. Co. has increased its capital stock from $250,000 to $600,000.

SHEFFIELD, IA.—The Sheffield El. Lt. & Pwr. Co. has purchased one 135-kva, 2300-volt, two-phase, 720 r.p.m. Triumph generator (belted type) and expects soon to purchase 12 lamp standards for five-lamp clusters and armored cable for same. The company also would like to receive prices on one 1¼-in. and one 1½-in. centrifugal pump which will prime itself at 12 ft. or 13 ft., directly connected to a single-phase motor, for use as a small fire engine. C. C. Carhart is owner and manager.

MARSHFIELD, MO.—The Marshfield El. Co. expects to purchase a pump and motor for well for ice plant; also 50 fans and 100 flatirons. John E. Hosmer is secretary and manager.

SALEM, MO.—The Salem Lt. & Pwr. Co. expects to purchase within the next two months one 20-kw to 30-kw generator and steam engine to relieve the 90-kw machine after midnight, also 20 5-amp meters. C. A. Wallof is general manager.

ST. LOUIS, MO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 20 for a new plumbing system, conduit and wiring system and interior lighting fixtures in the United States custom house at St. Louis, Mo. Drawings and specifications may be obtained from the custodian of building or at the above office. O. Wenderoth is supervising architect.

SWEET SPRINGS, MO.—The town of Sweet Springs expects to purchase one 75-kw generator and one or two engines for the municipal electric-light plant within the next 30 days.

BLAIR, NEB.—At an election to be held Nov. 28 the proposition to issue bonds for the installation of a municipal electric-light plant will be submitted to the voters. Plans and estimates have been prepared by the Towle Engineering Co., of Omaha, Neb. S. W. Chambers is city clerk

BRUNING, NEB.—The village of Bruning has engaged Grant S. Fulton, engineers, of Lincoln, to prepare plans and supervise the construction of an electric-light plant and water-works system, contracts for which will be let about Jan. 15, 1914. The cost of the work is estimated at $16,000. J. J. Breckert is clerk.

CHADRON, NEB.—The Chadron El. Lt. & Power Co. expects to purchase within the next six months some electrical supplies. Kass & Klingaman are proprietors of the electric plant.

ARMA, KAN.—Bids will be called for in about 30 days for the construction of an electric-light plant and water-works system, to cost approximately $30,000. Albert C. Moore, of Joplin, Mo., is engineer.

CAWKER CITY, KAN.—The City Council will soon submit the proposal to issue $7,000 in bonds for the purchase of the local electric-light system to the voters.

DOUGLAS, KAN.—Plans are being prepared by Albert C. Moore, engineer, of Joplin, Mo., for the proposed water-works system, for which bonds have been voted. The equipment of the proposed plant will include oil engines, generator, motor-driven pumping machinery, [illegible] The bonds for the above will probably be called for the latter part of December. C. A. Ogg is city clerk.

LIBERAL, KAN.—The Liberal Lt., Ice & Pwr. Co. expects to purchase within the next three months a carload of 25-ft. and 30-ft. (butt-treated) poles. H. W. Magruder is president and manager.

## Southern States

WENDELL, N. C.—The City Council has purchased a site on Little River and is receiving proposals from various electric companies for the construction of plant and will close contracts within the next 10 days. As yet no engineer has been engaged. J. Ackley Wall is city clerk.

WINSTON-SALEM, N. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 16 for the extension (including plumbing, gas piping, heating apparatus, electric conduits and wiring and approaches) of the United States post office at Winston-Salem. Drawings and specifications may be obtained at the above office or from the office of the custodian, at Winston-Salem. O. Wenderoth is supervising architect.

BRADENTOWN, FLA.—The Manatee El. Co., of Bradentown, expects to purchase within the next two months about 50 meters and 10 transformers, and within the next three months it expects to purchase 100 series incandescent lamps. The company may also install a new circulating-water set. P. R. Chambers is local manager.

PASSAGRILLE, FLA.—The proposal to issue $11,000 in bonds for municipal improvements, to include the construction of an electric-light plant, completion of water-works system and improvements to street and seawall, will be submitted to the voters.

HURTSBORO, ALA.—The city of Hurtsboro is reported to have awarded the contract for the proposed municipal electric-light plant and water-works system to the J. B. McCrary Co., of Atlanta, Ga. Bonds to the amount of $10,000 were recently voted for the work.

GLOSTER, MISS.—The Woodmere Springs Lt. & Wtr. Co., it is reported, contemplates the construction of a hydroelectric-power plant. John L. McGehie, of Gloster, is interested in the project.

JONESBORO, ARK.—Plans have been prepared for the construction of a new power house (80 ft. by 120 ft.) for the State Agricultural College at Jonesboro, to replace the one recently destroyed by fire. Two 100-hp return-flue, bricked-in boilers, one 25-kw, 110-220-volt direct-current generator and an engine directly connected (Corliss engine preferred) will be required for the plant. Other machinery for the plant will not be selected for some time. For further information address V. C. Kays, principal, Jonesboro.

RAYNE, LA.—The managers of the municipal electric-light plant expect to purchase within the next three months one 60-hp crude oil engine. E. J. Bertrand is superintendent.

ALTUS, OKLA.—The managers of the municipal electric-light plant are contemplating the erection of a transmission line to Olustee, a distance of 8 miles, to furnish electrical service in that town; also to furnish elec-

icity to the farmers along the line for irrigation purposes. W. G. mith is superintendent of the municipal plant.

CHANDLER, OKLA.—The Chandler El. Co. expects to purchase ithin the next 30 days one 40-kw or 50-kw, 60-cycle or 133-cycle, 2400-olt generator for arc-lamp circuit. The company has recently purchased a 5-hp Foos gas engine. D. M. Bangs is secretary.

MUSKOGEE, OKLA.—The Sequoyah Club is planning to install a mall power plant at Buffington, about 44 miles east of Muskogee, to urnish electricity for lighting club house and grounds. The equip-ent will include a small undershot waterwheel and generator of ufficient output to maintain 200 or 300 lamps and switchboard for ame; 200 or 300 incandescent lamps, and electrical supplies for above. . M. Graham, of Muskogee, is engineer. Joseph Dickmann, of Musko-ee, has contract for construction of dam. Homer Needles is president f the Sequoyah Club.

BALLINGER, TEX.—Citizens of Ballinger and surrounding territory re considering a proposal to build a large irrigation and power dam on he Colorado River to cost about $4,000,000. The proposed dam would tore sufficient water to irrigate 300,000 acres and develop considerable ower. If the proposal now under consideration falls through an attempt will be made to have the federal government take up the matter.

ELKHART, TEX.—C. H. Martin, manager of the Texas Pwr. & Lt. o., of Palestine, has submitted a proposal to the Town Council for fur-nishing electrical service here. It is proposed to erect a transmission line from Palestine to Elkhart, a distance of 12 miles.

MARFA, TEX.—The Marfa El. Lt. & Ice Co. has recently installed two new three-phase generators and one Fairbanks, Morse & Co. oil engine.

## Pacific States

LEAVENWORTH, WASH.—The Tumwater Lt. & Wtr. Co., of Leavenworth, has been granted a 25-year franchise to furnish electrical and telephone service here.

SEATTLE, WASH.—Plans, it is reported, have been announced by the Skagit Pwr. Co., controlled by the Stone & Webster Corpn., of Boston, Mass., for the development of the water-power sites recently granted by Secretary Houston of the Department of the Interior on the Skagit and Cascade Rivers. On the Skagit River a concrete diverting dam 50 ft. high, a tunnel conduit 3.7 miles in length and a power house will be built. On the Cascade River the water will be diverted by a concrete dam 20 ft. in height and 200 ft. long. A flume and tunnel will carry the water a distance of 6 miles to the proposed power plant. The present plans provide for equipment to generate 50,000 hp at the two plants. Electricity generated at the plants will be transmitted to Seattle, Tacoma and adjacent cities.

SPOKANE, WASH.—Final contracts, it is reported, will soon be awarded by the Chicago, Milwaukee & Puget Sound R.R. Co. for equipping the railroad for electrical operation from Harlowton, Mont., to Avery, Idaho, a distance of 440 miles. The cost of the work is estimated at $7,000,000. The railroad will also be equipped from Spokane, Wash., to Coeur d'Alene, Idaho, a distance of 36 miles, for electrical operation. A. J. Earling, of Chicago, Ill., is president.

TACOMA, WASH.—The city of Tacoma expects to install an ornamental street-lighting system on about 30 blocks. B. W. Collins is superintendent of electrical works.

TENINO, WASH.—The local electric-light plant, owned by Wilbur B. Foshay, Milliard Lemon and others, has been taken over by the Northwest El. & Wtr. Co., of Seattle. The new owners, it is said, contemplate extensive improvements.

WENATCHEE, WASH.—The City Council has awarded the contract for installing cluster lamps on Wenatchee Avenue to the Western El. Co., of Seattle, at $3,495.

PORTLAND, ORE.—The Sunnyside Improvement Association has petitioned the City Commissioners for a better street-lighting system in the Sunnyside District.

SANDY, ORE.—Application has been made to the Council by Mc Cormick & Botkin for a franchise to erect transmission lines through Sandy from their proposed power plant on Cedar Creek.

THE DALLES, ORE.—Secretary Lane of the Department of the Interior, at Washington, D. C., has approved an expenditure of $15,000 for an investigation of an interstate water-power project near The Dalles. The State has already appropriated the same amount for this purpose. The proposed project is on the Columbia River. Preliminary surveys indicate the feasibility of a large power development and, in addition, the irrigation of a large tract of land in the Columbia Valley. Investigations will be made by a joint board, consisting of representatives of the Department of the Interior, engineers of the army and the State of Oregon.

HAILEY, IDAHO.—The Rockwell-White Pwr. Co. is contemplating extensions to its distribution lines in Hailey.

PHOENIX, ARIZ.—The City Council has decided to call a special election, to be held Nov. 26, to vote on the proposition to issue $275,000 in bonds for public improvements, of which $25,000 will be used for electric-lighting.

PITKIN, COL.—The Rocky Mountain Devel. Co., with headquarters in Pitkin, has secured all the rights, titles and easements from the State of Colorado, the Forestry Department, the Departments of the Interior and Agriculture, in Washington, to the Roaring Fork of the Grand River and Difficult Creek, in the Sopris forest reserve, for power development. The company proposes to build a hydroelectric plant and transmit electricity to Pueblo, Colorado Springs, Denver and other Colorado cities. It is estimated that from 15,000 hp to 60,000 hp is available. The directors of the company are: William J. Orange, secretary; George S. Foster, Harry A. House and R. M. Stetson, all of Pueblo.

## Canada

CALGARY, ALTA.—Tenders will be received by the Bowness Improvement Co., 202 Eighth Avenue West, Calgary, until Dec. 31, for machinery and equipment as follows: (L) One 200-kw traction motor generator; (M) one four-panel switchboard; (N) one 250-kva generator; (O) one vertical, single-acting, multi-cylinder gas engine. Plans and specifications may be obtained from T. L. Turnbull, consulting engineer, 202 Eighth Avenue West, Calgary.

FERNIE, B. C.—The city of Fernie expects to purchase within the next seven months an automatic voltage regulator for four-wire, two-phase, 60-cycle, 2400-volt current for two machines (150-kw each); S. K. C. system, one switchboard wattmeter, poles and wires for construction of 3 miles of distribution lines, 100 5-amp and 10-amp, 110-volt, 60-cycle, single-phase, two-wire meters. James E. Finn is superintendent of municipal electric plant.

WINNIPEG, MAN.—Tenders will be received by the Board of Control until Dec. 11 for a year's supply of direct-current and alternating-current electric induction meters. Specifications, etc., may be obtained at the office of J. G. Glasco, 54 King Street, Winnipeg, Man.

WINNIPEG, MAN.—At the coming municipal elections a by-law will be submitted to the ratepayers asking an appropriation of $1,000,000 for extensions to the municipal light and power system. Of this amount $500,000 will be needed for the new transmission line. Tenders for the proposed transmission line will not be called before spring, but contractors will soon be asked for proposals for piling and other work in connection with the preparation of right-of-way. This tower line will be carried along the right-of-way of the present 60,000-volt line, which is about 75 miles long, and will carry two 110,000-volt lines with suspension-type insulators. The type of towers has not yet been decided upon.

BROCKVILLE, ONT.—The Electric Light Commissioners expect to erect within the next two months a boiler room and to purchase within the next 30 days two water-tube boilers (300 hp each), with stokers, a motor-driven water-works pump having a capacity of 3,000,000 U. S. gal. per 24 hours, complete with motor, switchboards, etc. E. J. Philips is manager.

PORT ARTHUR, ONT.—The electrical department of the municipal electric light, power, railway and telephone system expects to erect 3 miles of transmission line to pumping station, 25,000-volts stepped down to 2200 volts. The line will be erected on cedar poles with No. 2 aluminum wire for 600 hp. A similar line has just been completed to the Canadian Northern Railroad elevator and the Dominion elevator for 1500 hp. Richard Fox is superintendent of electrical department.

TORONTO, ONT.—If the provincial government gives its consent work will soon be started on the hydroelectric project at Eugenia Falls, which when completed will furnish electricity in Huron, Bruce and Grey County municipalities. The Hydro-Electric Commission has contracts with the municipalities of Owen Sound, Chatsworth, Meaford, Flesherton, Thornbury and Markdale. The cost of the scheme embracing the municipalities, including the transmission lines, is estimated at about $400,000, while linking up Collingwood will bring the total cost to about $500,000.

CHARLOTTETOWN, P. E. I.—A new company, known as the Charlottetown El. Co., has been organized to take over the property of the Charlottetown Lt. & Pwr. Co. The City Council recently made an offer of $96,000 for the entire plant, which was voted down by the ratepayers.

MURRAY BAY, QUE.—The Labrador El. & Pulp Co., Ltd., of Murray Bay, expects to purchase within the next six months one 250-hp engine to operate an alternating-current generator for lighting the city; also within the next four months to purchase two transformers (10,000 kw) and 50 cedar poles for repairing 20 miles of lines. J. O. Duguvay is manager.

SHAWINIGAN FALLS, QUE.—The St. Maurice Lt. & Pwr. Co., of Shawinigan Falls, expects to erect within the next six months about 15 miles of 50,000-volt transmission line from Nicolet toward Pierreville. Joseph G. Telmosse is superintendent.

## Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Dec. 3 for switchboards, electrical cable, conduit and fittings and miscellaneous electrical apparatus and structural steel, under circular (No. 810). Bids also will be received until Dec. 4 for galvanized steel or iron steel cable, steel wire, galvanized ridge roll rivets, taps, cable clips, brass tubing,

gaskets, magnesia pipe covering, magnesia boiler lagging, etc., under circular (No. 808). Blanks and general information relating to these [illegible] from the above office, or from the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is purchasing officer.

## New Incorporations

SWANTON, OHIO.—The Swanton Lt. & Pwr. Co. has been incorporated with a capital stock of $10,000 by Abner D. Baker, Fred E. Pilliod, T. J. Pilliod, Robert S. Graves and A. Q. Price.

HARRISBURG, PA.—Charters for nine electric companies have been granted by the State Department to operate in eastern Pennsylvania. Joseph P. Murray, W. F. Callaghan and F. Stanley Saurman, of Philadelphia, took out charters for the Hatfield, Souderton and Silverdale El. Lt. & Pwr. Cos., each capitalized at $5,000, to operate in the boroughs named. Charters were granted to H. A. Mendenhall, of Toughkenamon; S. Pusey, of West Grove, and H. D. Anderson, of Pittsburgh, for six companies to operate from Kennett Square. Each company is capitalized at $5,000, and they will serve in the Chester County districts as follows: West Grove Borough, New Grove Township, London Grove Township, Kennett Township, East Marlborough Township and Avondale Borough, each company taking the name of the district it operates in.

HONEY CREEK, WIS.—The Honey Creek El. Co. has been granted a charter with a capital stock of $4,000. The incorporators are: H. B. Miller, E. F. Healey and L. L. McDonald.

MONTREAL, QUE.—The Quebec Devel. Co. has been incorporated with a capital stock of $2,500,000 for the purpose of acquiring water rights, the erection of electric systems and generating plants, building underground subways and manufacturing electrical machinery. The main office of the company is in Montreal.

SALABERRY DE VALLEYFIELD, QUE.—The Valleyfield Wtr. Pwr. Co. has been incorporated with a capital stock of $1,000,000 by N. A. Ostiguy, J. Lowe and A. Cossette.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED NOV. 11, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,077,972. RELAY FOR TWO-WIRE NOTCHING SYSTEMS; E. R. Carichoff, Schenectady, N. Y. App. filed Aug. 9, 1911. For controlling successively operated switches such as are used for controlling railway motors.

1,078,013. ELECTRIC HORN; C. F. Townsan, Mitchell, S. D. App. filed Feb. 25, 1913. A tapper bar strikes a ball seated in a hole in the diaphragm.

1,078,035. AUTOMATIC ELECTRIC DISPATCH SYSTEM; J. Deschamps, Paris, France. App. filed Jan. 26, 1912. A car in one section of an electric railway modifies the circuit conditions for a car in another section.

1,078,058. TIMING DEVICE; C. R. Moore, Lafayette, Ind. App. filed Nov. 27, 1912. Combination of magnets for maintaining the oscillation of a timing pendulum.

1,078,063. THERMOSTATIC FIRE ALARM; J. Rancourt, Quebec, Canada. App. filed May 3, 1913. Pivoted circuit-closing arm disposed to be engaged and operated by the swinging indicator needle of a thermostat.

1,078,076. POTENTIAL REGULATOR; W. Welsch, Berlin, Germany. App. filed Jan. 5, 1912. Transformer winding and core divided so that groups of windings having independent magnetic circuits are cut into or out of circuit, generally alternately, as the switching device is moved.

1,078,106. HARMONIC RELAY; K. B. Miller, Chicago, Ill. App. filed July 17, 1909. For selective signaling on multi-party telephone lines.

1,078,127. RAILWAY SIGNAL; J. P. Coleman, New York, N. Y. App. filed April 17, 1909. Semaphore system.

1,078,131. PROTECTIVE DEVICE FOR STREET CARS; E. E. F. Creighton, Schenectady, N. Y. App. filed June 7, 1912. Automatic system of charging the electrolytic cells which form the discharge path.

1,078,133. PNEUMATIC ELECTRIC TRACKER BAR FOR MUSICAL INSTRUMENTS; C. W. Dorricott, Philadelphia, Pa. App. filed Nov. 4, 1912. Contacts are housed to protect them from the dust and lint carried by the music roll.

1,078,141. OIL-COOLED TRANSFORMER; F. C. Green, Pittsfield, Mass. App. filed Jan. 24, 1910. Transformer tank, cooler and circulating pump all united in one structure.

1,078,172. ELECTRIC CONTACT AND INDICATOR; R. T. Smith, Reno, Nev. App. filed Dec. 18, 1912. The visual indicating lamp, when screwed into its socket, closes the circuit to the electric heater, iron or other device.

1,078,174. BRUSH HOLDER FOR DYNAMOS; C. H. Smoot, Chicago, Ill. App. filed Dec. 14, 1906. For high-speed turbo-generators; combination of brush of slight inertia and a weight of relatively great inertia exerting pressure on the brush through a stiff spring.

1,078,179. ELECTRIC GENERATING SYSTEM; H. H. Wait, Chicago, Ill. App. filed Oct. 7, 1909. Provides, in addition to the shunt and compensating series windings, a compound series winding so connected that as the load on one machine increases the field strength of the other machine is increased.

1,078,181. BOX FOR ELECTRIC CONDUITS; H. J. White, San Francisco, Cal. App. filed Oct. 6, 1910. An inner perforate shell and an outer imperforate shell which may be reamed out in register with any of the perforations in the thicker inner shell.

1,078,194. BRUSH HOLDER FOR ELECTRIC MOTORS OR GENERATORS; E. A. Halbleib, Rochester, N. Y. App. filed Nov. 29, 1912. Special method of securing the supporting rods on which the brush holders are pivoted.

1,078,195. ELECTRIC SWITCH; E. A. Halbleib, Rochester, N. Y. App. filed, Jan. 20, 1913. "Kick switch" for automobiles.

1,078,201. SUPPORT FOR TELEGRAPH AND TELEPHONE WIRES; H. L. Hoybook, Tyler, Tex. App. filed Feb. 1, 1912. Annular supporting member and insulators seated therein and slotted to receive the wires.

1,078,206. ELECTRIC METER; J. Mayer, Seattle, Wash. App. filed May 13, 1912. Records upon separate dials the consumption of current during specific periods of time.

1,078,218. TROLLEY; E. Reddick and J. P. Noel, Hackensack, N. J. App. filed April 11, 1912. Corrugated cam enlargements on the outer surfaces of the wheel flanges.

1,078,225. ELECTRICAL WELDING OF SHEET METAL; E. Thomson, Swampscott, Mass. App. filed Oct. 21, 1909. String of metal contact pieces for localizing and locating the spot welds.

1,078,226. METHOD OF WELDING; R. D. Thomson, Swampscott, Mass. App. filed May 12, 1911. Subjects one piece to end pressure and heating current to form a welding projection on one side thereof and welds the end of a second piece to the said projection.

1,078,229. SIGNALING SYSTEM; H. G. Webster, Chicago, Ill. App. filed Sept. 4, 1906. Receiving devices less in number that the circuits; prevents false signal indications when signals are transmitted over separate circuits simultaneously. (Forty-seven claims.)

1,078,274. ELECTRIC CLOCK; H. Gillette, Chicago, Ill. App. filed Oct. 21, 1912. Economizes current by opening the circuit instantaneously after each closure thereof by the master clock.

1,078,286. GAS ENGINE; L. Illmer, Jr., Cincinnati, Ohio. App. filed April 4, 1907. Toggle linkage for actuating the poppet valve of a two-stroke-cycle gas engine.

1,078,290. ELECTRIC RIVET FURNACE; W. S. Johnson and J. W. Sheffer, Berwick, Pa. App. filed Jan. 27, 1913. Electrode formed with a chamber to receive the head of a rivet and a movable electrode to engage the end of the rivet.

1,078,343. THERAPEUTIC APPARATUS; A. Fumo, New York, N. Y. App. filed April 15, 1913. Circuit is completed through the tonic and the body of the patient as the tonic is poured over the parts treated.

1,078,368. LINE INSULATOR; O. C. Meusebach, San Antonio, Tex. App. filed Dec. 24, 1912. Insulator pins project downwardly from within sheet-metal casing which forms the cross-arm.

1,078,404. ELECTRIC SWITCH; C. E. Avery, Jersey City, N. J. App. filed April 15, 1913. Push-button construction for door-bell switches.

1,078,410. ALARM, SIGNALING AND CONTROLLING DEVICE; E. H. Bock, Berlin, Germany. App. filed Oct. 17, 1911. A light needle dependent from an elastically suspended weight, by its vibrations, serves to close a circuit.

1,078,425. LOCK; A. S. Franks, New York, N. Y. App. filed Aug. 6, 1913. Can be operated from the interior at any time, but can be operated from the exterior by a magnet only.

1,078,439. REPULSION-MOTOR-CONTROL SYSTEM; C. B. Hoffmann, Cincinnati, Ohio. App. filed June 19, 1911. For alternating-current insulated-block signaling systems.

1,078,458. FUSE PLUG; H. T. Paiste, Philadelphia, Pa. App. filed Dec. 6, 1911. Has a fuse-carrying capsule which is readily insertible within the fuse body.

1,078,463. MINE-SHOT-FIRING SYSTEM; G. I. Rawson, St. Louis, Mo. App. filed May 4, 1909. The apparatus for successively firing the charges is located in the mine adjacent to the chambers in which the shots are to be fired and is controlled from the surface.

1,078,472. FUSE PLUG; G. B. Thomas, Bridgeport, Conn. App. filed Nov. 25, 1912. Cap of the plug is crimped to interlock with ribs on the body of the plug and has its lower edge turned under a peripheral flange on the body to prevent separation.

1,078,476. BURGLAR ALARM; O. Wiggers, Hooper, Utah. App. filed March 8, 1913. Circuit-controlling plunger passes through an opening in the wall of the safe into engagement with a box or other article inside the safe.

1,078,489. TROLLEY GUARD; P. Dragon, C. D. George and R. J. Palmerio, Philadelphia, Pa. App. filed March 9, 1912. Parallel-[illegible] guard attached to the trolley wheel and extending rearwardly therefrom.

1,078,523. KNIFE-SWITCH BLADE; A. K. Sutherland, Plainville, Conn. App. filed Jan. 10, 1913. An attaching piece is swaged into recesses in the end of the switch blade.

1,078,550. BURGLAR ALARM; E. Ogle, Dallas, Tex. App. filed April 12, 1912. A resilient member on the [illegible] seat forms against elongated contact strips seated in the channels which guide the sash.

1,078,586. SOCKET FOR ELECTRIC LAMPS; G. C. Knauff, Chicago, Ill. Apl. filed May 28, 1913. Spring-pressed [illegible] for socket which receives the lamp in one end and the terminal plug in the other end.

1,078,597. PNEUMATIC GOVERNOR; E. S. Ashton, Chicago, Ill. App. filed July 31, 1911. Governing unit for maintaining constant pressure in air brake or like fluid pressure system.

1,078,597. HOLDER FOR HIGH-TENSION ELECTRODES; A. R. Darling, Indianapolis, Ind. App. filed Jan. 6, 1913. Inner and outer members separated by an air space with a connecting socket in the inner member.

13,643 (reissue). ELECTROLYTIC DEVICE FOR GENERATING OXYGEN AND HYDROGEN; R. Moritz, Wasquehal, France. (Original patent No. 981,102, issued Jan. 10, 1911.) Prevents possibility of the admixture of the two gases in the apparatus.

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**Rapid Station Erection**

The new turbo-generator station of the Merchants' Lighting Company at Little Rock, Ark., described in our columns this week, is notable as showing that the judicious selection of standard equipment and active superintendence can put a thoroughly up-to-date generating station into commission in an astonishingly short time. The company obtained its franchise contingent on putting the plant into operation within a year—to wit, on June 3 last—and through one source of delay or another it was not until Nov. 15, 1912, that the work was actually begun on the station. Thereafter the work was actually rushed ahead at almost record-breaking pace. The equipment consists of two 1250-kva horizontal turbo-generator sets with turbine-driven exciters, and the whole equipment of the station is of well-known standard types, such as may be obtained from manufacturers on relatively short notice and need exceptionally little inspection after being installed. The only unusual feature of the plant is one enforced by the bad habits of the Arkansas River, which has a 28-ft. rise and fall. The whole condensing equipment has therefore been placed at the bottom of a pit cut out of solid rock to a depth of 41.5 ft. By this means condensation is secured in spite of the worst vagaries of the stream. Notwithstanding the rock cutting thus made necessary and the delays incident to the rainy season, not only the plant but the entire distribution system was ready for operation on May 13, 1913, three weeks ahead of schedule time. It is worth mentioning that the distributing system throughout the entire business district of the city is laid underground, the first distribution of this kind in Arkansas. Tests of the completed station show one interesting feature in the very successful use of ordinary slack coal costing only $2.10 per ton in the bunkers. The coal consumption is reported as 3.6 lb. per kw-hr., while the water rate on a considerably underloaded turbine is 37.5 lb. per kw-hr. The evaporation of a little more than 10 lb. of water per pound of coal thus shown is striking evidence of the efficiency of a well-fired water-tube boiler.

**Ozone Machines and Public Health**

We print on page 1093 of this issue an interesting letter from Dr. Charles P. Steinmetz commenting on an abstract we recently published of an article in the *Journal of the American Medical Association* on the use of ozonators for air purification. We quite agree with Dr. Steinmetz that the subject of ozone, in relation to the air we breathe, is very large and should be investigated jointly by chemists, physiologists and electricians. It is unfortunate that excessive claims have been made for ozone by over-enthusiastic panacea agents, on the one hand, and these have been met, on the other hand, by somewhat drastic countercharges from certain members of the medical profession. No reasonable person is likely to dispute the proposition that air containing a relatively high concentration of ozone is unfit for breathing. This does not necessarily contravene the use of ozone as a purifier and disinfectant. It might be pointed out that the subject of ozone in relation to ventilation was commented upon in our editorial columns (page 266, Aug. 9, 1913) and was discussed in the correspondence columns on Sept. 6 and 13, 1913. It seems to be generally admitted that ozone is a powerful natural oxidizing agent in nature, and that one of the hygienic advantages of living near the ocean is the presence of a certain small percentage of ozone in the air. There can be no question as to the benefits derived from ozone in the artificial sterilization of water. Like any other germicidal substance, an excessive quantity may be dangerous to health. Meanwhile, both exaggerated claims and exaggerated alarms are not likely to produce any useful result, except perhaps to stimulate cautious and scientific investigation over the very large field brought into discussion.

**Energy Supply for Chicago Railways**

In this issue we print a synopsis of the important contracts recently entered into by the Commonwealth Edison Company of Chicago and the local electric railway companies. These agreements are the outcome of long-continued and thorough study of the economies of electrical generation and transmission. They furnish an eloquent testimonial to the reliability of central-station service, for this quality is the chief requisite of railway operation. Delays in transportation not only involve direct loss, but the indirect results are even more serious. The public, increasingly critical, is particularly sensitive to loss of time through poor service. Cheap energy is, therefore, expensive in the long run if the service is unreliable to any considerable degree. The fact that the electric railways in Chicago are willing to assume the risks connected with the purchase of such a vital element of their existence as their energy supply means that the past five years' experience has convinced them that it is safe to depend upon the central station for continuity in service. This is a most significant fact. From the standpoint of the central station the arrangement seems quite ideal. Until now there have been several transmission systems, including substations, covering the same territory. Each of these separate systems must be provided with extra machines for expansion and for emergency purposes, with low operating load-factors, very much lower indeed than those of the power plants.

The combined cost of three systems is obviously much greater than one, even with the same total rating, but the rating of a combined system need not be so great as that of its components. Not only is the necessary reserve smaller, but the element of diversity acts to increase the load-factor. Incidentally, danger from electrolysis is minimized because of the reduction of the amount of conducting material underground and the consequent higher resistance in the path of the stray currents. In the case of the Chicago elevated railways the Commonwealth Edison Company gains a great advantage in the provision to use the overhead structures for carrying cables. Such construction will not only be cheaper than underground conduits but the cost of preventing electrolytic troubles will be reduced. Taken altogether, the new contracts are evidence of progress and their consummation is cause for general congratulation.

## Hasten Water-Power Development

There was much disagreement in the fifth National Conservation Congress, but there was agreement on certain principles of first importance. If we disregard the politics, stump speeches, resolutions and by-plays with which the proceedings were filled, we find that some real progress was made. It is fortunate that the members of the water-power committee were able to agree on a statement of principles and that the division which led to a majority and a minority report did not nullify its treatment of the entire subject. The statement of principles adopted by the convention affords a groundwork for constructive progress which should be used effectively and have more enduring life than the political by-plays which tended to obscure the real work done. An introduction to the statement of principles recognizes first the wisdom of applying to water-powers the regulation and control that are held over other enterprises operated under governmental franchises. Regulation is a well-established, sound public policy in this country. If properly directed, it protects both the public and the utility. If successful, it will be invoked to safeguard the investor's interest and the consumer's interest in water-powers as well as in other franchise-receiving properties. The principles further recognize that for the purpose of preserving other natural resources which can be exhausted the development of water-power with proper safeguards of the public interest should be earnestly encouraged and hastened. Agreement on this point means much.

The only way to encourage and hasten development is to make contracts for the utilization of water-power. As in every other act of barter, this involves two parties. The government represents one and capital the other. If the government terms are onerous, capital will not invest. If the government terms are sufficiently favorable, capital will compete. If capital does not compete, it is because conditions are not sufficiently attractive to make it do so. If the parties to a bargain under discussion fail to get together, the result is the non-utilization of resources which all deplore. This is what all want to prevent. If "monopoly" is willing to develop while other capital is not, then it is better for the country that "monopoly" should furnish the funds. "Monopoly" is used here to represent the pilloried object of attack of those who rail against concentration of water-power development. If the desire is to prevent concentration, the remedy is to surround franchises with such alluring assurances of great gain as to cause a stampede of capital toward these enterprises. When the contrary policy is favored and the possible profits are unduly reduced, capital is repelled and the project falls to those who are best equipped by experience and resources to take the slim chance left.

As a matter of fact, so-called monopoly capital is only another term for banking capital. Banking capital is the commodity of the banker that corresponds to the merchandise of the merchant. Banking capital becomes true investor's capital when the securities of which it is the basis are placed upon the public market. There is no actual monopoly of capital. As in all other forms of industry, so it is in water-power development. Some will lead where others are content to follow or to take no part at all. Some see opportunity where others hesitate to take risk. Some forego immediate profits for the chance of future greater profits. Those who take risk are entitled to profits; those who balk at risk lose profit. If a franchise is granted and utilization of the water-power fails to prove profitable, the loss is on those who make the investment. The latest water-power development to be made commercially available was nine years in process of construction. What business man or individual accustomed to figuring interest carefully will say that the chance of profit should not be commensurate with risk in such a case?

The principles recognize that the franchise or privilege should be irrevocable except for cause for a definite period sufficient to be financially attractive to investors. The proper theory is that this period should be long enough to assure such amortization of cost of the property as will lessen the element of risk to a point where the chance of protection and rate of return will induce capital to invest. In theory this should mean absolute protection. Practically it does not, because investors are frequently careless and take undue risks. After the expiration of this period, the principles declare, the privilege should continue, subject to revocation by the government upon payment of the value of the physical property and improvements. An amplification of this clause is found in another section which provides for compensation equal to a fair valuation of the property, exclusive of franchise and consequential damage. No definition of fair valuation is attempted. The other principles deal mainly with redetermination of the compensation at intervals of not over ten years and with the general subject of compensation, make the privilege unassignable except with the approval of the government and provide for the development of the whole capacity of the site as rapidly as the granting officer may require with consideration of market demands and conditions. The paragraph relating to compensation recognizes the close relation between rates and compensation and the fact that local regulation of rates may affect the compensation to the detriment of the investor. This raises a problem that will be difficult to solve in the event of a dual control such as this provision recognizes may arise. It seems as if the government, rather than the rate-regulating body, would have the controlling voice in such an event.

## Daylight and Artificial Light

One of the standing puzzles in illumination is the extraordinary difference that manifests itself between the conditions of daylight and artificial illumination. Perhaps the most commonly noticed feature of the matter is the extreme difficulty of adding artificial illumination to daylight as, for instance, when dusk approaches and lamps must be placed in service. The first results are usually unpleasant and the best plan is to pass suddenly from one method to the other by lowering the window shades and using all the lamps. Many explanations have been offered for the phenomena involved, the difference of direction, of color and of intrinsic briliancy being the three things most prominently considered. There is no doubt that good seeing is facilitated in the passage from daylight to artificial light by preserving the same direction in general for both cases. To change from a left-hand to a right-hand lighting, or the reverse, is somewhat annoying, apparently for purely psychological reasons which after all weigh heavily in such methods.

The color difficulty might be considerable in the case of daylight lighting from a bright sky, but the same reasoning does not apply to lighting by the late afternoon sun, which is of a color quite comparable with artificial light. One can look at a ruddy sunset with comfort and yet resent a change to tungsten lamps. The difference in intrinsic brilliancy may perhaps be a more important factor in the results than either of the others. It would be interesting to know, for instance, whether in going through a school one would find a great difference in the average pupillary diameter by fading daylight and by good artificial light. It is not at all impossible that with the very low intrinsic brilliancy of daylight the pupil opens out considerably more than it would at approximately the same total illumination received from artificial sources placed, as they generally are, even fairly well out of the field of view. In this particular the sharp contrasts often found in artificial lighting may be a handicap to some extent.

Most attempts to diffuse artificial light, as, for instance, in indirect or semi-indirect illumination, produce a result that is lacking in definite direction, while natural light in almost every instance is very strongly unidirectional. It frequently varies enormously in intensity from points near the window to those well within the room. It varies indeed to an extent that would be regarded as absolutely impermissible in artificial lighting, and nevertheless the windows may give on the whole very good light everywhere. It would be a valuable experiment to make actual trial in a good-sized room to reproduce daylight conditions as did Dr. Herbert E. Ives in some valuable recent experiments in a small room. Of course, when there is any marked change in intensity of illumination the eye has to go through a certain process of adaptation, but the major part of this process is a very brief one, although it may bear an important relation to the case in hand.

The truth is that one of the large problems that confront the illuminating engineer is not the mere furnishing of a certain number of lumens from sources inoffensively placed, nor is it to distribute these lumens in a reasonably uniform way. It is to find out the specially advantageous features of daylight lighting and to attempt to reproduce them in a practical way. As a rule the same persons are not intimately conversant with both kinds of lighting, and as we have pointed out, there are matters of psychology to be dealt with as well as physiology and pure engineering.

The subject ought to be taken up by some unbiased body, such, for example, as the committee on the American Medical Association, and, if possible, at least the conditions of the problem sufficiently well determined to encourage attempts at solution. As it is now, it is possible to design excellent natural lighting or first-rate artificial lighting, each after its own kind and each based mainly on empirical data. What is acutely needed in the analysis is such a study as will put both on a scientific basis. The amount of data bearing more or less directly on the topic is appallingly great, but the experimental facts are quite without proper co-ordination in the present state of affairs, and with the new illuminants that are being developed a thorough investigation of the situation is greatly to be desired. We put the matter before our readers in the hope of arousing some much needed activity.

## Energy Losses in Transmission Towers

When energy-transmission wires are carried overhead on ordinary wooden poles there is no appreciable loss of energy in the poles, but when high-tension lines are carried on steel poles or towers the steel of the structures becomes magnetized to some extent, and energy losses take place, due either to eddy current or hysteresis, or to both. This is particularly likely to occur if any one of the wires passes through a closed loop of steel in the structure of the tower. The only question of importance to the electrical engineer is whether the losses thus incurred are sufficiently great to be serious from any practical standpoint. An article in this issue throws light upon the question in the case of a particular type of tower structure, where losses might be clearly anticipated owing to the threading of the tower structure by one of the overhead conductors.

The tests described indicate that the losses likely to be encountered with 150-kv transmission over 240 miles on such towers is not serious. They also show that the permeability of the steel members subjected to the working mmf at 100-amp line-current was 935. The actual losses measured show an increase faster than the first power of the frequency and also roughly proportional to the square of the current at 60 cycles per second. It would seem, therefore, that hysteresis plays a minor part in the losses, and that eddy currents assume the major part. A full discussion of the observed losses would be likely to develop considerable interest, although they might also develop considerable complexity. Although, with attention to structural details, the iron losses in tower lines may not attain serious proportions, yet it is interesting to note that it may prove desirable to take them into account. In this way not only dynamo machines but also transmission lines may have to be debited with iron losses as well as copper losses.

# The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

## Results of Boston Electric-Vehicle Salon

It is unofficially stated that the recent electric-vehicle salon held at Boston under the auspices of the Electric Motor Car Club of that city resulted in the immediate sale of electric passenger cars to the value of $40,000, and that 2500 persons of recognized social and financial standing visited the display during the three days it was open. In effect, every other car exhibited was sold during the salon.

## Accident Prevention Committee of N. E. L. A.

An accident prevention committee has been appointed by President J. B. McCall of the National Electric Light Association. The first meeting of the committee was held in Rochester, N. Y., on Nov. 19. Several business sessions were held by the committee and time was taken for inspection of the plants of the Rochester Railway & Light Company and various interesting features of the city. The committee went carefully into the work of the general safety committee of the Rochester company.

The following were appointed members of the accident prevention committee: Messrs. Martin J. Insull, M. W. Alexander, Alexander Taylor, J. B. Douglas, H. W. Moses, H. L. Lucas, T. A. Kenney, Victor Noonan, Dr. E. B. Rosa and Charles B. Scott, secretary

## Activities of the Commercial Section, N. E. L. A.

The Commercial Section of the National Electric Light Association, of which Mr. T. I. Jones, of Brooklyn, is chairman, is busily engaged in rounding out its work for the next convention. The various committees and subcommittees meet at regular and frequent intervals either at the association headquarters in New York City or elsewhere, at the convenience of the committees, to discuss the different phases of Commercial Section work. As noted in these columns last week, the committee on wiring of existing buildings, of which Mr. R. S. Hale, of Boston, is chairman, met in New York on Nov. 19. On Nov. 20 the "Electrical Salesman's Handbook" committee, Mr. C. J. Russell, of Philadelphia, chairman, met at association headquarters in New York. All the members of the committee were present. Details for the revision of the solicitors' handbook were discussed and plans laid to make the publication of the greatest possible value to members of the section. The committee hopes to issue the first section of the revision some time during January.

The committee on non-peak and high-load-factor business met at the association offices on Nov. 21 and outlined the work for the year. In addition to the chairman, Mr. George H. Jones, of Chicago, the following members of the committee were present: Messrs. John C. Parker, of Rochester; C. H. Stevens, of Brooklyn; C. A. Greenidge, of New York, and R. H. Tillman, of Baltimore. The plans outlined include a description of each class of business to be covered, its salient features and the points to be considered in securing the business. The next meeting of the committee will be held during January, but the date and place have not yet been decided.

Mr. Parker H. Kemble, of Cincinnati, chairman of the committee on electrical merchandising and advertising, has called a meeting of his committee for Dec. 5 in Cincinnati. This will be the first meeting of the committee, and the policies and plans for the year will be discussed.

The first meeting of the committee on education of salesmen, Mr. F. C. Henderschott, of New York, chairman, will be held on Dec. 5 at the National Electric Light Association headquarters in New York.

The executive committee of the Commercial Section will meet at Nela Park, Cleveland, Ohio, on Dec. 8. Through the courtesy of the National Electric Lamp Association automobiles will take the committee from the Hollenden to Nela Park, where a meeting room will be placed at the disposal of the committee.

## Electric Buses Recommended for New York

The Electric Vehicle Association of America is lending its support to the People's Five-Cent Bus Company in its fight for a franchise to operate twenty routes in New York City. Various electric-vehicle interests are rallying to the support of this concern, which had a hearing before the Board of Estimate on Nov. 13. Among the speakers at this hearing were Mr. Frank W. Smith, president of the Electric Vehicle Association of America, and Mr. M. R. Hutchison, representing Thomas A. Edison. Mr. Smith presented evidence of the ease of operation of electric vehicles and their simplicity of control. He stated that within New York City are 500 enthusiastic owners of electric trucks, using 2100 of these vehicles, and that these owners would be willing to testify as to the greater safety in operation of electric vehicles. Mr. Edison submitted through his representative, Mr. M. R. Hutchison, the following letter: "I believe that for traction in cities the electric motor will displace all other motors. Already it has displaced steam on street cars, elevated railways and subways. It drives all of the elevators and most of the machinery in the city. If buses are desirable for inter-city traffic, the electric is the only practical one. It is noiseless, has half the destructive effect of a gasoline engine, and can be stopped quicker than the gasoline vehicle, with the added economic value of much cheaper operation."

## Government Suit Against Bell Telephone Companies

In the suit brought by the United States against the American Telephone & Telegraph Company, the Pacific Telephone & Telegraph Company and the Mountain States Telephone & Telegraph Company, the government alleging restraint of trade in violation of the Sherman law by the stifling of telephone competition in Washington, Oregon, Idaho and Montana, hearings have been held in a number of cities before Miss Mary E. Bell, of Portland, Ore., special examiner for the Department of Justice. Witnesses have been examined in Portland, San Francisco, Tacoma, Seattle, Spokane, Butte, Denver and Chicago. The taking of testimony in Chicago began on Nov. 19. Mr. W. S. Vivian, of Grand Rapids, Mich., and Chicago, secretary of the new Independent Telephone Association of America, was the first witness in Chicago. Mr. B. G. Hubbell, of Buffalo, president of the Federal Telephone & Telegraph

ompany, an independent concern, was the next witness. On cross-examination Mr. E. S. Pillsbury, of counsel or the Bell companies, brought out the fact that the Fedral Telephone & Telegraph Company is a consolidation of bout eighty-five operating telephone properties in western Jew York. Mr. E. D. Schade, an independent telephone perator of Johnstown, Pa., told of the situation in his eighborhood. Mr. John Z. Miller, of Erie, Pa., and other Vitnesses also testified on behalf of the government. It s probable that hearings will be held in New York and Philadelphia.

## Main-Line Electrification of Chicago, Milwaukee & St. Paul

Before Jan. 1, probably, the Chicago, Milwaukee & St. Paul Railway Company will have reached a decision as to he type of equipment to be employed for the extensive nain-line electrification of its railroad over the mountains n Montana. It is practically certain that the overhead rolley system will be used to convey the electrical energy o the motors on the electric locomotives. Either the 14,000-olt, 25-cycle alternating-current system will be used or he direct-current 2400-volt system. Plans which have been ubmitted by the General Electric Company and the Westnghouse Electric & Manufacturing Company are now under onsideration. For the railroad company the entire matter f electrification has been placed in the hands of Mr. C. A. Goodnow, vice-president in charge of operation and construction.

At first it is proposed to electrify a division of the raiload 113 miles long, extending over the Rocky Mountains etween Three Forks and Deer Lodge, Mont. This work vill be begun early in 1914. Ultimately the electrification vill be extended to that portion of the main line between Harlowton, Mont., and Avery, Idaho, a main-line disance of 440 miles and, including sidings, a total of 450 niles of track. This work will mean an outlay on the part f the railroad company of perhaps $6,000,000 or $8,000,000, nd the electrical construction work will proceed at such a ate that the annual expenditure will be about $1,500,000 or $2,000,000.

Experience with heavy railroad operation in and near New York City shows that electric locomotives can be run 000 miles without inspection under the conditions existing here. The locomotives which will be placed in service on he mountain divisions of the Chicago, Milwaukee & St. Paul can be relied upon to make from 250 to 300 miles at he outset. As there will be no delays for coaling, taking n water, cleaning fires or waiting for steam, it seems a air conclusion that the tonnage will be handled with fewer ocomotives, higher average speed and with a regularity which will result in better operating conditions. Passengers vill be able to enjoy the mountain scenery without the anoyances incident to steam locomotion. Another point of nterest is that while the steam locomotive is at its worst n freezing weather the electric locomotive is at its best at hat time, since practically the only difficulty with the elecric locomotive is to keep the motors from heating when loing maximum work.

One of the important benefits to result from electrical peration is the regenerative control of trains descending nountain grades by means of which energy will be returned o the line.

Energy will be purchased from the Montana Power Comany as already noted in these columns. The plans of the ower company for carrying the railroad load were outined in our issues of Dec. 21, 1912, and Jan. 11, 1913, and he details of the contract between the railroad company nd the power company for energy were published in our ssue of Feb. 8, 1913. Other details of agreement between he power company and the national government were outined in the issue of Jan. 11, 1913.

## Ozone Machines and Public Health

In our issue dated Nov. 15, on page 993, appeared an abstract of an article entitled "The Alleged Purification of Air by Means of the Ozone Machine," which had been published in the *Journal of the American Medical Association*, by Dr. W. A. Sawyer, director of the Hygienic Laboratory of the California State Board of Health, aided by H. L. Beckworth and E. M. Skolfield. We publish below a letter from Dr. Charles P. Steinmetz containing some interesting comments on the experiments mentioned in our earlier issue and giving valuable suggestions for a proper investigation of the subject under discussion.

*To the Editors of the Electrical World:*

SIRS:—On page 993 of your issue of Nov. 15, under the title "Ozone Machines and Public Health," I have read an abstract of some investigations on ozone published in a recent number of the *Journal of the American Medical Association.*

While I personally do not like the smell of ozone and therefore do not care to have it about, nevertheless some of the conclusions reported by the experimenters appear to me inconsistent, so that it may be well to caution the reader against accepting them without further evidence. For instance:

Guineapigs were harmed and killed by a very high concentration of ozone, and from this the conclusion is drawn that an extremely low concentration of ozone is harmful. With the same reasoning, since guineapigs kept in pure oxygen are harmed and killed, the conclusion may be drawn that the 20 per cent of oxygen contained in the air which we breathe is harmful and that we are all in imminent danger of death. Any corrosive non-poisonous agent in sufficient dilution becomes harmless, and while, for instance, the drinking of concentrated hydrochloric acid would be fatal, free diluted hydrochloric acid normally exists in our stomachs as an agent of digestion.

Also, the report states, ozone in higher concentration destroys odors, while in low concentration it "masks" them. It is hard to conceive, without very conclusive evidence, why the action of ozone should be different in one case from its effect in the other.

The experiments with bacteria described are hardly remarkable. I believe any chemist would have predicted that under the conditions of the experiment ozone should have no effect on bacteria.

Ozone is active oxygen, and as such at ordinary temperatures gives many of the reactions which ordinary oxygen exhibits at incandescence; that is, it oxidizes or burns combustibles, such as organic matter. Thus an oxidizable gas, such as the smell of a smoldering tallow candle and most organic smells indicate, should be destroyed sooner or later, depending on the concentration, while a non-oxidizable gas, as, for instance, that indicated by the smell of chlorine or nitric oxide, would not be affected by ozone.

As dryness interferes with chemical action, it should be expected that dry bacteria would be very resistant against ozone. As the action of ozone is oxidization or combustion, bacteria contained in jelly could be affected only by the complete destruction of the jelly. Or bacteria in drinking water containing large amounts of organic impurities could be destroyed only by quantities of ozone sufficiently large to burn up the entire organic matter. For this reason, in water sterilization by ozone, previous filtration is generally used. The last number of *Chemical Abstracts* (Nov. 10) gives a list of nine European cities in which water sterilization by ozone is in successful operation, and abroad such public works are not constructed without previous comprehensive study of the process by competent scientific authorities.

In view of the rapidly increasing industrial application of ozone, on the one hand, and the many wild claims made

cranks and humbugs, on the other, it would in the interest of the electrical industry be extremely desirable if a [illegible] and impartial investigation on ozone and its industrial, domestic and medical use were made by a competent group of scientists. Such investigations, however, could not be carried out by men of one profession only without leading almost certainly to wrong conclusions caused by generalizations from special cases, as I pointed out above. A proper study of the problem, indeed, would require the co-operation of competent physicians, physicists and chemists.

In the literature of ozone at present there seems to be practically no statement which is not flatly contradicted by exactly the opposite statement made by equally high authority.

*Schenectady, N. Y.* CHARLES P. STEINMETZ.

## The Industrial Truck for Handling Freight

At the meeting of the Electric Vehicle Association of America held in New York on Nov. 25 a paper entitled "The Industrial Truck as a Factor in the Efficient Handling of Internal Freight" was read by Mr. W. W. White, of the General Vehicle Company. Preceding the presentation of Mr. White's paper, Chairman F. W. Smith called on Messrs. C. D. Marsh, Day Baker and E. S. Mansfield to tell of the electric-vehicle salon at Boston. The co-operation of pleasure-vehicle, commercial-vehicle and central-station people in making the exhibition at Boston a success was described, and Mr. Baker illustrated his remarks with several lantern slides showing views of the ballroom of the Copley-Plaza Hotel, where the salon was held.

In his paper Mr. White classified as industrial trucks the battery-truck crane, the freight truck, the baggage truck and certain kinds of tractors. Each type has its special fitness for certain kinds of work, the freight truck in particular being very elastic in the range of service performed and also in the special equipment which may be added, such as hand-winches, small hoists, booms, etc. The simple industrial or freight truck is built in sizes and capacities suitable for moving loads on piers, in freight sheds, warehouses and industrial establishments generally. Its clearance and radius of action permit it to pass through congested places, going forward and backward with ease and facility, and it is capable of ascending gradients of 10 to 25 per cent. On piers and railway terminals it can deliver its load on the deck of a vessel or within a freight car. The capacity of such trucks is usually 2000 lb., as this rating has been found the limit for trucks capable of the widest range of action.

Since approximately 75 per cent of the 300,000 railroad and steamship freight handlers push hand trucks, and since these hand trucks can unquestionably on a four-to-one basis be reduced to 55,000 by electric trucks of the proper type, the possible economies in the internal handling of freight by common carriers become apparent. The greatest saving derived in using an industrial truck is in labor, a single truck often displacing four or five men.

In the discussion following the reading of the paper, Mr. Day Baker spoke of the ignorance of the average industrial-truck operator and the provision often made to have the truck stop automatically should the driver jump off his platform suddenly on account of fright or negligence. Mr. H. L. Stockbridge said that the companies are beginning to realize that trained men are required to operate these trucks.

Mr. White, in reply to a question concerning tires, said that rubber has been found to be the best material, and unless the trucks are excessively loaded the tires will hold up very well. He explained that batteries last twice as long with industrial trucks as with street trucks because the vibrations are less and the cycles of charge and discharge [illegible] uniformly.

## Rival Telephone Associations

The Independent Telephone Association of America has been formed with headquarters in Chicago. The National Independent Telephone Association has been in existence for a number of years, representing companies that compete with the American Telephone & Telegraph Company and its subsidiaries. Within the last two or three years, however, it has been charged that some of the prominent men in the National association have been openly or secretly affiliated with the Bell interests and within a year two associations of dissatisfied independents have been organized. These were the United Independent Telephone Association of America and the Telephone Service Association. On Oct. 18, at a meeting in Chicago, the Independent Telephone Association of America was organized, and the members of the Telephone Service and United associations became members of the new organization. The officers are: President, Mr. E. B. Fisher, Grand Rapids, Mich.; vice-presidents, Messrs. G. W. Robinson, St. Paul, and E. D. Schade, Johnstown, Pa.; secretary, Mr. W. S. Vivian, Chicago and Grand Rapids, Mich. Mr. Frank L. Eldridge was made manager of the telephone service department. The directors include Messrs. Richard Valentine, Janesville, Wis.; W. J. Uhl, Logansport, Ind.; Samuel Hill, Portland, Ore.; J. H. Wright, Jamestown, N. Y.; B. G. Hubbell, Buffalo, N. Y.; E. N. Cooke, Philadelphia, and others.

The constitution of the new association provides that the association shall be composed of telephone companies "independent of and not owned and controlled by the American Telephone & Telegraph Company, directly or indirectly." The annual meeting of the new association will be held in Chicago on Feb. 10.

## Progress of Coon Creek Development on the Mississippi Near Minneapolis

Construction work on the Coon Creek Rapids hydro-electric development of the Northern Mississippi River Power Company, 11 miles from Minneapolis, is being pushed along rapidly by the engineers and constructors, H. M. Byllesby & Company. Seven hundred men are now engaged on the dam, which, it is planned, will be completed by January.

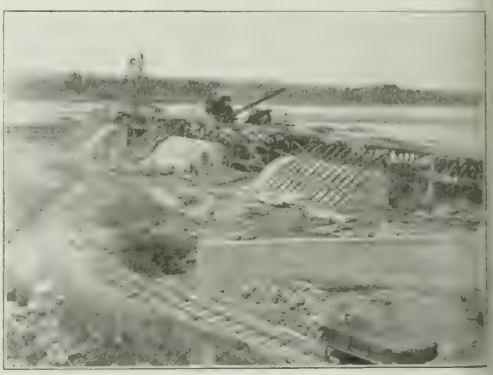


FIG. 1—SPILLWAY UNDER CONSTRUCTION

All except three 54-ft. sections of the dam are complete now, and these will be left open for water to pass through until everything is in readiness for filling the reservoir. Closing these sections will require only a few days' work as rails have been driven and the apron for the entire dam

as been completed. The draft-tube sections in the power ouse are in place and five of the seven concrete scroll ases have been poured.

The generating station will utilize a head of 17.5 ft. nd have an initial rating of 10,500 hp, developed by five nits, although eventually seven units will be installed, with total rating of 14,700 hp. The new plant will supplement he power resources of the Minneapolis General Electric Company and is to be tied in electrically with the 45,000-w system which includes two other water-power plants, ocated at Taylor's Falls and St. Anthony Falls, and three team stations, located in Minneapolis and St. Paul. Since ll six stations will be operated as one system, no water-vheel-driven exciters have been provided for the Coon Creek plant. Instead two 300-kw motor-driven sets will e installed, the second unit being held as a reserve.

At the site of the new plant the Mississippi River formerly flowed through two channels separated by an island. A spillway dam 1000 ft. long has been built across the vider and shallower channel, and the plant structure has been built over the narrower and deeper channel. The entire works thus consist of earth embankments with core valls 557 ft. long, the power house and retaining section, 498 ft. long, including sluicegates, log chute and fishway, nd the spillway, 1000 ft. in length, making the total length of the construction 2055 ft.

The illustration shows the spillway under construction vith its steel-trussed forms used in shaping the alternate sections and later employed with stop logs to close up the remaining sections. The spillway dam, which is of solid-concrete, gravity type, is built on a foundation of round piles driven to hard-pan, with two rows of sheet steel piling for cut-offs. Capping it will be twenty-eight Tainter gates used to regulate the level of the water in the reservoir. Each gate has a clear opening of 33 ft. and weighs 12,000 lb.

The forms for the draft tubes were constructed in sections, which are removed after the concrete sets and used over again. Construction of the large draft-tube and scroll-case forms in such sections has the advantage of allowing the sheeting to be placed on the shore and accelerates erection, since both forms and excavation can proceed at the same time. Each tube is designed to discharge 320 cu. ft. per second at 17.5 ft. head. The spillway has

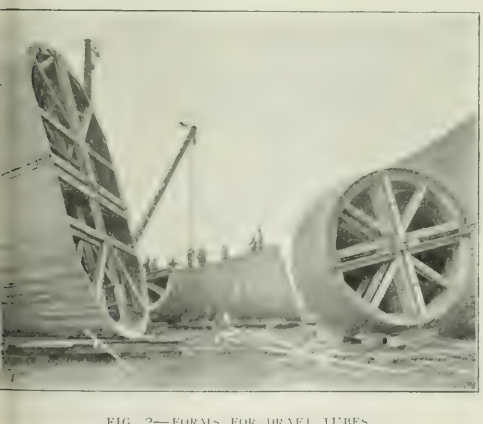


FIG. 2—FORMS FOR DRAFT TUBES

been designed for a maximum flow of 80,000 second-ft., although 60,000 second-ft. is the maximum stream flow of which there is any record.

The plant building will be of brick with a structural-steel frame and concrete floors. Allis-Chalmers vertical-type single-runner waterwheels will drive General Electric direct-connected generators rated at 1625 kva and 2300 volts at 62 r.p.m. These machines will deliver three-phase, 60-cycle energy to the station bus, from which it will be stepped up to 13,200 volts by delta-connected 1375-kva General Electric transformers. This combination of 2300-volt generators and step-up transformers was found to be less costly than equivalent 13,200-volt alternators would have been under the conditions of low speed and large size imposed by the low head available.

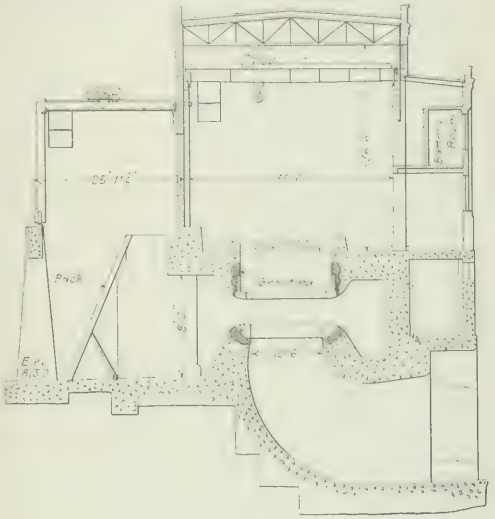


FIG. 3—SECTION THROUGH POWER HOUSE

A three-phase transmission line of 250,000-circ. mil conductor cross-section connects the Coon Creek site with Minneapolis. Later, another line will be built north to the town of Anoka.

## Combination Distribution System for Panama

A committee, consisting of Mr. H. Rowe, chairman; Mr. C. L. Bleakley, Mr. R. K. Morris and Capt. W. H. Rose, appointed to consider lighting, power, telephone and fire-alarm systems for the permanent towns on the Panama Canal Zone has investigated three types of construction, as follows: (1) Overhead construction, where the wires are carried on wood, concrete, or steel poles; (2) underground construction with armored cables, where the wires are inclosed in lead-sheathed cables, which are protected from mechanical injury by a steel band or wire armor, the cables to be laid directly in the ground with no other form of protection; (3) underground conduit construction, where lead-sheathed cables are pulled through underground conduit composed either of vitrified clay or bituminized fiber ducts laid in concrete, with concrete manholes at intervals varying from 250 ft. to 500 ft.

The committee was unanimously of the opinion that the overhead system should be discarded in the permanent towns, but in view of the fact that in these towns the present roads and buildings will probably be used as long as their upkeep is not excessive, the committee recommended a combination system based upon the following:

In case of entirely new town layout and construction, the underground conduit system should be installed at the same time as other permanent structures, such as roads, buildings, sewers, etc. In the case of branch lines to isolated buildings or to isolated small groups of comparatively unimportant buildings, the armored cable system could be used for the lighting and power circuits, and an under-

ground lead-covered cable, without armor, for telephone, telegraph and fire-alarm circuits.

In case of the towns now existing, which will remain as permanent towns, but in which structures will later be replaced by permanent ones, the underground conduit system should be installed in such locations as will not have to be changed later on. The underground armored cable system may be used where this fact cannot be determined, where topographical conditions are unfavorable, or in serving isolated buildings or groups of buildings.

## Strike at Schenectady Works of the General Electric Company

Labor troubles at the Schenectady works of the General Electric Company have resulted in partial cessation of work there. On the morning of Nov. 25, after negotiations between the company and representatives of the men, from one-third to one-half of the employees struck. During the day many of those who had remained at their posts in the morning left their work. A number of the men have since returned to work, and at the time this issue went to press about 13,000 were out. The men say it is a "demonstration." Two workers who were laid off are the ostensible cause of the trouble. These employees were said to have been active in union matters and for that reason the action taken by the company in regard to them was made the basis of a strike. However, other definite causes which had a potent influence in the matter were the existence of unions among the employees between which there has always been strong feeling. These unions were branches of the Industrial Workers of the World and the American Federation of Labor, between which there is strong opposition. According to reports from Indianapolis, executive officials of the American Federation of Labor sent telegrams from that city to representatives of local unions at Schenectady urging strongly that no strike be called at this time and for the reasons advanced in this case. Another important element in the stiuation is the political unrest existing in Schenectady because of the socialist factor in city politics. The term of office of Mayor Lunn, the socialist head of the city, expires on Dec. 31. The political sentiment arising from the defeat of the socialist ticket at the last election is accentuated by the approaching retirement of Mr. Lunn from office.

Mr. G. E. Emmons, manager of the Schenectady works, made the following statement in regard to the strike on Nov. 25:

"Owing to a falling off in business it has become necessary for the General Electric Company to reduce force in all of its apparatus factories, the Schenectady works being the last to be affected. Instructions were accordingly issued to the superintendents of the various divisions directing that such reductions in force as were necessary to meet business conditions should be made. In line with such instructions, the superintendent of the wiring device department, where a falling off in business was especially felt, directed that a considerable number of employed be laid off. Without any intent to discriminate against any individuals or class of employees, it happened, on the merits of the case, that a certain man and woman who had been prominent in labor matters were laid off, among others, in the department where they were employed. The man, a plater, was the last to be laid off in his particular line of work in the department involved. The woman was employed with eleven others upon a certain class of work. In selecting those to be laid off consideration was given to the term of employment, and the six who were retained have been longer in the employment of the company than any one of the six laid off. After notice of lay-off had been given a committee waited upon General Superintendent Smith, claimed that undue discrimination had been used in laying off the two employees, and demanded their reinstatement.

"This was followed by further conferences, and Saturday morning the matter was first officially brought to the attention of the manager of the works, who, with a committee representing the employees, held a prolonged discussion, with the result that it was agreed that an investigation should be made by General Superintendent Smith, the foreman of the department involved and the committee representing the employees, and that the matter should be treated upon its merits. The committee was informed that the manager of the works would be out of town Monday and therefore could not again be seen until Tuesday morning. An investigation was begun Monday morning, which lasted until after 1 o'clock, when the representatives of the employees left the conference. During the conference General Superintendent Smith stated that the company was prepared and willing to give the two individuals transfers to other departments if it could be done without injustice to other employees, and that when business conditions warranted they would be returned to their former positions. This was done to indicate clearly that there was no intent to discriminate. About 2 o'clock the committee returned to state that its members had been instructed to demand reinstatement of the two employees to their former positions before 3 o'clock, or the works would be struck. It was stated that the manager would not be home until 9 o'clock that evening, and the delegates were asked to defer action until they had had an opportunity to further discuss the matter with him. It was Mr. Smith's understanding that the committee would communicate by telephone with the manager upon his return to the city. Mr. Emmons reached his house shortly after 9 o'clock, but no communication from the employees was received by either him or Mr. Smith, and it was therefore understood that no action would be taken until further conference.

"About 3 o'clock Tuesday morning a national representative of one of the unions telephoned to Mr. Emmons asking if the latter would not participate in a conference at 8 o'clock that morning, provided one could be arranged Mr. Emmons agreed to participate in such conference While this latter conference was in progress many employees left the plant without waiting for its conclusion and were followed during the morning by a large proportion of the force.

"The management regrets that this action was taken by its employees, believing that it was hasty, ill-advise and unfair to the company, to its employees and to the community of Schenectady."

## Action of the Conservation Congress

The Fifth National Conservation Congress, held a Washington last week, resolved itself into what was almos a water-power conference.

The congress, by a test vote of three to one, was clearly in the control of a group of men led by Messrs. Giffor Pinchot, James R. Garfield, Henry L. Stimson, ex-Secretar of War, and Walter L. Fisher, of Chicago, ex-Secretary o the Interior.

Mr. Pinchot was urged by his friends, including Mr Charles Lathrop Pack, president of the congress last year who was re-elected, not to force this resolution throug the congress. He persisted, whereupon it was reported i the newspapers that Mr. Pinchot and Mr. Pack had agree to go separate ways in the future.

Mr. Pack denied a quarrel with Mr. Pinchot over cor servation and issued the following statement:

"What I did say to Mr. Pinchot was this: Gifford, I hav

worked with you for ten years and have been your friend. You can't drive me away from you now even though I think it is a grave mistake of judgment for you to bring this question up at this time. The congress has already acted favorably upon the unanimous recommendations of the water-power committee, and most of the members of the committee and a majority of the delegates interested in water-power have gone home believing the water-power subject finally disposed of. To force a vote by a minority of the delegates would be unfair to these people and might alienate many men who have shown themselves true friends of the cause of conservation.'"

Owing to the dissatisfaction of some of the delegates to the congress, who declared that Mr. Fisher as acting chairman had used "steam-roller" methods in his conduct of the congress, the Arkansas delegation withdrew and is attempting to form another conservation congress to deal solely with water-power matters. Mr. Walter Powell, of Arkansas, chairman of that delegation, issued a statement in Washington at the close of the meeting, in which he said he had been delegated by representatives of twenty-three states of the Middle West, West and South to call a separate convention which would take up only the subject of water-power and irrigation. He declared that it would be composed of practical men, not of government officials and former Cabinet officers, and would try to come to some definite conclusion on the subject of conservation from the practical and not the theoretical standpoint. This convention will be held in about a month, and states from Maine to California will be represented. It will probably be held in Washington, though it might possibly be held in St. Louis, Mr. Powell said.

### Comments on the Congress

Commenting on the action of the congress, Prof. George F. Swain said:

"If the action of the Conservation Congress regarding the merits of the water-power question can be disentangled from all political considerations, I think it will be found that some real progress was made. The water-power committee, while it could not agree on a full report, was nevertheless able to agree unanimously on certain fundamental principles which should govern our water-power policy and which, if adopted, will much improve the present situation. The most important of these were:

"1. The recognition of the right of federal control.

"2. The abandonment of the revocable franchise now required by law and the substitution of the indeterminate franchise having no fixed term, this franchise to be irrevocable and unchangeable for a considerable period, sufficient to make the franchise financially attractive, except that it may be revoked during this period for cause, subject to review by the courts; thereafter the terms to be adjusted at fixed intervals; the government to have the right to take over the property at any time after the first period by paying a fair value therefor, exclusive of the franchise value.

"3. The adoption of the principle that the charge made by the government should be in the form of a division of the earnings above a defined percentage on the money properly invested which the company is to be allowed to earn before any charge is made, except in some instances a small nominal one.

"The essential difference between the two reports was that the majority believed that, subject to the above conditions, and in view of the state regulation almost everywhere existing, there was nothing to be feared from a monopoly of water-power, but that the main emphasis should be placed upon development in order that the use of this resource, the utilization of which saves one of our non-renewable resources, should be encouraged to the utmost.

"The minority report, however, placed the main emphasis upon the prevention of monopoly."

Mr. Gifford Pinchot has summarized his views as follows: "The result will be to strengthen the advocates of development under public control, make it harder for reactionary interests to prevent legislation fair to both sides and so will, in my judgment, tend directly and powerfully to adjust settlement of the controversy and the increase of development, which is what we all want."

Mr. Lewis B. Stillwell said: "The congress has accomplished something that will be valuable in a constructive way. It has placed both sides on record. What is necessary now is to follow up the work of the congress, to have the law providing revocable franchises repealed and one embodying the adopted recommendations enacted."

Mr. Arthur Williams, chairman of the public policy committee of the National Electric Light Association, said: "The action of the congress is the first step in straightening out the inadequate and unfair legislation of the past and in opening up the development of this natural resource on very broad lines and under conditions which protect the government—state or national—the public and the investors and encourage good management. In none of the reports—the majority and minority and the unanimous recommendations—was there any suggestion of penalizing the investor. The use of the term 'franchise,' rather than 'permit,' in the minority report is significant and indicates what should be the true status of a water-power grant. The tendency toward federal rather than state control was also indicated in all reports."

### Addresses Before the Congress

Mr. W. V. N. Powelson read a paper before the congress on Nov. 19. The general object of the paper was to present a measure of the waste of natural resources due to the non-development of water-powers. Mr. Powelson said that a little reflection would show that it is possible that the evil of non-development, if continued long enough, may exceed the evil of unwise development. The true interest of the public lies now between these two extremes. It is not possible to remain in the present situation with a practical embargo on the development of sites now controlled by the government without losses, nor can the country without danger permit the development of these sites unless an efficient governmental control is retained over them after development.

Continuing, Mr. Powelson said that so far it has seemed the part of good strategy to throw away one thing of value to gain another which promises to be of greater value. The country must not continue to throw away until it exceeds the value of the thing it is striving for. There has been ample opportunity during the last three years for reflection, study and the preparation of plans, and the people are now looking to the leaders of the conservation movement to come forward with a practical scheme of legislation that will bring about speedy development of needed powers under efficient public control and thus definitely put a stop to the enormous waste involved in the non-development of these powers.

Senator Theodore E. Burton, of Ohio, in an address before the congress on Nov. 19, said that the amount of energy employed in industry and transportation in the country is estimated at 31,500,000 hp, of which 5,500,000 is derived from flowing water and the remaining 26,000,000 from steam. Coal consumption for 1912 was 427,000,000 tons. In the generation of the 26,000,000 hp by steam more than two-thirds of this quantity of coal was consumed. There is available in the United States 30,000,000 hp from water which can be readily developed. By development an additional quantity, probably 150,000,000 to 200,000,000 hp, could be made available. Senator Burton said that the greatest embarrassment has been caused by the conflict between opposing ideas regarding national and state control.

Senator Burton added that one feature of the question most imperfectly comprehended by the general public is yet

the most direct consequence, that is, electrification of the great transcontinental railways. Railway managers have just awakened to this possibility. It has been estimated that there is water-power which can readily be developed in the Northwestern States sufficient to operate every mile of railway west of a line drawn north and south through the center of the State of Montana and north of a line drawn from the southern boundary of Colorado to the Pacific Coast. This would include some of the great railway systems and the actual saving in fuel consumed would reach $4,000,000. In conclusion, Senator Burton said that the only way to gain benefits from water-power resources is to develop them. There is now a deadlock. The friends of the conservation movement in Congress are strong enough to defeat the efforts of those who seek to put through the unlimited grants of former days. On the other hand, those who believe that Congress ought to continue an obsolete policy are strong enough to prevent the enactment of constructive legislation. Water-power is now the one great asset of the nation which is running to waste and whose value will not be diminished by use.

## Wireless Patents Suits

In 1910 the National Electric Signaling Company began suit against the Telefunken Wireless Telegraph Company of America for infringement of United States patents Nos. 918,306 and 918,307, which were issued in 1909 to Prof. Reginald A. Fessenden and are owned by the National company. The case was fought through the District Court, and on Oct. 20, 1913, the United States Circuit Court of Appeals for the Third Circuit (Judges Gray, Buffington and McPherson) handed down an opinion in which the Fessenden patents were sustained and the Telefunken company declared an infringer.

Having these two patents adjudicated, the National Electric Signaling Company at once began an action for injunction against the Marconi Wireless Telegraph Company of America, which is alleged to be one of the largest infringers of the patents. A hearing in this case was held at Trenton, N. J., on Nov. 17, at which time Judge Rellstab issued a preliminary injunction restraining the Marconi company from further infringement except as to its pending contracts with the United States Navy. From the representations of the Navy Department it appeared to the court that a severe inconvenience might result if the Marconi company were not allowed to deliver the instruments already contracted for, so this was permitted by the court under the provision that there be given a bond of $25,000 for the protection of the owners of the Fessenden patents.

Following the order of court described above there was filed a motion to suspend the injunction, with affidavits from the Marconi company's engineers stating that the apparatus complained of as infringing was installed at over 500 stations and that to remove it would require some two months' time. In the argument before Judge Rellstab Nov. 21, at Trenton, ex-Attorney-General John W. Griggs stated for the Marconi company that removing the apparatus immediately, as originally ordered, would so cripple the wireless service that if an accident at sea should occur great loss of life might result. With this in view, Judge Rellstab suspended the injunction temporarily as to existing ship stations and those on shore intended for ship communication, but still restrained the Marconi company from installing the infringing apparatus at any new plants pending final settlement of the case. He further required a bond of $100,000 to guarantee payment to the National company of any damages which may be proved to arise from the partial suspension of injunction.

The invention concerned is a method of sending and receiving wireless telegrams by use of high-pitched sparks. These rapid musical sparks produce a distinct tone at the receiving station and so permit the operator to distinguish them from other and lower-pitched sounds merely by concentrating his attention on the desired signals. Wireless telegraph outfits using sparks of this character have come into general use in the past two or three years and are said to have increased materially the value of wireless service.

## Public Service Commission News

### District of Columbia Commission

The Public Utilities Commission of the District of Columbia has been ordered by the United States Senate to make an investigation of the affairs and rates of the Chesapeake & Potomac Telephone Company, which operates in the District of Columbia.

### Wisconsin Commission

In a decision on the application of the Neshkoro Light & Power Company for authority to increase rates, the Wisconsin commission prescribed a schedule of charges which will effect a decrease in rates. An analysis of the company's accounting methods showed that the accounts had been kept erroneously and that, instead of earning an insufficient return upon the investment, the property was earning approximately 15 per cent. The company had in effect a primary rate of 10 cents for the first 100 kw-hr. used per month. The rates prescribed are as follows: primary rate, 9 cents net for the first sixty hours' use per month of the active connected load; secondary rate, 7 cents net for the next forty hours' use per month; excess rate, 4 cents net. The consumers are divided into classes A, B and C, according to the percentage of connected load, in a manner similar to that used by the commission in the majority of its rate cases.

The rates for motor service are to consist of a charge of $1.25 net per active horse-power capacity per month, plus a charge of 4 cents per kw-hr. for energy used. The active connected load is to consist of 90 per cent of the first 10 hp, 75 per cent of the next 20 hp, 60 per cent of the next 30, and 50 per cent of the connected load in excess of 60 hp. A minimum bill of $2.50 per month is provided for.

The commission criticised the company for the laxity which is apparent in its accounting methods and stated that records, if properly kept in the future, might justify the commission in amending its present decision, to the advantage of the applicant.

The commission has fixed the sum of $137,500 as the price to be paid by the city of Manitowoc for the property of the Manitowoc Electric Company. The city voted to acquire the property under the provisions of the indeterminate permit law. A present value of $132,770 and a reproduction cost of $173,708 were given to the property by the commission's engineers.

The application of the Clinton Telephone Company for authority to extend its lines into the territory served by the Bergen Telephone Company has been denied. It appears that a former subscriber of the petitioner, upon moving into the district served by the objector and failing to receive adequate service, requested the petitioner to extend its lines a distance of about 80 rods to his place of residence. This request was denied by the commission on the ground that it was contrary to the intentions of the Legislature in framing the Kneen anti-duplication law and that to grant the apparently reasonable request would be to establish a dangerous precedent.

The Portage American Gas Company has been ordered to reduce its rates on gas. With a cost new of $112,240 and with depreciation and interest computed at 2 per cent and 7.5 per cent respectively, the commission decided that gas could be sold in the city of Portage for the following rates: first 2000 cu. ft. per month, $1.30; next 3000 cu. ft., $1.20; next 5000 cu. ft., $1.10; next 10,000 cu. ft., $1; over 20,000

u. ft., $0.90. The present minimum bill of 13 cents per month was abolished and a minimum bill ranging from 25 cents for a three-light meter to $4 for a 200-light meter was ordered substituted therefor.

### West Virginia Commission

Officials of the Virginian Railway Company protested to the West Virginia Public Service Commission that the construction of a dam 140 ft. high in the New River at Hinton, W. Va., planned by the Virginian Power Company, would interfere with the plans for the construction of a through railroad from tidewater to the great lakes. The Virginian Power Company has asked for approval of a plan to erect eight dams along the New River. The railway company declares that necessary grade changes to avoid a dam of this height would increase the cost of a projected line of railroad $2,650,000, while the cost of a double-track line over the same route would be increased $2,977,470.

### New Jersey Commission

The Board of Public Utility Commissioners has addressed a communication to the City Commissioners of Jersey City regarding the proposed investigation of gas rates in Hudson County. The board holds that it would be unwise to make such an investigation at this time inasmuch as the present state-wide rate of 90 cents per 1000 cu. ft. charged by the Public Service Gas Company is far more advantageous to the people of the State at large than if municipal units were established. The attention of the commissioners is called to the fact that even if Hudson County were placed in a separate division for rate-making purposes, little if any actual benefit would result. Supporting this contention, the board points out that the State might be divided into five divisions, as has been suggested, and if so the approximate rates in each would be: Essex division, $0.837; Hudson division, $0.872; Bergen division, $1.17; central division, $1.293; southern division, $1.095, such rates being based upon investigations made by the board recently in the Passaic district.

The board has dismissed the complaint of the Postal Telegraph & Cable Company against the New York Telephone Company to accord it certain reductions in tolls on messages delivered over the company's lines and affirming that such reductions had been granted the Western Union Telegraph Company. The board finds no merit in the complaint as the testimony shows that the Postal company sought only the reduced tolls on inward-bound calls to its customers, whereas the contract between the Western Union and Telephone companies provides for both inward and outward-bound messages. The Telephone company expressed willingness to make a contract with the Postal company similar to that now existing with the Western Union company, but refused to divide it so as to make it applicable only to the delivery of messages.

### California Commission

A decision has been rendered by the Railroad Commission of California declaring excessive and unreasonable all the long-distance telephone rates of the Pacific Telephone & Telegraph Company in California. The commission cut the rates 21 per cent and allowed two minutes for conversation as against one minute heretofore allowed. The commission's order required that 30 per cent of long-distance revenues be credited to city exchanges instead of 15 per cent.

### Michigan Commission

The report of the Michigan Railroad Commission on the telephone situation states that the system is overloaded with unnecessary calls which should be eliminated. This applies to each class of service. Party lines, used by 52 per cent of the subscribers, show many more calls per day than are normally allowed. The commission recommends a metered service.

# Current News Notes

The Electric Way.—On the rear of his electric delivery wagons a prominent merchant in a Middle West city has had affixed the legend: "Goods Bought at Brown's Get Home Before You Do—The Electric Way."

* * *

Water-Power in National Forests.—The national forests of the United States contain waterfalls with an aggregate estimated capacity of 12,000,000 hp. These sites are available for use under permit from the Secretary of Agriculture at Washington.

* * *

Melting Points of Copper Alloys.—"The Approximate Melting Points of Some Commercial Copper Alloys" is the subject of a report by Messrs. H. W. Gillett and A. B. Norton, which has just been issued as Technical Paper No. 60 of the United States Bureau of Mines. The director of the bureau, Washington, D. C., has copies for free distribution.

* * *

Electricity in Calcutta.—The electrical engineers in Calcutta, India, have formed a local section of the Institution of Electrical Engineers, electing Mr. R. Winkfield its first chairman. The Calcutta Electric Supply Company at present has connected to its system over 40,000 fans, 370,000 lamps and 1096 motors, the latter varying from 1 hp to 250 hp in rating.

* * *

The Southern California Edison System.—The Southern California Edison Company, with headquarters at Los Angeles, operates seven water-power plants, three steam plants and fifty-one substations, supplying service over approximately 12,500 sq. miles of territory. Its transmission lines aggregate 822 miles in length, with a secondary distribution system totaling 1900 miles.

* * *

The First U. S. Patent on Ice-Making.—On exhibition at the National Museum, Washington, D. C., is the first patent for the artificial manufacture of ice granted by the United States government. It was issued as No. 8080 on May 6, 1851, to Mr. John Gorrie, of New Orleans, La. Both the papers accompanying the case and the patent itself are written by hand on parchment and are still in excellent condition.

* * *

Via Wireless from Togoland to Berlin.—The German government has prepared plans for the erection of a long-range wireless-telegraph station in Togoland, German West Africa, with sufficient power to have communication directly between Togoland and Berlin, thereby connecting Germany directly with all its African colonies. Other wireless stations have been and are now being constructed in Germany's other African colonies.

* * *

Electric "Star of Hope" for New York Park.—During Christmas week each year an electrically lighted 60-ft. Christmas tree is erected in Madison Square Park, New York City, to bring Christmas cheer to the city's homeless. To supplement this holiday feature, several unknown philanthropists have just had erected in the same park an electrically lighted star on a 30-ft. pole and have endowed this sign of hope for its operation during all the nights of the year, except when the electric Christmas tree is ablaze during the holidays.

* * *

A Thirteen-Million-Dollar Water-Power Plant for Southern Italy.—The Italian Parliament has passed an act authorizing the construction of a 150,000-hp hydroelectric development in Calabria, in southern Italy. The contemplated construction work will require the erection on a

grand scale of three dams at an estimated cost of some $13,000,000. In the aggregate it is expected to supply about 150,000 hp for traction, illumination and the development of industries, not only in Calabria, but also in Apulia and throughout southern Italy in general. Energy will also be employed on a large scale for irrigation purposes.

* * *

Municipal Plant Seeks Trained Manager.—The city of Owensboro, Ky., will shortly appoint a qualified engineer to act as city clerk and manager of the municipal electric-light and water plants. By combining the several offices and giving the consolidated position an adequate salary, the Mayor hopes to be able to get a man with sufficient technical training and executive ability to run the utilities on a modern and efficient basis.

* * *

Utah Power & Light Company a Trespasser on Forest Lands.—The United States Circuit Court of Appeals handed down a decision at St. Paul, Minn., Nov. 22, in the case of the government against the Utah Power & Light Company, of Logan, Utah. The court decided that the power company has no rights to land it occupies which is a part of the National Forest in Cache County, Utah. The decision, which reverses the District Court of Utah, in effect practically will make possible confiscation by the government of the greater part of the plant, in which $5,000,000 is said to be invested.

* * *

Ontario Hydroelectric Commission to Make Further Reductions in Rates.—According to the report of Mr. F. A. Gaby, chief engineer of the Hydro-Electric Power Commission of Ontario, the municipalities served by the hydroelectric system have been able to meet all obligations for operation and maintenance charges, including interest and sinking funds and to accumulate a balance available for depreciation and reserve accounts, without drawing on the ordinary tax receipts for deficits. This surplus ranged from 10 per cent to 56 per cent. There are now forty-six municipalities on the Niagara system, taking an aggregate of 52,000 hp. The Hon. Adam Beck, chairman of the commission, stated that further reductions in charges would be made next year, and that a formal announcement of these new rates will be made as soon as the municipalities have been consulted. In the cases of Toronto, Ottawa and London the commission has already prepared figures and will recommend that lower rates be made effective on Jan. 2. In Ottawa and London the present cash discount of 10 per cent on domestic and commercial lighting will be increased to 25 per cent, and a reduction of 18 per cent will be made in energy charges for motor circuits and for street lighting.

* * *

Prize Winners at Jobbers' Meeting.—At the November meeting of the Electrical Supply Jobbers' Association at Hot Springs, Va., Nov. 18 to 20 inclusive, field and indoor tournaments were provided. There was a golf tournament for manufacturers during the morning of Nov. 19 and a tournament for jobbers during the afternoon of the same day. On Nov. 18 and 19 there were pool and billiard tournaments, and during the afternoon and evening of Nov. 19 bridge and "five hundred" were played by the ladies. The following is the list of the prizes and winners: Manufacturers, golf—silver overlay water jug, Mr. Van Rensselaer Lansingh, Cleveland; golf bag, Mr. H. L. Everest, Jr., Chicago; silver overlay pitcher, Mr. R. F. Valentine, Cleveland. Jobbers, golf—silver overlay decanter, Mr. F. D. Van Winkle, Cincinnati; golf bag, Mr. F. B. Elliott, Philadelphia; cup, Mr. N. G. Harvey, Chicago; head lamp, Mr. L. V. Garron, Philadelphia; side lamps, Mr. F. P. Vose, Chicago; horn, Mr. G. B. Hill, Pittsburgh; vibrating horn, Mr. H. C. Lucas, Philadelphia; trouble finder, Mr. C. S. Walker, Indianapolis; tail-lamp, Mr. C. Scudder, Jr., St. Louis. Billiards—water pitcher, Mr. E. H. Haughton, Cleveland. Pool—water pitcher, Mr. H. F. Watson, Chicago. Ladies, bridge—cologne bottle, Mrs. H. S. Wilson, Philadelphia; tea samovar, Mrs. C. J. Litscher, Grand Rapids, Mich.; electric frying pan, Miss N. N. Sibley, Perth Amboy; electric frying pan, Mrs. E. K. Patton, Chicago; electric fan, Mrs. F. V. Burton, Bridgeport. Ladies, "five hundred"—electric percolator, Mrs. H. Hutchissen, Cleveland; toaster stove, Mrs. H. M. Savage, Boston; electric chafing dish, Mrs. F. M. Pierce, Chicago; electric fan, Mrs. R. Herstein, Memphis.

* * *

## SOCIETY MEETINGS

Publicity for Electrical Congress.—Mr. Preston S. Millar, past-president of the Illuminating Engineering Society, has been appointed chairman of the committee on publicity of the International Electrical Congress to be held at San Francisco in September, 1915. Other members of the committee are Messrs. F. H. Gale, Schenectady, N. Y.; J. C. McQuiston, Pittsburgh, Pa.; A. H. Halloran, San Francisco, Cal., and O. H. Caldwell, New York.

* * *

Washington Section, A. I. E. E.—The Washington (D. C.) Section of the American Institute of Electrical Engineers held its first meeting of the season Nov. 11, when Mr. Norman Macbeth, editor of *The Lighting Journal*, made an address on "The Growing Recognition of Proper Lighting." Mr. H. C. Eddy, chairman of the section, and Mr. John H. Finney, past-chairman, were appointed members of a local committee to represent the Institute during the Conservation Congress held at Washington Nov. 18 to 20.

* * *

Ohio Society of Engineers.—The Ohio Society of Mechanical, Electrical and Steam Engineers held its eleventh annual meeting in Columbus on Nov. 20 and 21. About fifty members were in attendance. Among the papers and addresses was one by Mr. Francis C. Caldwell, professor of electrical engineering at Ohio State University, on "Quartz-Tube Mercury-Vapor Lamps," and another by Mr. George N. Lemmon on "Recent Developments in Electrical Transmission." The sessions of Nov. 21 were held at the Ohio State University, where the visitors were entertained at lunch and dinner.

* * *

Pittsburgh Section, I. E. S.—The Pittsburgh Section of the Illuminating Engineering Society will hold a joint meeting with the local section of the American Institute of Electrical Engineers, in the Auditorium, Oliver Building, Pittsburgh, Friday, Dec. 12. At this session the following papers are scheduled for presentation: "A Problem in Boulevard Lighting," by Mr. J. M. Froelich; "Variables in Street Lighting," by Mr. J. F. Martin, and "Some Aspects of Free Lamp Renewals," by Mr. Thomas F. Campbell. Mr. Alan Bright, 827 Wabash Building, is secretary of the Pittsburgh Section of the I. E. S.

* * *

Electrical Contractors' Association of Texas.—The state convention of the Electrical Contractors' Association of Texas was held at Waco, Tex., Nov. 13. Delegates from Dallas, Greenville, San Antonio, Fort Worth, Houston and Waco were in attendance. In the absence of President Martin Wright, of San Antonio, Vice-president Jack Owens, of Waco, presided. The following officers were elected: President, Mr. A. J. Anderson, Fort Worth; vice-president, Mr. W. H. Earle, Dallas; treasurer, Mr. George Bounds, Fort Worth; secretary, Mr. C. M. Cockrell, Dallas; director to national convention at Detroit in July, 1914, Mr. William Clower, Dallas; alternate, Mr. E. T. Bordeu, Houston. Fort Worth was selected as the place of the next convention April 25, 1914.

# New Turbine Installation at Little Rock, Ark.

**Station of the Merchants' Lighting Company built in six months, together with complete underground and overhead distribution system—Condenser pit to accommodate varying river stages**

PRINCIPAL interest attaches to the new turbine station and distribution system of the Merchants' Lighting Company at Little Rock, Ark., as a result of the rapidity with which this 2500-kw plant was built.

The company was granted its lighting franchise June 3, 1912, but on the condition that the plant should be in operation by the same date on the following year. Owing to various delays actual construction was not begun until Nov. 15, 1912, but from that date on the work was pushed energetically, despite the serious handicap interposed by the rainy season which had meanwhile set in. By May 13, however—three weeks before the date scheduled in the franchise—both plant and distribution system were ready for operation and the complete installation has since been in regular service.

The power-house building is of pressed brick and rests upon the famous rock projecting into the Arkansas River, from which the city receives its name. This landmark is the first rock seen on the river trip from New Orleans up the Mississippi and thence up the Arkansas River to the city of Little Rock. The power-house building measures 114 ft. by 96 ft. in plan and is 45 ft. high.

The roof trusses in the boiler and turbine rooms are of the Howe type. A monitor roof extends down the center of the boiler house and is carried by two Fink trusses elevated 5 ft. above the main roof. The latter is of red tile and is covered with a layer of felt roofing, on which a tar-and-gravel coating is in turn laid. The boiler-house front is largely filled in with galvanized-steel sashes and wire-glass. Rolling steel curtains are to be installed beneath the wire-glass in the boiler-room panels.

### Steam-Plant Equipment

The boiler equipment consists of three vertical-header Babcock & Wilcox boilers, carrying a working pressure of 200 lb. per sq. in. and equipped with forged-steel headers, nozzles and mud drums. Each boiler evaporates 10,700 lb. of water per hour from and at 212 deg. Fahr. The boilers are elevated 2 ft. above the standard setting, and the corner posts are placed outside of the brickwork so that stokers may be installed at a later date.

The stack was erected by the Weber Chimney Company and is of the latter's standard coniform type, 175 ft. high by 8 ft. 6 in. in diameter at the top. It is lined with an additional stack 50 ft. high, with an air space between the two stacks for expansion and contraction. The concrete mixture used consists of one part R. W. Hunt tested Portland cement, three parts clean, sharp, deep-water sand, and five parts of clean, sharp trap-rock passed through a 1-in. screen. Four galvanized-steel lightning rods, spaced 90 deg. apart, extend the height of the stack, projecting onto bedrock at the base and 5 ft. above the top. During a

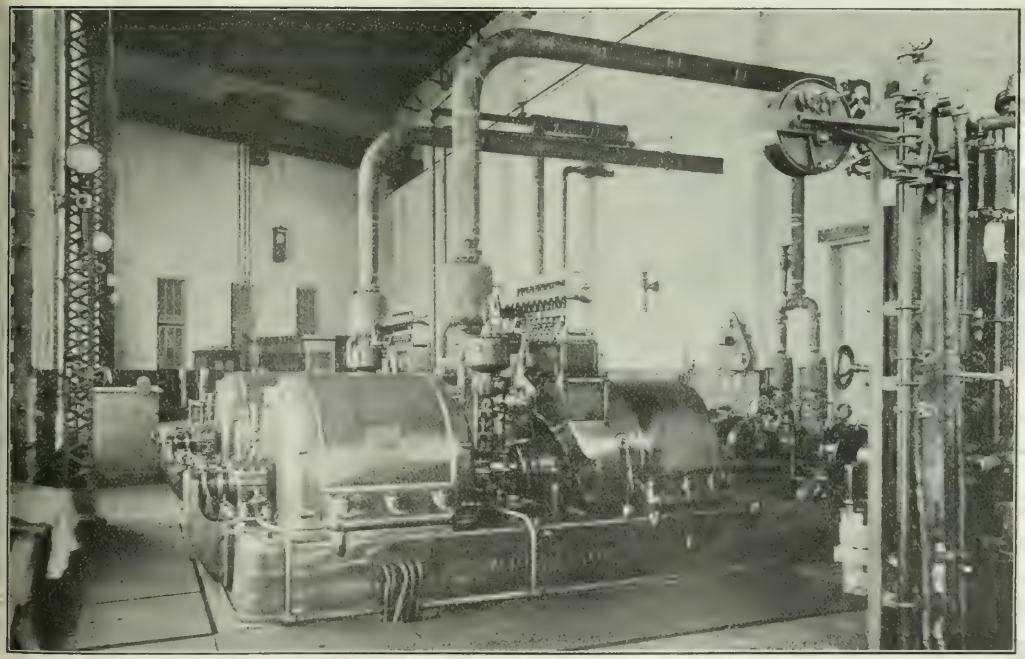


FIG. 1—TURBINE ROOM IN PLANT OF MERCHANTS' LIGHTING COMPANY, LITTLE ROCK, ARK.

[illegible] thunderstorm lightning struck the stack, and except for momentarily illuminating the boiler house, close inspection has shown absolutely no damage at all, not even a chip being loosened from the top of the stack. The breeching is of No. 4 Birmingham gage iron and measures 11 ft. 6 in. high by 5 ft. 6 in. wide, with an expansion joint between each battery of boilers.



FIG. 2—INTERIOR OF BOILER ROOM

All three passes of the boilers are built of firebrick of the very best grade. There is additional room in the boiler house for two more units similar to those now in use. A traveling-pan ash conveyor made by the Webster Manufacturing Company, with dumps adjoining each boiler, cares for all ashes from the boiler house.

"Vigilant" boiler feed-water regulators are installed on each boiler, maintaining an even and constant water level. One 1200-hp Cochrane feed-water heater and purifier supplies the necessary heat to the feed water. At present the feed water is held at 212 deg. Fahr. The feed-water

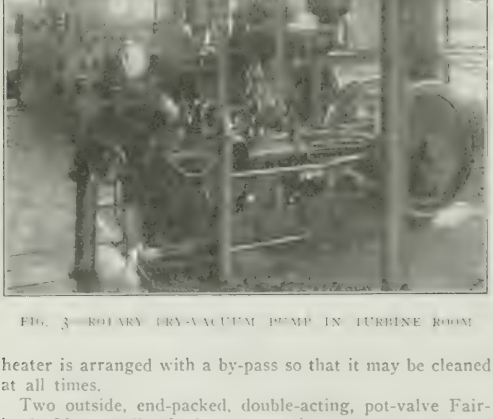


FIG. 3—ROTARY DRY-VACUUM PUMP IN TURBINE ROOM

heater is arranged with a by-pass so that it may be cleaned at all times.

Two outside, end-packed, double-acting, pot-valve Fairbanks-Morse boiler-feed pumps, each rated at 140 gal. per minute, supply the necessary boiler-feed water and are equipped with Fisher governors operating in connection with the Vigilant boiler feed-water regulators already mentioned.

STEAM PIPING.

The steam piping consists of a 10-in. main steam hea of extra-heavy Spellerized steel, with Van Stone joints a extra-heavy, spot-faced, rolled-steel flanges. The m steam header is supplied with steam from 8-in. lines fr each boiler. In each boiler-supply line are located both gate valve and an automatic stop-and-check valve. T main steam turbines are supplied through 6-in. lines fr the main steam header.

Below the main steam header, and attached thereto three points, is the auxiliary 4-in. header, made up extra-heavy steel pipe and Van Stone joints, with ext heavy, spot-faced, rolled-steel flanges.

In addition to this header, a drip header, tapped i every fitting, drains the condensate from the main ste header directly back to the boilers through a stop va and a check valve tapped in ahead of the respective boi blow-off valves. Homestead blow-off cocks, in connect with standard Babcock & Wilcox blow-off angle valves, used. The boiler-feed lines are of extra-heavy steel pi with Van Stone flanges.

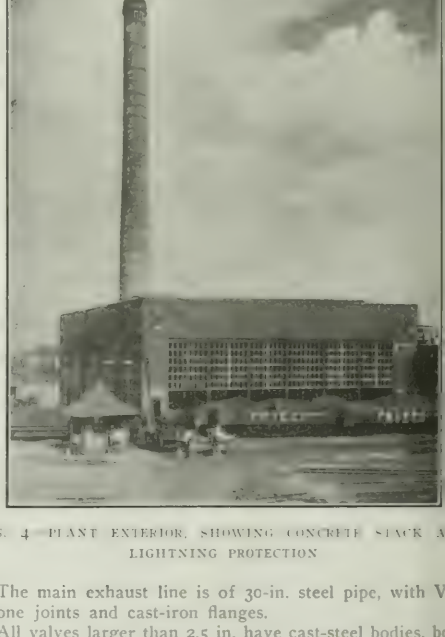


FIG. 4—PLANT EXTERIOR, SHOWING CONCRETE STACK A LIGHTNING PROTECTION

The main exhaust line is of 30-in. steel pipe, with V Stone joints and cast-iron flanges.

All valves larger than 2.5 in. have cast-steel bodies, b nets and yokes, with monel-metal valves, seats and ste All fittings such as ells, tees, separators, etc., are of c steel. All valves and fittings 2.5 in. and smaller are extra-heavy brass throughout. This high-grade pipi was employed since it is planned shortly to install sup heaters for 150 deg. superheat, which will require the v best metal. A Foster reducing valve reduces the boi pressure on the auxiliary steam engines from 200 lb. to lb. per sq. in.

All atmospheric exhaust piping from the main ste turbines and feed-water heater is of galvanized Ameri spiral-riveted pipe, with Burt exhaust heads. Davis au matic atmospheric relief valves are installed in the atm pheric-exhaust lines from the main turbines. These li are outside of the building and are sealed with heavy so that in cold weather no trouble will be experienced fr frost. Filters are installed in the line supplying bear

water to the main turbines, as much trouble has been experienced at Little Rock with the city supply.

All steam piping is covered with standard 85 per cent magnesia, bound in muslin, painted black and fixed with brass bands at 30-in. intervals. All hot-water lines are covered with standard air-cell magnesia covering similarly bound with brass bands. Steam lines are painted black, water lines gray, air lines blue, cylinder-oil lines green, and engine-oil lines red, so that the operators can make no mistake in the pipes.

### Condensing Equipment

Steam from the main turbines is condensed by one 3300-sq. ft. two-pass Alberger surface condenser, which is piped to permit reversal of the circulating water. The cooling supply is taken directly from the Arkansas River through a 24-in. cast-iron flanged pipe line. A 16-in. cast-iron flanged siphon leg forms the return to the river, thus balancing the greater part of the static head. Double screens are employed at the entrance of the 24-in. suction line, and wherever circulating-water pipe lines change cross-section eccentric reducers are used so that no air pockets may form.

The condensers are supplied with water by two 10-in. Alberger double-suction horizontal, split-case volute pumps, with outboard, ring-oiled bearings, deep stuffing boxes and lantern glands. From the hot well condensed steam is taken by two two-stage turbine pumps to the fill-up tank in the boiler room. One hot-well pump is driven by a three-phase, 220-volt, 60-cycle General Electric motor running at 3600 r.p.m., and the other hot-well pump is operated by a Terry turbine. All condensing equipment is installed in a condenser pit located directly beneath the turbines and hewn out of the solid rock to a depth of 41 ft. 6 in. This pit provides for the 28-ft. rise and fall in the stages of the Arkansas River. All waste water from the glands in this pit drains to a sump located therein and is pumped out by an automatic 2-in. vertical Worthington volute pump directly connected to a 2-hp induction motor. All bearing water and other clean waste water is drained

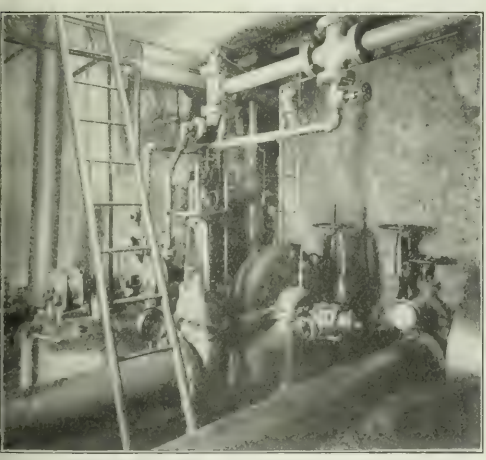


FIG. 5—CONDENSER EQUIPMENT IN PIT 41 FT. BELOW TURBINE FLOOR

to the bottom of this pit into a steel tank, from which it is pumped by one double-acting, single-cylinder, outside-packed Burnham steam pump controlled by a float from the tank water level.

Crane-tilt steam traps care for the condensate from the separators of the main and exciter turbines. Alberger rotary, dry-vacuum pumps are of the flywheel type, giving a full stroke, and are fitted with balanced valves. A vacuum of 28 in., measured with a mercury barometer, has been maintained throughout the summer months, which is an exceedingly good record considering the high temperature of the condensing water.

A 15-ton crane traverses the turbine room, and its main chain is long enough to permit the hook to be lowered 40 ft. below the turbine-room floor, so as to handle the condensing equipment in the pit easily when this is desired.

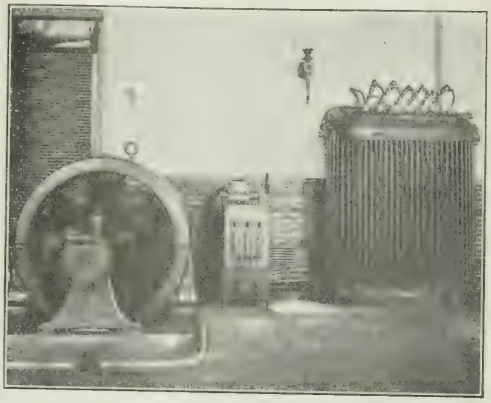


FIG. 6—TRANSFORMER AND SYNCHRONOUS CONVERTER

### Turbine Room

The turbine room is 114 ft. long by 35 ft. 6 in. wide and measures 42 ft. in height. The main units consist of two 1250-kva, 2300-volt, three-phase, 60-cycle, 3600-r.p.m. horizontal General Electric turbine-alternator sets. Exciting current is furnished by two 35-kw, 125-volt turbo-generators. These exciters are flat-compounded, so that, if desired at a later date, Tirrill regulators may be installed without further complications.

On the switchboard each of the two turbine panels is equipped with a voltmeter and eight-point plug, three ammeters, a direct-current field ammeter, a three-phase indicating wattmeter, a kilowatt-hour meter and an automatic oil switch with definite time-limit relay. Each exciter panel has an ammeter and voltmeter and the usual rheostats. The four three-phase feeder panels for light and motor service are equipped with automatic oil switches controlled by inverse time-limit relays.

Direct current for the system is supplied by 300-kw, three-phase, 60-cycle, three-wire, 500-volt General Electric rotary converters, arranged for 10 per cent boosting or lowering from the alternating-current side for direct-current voltage regulation.

### Distributing System

The distributing system throughout the business district is entirely underground and has the distinction of being the first such system of its kind in Arkansas. The city of Little Rock is without storm sewers of adequate size to care for the drainage, and the result is that during heavy cloudbursts the downtown districts often become flooded, putting streets, alleys and sidewalks a foot under water. In order to keep its manholes and conduits dry, the Merchants' company constructed a main sewer of 8-in. salt-glazed vitrified clay pipe, with laterals of 6-in. similar pipe, under all conduits and manholes in the business district. This sewer system has a minimum drain of 6 in. for each 100 ft. Each manhole is trapped directly into the sewer with an ordinary P-trap and ball screen, and absolutely no water has been found in any manhole either during or immediately after the heaviest cloudbursts. The main sewer discharges into the Arkansas River directly at the rear of the power

house and in view of the turbine room so that the working of the sewer may be observed at all times.

All conduits are made up of units of three-hole or four-hole ducts with broken joints, while an envelope of concrete 4.5 in. thick entirely surrounds the finished conduit. Each joint has been wrapped with cheesecloth 6 in. wide, and all conduits were thoroughly scraped and mandreled



FIG. 7—ORNAMENTAL STREET LIGHTING IN UNDERGROUND DISTRICT

after completion. All ducts are of 3½-in. actual bore, and no duct was allowed to enter the work which showed the least irregularity, roughness, bend, crack or other defect. The manholes are square in cross-section, with a 6-in. reinforced-concrete roof, a 6-in. concrete floor and the walls built of vitrified paving block laid in cement mortar, making a thoroughly waterproof job. Manhole covers of a very heavy type are used. They are circular in form and have openings large enough to admit freely a 100-kva subway transformer. Nearly all manholes are 8 ft. by 8 ft. in cross-section, except in a few cases where very congested piping conditions were found. Here they were reduced to 6 ft. by 8 ft. in section. Six-foot head-room is allowed in all manholes. There are 104,000 duct-feet in the underground system, and the average cost, including sewers and manholes, was 22 cents per duct-foot. This is very reasonable, con-

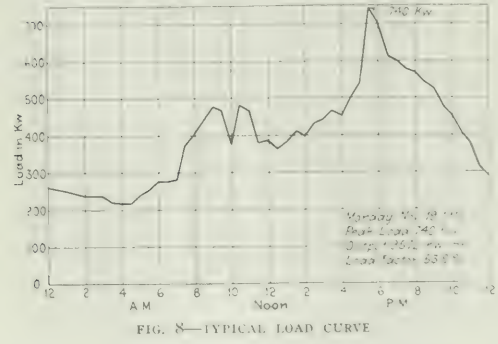



FIG. 8—TYPICAL LOAD CURVE

sidering the fact that sewer cuts 18 ft. deep through the city streets were met with in several instances.

## System of Feeder Cables

The business district is divided into three sections, fed by three 2300-volt cables. These comprise one three-conductor, 250,000-circ. mil cable, one three-conductor 4/0 cable, and one three-conductor 2/0 cable. All are paper-insulated and lead-covered and have been tested for five minutes at 20,000 volts. The reason for requiring this high test pressure is that after the confines of the business district are passed, these cable circuits become aerial lines and danger exists of contact with the 10,000-volt series street-lighting circuits. For secondaries, three-conductor, paper-insulated, lead-covered cable made up of two 300,000-circ. mil and one No. 0 copper conductor is used. All secondaries in the respective districts are cut in without fuses to the transformers, and all transformers are banked.

Primary three-pole, three-way Johns-Manville junction boxes are used, with disconnecting switches and fuses, so that each transformer is fused and disconnecting switches may be replaced with line fuses, where needed, at proper intervals. The secondary junctions are three-conductor, four-way boxes, with disconnecting switches on the mains and transformers and with fuses in the feeders going out of the manhole. This construction permits any one business block to be cut out automatically in case of fire, without injuring or inconveniencing any other section.

Direct current is distributed through paper-insulated,

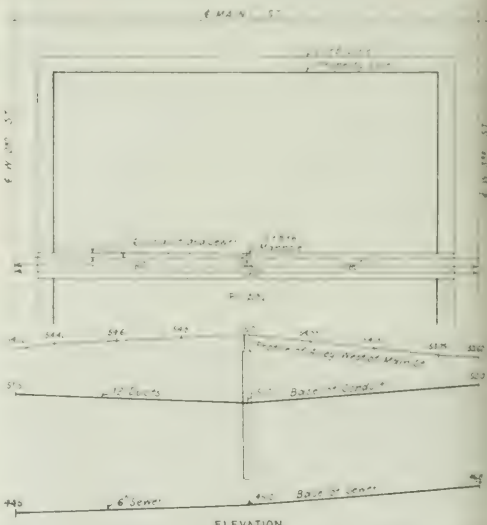



FIG. 9—UNDERGROUND CONDUIT AND SEWER CONSTRUCTION

lead-covered cables containing three conductors—two No 2/0 wires and a No. 2 neutral. This cable has all been tested to 5000 volts. Three-way junction boxes are here used, the mains being three-pole and the branches two-pole, so that 250-volt direct current may be derived at each manhole for the operation of elevators, printing presses and other direct-current service.

## Plant Efficiency Obtained

The station described has been operating since May 13, having been erected complete in the short space of six months. Considering the distance from the manufacturers and all sources of supply, in addition to the difficulties interposed by the rainy season, this construction feat was a very rapid piece of work.

During the month of August 215,000 kw-hr. were sold with a maximum demand on the station of 420 kw and a load-factor of 74 per cent. The water rate of the station is 37.5 lb. of water per kilowatt-hour, with a coal consumption of 3.6 lb. per kilowatt-hour. Ordinary slack, running 13,400 lb.-Fahr. thermal units per lb., is used and costs $2.10 delivered in the company's bins. On Nov. 18 the con-

ected load consisted of 1423 hp in three-phase, 60-cycle otors, the equivalent of 27,514 50-watt alternating-current ncandescent lamps, 94 hp in 220-volt direct-current motors, fty-six 6.6 alternating-current series-arc lamps, eight 110-olt multiple-arc lamps and four General Electric flame-arc mps.

With the large contracts recently closed, it will soon be necessary to install an additional 2500-kw turbine, besides an additional boiler, with chain-grate stokers and superheaters, to care for the company's rapidly growing business.

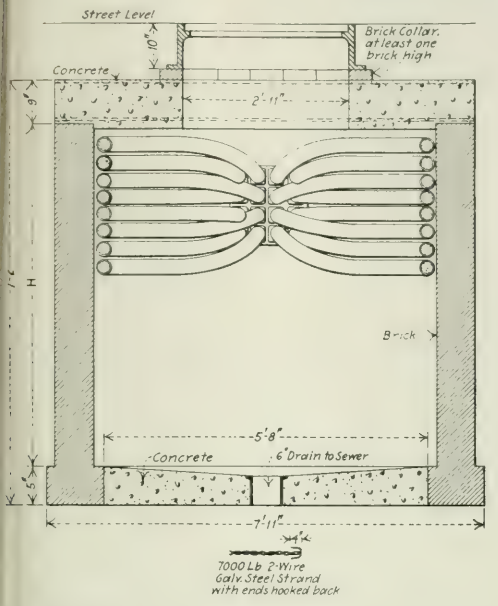



FIG. 10—CONSTRUCTION OF MANHOLES

Among the recent activities of the Merchants' Lighting Company was the execution of a thirty-year contract with the city of Argenta (which is a community of 15,000 people directly across the Arkansas River from Little Rock), closing down the latter's 600-kw municipal plant, which formerly furnished all the municipal and practically all the commercial lighting in Argenta. The company has also contracted for replacing two 125-hp American-Diesel oil engines in the plant of the Arkansas Cold Storage Company with 300-hp induction motors. The maximum demand on the Argenta municipal plant last winter was 315 kw, with an output of 700,000 kw-hr. During the summer just closed the demand of the Arkansas Cold Storage Company was 240 kw, with a consumption of 850,000 kw-hr. for the year.

An accompanying illustration shows the ornamental tungsten lighting equipment operated by the company in the underground-distribution district. The top globe on each post contains a 100-watt tungsten lamp and the four lower spheres each one 60-watt unit. About sixty of these standards have been installed within the last four months.

The power plant of the Merchants' Lighting Company was designed and constructed by Mr. C. E. Rose, of Little Rock, who is now the general manager of the company.

## Hydroelectric Project on Klamath River

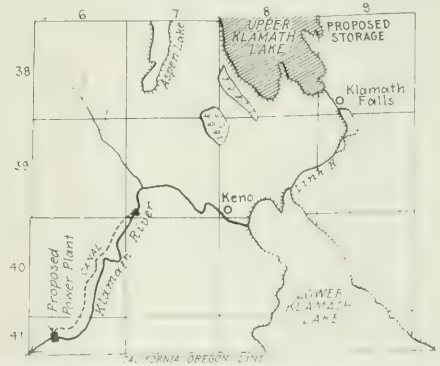
A large water-power project on the Klamath River below Keno, Ore., has recently been surveyed in a preliminary way by the State Engineer and the United States Reclamation Service under the provisions of the state law authorizing co-operation. This project is incidental to reclamation work in this region, and the investigation is being carried on from the fund of $100,000 now available.

A canal 10.5 miles long in Oregon, terminating about 2 miles above the California-Oregon boundary line, will afford a fall of 780 ft. With limited storage in Upper Klamath Lake 1200 cu. ft. of water per second can be relied upon during the dry season. This will furnish approximately 100,000 gross hp. As the prospects appear favorable for constructing a large reservoir near the lower end of the canal, the low-water output of this project will compare favorably with the famous Keokuk plant on the Mississippi River, which has only 20,000 cu. ft. of water per second at low stage with 39 ft. fall. While the canal will involve considerable rock and tunnel work, the preliminary estimate is $200,000 per mile, or $21 per horse-power for the cost of this feature.

The water necessary for this project has been withdrawn from entry under the provisions of law, and in conformity with the State's contract with the Secretary of the Interior. This withdrawal will not conflict with any of those projects now contemplated near Keno, and the water will be returned to the stream about a quarter mile above the intake of the proposed Shasta Valley Canal.

A preliminary report has been made with a view to irrigating a tract 24 miles in length by about 12 miles in width in Shasta Valley, Cal., by the storage of water in upper Klamath Lake, Ore.

The Southern Pacific Company is now building a large power plant on the Klamath River just over the line in California, which prevents the Shasta Valley people from diverting the regular flow of this stream. The water-right situation is thus quite complicated and can only be adjudicated by the closest co-operation between the two states and the nation, or under some federal law paramount to the rights of the individual state in case of disagreement.

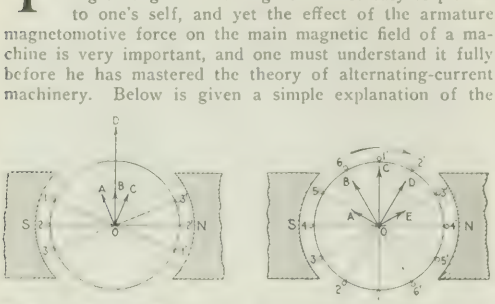



MAP SHOWING PROPOSED HYDROELECTRIC DEVELOPMENT IN OREGON

# Armature Mmf Relations in Synchronous Machines

**Simplified graphical treatment of the effect of single-phase and polyphase armature ampere turns on the field magnetism. By J. H. Morecroft**

THE magnetic effect of an alternating current flowing through a revolving coil is not easy to picture to one's self, and yet the effect of the armature magnetomotive force on the main magnetic field of a machine is very important, and one must understand it fully before he has mastered the theory of alternating-current machinery. Below is given a simple explanation of the




FIGS. 1 AND 2—VARIATION IN MAGNITUDE AND POSITION OF MMF IN SINGLE PHASE ARMATURE AT UNITY POWER FACTOR

effect which seems to be a new way of looking at the matter. It is possible that other writers have used this idea, but the present writer does not remember having seen it stated anywhere.

The single-phase alternator will be first considered. The premise on which a start is made is that a group of coils (such as are found on the armature of alternating-current machines) produce practically the same magnetic effect as a properly placed single coil carrying a suitable current, for example, the elementary single-phase alternator shown in Fig. 1.

It is assumed that there are three coils, 1-1′, 2-2′ 3-3′, making up the single-phase winding so that these three coils are connected in series and hence carry the same current. The magnetic effect (at *O*) of these three coils may be duplicated by a winding of only one coil carrying about three times as much current as that carried by coils 1-1′, etc. In Fig. 1 the mmfs of the three separate coils are shown by *OA*, *OB* and *OC*; the resultant mmf of the three is evidently *OD*, which is in the same direction as *OB* and nearly three times as large. It is evident that the mmf *OD* could be produced by coil 2-2′ acting alone, provided it carried enough current.

Hence the single-phase winding shown in Fig. 1 could be sufficiently well represented by a winding of only one turn (in the plane of coil 2-2′), which turn carries enough current to give about the same number of ampere-turns as does the actual winding. Similarly, a two-phase winding may be represented by a two-coil winding and a three-phase winding by a three-coil winding.

Considering the mmf of a single-coil armature carrying current in time-phase with its generated emf. The various positions this coil assumes as it revolves are shown by 1-1′, 2-2′, 3-3′, etc., of Fig. 2. At 1-1′ no emf is generated, and hence there is no current and the coil produces no mmf. At 2-2′ the current has some small value and the mmf of the coil is proportional to this value and is perpendicular to the plane of the coil 2-2′; it is shown by the vector *OA*. As the coil moves around the current increases and so does the mmf; this is a maximum (shown at *OC*) when the coil has the position 4-4′. As the coil moves farther the current starts to diminish, so that at position 5-5′ the mmf is given by the vector *OD*, etc.

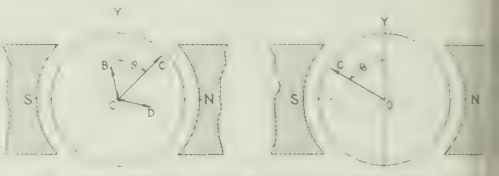
It is known that in an ordinary alternator the form of the current curve is given by the equation $i = I_m \sin \omega t$, where $\omega$ is the angle through which the coil has revolved from its zero position, 1-1′. If now the mmf vectors are carefully plotted, it will be found that they lie on a circular locus as shown by the dotted circle of Fig. 2. As the coil revolves, its mmf vector continually passes over the same locus.

An examination of the form of this locus shows that for nearly all positions the coil has a magnetizing or demagnetizing effect combined with a cross-magnetizing effect. For example, in position 2-2′ the armature coil is magnetizing the main field and also cross-magnetizing it. In position 4-4′ the effect is entirely a cross-magnetizing effect, and in position 1-1′ no mmf is produced by this coil. When the coil has revolved 180 deg. (electrical space) the main field has been first strengthened and then weakened (a complete cycle of change in field strength), and it has been distorted from its normal position a maximum and has returned to its normal position.

Therefore a complete cycle of field changes occurs while the coil revolves 180 deg.; hence when the coil has revolved 360 deg. (thereby generating one complete cycle of emf) the main field has been through two complete cycles of change in strength and position. Thus a search coil placed on the pole of a single-phase alternator shows an induced emf of a frequency equal to twice that of the armature emf. This double frequency emf in the search coil is produced by the single-phase armature reaction. Its magnitude depends upon the magnetic leakage between the field and the armature and upon the ratio of armature ampere-turns to field ampere-turns.

Hence in a single-phase alternator the armature reaction results in a pulsating strength and varying position of the main field. This action produces excessive heating in the pole faces, due to eddy currents and hysteresis in the material of which the pole is composed.

Although not a part of this discussion, it is interesting to note that the changes in field strength due to armature




FIGS. 3 AND 4—VARIATION IN POSITION OF MMF WITH ANGLE OF LAG OR LEAD

reaction result in the generation of higher frequency emf in the armature. For example, suppose a revolving armature, single-phase alternator in which, when the main field is constant, an emf of 60 cycles is generated in the armature. As soon as current exists in the armature the armature reaction produces a variation in the main field of $2 \times 60 = 120$ cycles per second. Now, this 120-cycle

field will produce in the armature (revolving with a speed of 60 cycles) $120 + 60 = 180$ cycles per second. Hence the armature and main field of a single-phase alternator continually react on one another, resulting in the generation of very high frequency emfs, although the armature has a comparatively low rotative speed. One of the well-known high-frequency alternators (used in wireless telegraphy) operates upon the principle of utilizing this effect of armature reaction.

When the armature current and generated emf are in time-phase with one another it is evident (by inspection of Fig. 2) that the main field suffers no *net* magnetizing or demagnetizing action. While the coil moves from position 1-1′ to position 4-4′ the field is being magnetized by the armature current, but when it moves from 4-4′ to 1′-1 the field is being demagnetized. Neglecting the variability in permeability of the magnetic circuit as the flux density changes, the net effect on the average strength of the field is zero.

When the armature current lags behind the generated voltage the shape of the armature mmf locus is the same as before, but the circle is moved into some such position as shown by Fig. 3. The maximum mmf *OC* occurs after the coil has passed the center of the pole faces by an angle equal to $\theta$, where $\theta$ is the phase difference of the emf and current in the armature. An inspection of Fig. 3 will show that the armature will actually demagnetize the field in this case. Two mmf vectors symmetrically placed with respect to the diameter of the circle, such as *OB* and *OD*, neutralize one another in Fig. 1 in so far as their magnetizing and demagnetizing components are concerned, but in Fig. 3 this is not so. The demagnetizing effect of *OD* is much greater than the magnetizing effect of *OB*, and any other pair of symmetrically placed mmf vectors yield the same result.

Hence with a lagging current the single-phase alternator has a field which not only pulsates in strength and position but also decreases in average strength as the load increases. The amount of distortion of the field from its normal position is less than when $\theta = 0$, but the shift takes place on both sides of the normal position, whereas when

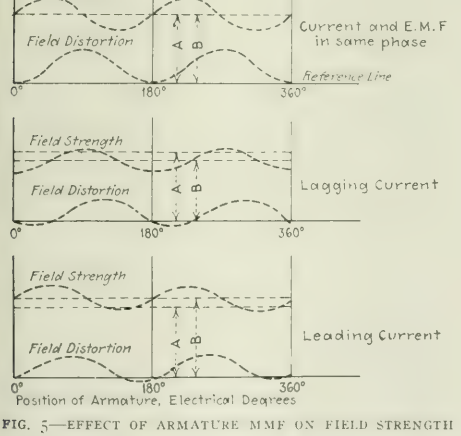
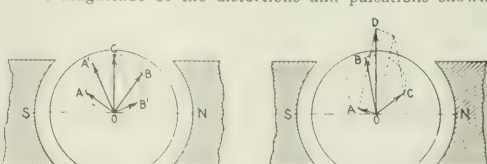



FIG. 5—EFFECT OF ARMATURE MMF ON FIELD STRENGTH

$\theta = 0$, the field is distorted only in the direction of rotation of the armature.

When a leading current exists in the armature the circular locus of armature mmf is moved backward as shown in Fig. 4. In this case the effect of armature mmf is to strengthen the field as well as to distort it. The effect of the armature mmf on the field strength in the three cases is shown by curves in Fig. 5. In these curves $A$ represents the strength of the field at no load, due to field mmf only. $B$ is the average strength of the field at full load. Positions of the "field distortion" curve above the reference line indicate a twist in the field in the same direction as that in which the armature rotates, and positions below the reference line signify twist opposite to the armature rotation.

The magnitude of the distortions and pulsations shown




FIGS. 6 AND 7—MMF RELATIONS IN TWO-PHASE ARMATURE

in Fig. 5 depends directly upon the load the machine is carrying. When $\theta = 90$ deg. (a condition which is approximated when the armature of an alternator is short-circuited) the ratio of $(A - B)$ to $A$ is determined by the ratio of armature ampere-turns and field ampere-turns.

Consider now a two-phase armature (carrying a balanced, non-inductive load) on which are wound two single coils at right angles (electrical space) to each other. Each coil will act in exactly the same manner as described for the single-phase alternator. The mmf locus for both coils will be the same circle, and at any instant there is acting on the main field a mmf which is the resultant of two chords of the circle separated from each other by 90 deg. The result is shown in Fig. 6. Consider that at the first instant phase 1 is producing a mmf *OA* and phase 2 has a mmf *OB*; the resultant of these two is *OC*, and the diameter of the circle. An instant later phase 1 has a mmf *OA′* and phase 2 a mmf *OB′*; the resultant is again *OC*. Now, no matter what position of the armature is considered, it will be found that the resultant mmf is *OC*. Hence it is seen that the armature of a balanced two-phase generator produces a mmf which remains constant in magnitude and stationary in space as the armature revolves.

Neglecting the correction factor (required when the actual distributed winding of a phase is supposedly replaced by a single coil carrying suitable current), it is evident that the magnitude of the armature mmf of a two-phase machine (in ampere-turns) is equal to the number of turns per phase multiplied by the maximum value of the current in either phase.

The position of the armature mmf (with respect to the main field) depends entirely upon the angle of time-phase difference between the current and the generated emf. When the load is non-inductive the mmf vector is perpendicular to the main field (as in Fig. 6) and the only effect of the armature mmf is to distort the main field. It may indirectly weaken the field somewhat owing to the crowding of the magnetic flux in to the trailing pole-tips, resulting in decreased permeability of the pole. If the load draws a lagging current from the armature, the mmf vector *OC* is shifted in the direction of the armature rotation, resulting in a direct demagnetizing action by the armature, as in the case of a continuous-current generator with brushes shifted forward.

In case the armature carries a condensive load the armature mmf vector is shifted against the direction of rotation, thereby resulting in a strengthening of the main field by the armature mmf as well as the distortion in the same direction as that in which the armature is rotating.

For a three-phase generator consider an armature on which are three coils at 120 space-degrees to each other. Each of these three coils has the same effect as that described for a single-phase armature, and at any instant the total armature mmf is obtained by adding three vectors on

circular locus, 60 deg. apart. Such a construction when carried out (Fig. 7) shows that in the three-phase alternator, as in the two-phase machine, the armature mmf is constant.

In magnitude the mmf vector is 50 per cent greater than that for a two-phase machine having the same number of turns per phase and carrying the same current per phase. This relation may be shown either analytically or graphically. In Fig. 7 the length of the vector *OD*, which is the resultant of *OA*, *OB* and *OC* (which are 60 deg. apart), is 50 per cent greater than the diameter of the mmf circular locus. No matter where the three vectors *OA*, *OB* and *OC* are taken, provided they are 60 deg. apart, their resultant is the same, namely, *OD*.

The position of the resultant armature mmf vector depends here also upon the angle between the generated voltage and the armature current.

If $I$ is the current per phase in the balanced polyphase armature, in effective value, $N$ is the number of turns per phase, and $k$ is the reduction factor (required for changing the effect of the distributed winding to that of a concentrated winding), then in the two-phase machine

$$\text{Armature mmf} = 0.4\pi\sqrt{2}INk$$

For the three-phase machine

$$\text{Armature mmf} = 1.5(0.4\pi\sqrt{2}INk)$$

In either case the mmf may be divided into its two components by multiplying by sin $\theta$ or cos $\theta$.

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## Hysteresis and Eddy-Current Losses in Transmission Towers

In connection with the design of 5200 transmission-line towers for the Pacific Light & Power Corporation, of Los Angeles, Cal., by the Stone & Webster Engineering Corporation, Boston, Mass., the preliminary calculations indicated possibility of hysteresis and eddy-current losses which deserved experimental study. The electrical engineering department of the Massachusetts Institute of Technology was requested to make an investigation of the magnitude of these losses, and the work was completed last summer by Messrs Oscar M. Arnold and Henry C. Harrison under the general direction of Dr. Harold Pender. As was anticipated, the losses were found to be exceedingly small, varying on test at 200 amp, the normal full-load current of the line, from 18 watts per tower at 25 cycles to 28.8 watts at 60 cycles. In view of the special design of tower

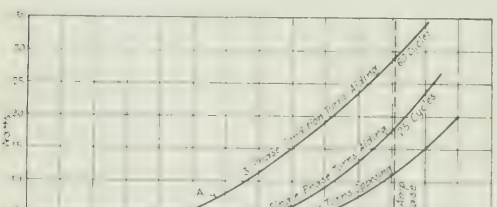


FIG. 1—WATTS LOST IN HYSTERESIS AND EDDY CURRENTS

employed and the method of testing these losses upon a typical tower structure at Boston, an outline of the work performed is of much interest.

The transmission lines will extend from Big Creek, near Fresno, to Los Angeles, a distance of about 240 miles. Three lines will be erected, each being designed to carry 4500 kva at 150,000 volts, the frequency being 50 cycles. The towers are of uniform dimensions, spaced from 600 ft. to 700 ft. apart. Each line conductor consists of a seven-stranded steel core surrounded by thirty aluminum strands giving a total diameter of 0.95 in. Nine-disk to eleven-disk strings of suspension insulators are employed. The towers differ from the usual design in the method of supporting the middle wire of the three-phase system, which is carried through the center of the structure as indicated in the accompanying diagram.

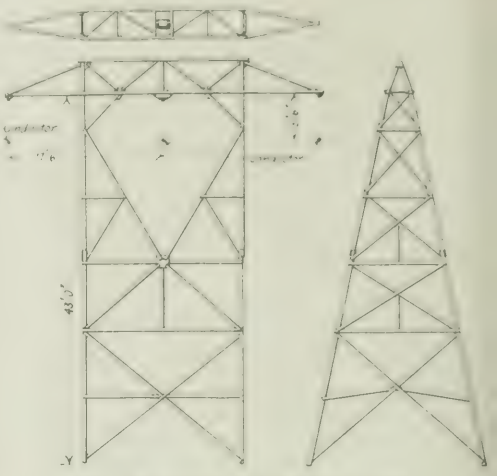


FIG. 2—STANDARD TOWER CONSTRUCTION

The towers each consist of a rectangular pyramidal frame carrying a line-supporting truss at the top, the truss extending at right angles to the direction of the line and having its bottom chord 43 ft. above the ground. The line conductors are hung 5½ ft. below the truss and are about 17.5 ft. apart in a horizontal plane. To enable the tests to be made at Boston the Stone & Webster Engineering Corporation erected such a tower on a vacant lot near the Institute laboratories.

As three-phase energy of the desired current and voltage was not available, single-phase current was used in testing. To approximate three-phase conditions the line was run down one side of the tower, back through the center, down the other side and back through the center. The connections were arranged to permit varying the ampere-turns around the tower. A double-throw switch connected the line either to a storage battery or to the low-tension side of a potential transformer. The high-tension side of the transformer could be connected to 25-cycle or 60-cycle mains. A second double-throw switch between the instruments and the source of power reversed the current in the line and instrument current coils, thus eliminating errors from stray fields. The accompanying diagram illustrates the scheme of connections. The wattmeter used was of the electro-dynamometer type with an ironless magnetic field and large current coils specially wound for these tests. All readings were taken with the moving coil in the same position, the reading being by the zero deflection method.

Tests were made of the loss in the line with direct current and with 60-cycle and 25-cycle alternating current with the turns through the tower both added and opposing. The loss measured was the total loss in the line from the laboratory building plus all tower losses. There was no iron or steel structure near the line to introduce external hysteresis or eddy-current losses. The total drop in the line was 5 volts, the line being carefully insulated and the tests run only on dry days to render leakage losses inappreciable. Before conducting the tests the wattmeter was adjusted so that the closing of the potential circuit caused no deflection,

thus eliminating the effect of the earth's field. Braided lamp cord was used for potential leads, to obviate leakage and inductive errors at this point. The standard runs were made as follows:

The lines were connected to the storage batteries and the current adjusted to a constant value. One observer held the current at this value while a second read the wattmeter, the direct-reading ammeter and the direct-current

SUMMARY OF TOWER LOSSES

| Amperes, Three-Phase Current | Watts Loss in Tower at 60 Cycles | Watts Loss in Tower at 25 Cycles |
|---|---|---|
| 50 | 1.8 | 0.4 |
| 100 | 5.9 | 1.8 |
| 150 | 16.1 | 6.8 |
| 200 | 28.8 | 18.0 |

and alternating-current voltmeters. The current was then reversed, adjusted to the previous value and held constant for another set of readings. The line was then connected to the 60-cycle circuit, the current adjusted to the former value and held constant for a third set of readings. After this the line was again connected to a direct-current supply, the current adjusted to a new value and the former procedure repeated. After the tests all instruments were carefully calibrated with a potentiometer. The magnetization curve of the tower was obtained by winding an explor-

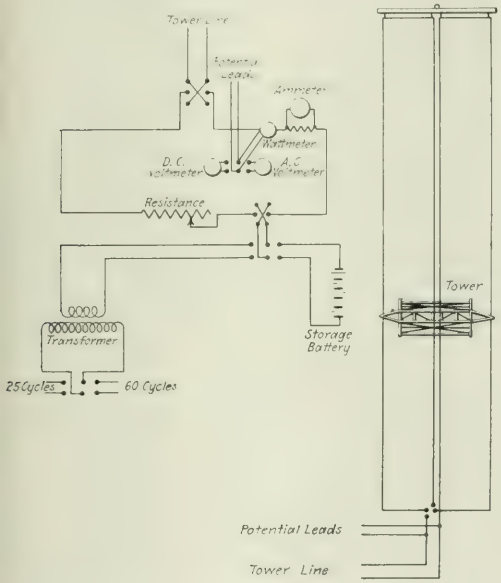



FIG. 3—SCHEME OF CONNECTIONS FOR TESTING LOSSES IN TOWERS

ing coil of ten turns around the frame at a point near the cross-arm and connecting in series with the test coil an air-core solenoid and a ballistic galvanometer. The galvanometer was calibrated by passing current through the line, suddenly reversing the current and reading both the line current and the galvanometer needle deflection. It was found by calculation that skin effect in the conductors as run through the tower was negligible.

RESULTS OF TESTS

The final results of the tests are shown in the accompanying curves and are taken from the difference of the average measurements of the power input with direct current and alternating current under the various conditions. Curve A shows the tower loss with 60-cycle current and the turns aiding, this being the maximum loss. Curve B shows the loss with 60-cycle current and turns opposing.

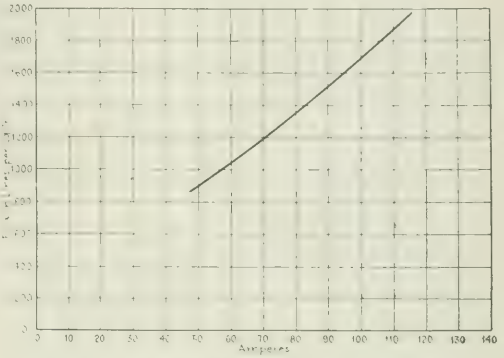



FIG. 4—TOWER MAGNETIZATION CURVE

Curve C is with 25 cycles and the turns aiding, the loss with turns opposing at this frequency being too small for measurement. With the total loss in the circuit measured to a precision of 0.4 per cent, the loss in the tower is known to about 4 per cent. The magnetization curve of the tower is also shown, the abscissas representing the line current measured and the ordinates the total lines of flux passing through the exploring coil. A large part of the magnetic circuit was air, but the reluctance of the air circuit is so large, compared with that of the steel circuit, that it was assumed that all the lines of flux pass through the steel members included in the exploring coil. With the effective three-phase current at 100 amp the permeability was tested and found to be 935, the field intensity being 0.286 lines per sq. cm.

A brief summary of the results is given in the accompanying table. On this basis the maximum tower loss in the three lines at 60 cycles would be 149 kw, or only 0.124 per cent of the total power transmitted. The actual system frequency is 50 cycles, which would reduce this under actual operating conditions. The tests indicate that the energy loss in the towers is more than offset by the advantages gained through their mechanical construction.

## Extensions to Edison "Soo" Plant

The Edison Sault Electric Company's water-power plant in the rapids at Sault Ste. Marie, Mich., a station which has figured in interesting government condemnation proceedings, is now being extended to the limit line of the future American locks, so that by replacing with larger units the four 450-kw generators now installed space will be provided for six 750-kw turbine sets. When the new extension is made a 750-kw alternating-current generator directly connected to an Allis-Chalmers vertical water turbine will be installed. The turbine unit will be rated at 900 maximum hp and 100 r.p.m., and the generator will operate in synchronism with the 4000-2300-volt machines now installed. Next spring changes are contemplated in the arrangement of the switching equipment. Energy from this station is furnished to the city of Sault Ste. Marie and to the government for operating the locks.

# Central-Station Energy for Chicago Railways

**Terms of the contracts between the Commonwealth Edison Company and the surface and elevated lines of Chicago—Economies effected in investment, generating, transmission, distribution and operating costs**

REVISED contracts, covering energy supply during the remaining life of the Chicago railway companies' franchises, have just been executed between the Commonwealth Edison Company on the one hand and the companies operating the elevated and surface railways of Chicago on the other. Under these contracts, as a result of the more efficient use of generating and distributing equipment provided for, energy will be furnished to net a lower price than before while at the same time more reliable service will be given.

The Commonwealth Edison Company has consistently maintained the position that it is uneconomical to supply the various energy needs of the same territory by means of more than one system of electrical transmission. For several years past the company has supplied all of the energy requirements of the Chicago City Railway surface system and part of those of the Chicago Railways (surface) and of the elevated railways. The railway portion of the output of the Edison company's power plants has thus rapidly increased until it is now 70 per cent of the total. These plants have been enlarged to care for the increased demand, while the few existing railway generating stations are being gradually put out of commission.

The Edison company has been supplying 25-cycle, three-phase energy at 900 volts pressure to substations owned and operated by the railway companies. In addition, it has operated substations in the same territory, transforming the high-voltage, three-phase alternating current into 4000-volt, three-phase form for distribution by the four-wire system, and to 2300 volts, single-phase, for distribution to lighting and industrial power circuits. The latter substations have been connected with the power plants by underground cables entirely distinct from the railway cables. The surface railway lines have also required transmission lines and substations separate from those of the elevated lines.

### Results of Present Duplication

The results of this duplication have been several. In the first place, an excessive number of expensive substations have been required. Second, and possibly more important, the load-factor of the cables has been low and the cost of cables and conduit correspondingly large. Third, the unnecessarily large number of cables has increased the tendency to electrolysis.

The new contracts, as their terms given in some detail in the following paragraphs will show, remove the necessity for this duplication. They are modifications of the contracts under which the railways have been operating for some years and have been framed not only with a view to greater efficiency under existing conditions but to provide the city with possible management by the city or its lessee. It is assumed further that at any time the steam railways having terminals in Chicago may electrify them and may desire to purchase energy from the lighting company. Hence the articles of the contracts are carefully worded to permit the company to use its generating and distributing equipment for all of these purposes if able to offer satisfactory prices for energy.

The first part of the amended contract with the Chicago Railways Company is taken up with a definition of the maximum demand which the Commonwealth Edison Company may be called upon to supply. As in the old contract, this maximum demand for any month is calculated from the heaviest hourly morning and evening loads on three consecutive days so selected as to yield a total energy consumption for the six hours greater than would be obtained as the total of the corresponding six hours on any other three consecutive days. The Edison company must be ready to supply a maximum demand of 20,000 kw or one equal to that established by the loads of previous months if they exceed 20,000 kw. To provide for the extra power required for heating cars in extremely cold weather, the "emergency energy" consumed when the temperature of the air is at or below 15 deg. Fahr. is excluded in determining the maximum demand.

The second part of the contract covers the scale of prices for energy. This, as before, is made up of two parts, but a sliding scale is provided for both primary and secondary charges. These are shown in Tables I and II.

TABLE I—PRIMARY OR POWER CHARGE

| Maximum Demand | Primary Charge per Kw |
|---|---|
| First 30,000 kw | $1.25 |
| 30,000 to 60,000 kw | 1.00 |
| 60,000 to 90,000 kw | 0.917 |
| 90,000 to 120,000 kw | 0.875 |
| Above 120,000 kw | 0.833 |

These charges are subject to a correction for the price of coal. If during any two-year period the price of coal having a heating value equivalent to that of coal from mines in Central Illinois delivered at the storage yards of the Edison Company exceeds on the average $1.90 per ton, the railway company shall pay an extra charge to cover this excess. The correction in dollars is obtained by dividing by 1000 the number of kilowatt-hours delivered during the two-year period and multiplying this by the excess price of the coal. This calculation is obviously made on the basis of a payment by the railway company of 2 lb. of coal per kw-hr. That is:

$$\text{Excess cost of coal} = \frac{2 \times \text{kw-hr.}}{2000} \times \text{cost} - \$1.90.$$

TABLE II—SECONDARY OR ENERGY CHARGES

| Monthly Energy Consumption | Charge per Kw-hr in Fractions of a Cent |
|---|---|
| First 5,000,000 kw-hr | 0.400 |
| 5,000,000 to 10,000,000 kw-hr | 0.395 |
| 10,000,000 to 15,000,000 kw-hr | 0.390 |
| 15,000,000 to 20,000,000 kw-hr | 0.385 |
| 20,000,000 to 25,000,000 kw-hr | 0.380 |
| 25,000,000 to 30,000,000 kw-hr | 0.375 |
| 30,000,000 to 35,000,000 kw-hr | 0.370 |
| 35,000,000 to 40,000,000 kw-hr | 0.365 |
| Over 40,000,000 kw-hr | 0.360 |

On the other hand, if the cost of the coal is less than $1.40, the electric company is to pay to the railway company a sum calculated as described.

### Transmission and Distribution Economies

As so far described the new contract differs only in detail from its predecessor. The next feature, however, is designed to effect transmission and distribution economies and involves the joint use of substations by the two companies or the erection of substations by the lighting company alone. As at present, the railway company will own and operate at least a part of the required substations, but if there is in these ample space for the equipment required by the lighting company for its lighting or other business such equipment may be installed under terms mutually agreed upon. This equipment may include rotary converters for 600-volt service, and the Edison company agrees that if it has available capacity in the transforming equipment it will sell direct-current energy to the railway company for use in the vicinity of the substations. The Edison company further agrees to install substations where needed or required and to sell direct-current energy under the same general terms as alternating-current energy, with an additional charge for conversion and for a share of the cost of maintaining the substation based upon the proportion of its output used by the railway company.

The advantages gained by the new arrangement are partly these: From one substation it will be possible to supply service for all purposes, including railway energy for different companies occupying the same territory. For example, the elevated and the surface roads which now have separate systems of substations can be supplied from one system, thus greatly reducing the number of substations required. A reduction in number of substations renders the transmission systems simpler and thus more reliable and at the same time cuts down the transmission cost.

The railway company has agreed to generate no electrical energy during the period from Nov. 1, 1914, to Jan. 31, 1924, but reserves the right to do so after that date. In resuming generation, however, it is provided that Edison service shall be used in such amount as shall insure an average monthly load equal to 35 per cent of the amount which the lighting company must, under the contract, stand ready to supply.

The new contract differs from the old one in that the energy will be metered in alternating-current form at the high-tension terminals of the transformers in cases where the railway company operates the rotary converters, and otherwise at the points where service is delivered to the direct-current feeders.

### Provisions in Event of Consolidation

Looking forward to a possible consolidation of the railway systems of the city, the contract provides a new maximum scale of charges for use in such a contingency. These are similar to the ones already tabulated except that the rates apply to different ranges of consumption as follows: Primary charge, $1.25 per kw. up to 75,000 kw; $1, excess to 150,000 kw; $0.91, excess to 225,000 kw; $0.875, excess to 300,000 kw; $0.833, excess above 300,000 kw. The accompanying secondary charges are 0.4 cent up to 12,500,000 kw-hr. per month; 0.395 cent for excess to 25,000,000 kw-hr.; 0.390 cent for excess to 37,500,000 kw-hr.; 0.385 cent for excess to 50,000,000 kw-hr.; 0.380 cent for excess to 62,500,000 kw-hr.; 0.375 cent for excess to 62,500,000 kw-hr.; 0.375 cent for excess to 75,000,000 kw-hr.; 0.370 cent for excess to 87,500,000 kw-hr.; 0.365 cent for excess to 100,000,000 kw-hr., and 0.360 cent for excess above 100,000,000 kw-hr.

The remaining features of the contract involve provisions for arbitration in case of dispute as to service and charges, method of measuring and checking all physical quantities upon which charges are based, notification of proposed changes in demand for power on the one part and of ability to supply power in excess of contract stipulations on the other, and other details necessary to the satisfactory operation of the agreement.

The new contract has been in force for several months but has just been made public. The operation is very satisfactory and is already resulting in marked economies in construction and operation of substations.

### Chicago City Railway and Elevated Contracts

The Chicago City Railway Company has used Edison energy exclusively for nearly five years. Its original contract covered a five-year period. The new contract is, therefore, in the nature of a renewal. The railway company, however, obtains a better rate for energy and, by agreeing to the joint use of substations, co-operates in securing the economies already described. The terms of the contract are virtually the same as those of the Chicago Railways' contract.

The Commonwealth Edison Company has supplied an increasing proportion of the energy required by the five elevated railways, but the railway companies, having several power plants of varying degrees of excellence, have continued to operate the most economical of these in order to keep down the service charges and to insure an extra source of energy supply. They have now, however, agreed to take the entire supply from the lighting company for a term of twenty-five years. The principal feature in which the elevated contracts differ from the others is the provision made for the leasing by the Edison company of all power plants and substations at rentals so graduated as to cover natural depreciation of buildings and equipment. By thus controlling all of the electrical equipment the electric company will be able to operate the steam plants or not as may prove more economical, and can utilize the substations in the general distribution scheme already outlined.

### Working Conditions of Agreement

In the operation of the power plants and substations the lighting company agrees to maintain the equipment in good running order and to pay the taxes assessed against the property. The railway companies are to supply coal-handling and ash-handling service for the power plants, for which service a reasonable charge is to be made. The railway companies guarantee, however, that the cost of such service and of maintaining a satisfactory supply of water for condensing purposes shall not exceed these costs at the beginning of the contracts. The lighting company has the option of purchasing the power plants, substations and equipment on a scale of prices graduated according to years and allowing for depreciation, but at the same time either party may release the generating stations from the lease.

The electric company also gains the right to install wires and cables upon the elevated structures, with the necessary poles and cross-arms, provided that these do not interfere with the use of the structures for railway purposes.

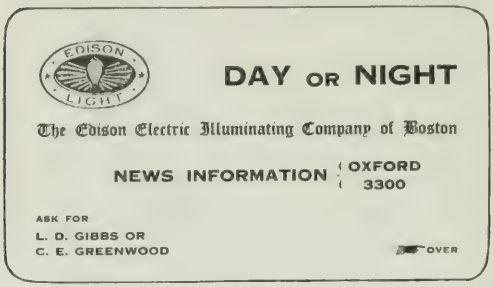
The Edison company is to furnish direct-current energy at 600 volts, and as the original contract was drawn in terms of alternating-current energy, the alternating-current equivalent of the direct-current energy is calculated on the basis of transformation efficiency at 93 per cent. The following additional charges are made for transformation: Primary charges, 30 cents per kw-hr. up to and including 10,000 kw; 26 cents for the excess between 10,000 kw and 20,000 kw, and 23 cents for the excess over 20,000 kw. The railway companies also pay a proportional share of the cost of operating the substation and an energy charge of 0.025 cent per kw-hr. for all energy delivered. They also agree to take a limited amount of energy in direct-current form at the generating stations; for example, the Metropolitan West Side Railway takes not to exceed 10,000 kw.

# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Central-Station "News Card"

To facilitate the supply of prompt and reliable information about happenings of popular interest on its system, the Boston Edison company has furnished its superintendent of advertising and the editor of its monthly publication, *Edison Life*, with cards emphasizing the readiness of these men to respond to press inquiries at all hours. On one side is given the company's telephone number and




"NEWS CARD" OF BOSTON EDISON COMPANY

on the other is a small map of the 700 sq. miles of territory served by the distribution system. These cards are given to local newspaper correspondents and other persons likely to be interested. In case of any event of electrical concern in any of the forty municipalities covered by the company in and about Greater Boston, reference to the card shows at a glance the exact relation of the place to the rest of the territory, checking the extent of the system for the newspaper man's convenience. The cards also carry the company's recently adopted motto, "Public service for public comfort."

## Electric Truck an Adjunct to Appliance Campaign

The Denver Gas & Electric Light Company is continuing to popularize electric vehicles in its city by co-operating with dealers and helping manufacturers to introduce their products. Three or four electric commercial trucks are now available for demonstrating purposes, and the electric vehicle department of the company has induced the manufacturer of a moderate-priced electric truck to establish an agency in the city Practising in earnest its own doctrines, the electric-service company is also gradually providing its salesmen with electric cars.

Twenty-four electric trucks are being used by the company, one of which has recently been enlisted in a special delivery service. In the morning the truck is used to distribute appliances for customers' trial. During the afternoon the same wagon and its driver are turned over for the use of one of the salesmen who visits residences of customers where appliances have been left on trial. Sales are made in 75 per cent to 90 per cent of the cases of devices left on approval, it is asserted, and the remainder are brought back to the company's office on the truck. Besides saving considerably on the customary livery bill for collecting unsold appliances, the company advertises its services by displaying placards on the vehicles and also demonstrates the utility of the electric truck.

## Two-Cent Rate for Electric Cooking at Jacksonville, Fla.

The trustees of the Jacksonville (Fla.) municipal plant have announced a rate of 2 cents per kw-hr. for all electricity used for cooking and heating purposes. The step was taken to develop day load for the generating station, and the use of electric stoves, ranges, cooking devices and luminous radiators will be encouraged. In premises already equipped for electric lighting no extra charge will be made for running the special heating circuit. At the 2-cent rate the local management estimates that the average household cooking bill will amount to less than $2 per month.

## Trial Irrigation Pumping in Nebraska

The McCook (Neb.) Electric Company has installed an electrically operated pumping equipment on the County Poor Farm at Red Willow, Neb., to demonstrate the practicability of electric irrigation locally. The idea has prevailed that the underflow in this vicinity is insufficient for irrigation, but through the successful operation of this trial equipment it is hoped to change this opinion. The electric service company is also negotiating with the municipality of Red Willow and with the Burlington railroad to furnish energy for pumping the water used by them.

## Energy Costs in Electrically Operated Brickyards

In motor-driven brickyards the cost of production varies with the character of the clay used as the basis of the product, more power being required to grind some clays than others. In the accompanying table are given data on energy consumption and unit costs of production taken from tests made in the Connellsville region in Pennsylvania and in the Ohio Valley district near East Liverpool.

ENERGY CONSUMPTION AND UNIT COSTS

| | Kw-hr. per 1000 Bricks | Cost in Cents per 1000 Bricks |
|---|---|---|
| Connellsville region | 18 | 27 |
| Upper Ohio Valley district | 28 | 42 |

In these regions, where basic clay of the proper sort is found, the brick-making industry furnishes an attractive load for the electric-service companies. Owing to the hours of work in the brick plants the majority of the machinery is off the mains by 4:30 p. m. before the central station lighting peak is on. This business, however, has not come to the central-station unsolicited, for the motor service salesman has active competition to meet. As the price of natural gas for power purposes in these regions

ranges from 12 cents to 30 cents per 1000 cu. ft., prospective electric customers must be shown complete and convincing cost data before they will contract for motor drive.

## Electric Trucks in "Hurry-Up" Service

Among the fields in which electric vehicles are making decided inroads upon gasoline cars are such "hurry-up" services as those of hospital ambulances, police patrol wagons and fire engines.

Nine New York City hospitals now use electric ambulances and report satisfaction with these noiseless, reliable cars. Police patrol wagons and fire engines operated by electric energy are also giving highly successful service in a number of cities.

An interesting record was recently kept of an electric fire engine in service in Brooklyn. This machine went into operation in April, 1912, and during the first year it answered 319 alarms. Its operating cost for the twelve months was $188.74, compared with $549.28, which had been the cost of maintaining horses for this service during a corresponding period.

## A Co-operative Cold-Weather Window Display

Mr. J. Hartshorn, lighting contract agent for the Youngstown (Ohio) Consolidated Gas & Electric Company, has conceived the idea of putting something more in a



WINDOW DISPLAY AT YOUNGSTOWN, OHIO

window display than electrical appliances. Securing the co-operation of a local furniture dealer, the electric-service company borrowed a complete bedroom set and fitted up a model bedchamber, including all electrical appliances suitable for such a room. During the chilly days the luminous radiator and the electric bed-warming pad occupied prominent positions. The presence of furniture in the window of the electric shop caught the eyes even of those who pass the window many times every day. A neatly lettered placard in the foreground of the window gave the name of the merchant who had loaned the furniture for the display.

## Refrigeration Development at Springfield, Mass.

The United Electric Light Company of Springfield, Mass., has installed 121.5 hp in motor-driven refrigerating apparatus since May 1 and now has on its lines a total connected refrigerating load of 459 hp. Twenty-eight customers are using this service, the individual plants ranging in size from 3 hp to 70 hp. Seven installations are rated at 20 hp or over each. The average rate is from 2 to 3 cents per kw-hr. on the regular power schedule. The company has not found it necessary to offer any off-peak rates for this business because the merchants served so far prefer to use their equipments at any time. The majority of the installations are equipped with automatic starting and stopping apparatus. Mr. Walter L. Mulligan, general manager of the company, reports the testimony of customers indicating a saving of 40 to 50 per cent of their former ice bills.

## Electric Motor Drive in a Stationery Factory

In the accompanying illustrations are shown some of the striking features of electric motor drive as applied to the machinery of a large stationery manufacturing plant, based upon a recent critical examination of the establishment from the efficiency standpoint.

Fig. 1 shows the method of driving a ruling machine by

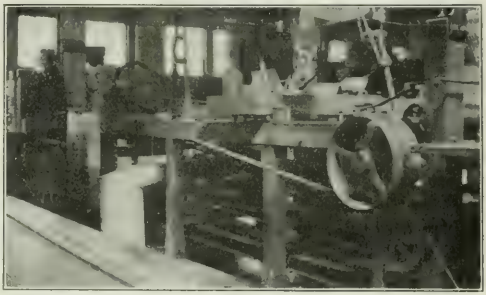


FIG. 1—RULING MACHINE DRIVEN BY VARIABLE-SPEED MOTOR

a variable-speed direct-current motor mounted on the top of the frame. The main shaft of the machine is connected with the motor pulley by a long belt, an idler being used to take up the slack and provide automatic adjustment of the belt tension. The drive is somewhat below the best standards of practice on account of the length of the belt, the

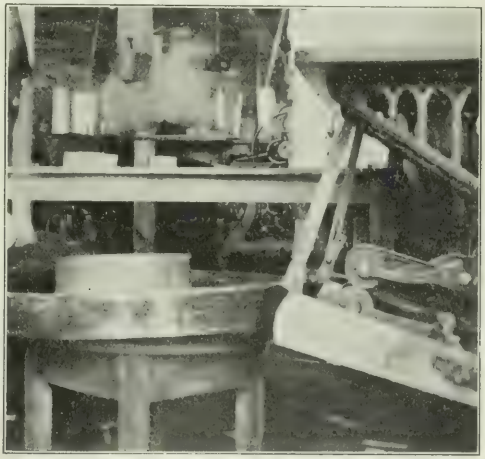


FIG. 2—MOTOR-DRIVEN CARD CONVEYOR

location of the motor far above the center of gravity of the machine and the absence of cross-bracing in the machine framing. Upon examination it was found that the vibration was too great for the best service. The unprotected belt also parallels a main aisle and is a source of danger at the machine pulley. It was considered advisable to install braces of iron rods, to place the motor near the main

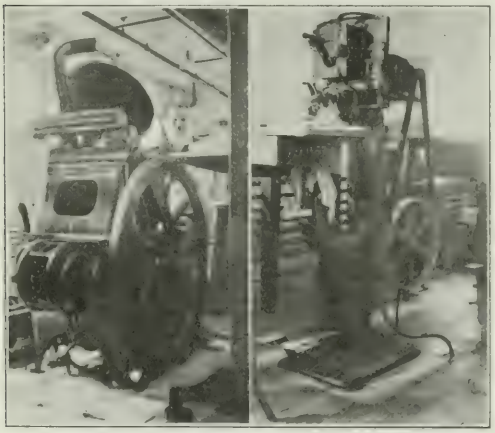
shaft on a suitable bracket and to provide for silent-chain drive with protection against injury to persons or clothing in the form of a chain guard.

In Fig. 2 a convenient receptacle for ruled cards is shown. As the cards are fed from the ruling machine by a motor-driven belt conveyor, they are discharged into a pivoted circular tray about 3 ft. in diameter, the tray being swung around to the packing operator's chair as the cards are needed. The arrangement saves piling the cards roughly in a box or basket, preserves the edges of the stock, minimizes the handling and enables cards to be piled by the operator in convenient numbers without the distraction of being obliged to seize the cards as fast as they fall from the belt conveyor.



FIG. 3—PRINTING AND STRIKING MACHINE

The protection of the operator against possible injury through gearing operation is shown in Fig. 3, illustrating a printing and striking machine driven by a small motor. Examination of the gears is easily accomplished by unlatching the gear-guard casing, which is hinged at the end, and which also contains a slot by which the setting of the gears can be altered when the machine is required for striking service in connection with the inscribing of emphasis lines on the cards. Although this is a mechanical detail not directly related to the motor drive, it is a useful feature of the installation and is a safeguard of no small importance under the conditions of forced production which prevail in the plant.



FIGS. 4 AND 5—FRICTION DRIVE OF PRESS AND MOTOR DRIVEN NUMBERING MACHINE

The convenience of motor drive is well shown in Fig. 4, which illustrates a Golding press in the plant driven by friction from a belt carried along an arc of the flywheel. The location of the motor above the floor by bolting it to the press frame renders the installation compact and facilitates cleaning under and around the machine. Complete adjustment of the belt drive is accomplished at the idler shown in the lower portion of the view. The wiring is loose and open to criticism, and the obvious recommendation was the use of conduit or flexible metal tubing from the floor outlet to the motor bushings.

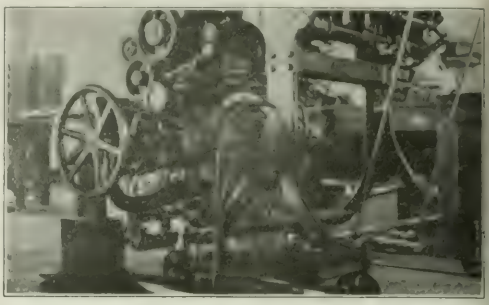


FIG. 6—COMPACT MOTOR DRIVE OF AUTOMATIC PRESS

Fig. 5 shows the compactness of the motor drive on a numbering machine in the factory. In this instance the question of vibration is unimportant, and as the machine has a metal frame with a large bedplate, there was no disadvantage in installing the motor and its controlling panel, with rheostat, on the upper portion of the machine. Useful aisle space is not sacrificed in this arrangement, as the belt drive between the motor pulley and the pulley on the main shaft of the equipment is carried inside the working table through a slot cut in the operating plane. The wiring is also carried in conduit from the floor outlet to the fuses on the machine panel. The motor may be started and stopped and the machine controlled by the operator without moving from her position on a stool in front of the machine, and the arrangement is one of the utmost convenience.

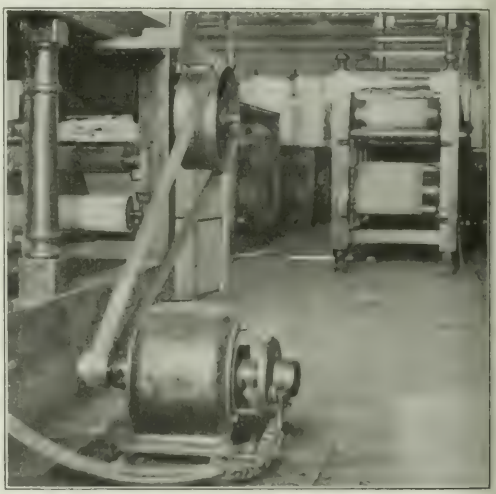


FIG. 7—IMPROPER LOCATION OF MOTOR DRIVING RULING MACHINE

The remarkable compactness of a well-designed motor

ve for individual service is shown in Fig. 6, where a p motor inside the frame of a 5-in. by 18-in. Harris omatic press operates the equipment without the sacri- of a single square inch of floor space that could be used any productive purpose. In this case an extremely rt belt is used and the speed reduction between the tor and the main shaft is small. The use of conduit

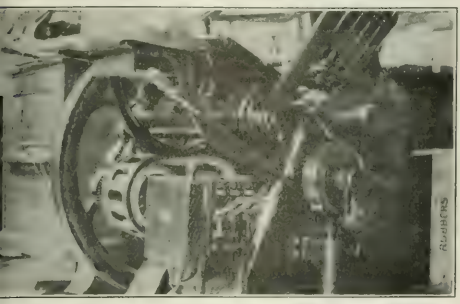


FIG. 8—PRESS DRIVEN BY 0.5-HP MOTOR

mits the 550-volt, three-phase service to be carried safely ough the machine frame to the motor switch, and the tor design provides for throwing the current directly n the rotor and fields without resistance or a compen- r, thus making the drive completely self-contained. e installation of the starting switch so that the blades downward and open, in case of gravity action, is an- er useful point which avoids the danger of sudden start- , and the location of the switch inside the frame safe- rds the circuit from closure by chance contact of the tch with the clothing or the hand of a passing ployee.

n Fig. 7 a faulty installation is shown of a motor driving o-called "faint-line" machine. The motor is located he aisle in a way that consumes valuable space and in- feres with free movement on the part of the employees, the wiring is crude and unprotected. In this instance ppeared undesirable to place the motor on a bracket at- ned to the wooden frame of the ruling machine, and the icated procedure for recommendation was therefore the ption of a short, silent-chain drive, with the motor im- liately under the main pulley, coupled with the use of

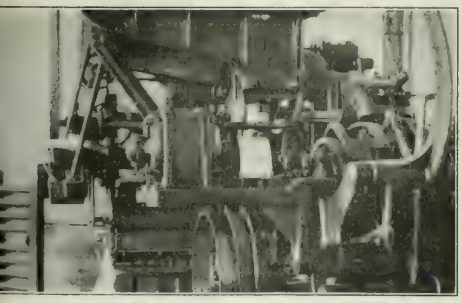


FIG. 9—LINOTYPE DRIVE THROUGH IDLER GEAR

duit in installing the final run of wires to the motor minals.

Another compact drive is shown in Fig. 8, which illus- es a 10-in. by 15-in. Prouty press in the plant driven by ½-hp motor. The provision of a hand guard over the tor pinion, means of ventilating the starting box by per- ations in the cover, and the use of a mechanical clutch, ilitating quick starts and stops, are the notable features. The consumption of power is also reduced by the use of a large flywheel, the motor supplying merely the energy required to maintain even rotation under moderate load conditions.

Figs. 9 and 10 illustrate recent progress in the application of motors to linotype machines in the printing section of the factory. In Fig. 9 the motor had to be mounted on a bracket high enough to clear the main pulley, and this necessitated the introduction of an idler gear between the motor gear and the gear on the main shaft. With this exception the drive accords with good practice, but in Fig. 10 a decided improvement is shown. Both motors are of 0.25-hp rating, but in the second case the motor was designed specially for linotype operation and occupies only about one-half the width on the machine required by the motor shown in Fig. 9. In the newer drive the motor was built with its pinion mounted on the shaft between the rotor and the outboard bearing, the gearing being protected by a shell attached to the motor frame and the bearing being carried by the shell. A home-made gear guard is effectively employed in Fig. 9, but in Fig. 10 the use of the shell as the guard for the gearing and for the support of the outboard bearing represents a decided advance in practice. The newer drive is more efficient, as one gear is omitted, and its

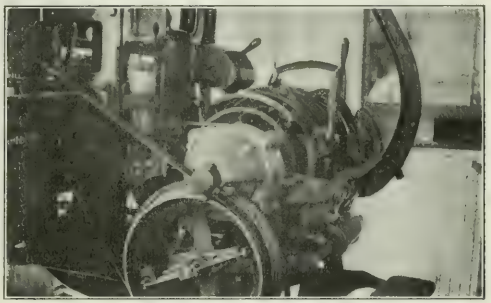


FIG. 10—DIRECT-GEARED DRIVE OF LINOTYPE WITH GUARD

increased compactness shows to what refinements it is still possible to carry motor designing.

## Motor-Driven Feed Cutter Saves Liveryman $170 a Month

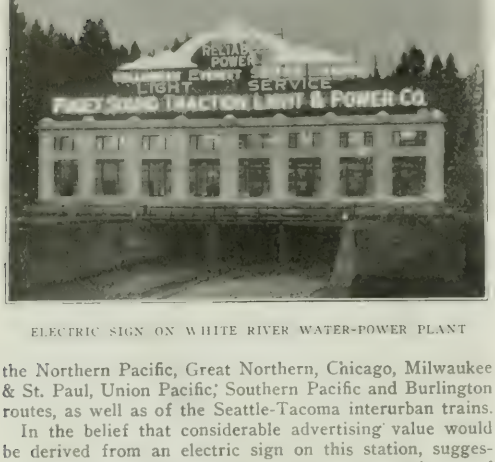
A progressive liveryman in Warren, Ohio, owning thirty driving horses is said to be saving $170 on each monthly feed bill since he installed an outfit for "predigesting" the food given to his stock. The apparatus consists of a 9-in. hay cutter driven by a 3-hp motor, a 12-hp boiler for steaming the food and a mixing vat. The total cost of the apparatus was $200 and the average monthly cost of operation is $10.

On the theory that chopped food is easier to digest and that practically all sustenance available is thus taken from the portions eaten, the amount of hay fed to these animals has been reduced 88 per cent, it is asserted, while the rations of oats and corn have been decreased 40 per cent, according to the report. Comparison of previous feed bills with those of the present dietary scheme, allowing for the cost of operating the chopping and steaming apparatus, shows an average monthly saving of $170, if the figures available are correct. The horses are doing the same daily work required of them under the former feeding conditions and no falling off in weight has been noticed. The plan has been in operation about two months—long enough to warrant the liveryman in counting the gains afforded him by its use.

# Illumination and Wiring

## A Huge Power-House Electric Sign

The White River hydroelectric station of the Puget Sound Traction, Light & Power Company is situated at Dieringer, Wash., 28 miles from Seattle and 13 miles from Tacoma, in plain view of passing transcontinental trains of




ELECTRIC SIGN ON WHITE RIVER WATER-POWER PLANT

the Northern Pacific, Great Northern, Chicago, Milwaukee & St. Paul, Union Pacific, Southern Pacific and Burlington routes, as well as of the Seattle-Tacoma interurban trains.

In the belief that considerable advertising value would be derived from an electric sign on this station, suggestions for such a display were requested from employees of the company, and of the many designs submitted the one by Mr. W. N. Gordanier, superintendent of the company's Electron power plant, was selected. As first proposed, the names of the cities shown were placed in geographical order from south to north, but later Mr. A. W. Leonard, general manager of the company, suggested rearranging them in the reverse order from north to south, so that the initials of the names would spell the word "Best" when all the other letters in the names were turned out, thus leaving the sign to read "Reliable Power"—"Best Light Service." The letters in these words are in red, and the remaining letters in each name come on by cities until the names are spelled out in full. The waterfall, as well as the boiling effect of the water at the bottom of the falls, is both realistic and beautiful.

The sign is 200 ft. long and 54 ft. high. It contains 4000 30-watt carbon lamps arranged in ninety-six letters, the largest of which is 8 ft. high. The sign has a total connected load of 120 kw, and its steel work alone weighs 18 tons.

## Wiring Ordinance to Prevent Theft of Electricity

An ordinance recently passed by the City Council of Fort Wayne, Ind., prescribes methods for all future wiring construction and specifies positions for meter settings with a view to preventing the theft of electricity which has been prevalent in the past. The ordinance requires that all wiring shall conform to the standards of the National Electrical Code, and in addition demands that all service wires shall be inclosed in approved conduit from the point of entrance to the meter centers. If the meter is installed on the exterior of the building, the service wires shall, according to the ordinance, be inclosed in conduit placed on the walls of the building.

A clause relating to the setting of electric meters recommends that preferably all meters shall be placed on the outside of the building and that in no case shall they be above the first floor. It is further provided that all meter centers shall be placed ahead of the main-line switch and branch blocks where service wires are protected by a fused cut-out.

The hope is expressed by the local central-station company that the extensive use of inclosed wiring and also of protective meter panels will reduce losses from theft of electricity.

## Ornamental Street Lighting in Hiawatha, Kan.

By H. S. Woods

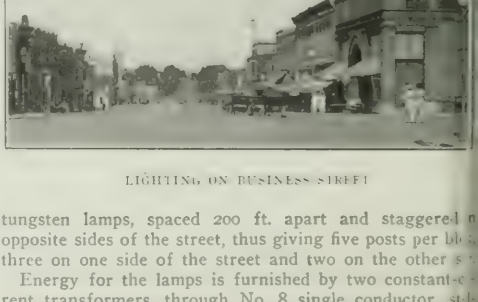
Hiawatha, Kan., is a town of 3500 people situated in the farming section in the northeastern part of the State. It has two electric-light plants, one a private corporation furnishing energy for industrial and private uses, and the other a municipal plant supplying energy only for street lighting purposes and for operating the city water-works.

The feature of the street lighting is the large amount of it that is done by series tungsten lamps, mounted on ornamental iron posts, both on the main streets and in the residence portion of the town.

Until two years ago the streets were lighted by series direct-current, inclosed carbon arc lamps, operated from an arc machine. At that time the first contract for street paving was let, and, needing additional street-lighting equipment, Mr. V. L. Dawson, superintendent, replaced the inclosed arc system with a fifty-lamp mercury rectifier set, including lamps, and installed the first part of the series tungsten lighting system that has spread all over the city as fast as the paving has been extended.

As soon as the present contracts are completed the city will have 5½ miles of pavement and 315 ornamental posts. The posts are manufactured in Hiawatha, being made up of a 30-in. ornamental cast base, a 48-in. section of 3-in. iron pipe and a 60-in. section of 2½-in. iron pipe joined by reducers, on top of which is mounted the holder for the socket and inclosing globe. The base of this globe is 12 ft. above the sidewalk. A 14-in. Alba globe is used with the 100-cp, 6.6-amp lamps used on the business streets and the 12-in. Alba globe with the 60-cp lamps in the residence districts.

On the business streets forty-eight posts with 100-cp 6.6-amp series lamps are used, eight posts being placed per block, four on each side of the street. In the residence districts there are 267 posts, with 60-cp, 6.6-amp series



LIGHTING ON BUSINESS STREET

tungsten lamps, spaced 200 ft. apart and staggered on opposite sides of the street, thus giving five posts per block, three on one side of the street and two on the other side.

Energy for the lamps is furnished by two constant-current transformers, through No. 8 single conductor, steel-taped cable, known as C. L. A. I. finished, some having rubber insulation and some varnished cambric. A total

boo ft. has been used. In the business section the cable laid under the pavement; in the residence section, where paving is 30 ft. wide, generally, the streets being boule-rded, the cable is laid in the dirt, just inside the curb-nes. The cable is run up in the posts to the sockets.



ORNAMENTAL LIGHTING IN RESIDENTIAL DISTRICT

Half of this system has been in service more than a ar, and the citizens have been so well pleased with its

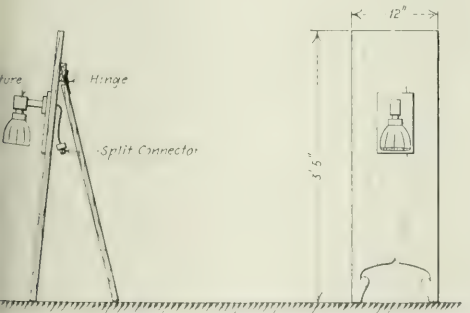
DATA ON HIAWATHA POSTS

| | |
|---|---|
| t of bare posts, each | $12.00 |
| t set up (including lamp, socket, inclosing globe, concrete base or foundation, and labor), each | 15.00 |
| rage cost of cable, per 1000 ft | 100.00 |
| t of laying cable in business section, per 1000 ft | 20.00 |
| t of laying cable in residence section, per 1000 ft | 10.00 |
| roximate average life of lamps | 1400 hr. |

amental appearance and illuminating value that they ve insisted upon its being extended wherever paving has n done, with the result that Hiawatha is one of the t lighted cities, of its size, in the State.

## Portable Display Panels for Wall Fixtures

Portable panels for exhibiting electric wall fixtures are ng used to advantage in the salesrooms of the Com-nwealth Power Company, Jackson, Mich. Fixtures dis-yed on these panels are shown to better advantage




PORTABLE DISPLAY PANEL FOR FIXTURES

n when grouped on the walls of the display room. In lition, the prospective purchaser may be seated while different types of fixtures are being exhibited.

The panels are inexpensive, being made of yellow pine ich is stained and grained to resemble oak. The ac-npanying illustration shows the construction of a panel l the method of mounting and connecting the lamp fix-ture so that it may be lighted while being displayed. The panel measures 12 in. wide and 41 in. high and is supported in an upright position by a leg hinged to the back. By using a flexible cable and a split-plug connector the lighted fixture may be exhibited in several positions. Mr. C. L. Falkinburg, who is in charge of the appliance sales department, devised this method of displaying fixtures and reports that by using the panels the company has sold many fixtures which had been in stock for a long time. The cost of material, labor and finish for eighteen of these panels amounted to $10 and the results obtained from their use are more than gratifying.

## Maintaining Alignment After Moving Corner Pole

When to facilitate reconstruction the telephone company's corner pole shown in the illustration was erected at a position about 4 ft. to the right of the site of the former pole on this corner, the electric-lighting lead which had occupied an auxiliary cross-arm at the top of the old pole was thrown out of line. An energetic lineman, however, with a desire for straight-line symmetry moved the small arm with its support to the end of the main arms of the new pole. The upright piece used consists of a standard 10-



SPECIAL CROSS-ARM FOR MAINTAINING ALIGNMENT

pin fir cross-arm. It is bolted to the telephone cross-arms by means of the space bolts used for holding the double arms in position. The construction was inexpensive and serves admirably.

## Ornamental Luminous-Arc System for Worcester Mass.

Plans are nearly completed for the installation of 300 ornamental luminous-arc lamps of 6.6-amp rating on the principal business streets of Worcester, Mass., the local merchants' associations having reached an understanding as to the type of illumination desired. Tentative agreements with the Worcester Electric Light Company have been discussed as to prices for service, and it has been figured that about 2.6 lb. of coal will be required at the company's plant for every kilowatt-hour delivered at the lamp: Fuel costs about 40 cents per ton more in Worcester than in adjacent seaport cities, and this factor is being considered by the company and the lighting committee of the City Council in arranging rates. A two-circuit installation will probably be made to enable half the lamps to be cut out at midnight. It is expected that the price to be paid by the city per ornamental lamp per year will not exceed the present unit cost of 4.4-amp all-night magnetite lamp service.

## The Eye as a Judge of Uniform Illumination

By J. R. Cravath

Although it is commonly known to illuminating experts that the eye cannot readily judge small differences in any illumination when the surfaces illuminated at different intensities are not close enough together for the contrast to be evident, yet it is doubtful whether even experts fully appreciate how great differences in illumination will be passed upon by the casual observer as being practically uniform. For this reason it is believed that some of the test results outlined below will prove of peculiar interest as showing how far from uniform the illumination may be and nevertheless be considered uniform by the ordinary observer.

Dearborn Street, Chicago, to the ordinary observer, at night has nearly uniform illumination on its street surfaces. The lighting of this street is by flame-arc lamps of the type now standard for Chicago street lighting, having vertical electrodes. There is one arc lamp on each electric-railway pole hung on a bracket extension on the top of each pole, so that the arc is about 25 ft. above the street level. The poles are placed from 110 ft. to 125 ft. apart along each curb. The street is 80 ft. wide. The unusual height of these lamps and their broad distribution of light give the general effect of a uniformly illuminated street surface. Another casual test for uniformity made by the writer was that of looking at the street surface while standing in a street car passing along the street. The lamps themselves would then be invisible. By looking intently at the street surface as the car passed along the variation in brightness or the illumination of the street surface seemed very small.

After making these casual observations with the eye the facts were investigated by means of photometric measurement. The horizontal illumination determined with a Sharp-Millar photometer at five points aong the curb line showed a variation of fully ten to one in foot-candles between the points under the lamps and points midway between the lamps. This result brings out forcibly the inability of the eye to judge differences in illumination unless these differences are in contrast with each other side by side as in the case of sharp shadows. In the case just described the merging from 1 ft.-candle to about 0.1 ft.-candle midway between lamps is so gradual that no one but an expert woud detect it unless the attempt were made to read a newspaper or do similar close work with the eyes while passing along the street. The latter test would indicate considerable difference.

Another illustration of the inability of the eye to judge differences of illumination where there is a gradual merging from one degree of illumination to another is in the case of shadows with an indirect system of lighting. The writer once tested the relative density of the shadow cast by a person's head at a given distance from a desk top in a room lighted with a number of direct units and later in a room lighted with a similar number and location of indirect units. The point of maximum shadow was selected in each case. With the indirect system it was only after very close observation that the point of greatest shadow in the room could be found, as apparently there was very little shadow. With the direct system no difficulty was encountered in locating the point of greatest shadow. Nevertheless, photometric tests showed that with the indirect system the illumination at the middle of the shadow was reduced 45 per cent because of the shadow, while with the direct system the illumination was reduced 51 per cent because of the shadow. The pronounced character of the direct shadow as compared with the indirect was due therefore largely to the fact that the shadow with the direct system had a sharp edge while with the indirect system there was simply a gradual merging from the shadow to the edge, and the shadow was therefore indefinable.

The practical lesson of the above observations is that satisfactory illumination is not necessarily very uniform and the variations permissible are much greater then are usually thought. In planning illumination the avoidance of sharp or sudden contrasts will compensate for much lack of uniformity.

## A 32,000-Lamp Electric Sign for San Diego, Cal.

A permit has been issued by the San Diego (Cal.) building department for the erection of what it is said will be the largest electric sign in southern California. The display, which will contain 32,000 lamps, will be 48 ft. high and will be placed on the roof of the Josse Building. It will cost $10,000. Across the top in large letters will appear the slogan: "San Diego, First Port of Call," while the lower half of the sign will be devoted to flashing electric displays of business firms. Energy to light the sign will be furnished by the San Diego Consolidated Gas & Electric Company.

## Recent Telephone Patents

With central-energy signaling systems, where the battery is continuously connected across the line, any point of low insulation resistance manifests itself not only through waste of energy but also at times through electrolytic action. It is to obviate these conditions that Mr. G. A. Betulander, of Sweden, has developed a system in which the battery is connected to the lines only during actual use. The result is accomplished by providing the stations with hand generators, by means of which the energization of the battery control is effected.

Mr. E. R. Corwin, of Chicago, has patented a common battery system in which the connecting cord circuits are devoid of signal lamps, the calling and supervisory signals being produced at the line lamp. This lamp indicates the arrival of a call, the desire for disconnection, and also through the application of a special current, shows the existing condition of the circuits pending response of the called station. The cord circuits are further arranged so that the operator's set is connected and disconnected automatically as the occasion demands. Ringing is automatically accomplished and an audible, ringing signal is sent back to the calling party. Mr. Corwin has obtained a second patent and, in conjunction with Mr. C. A. Bals, of Chicago, a third patent, describing different arrangements for controlling the connection and disconnection of the operator and ringing current for similar automatic ringing-and-listening manual systems. All of these patents have been assigned to the Corwin Telephone Manufacturing Company.

Three other patents which have been granted to Mr. R. Corwin and assigned to the Corwin Telephone Manufacturing Company describe an intercommunicating private branch system, adapted for use with automatic exchange systems. With such a system it is necessary that each terminal of the intercommunicating system be capable of seleeing at will an exchange trunk line. It is further necessary that a special station, designated a receiving station, shall be able to answer any trunk line and hold this line while connected with one of the other stations. This arrangement involves the necessity for any station to hold at will a trunk line against interference by other stations, even though having disconnected itself momentarily from the trunk line.

The circuits and system described by Mr. Corwin provide for these necessary features and for the visual signals at the receiving station to indicate the condition of the various trunk lines. The system as described is equipped with a key bank at each intercommunicating station by the manipulation of which the user may carry out the various switching functions.

# Letters to the Editors

## The N. E. L. A. and Motor Service

*o the Editors of the Electrical World:*

SIRS:—Years ago, when the National Electric Light ssociation was young, illumination was properly the chief opic for consideration and discussion. At the present time, owever, in many of the large systems electric light is a y-product and motor service is the chief source of income, s Mr. Samuel Insull has recently pointed out. So inter-oven are the problems of generation, transmission and tilization of electric energy that they must be considered oncurrently. The utilization of electricity for lighting is ell reflected in the activities of the National Electric Light ssociation, but motor service and motor application are elatively ignored, although the possibilities along the line f the correct application of electric motors in the various ndustries seem almost limitless with reference to the in-reased sale of energy from central stations.

In spite of its name, which might appear to limit its ctivities, the National Electric Light Association could ell pay a greatly increased amount of attention to the ubject of motor service by encouraging the presentation nd discussion of papers on the subject and arranging for arge exhibits of motor-driven machinery. It certainly does ot seem unreasonable to hope that such an exhibit would ome to be the Mecca to which would go annually many of he persons interested in the use of the electric motor in nanufacturing operations. With the rapid increase in the se of purchased energy, the National Electric Light Asso-iation seems the proper organization to take the initiative n establishing recognized headquarters for the considera-ion and exhibition of electric motors operating all kinds f machinery.

*Cleveland, Ohio.* H. F. STRATTON.

[In response to our request for his comments on the bove subject Mr. Joseph B. McCall, president of the National Electric Light Association, has sent us the letter printed below.—EDS.]

*To the Editors of the Electrical World:*

SIRS:—To anyone familiar with the central-station in-dustry in this country, or who has made a close study of he tendencies of the time, as evidenced by modern manu-facturing methods, efficient factory practice, etc., it comes somewhat as a shock to be asked why the utilization of elec-tricity for motor service is being relatively ignored by the central-station interests.

It is true, as pointed out in my address before the Penn-sylvania Electric Association, that in the early days our business was primarily that of furnishing electric illumina-tion. Electric power, even after it was found to be practi-cable and desirable, was looked upon for the moment as a by-product for a few years. We had to grow a little be-fore developing our business in a well-rounded manner. We built up the lighting load as rapidly as possible, and then began the effort to secure the very valuable power load, especially what might be termed the large wholesale user.

Increasingly more attention is being given by all central stations in the country to the matter of building up a motor load. Thousands of electrical horse-power are being added daily to the circuits of the various stations throughout the country. All the larger companies specialize in their efforts to increase the motor load, in which they have been ably aided and abetted by the manufacturers, so that to-day the factory which does not employ the electric motor for group or individual drive is considered out of date, even though that factory is not obtaining energy from the central station.

Many of us, also, are reaching out into fields heretofore considered outside of our province, and we are acquiring a railway load which in the earlier days was not dreamed of. As a proof that neither the central-station industry nor the National Electric Light Association, which represents the best thought of all those interested in the central-station industry, is neglecting the importance of the motor load, it is only necessary to quote statistics which show that while the central-station income from commercial lighting has increased 226 per cent during the past ten years, the income from the industrial power load has increased by 764 per cent.

A state or sectional convention never takes place which does not include papers on electric motor applications, and assuredly this subject will always maintain its proper place in our convention programs. J. B. MCCALL,

*Philadelphia, Pa.* *President N. E. L. A.*

## Diversity-Factor and Load-Factor

*To the Editors of the Electrical World:*

SIRS:—In your issue of Nov. 8 in reply to a request for a definition of diversity-factor you give the ratio as the reciprocal of that given by the American Institute of Electrical Engineers. Under Section G, "Definition and Explanation of Terms of the Standardization Rules," is the following: "(11) Diversity-Factor. 51a. Diversity-factor is the ratio of the sum of the maximum power demands of the subdivisions of any system or part of a system to the maximum demand of the whole system or of the part of the system under consideration, measured at the point of supply."

It is probably a matter of opinion, but a factor which cannot exceed unity seems much more fitting than one that is always greater than unity.

In connection with "factors" and their definitions, is it not about time something was done toward getting load-factor more clearly established? The Institute in its standardization rules gives no definite time and only states: "The load-factor of a machine, plant or system is the ratio of the average power to the maximum power during a certain period of time." It would seem that only one time interval could be considered, namely, 8760 hours per year. Fixed charges, which are very closely related to load-factor, are considered as extending over every hour in the day, month or year and are independent of normal operating hours or actual running hours. Methods of measuring the maximum demand vary widely. Graphic instruments will approximate the momentary peak, but it is customary with some companies to integrate these records over periods varying from a few minutes to a half hour. Other instruments will measure a lagged demand, but the lagging is very variable. Some instruments have a straight-line lagging curve and hence a true average for the specified interval, while others have curves of a higher degree and varying time intervals. It seems a pretty poor "factor" that necessitates the statement of a number of conditions before its value can be given. Even after all the unknown quantities become known it is often necessary to convert them to another "system" in order that the result may have a comparative value. Operating reports at times show a generator load-factor of 100 per cent when the machine is in use for only one hour out of twenty-four, while motor-service data published by one of the large manufacturers of motors is based on the average and connected load, although there is little relation, in many installations, between the demand and the sum of the motor ratings.

*New London, Conn.* CECIL W. BROWN.

[Diversity-factor was defined on the percentage basis, used by us, in the report of the N. E. L. A. committee on terminology and printed on page 370, Vol. III, of the *Transactions* for 1912.—EDS.]

# Field of the Operating Engineer

**A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers**

## Cost Data on Electric Welding

Some interesting figures on the cost of electric welding and the time required for various jobs are shown in the accompanying table of data based on the experience of several leading railroads as reported to the shop-practice committee of the Association of Railway Electrical Engineers.

TIME AND COST OF REPAIRS BY ELECTRIC WELDING

| | |
|---|---|
| Steel casting, crack 6 in. long by 1 in. deep, eight minutes | $0.04 |
| Steel casting, riser 4 in. by 4 in. cut-off, four minutes | 0.05 |
| Forged-steel locomotive frame, two breaks, twenty hours | 18.28 |
| Crack 12 in. long in boiler back-sheet, nine hours | 5.47 |
| Cast-steel tender frame, three breaks, twenty-seven hours | 19.00 |
| Broken railway-type motor case, cast steel, three hours | 1.95 |
| Enlarged holes in brake levers, steel bars, four minutes | 0.05 |
| Air-brake piston rods, broken, thirty minutes | 0.35 |
| Cracked axle boxes, welded in place, fifteen minutes | 0.15 |

SAVINGS MADE BY REPAIRS INSTEAD OF REPLACEMENTS

| | |
|---|---|
| Armature shaft repaired in place, worn journals | $13.16 |
| Railway-motor axle cap, large, cracked | 3.29 |
| Railway-motor armature bearing cap, broken | 5.80 |
| Railway motor gear case, top half broken | 6.82 |
| Truck side frame, Brill 27-G, broken | 43.68 |
| Truck side frame, Peckham 14-B, broken | 46.08 |
| Motor frame, GE-90, railway type, cracked | 13.92 |

SAVINGS MADE BY ELECTRIC WELDING OVER OTHER PROCESS

| | |
|---|---|
| Engine main frames, both broken | $44.40 |
| Driving wheel built up on tread, 3/16 in. | 7.28 |
| General repairs on fire-box side sheets | 276.11 |
| Filling in worn knuckle-joint bushing hole | 6.75 |
| Locomotive cylinder casting, seven cracks | 344.50 |
| Broken mud ring on locomotive boiler | 85.00 |

In its own report presented before the recent Chicago convention, the committee pointed out its conclusion that welding by electricity is cheaper than by any other process, since electric welding requires only one-half the time and involves one-third of the expense of other methods. Proof that electric welding has passed beyond the experimental stage is furnished by the fact that about 1000 locomotives are to-day running on American railroads each with some electrically welded part.

## Coals of the United States

Much valuable information on the subject of the coals of the United States is contained in Bulletin No. 22, just issued by the Bureau of Mines, describing analyses of 5000 samples of coal taken from 1500 mines in various American fields. Pains have been taken to present reliable information regarding the chemical composition and heating value of the fuels, the samples having been collected by experienced men and analyzed under carefully controlled conditions.

An increasing proportion of the coal consumed in power stations is being purchased under specifications based on chemical and calorimetric analyses. In any particular market the choice of coal is generally limited by its quality and by freight rates to one or two fields in which the character of the coal bed is comparatively uniform. By having on hand a representative analysis of the coal from a given district, the engineer can "check up" whether the coal he receives comes from the bed and district stated and whether it is being prepared for the market as carefully as it should be. Wide variations in the composition and heating value of coals from different districts and from different beds make analyses that are comparable (because of the care taken in sampling and analyzing the coal) almost indispensable to engineers having to install boiler or gas-producer plants in different cities.

The report just issued by the Bureau of Mines is in two parts, one describing the methods used in collecting and analyzing the samples and the results of the analyses, and the other giving the exact location from which each sample of coal was taken, together with a description of the characteristic features of the coal bed at the point of sampling, the nominal capacity of the mine and such notes on the preparation of the coal as may be useful to consumers. The data contained in these two volumes have never been equaled in scope and detail or in value for comparative purposes by similar figures published by any other coal-producing country in the world.

Copies of this bulletin may be obtained by addressing the director of the Bureau of Mines, Washington, D. C.

## Installation of Oil Burners

By R. T. Strohm

When installing oil burners the piping should be provided with unions near the burners, to facilitate the work of

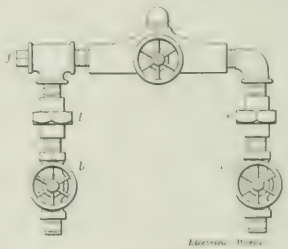


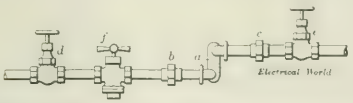

FIG. 1—PIPING FOR GEM OIL BURNER

taking them down when they must be repaired. This point is very clearly illustrated in Fig. 1, which shows the piping for a Gem burner *a*. The oil flows to the burner through the valve *b* and the connecting pipes, and the steam for atomizing is admitted through the valve *c* and the branch to which it is fitted. The unions *d* and *e* enable the burner to be detached from the system very easily and quickly. The plug *f*, when removed, allows the connection to be cleaned out. The valve *b* is closed, and a cap is placed over the end of the burner so that the steam will back up in the burner and blow back through the oil connection, cleaning it.

The pipe connections for a Best burner are shown in Fig. 2 in a diagrammatic way. The burner is located at *a* and the oil and steam lines are attached on opposite sides. There are unions *b* and *c* to facilitate the removal of the burner and stop valves *d* and *e* for oil and steam respectively. In addition, there is an oil-regulating cock *f*

tween the stop valve *d* and the burner, to enable the ow of oil to be regulated with great precision.

An end view and a vertical section of the regulating cock e shown in Fig. 3. It consists of a conical plug *a* that s a conical seat in the body *b* of the cock and that is ld snugly in place by the upward pressure of the spring The spring is kept in position by the extension *d* on the




IG. 2—PIPING TO BEST BURNER WITH OIL-REGULATING COCK

ottom of the plug and by the cap *e*. The latter can be nscrewed so as to allow the plug and the spring to be emoved from the body of the cock. The oil flows through triangular opening *f* in the plug. The opening is made riangular in form so as to insure close regulation of the il. The opening *g* in the body of the cock on the outlet ide of the plug is rectangular in shape and the outline of his opening is dotted around the opening in the plug. By irning the plug slowly, the amount by which the triangu- ar opening overlaps the edge of the rectangular outlet an be varied very gradually, thus giving close adjustment f the oil supply to the burner. The packing *h* around the tem of the plug is compressed under the screw cap *i* nd prevents leakage of oil around the stem.

The cock is opened fully or closed completely by giving he handle *j* a quarter turn. There is a lug *k* on the handle, nd it comes against a stop *l* cast on the body of the cock vhen the plug is turned to the closed position. Also, there s a knurled screw *m* in a bracket *n* fastened to the body f the cock. When the plug is turned to open the cock, he lug *o* comes against the point of the screw and the andle can be turned no farther. The screw can be ad- usted to give any desired amount of opening of the cock, nd the cock can be opened and set instantly to this posi- ion. The bracket *n* is hinged, and if the cock is to be pened to its full extent, the bracket is simply swung up- vard and backward, taking the stop screw *m* out of the vay of the lug *o*.

A form of valve for regulating the flow of oil with ex- reme nicety is shown partly in section in Fig. 4. The nner end of the valve stem carries a hollow cylinder *a* hat fits snugly in a circular hole in the seat *b*. In the ide of the cylinder is cut a triangular opening *c*, so that, vhen the stem is screwed out, the point of the triangular pening rises above the face *d* of the seat and allows the

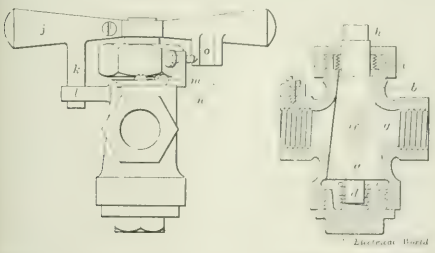


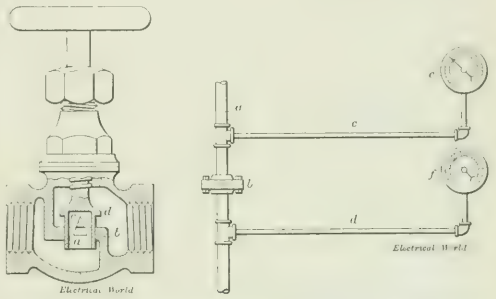

FIG. 3—COCK FOR REGULATING OIL SUPPLY TO BURNER

il to pass through. The higher the stem is drawn, the greater is the amount of opening.

Owing to the penetrative nature of oil fuel, the piping should be carefully put together and all joints should be ight. In making up the connections the pipe threads should be perfect and should be cut in oil, so as to be smooth and free from cracks. If the threaded end is made too long the pipe will screw into the fitting too easily and leakage may result. It is better to cut the threads so that it will require a considerable force on the pipe wrench to put the pipes together, as this will be more apt to give tight joints.

The pipes leading to and from the storage tank are usually permanent and are not likely to be taken apart, so the joints may be made up with a cement of litharge and glycerine to insure tightness. If it is possible to do so, elbows should be avoided in installing the oil piping, as the foreign matter in the oil will collect at these fittings and eventually clog the pipes. It is preferable to employ bends of long radius instead of elbows. It will be found advisable to arrange the piping in such a way that the oil can be turned off and live steam sent through the oil lines to loosen the deposits of asphalt or tarry matter and blow them out of the pipes.

The proportions of the furnace and the style of oil burner to be used will govern the number of burners that must be supplied in a given installation. To illustrate, if a furnace is long and narrow, a single burner giving a long, conical flame will be sufficient; but if the furnace is short and narrow, a single fan-tailed burner will give the desired results. In case the furnace is wide, two or more burners may have to be installed. Some makes of burners are so constructed that they can be made to throw a long, narrow flame or a short, wide one. It may be said that, as




FIGS. 4 AND 5—OIL-REGULATING VALVE, AND ARRANGEMENT FOR FINDING STEAM USED BY BURNERS

a rule, one burner for each 6 ft. or 7 ft. of width of furnace will be required. The capacity of the burner must also be taken into account. One manufacturer guarantees a capacity of from 5 to 350 boiler-hp with a single size and type of burner. Another rates his burners at from 75 to 100 boiler-hp each. Still others manufacture different sizes of burners of the same type, each size corresponding to a certain capacity.

The location of the burner is a matter that cannot well be considered apart from the furnace arrangement. In the case of the return-tubular boiler, it is common to find a burner in the center of each fire-door; but if sufficient capacity can be obtained by the use of a single burner it may be inserted through an opening between the fire-doors, cut through the boiler front and the front wall of the furnace. Whatever the location of the burner or burners, the furnace space should be utilized as far as possible. This is one reason why it is found advisable in some instances to locate the burners at the rear end of the furnace in inclined-tube water-tube boilers.

The importance of supplying dry steam for atomizing cannot be overestimated. A steady white flame is produced if the steam is dry; but if water is carried along with the steam the burner sputters and combustion is retarded. The presence of water in the steam may be due to priming of the boiler or to condensation in the pipe line leading to the burner. One way of avoiding such moisture

to superheat the steam, which can be done very easily by running the steam pipe from the boiler to the burner through the furnace or the boiler breeching. Such an arrangement, however, is not always convenient. It is advisable, then, to put a steam separator on the steam line near the burner, in which the steam will be freed of its moisture. This is accomplished by an abrupt change in the direction of flow of the steam, by centrifugal force set up during a whirling motion caused by spiral guides or vanes, or by the separating action of baffle plates. The moisture collecting in the bottom of the separator may be removed through a drip or by an automatic trap.

The economy of a burner is measured by the amount of steam it uses to atomize a pound of oil. There are several ways of determining this, but the simplest way is to condense the steam that issues from the burner in a given time, weigh it, and compare it with the amount of oil used in an equal period. A tank of cold water is set on scales and weighed accurately. Then the burner, with the same piping and connections as are used in ordinary operation, is submerged in the tank. The steam valve is then opened to the same extent as during the normal working of the burner and is left open for a definite time, say, a quarter of an hour.

The steam escaping from the burner will condense in the water in the tank, increasing the amount of water and the temperature. At the end of the given time the burner is removed and the tank and its contents are weighed again. The increase of weight represents the amount of steam used in the observed time. The accuracy of the test may be checked by taking the initial and final temperatures of the water in the tank and calculating how much steam at the usual working pressure would be required to produce the observed rise of temperature in the known weight of water. This result should agree fairly well with the increase of weight of the water in the tank. The amount of oil used in the same length of time can be calculated from the readings of the telltale on the tank, or from the readings of the meter on the oil line, if there is one installed.

This method is very simple and the apparatus is commonly available; but there is the disadvantage that during the test the burner does not operate under the same conditions as in service. When the burner is atomizing oil the issuing steam meets the resistance of the viscous oil in the mixing chamber or at the orifice, whereas in the testing tank the resistance is due to the water. These resistances differ more or less, and the greater the difference the greater the error in basing the economy of the burner on the results of the test. It is probable that the water will offer less resistance than the oil, so that the test will show the burner less economical in steam than it really is.

A more nearly accurate test may be made by using the apparatus shown in Fig. 5. The vertical pipe *a* leads to the burners and conveys the steam for atomizing. Between the two flanges *b* on this pipe is a thin plate in the center of which a hole 3/8 in. in diameter is drilled. The steam flows through this orifice in the plate on its way to the burners. On opposite sides of the flanges the pipes *c* and *d* are connected, leading to the steam-pressure gages *e* and *f*. The gages register the steam pressures on opposite sides of the orifice in the plate, and these pressures vary according to the amount of opening of the steam valve, and hence according to the rate of flow of steam. A series of tests are made with different openings of the steam-regulating valve, observing the pressures on the gages and catching and condensing the steam in a weighing tank filled with cold water. In this way a table is made up showing the amount of steam flowing through the plate in a given time for each different combination of pressures. After such a table is once compiled the steam consumption of the burners at any time may be found quickly by observing the pressures registered by the gages and then noting the corresponding steam rate in the table.

## Installation of Customers' Meters

Will you describe an approved construction for installing a watt-hour meter in a restaurant kitchen? No other place is available, according to the customer, whose business and friendship we are anxious to secure.
K. M. C.

Where a meter must be installed in a kitchen of this kind, or in any other place where it will be continually exposed to fumes and dampness, some kind of a moisture-proof box is essential. Wooden partitions should be avoided. Some vertical support free from vibration should be chosen. Exposure to the weather, even indirectly; sweating of water pipes, humidity from open tanks and moisture from various sources are some of the conditions to be especially avoided. In general, meters should never be installed in closets, bathrooms, toilets, bedrooms, attics or coal bins.

## Load-Factor and Diversity-Factor

Kindly furnish me with definitions of load-factor, diversity-factor and demand-factor. I have several conflicting definitions of these terms and would like to know which is correct.
H. M. G.

The confusion in terms reported by the correspondent is not surprising, for even the definitions as set down by the national electrical societies differ and in the case of diversity-factor are flatly contradictory. "Load-factor" is defined in the standardization rules of the American Institute of Electrical Engineers as the ratio of the average power to the maximum power during a certain period of time, such as a day or a year. Several different kinds of load-factor, on the other hand, are described by the National Electric Light Association committee on terminology in its report at the 1912 Seattle convention. "Connected load-factor" it defines as the ratio of the actual energy consumption to the energy which would have been consumed had the apparatus been in continuous operation at full rated load during the same period. "Capacity load-factor" for a generating station is similarly defined as the percentage ratio of energy actually generated to that which might have been generated by continuous operation at full rated load. The "maximum-demand load-factor" is stated to be the ratio of actual generation to the generation which might have been recorded had the plant operated continuously at its maximum load or output during the period. Again, the "daily load-factor" is obtained by taking the mean load for one day and dividing it by the peak load for that day. Similarly "yearly load-factor" is the ratio of the mean annual load to the peak load recorded during the year. There is also a confusing variety of usage in the number of hours per day on which the load-factor is to be based. Some engineers employ the eight-hour or ten-hour working day of the shop or factory in which the motors under consideration happen to be used. Others have preferred even the twelve-hour day. Obviously it would seem that all should agree on the twenty-four-hour day as the natural period, although on this basis the resulting load-factor percentages appear low. The scheme has, however, the advantage that a change in the length of the working day cannot make the load-factor appear greater than unity, and it also permits all systems to be compared on a common natural basis. "Diversity-factor" is defined by the N. E. L. A. rules as the ratio between the simultaneous demand of a number of individual services and the sum of the individual maximum demands of the same services. Diversity-factor is thus expressed in per cent and is a fractional quantity which can never be greater than unity. A definition exactly reversed is, however, given in the A. I. E. E. rules, where diversity-factor is defined as the ratio of the sum of the maximum demands to the maximum demand of the whole system. By this definition the diversity-factor will always be a number greater than unity. The "demand-factor" as defined by the A. I. E. E. rules represents the ratio of the maximum power demand of a system to the total connected system load.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*Modified Induction Motor.*—In the construction of alternating-current induction motors considerable valuable magnetic space is taken up by the windings in both the stator and the rotor. To reduce this space considerably with various resulting advantages is the object of a motor designed by Messrs. W. P. Durtnall and A. H. Binyon. The motor (Fig. 1) is especially adapted for industrial drive or

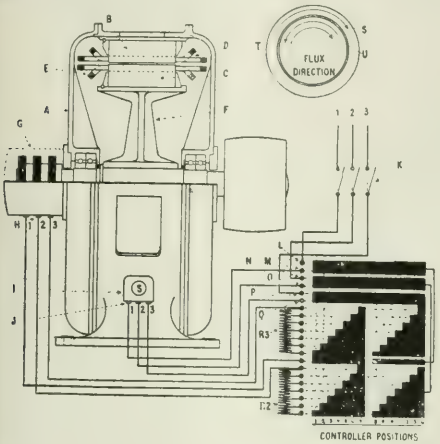



FIG. 1—DIAGRAM OF THE STANDARD THREE-PHASE MOTOR AND CONTROLLER

factory use. *A* is the cast-steel frame, *B* the stator stampings, *C* the rotor stampings, *D* the stator windings, *E* the rotor windings, *F* the cast-steel spider of light but strong construction, *G* the slip-rings for the rotor windings, *H* the insulated bushes taking the leads to the slip-rings, brushes or rubbing contacts, *I* the terminals of the stator windings, *J* the insulated bushes for the leads to same, and *K* is the main switch. Phase No. 1 is connected to controller terminal *L*, phase No. 2 to terminal *N*, and phase No. 3 to terminal *P*. Thence the current passes to terminals *M*, *O* and *Q*, and to stator terminals Nos. 1, 2, and 3. Assuming an eight-pole motor running on 50-cycle, three-phase current, the operation is as follows: Current from contact No. 1 is sent to the stator windings, which causes the resulting magnetic flux in the stator iron to revolve in the direction marked *S* in the circle diagram. At the same time the rotor is short-circuited by means of the three leads from the slip-rings to the controller, but, as rotor windings are wound for the same voltage and polarity as those of the stator, two compensating choking coils are inserted to stop an excessive amount of current flowing. Contacts Nos. 2, 3, 4, 5, 6 and 7 gradually cut out or short-circuit the choking coils and entirely short-circuit the rotor windings, the motor in the meantime running up to a synchronous speed of 750 r.p.m., which is half-speed. It may be left running at this speed for any period of time operating with good efficiency as an ordinary induction asynchronous motor. On contact No. 8, by reference to the connections in the controller, it will be seen that voltage and current are supplied directly to the rotor windings, but as the rotor speed is then only 750 r.p.m., the current flows through the choking coils, which are gradually short-circuited by turning the controller from No. 8 to No. 14 contact. The rotor then runs up to a speed of 1500 r.p.m., because the current sent to the rotor windings produces a revolving magnetic flux which turns in the direction marked *T* in the circle diagram, so that the magnetic action then taking place between the two primary members—that is, the rotor and the stator—compels the rotor to travel at a speed of 1500 r.p.m., while, at the same time, it runs "synchronously" and with the maximum of magnetic and electrical efficiency. Assuming that the total power of the motor is, say, 20 hp, then half the power input is taken by the stator and half by the rotor. The stator winding occupies only the space of a 10-hp winding, while the rotor occupies a like amount. The tooth depth is reduced, the stator and rotor heat losses are diminished, and the outside diameter is lessened for a given air-gap diameter and stated rating by reason of the fact that the pole-pitch span is less, quite apart from the reduction in extra iron permitted by the reduction in the space required for the winding in both stator and rotor. Being wound with eight poles for 1500 r.p.m. and 50 cycles instead of four poles, as is usual, the starting torque is high for the energy input.—London *Electrician*, Nov. 7, 1913.

*Direct-Current Armatures.*—J. Küntziger.—A mathematical paper on the calculation of the dimensions of direct-current armatures. The author first gives some general formulas relating to the principal dimensions. They concern the cooling surface, the form of the pole pieces, the total weight, the reactance voltage, the ohmic drop and the armature reaction. These formulas are then applied to the calculation of the dimensions of armatures, both bi-polar and multi-polar machines being considered.—*La Lumière Elec.*, Nov. 1, 1913.

### Lamps and Lighting

*Modern Electric Lamps.*—B. Monasch.—An English translation in abstract of the author's recent report before the German Association of Electrical Engineers, which has already been noticed in the *Digest*.—London *Electrician*, Nov. 7, 1913.

*Drawn Tungsten Filament.*—A note on a recent British patent (No. 22,548, 1912) of Pope's Electric Lamp Company and C. Trenzen, of Germany. The filaments are drawn in the cold and without previous mechanical treatment from a sintered mixture of tungsten and thorium or some of their salts. The resistance of the filament is 20 per cent less than the resistance of a similarly made pure-tungsten filament.—London *Elec. Eng'ing*, Nov. 6, 1913.

*Alternating-Current Flame-Arc Lamps.*—A note on a recent British patent (No. 28,122, 1912) of the British Thomson-Houston Company and the General Electric Company of America. The lamp is fed from an auto-transformer which is normally unsaturated, but when the arc resistance exceeds a certain amount the transformer becomes saturated and cannot supply the energy to maintain the arc. The latter is, therefore, extinguished and then re-made by a series magnet in the secondary circuit of the auto-transformer, which actuates the electrode feed.—London *Elec. Eng'ing*, Nov. 6, 1913.

*Neon Tubes.*—Georges Claude.—A brief paper on the

effect of the diameter of neon luminescent tubes on the potential difference at their terminals.—*La Revue Elec.*, Oct. 15, 1913.

### Generation, Transmission and Distribution

*Value of Coal.*—E. Boernstein.—In order to determine the value of a given coal it is necessary to know, above all other things, the ratio of water and ash to carbon and the calorific value. The available testing methods are exact and reliable. Sampling is of greatest importance. In the case of a given installation a heating test using a large quantity of coal should be carried out.—*Elek. Zeit.*, Nov. 6, 1913.

*High-Speed Machines.*—T. Pausert.—A review of two recent papers by Maurice Le Blanc. In the first a design of steam turbines with a single wheel running at 30,000 r.p.m. is dealt with. The second discusses the design of a gas turbine operation at a speed of the same order.—*La Revue Elec.*, Oct. 17, 1913.

*Sugar Industry.*—W. S. Scott.—An article on electric motor drive in the beet-sugar industry, with diagrams of load-curves in typical sugar plants and figures for the individual power requirements of different sugar machines.—*Elec. Journal*, November, 1913.

*Printing Motors.*—An illustrated description of alternating-current commutator motors for printing-press work, with diagrams giving results of tests.—London *Electrician*, Nov. 7, 1913.

### Traction

*Norwegian Railways.*—An abstract of a report of the Norwegian Waterfall Commission on the electrification of the Norwegian electric railways. At present 2976 km (1786 miles) of Norwegian railways are in operation and 3533 km (2120 miles) more are projected. The maximum power required for the railways now in operation would be 85,600 kw and the yearly energy consumption 118,000,000 kw-hr. For the projected railways these figures would be, respectively, 89,200 hp and 100,000,000 hp-hr. per year. The Norwegian state owns at present twenty-nine waterfalls, which can furnish 108,250 kw without regulation of the water and 542,000 kw if reservoir construction is resorted to. Thirteen of these waterfalls, with an aggregate capacity of 54,500 kw, have been acquired by the government especially for railway electrification. The transmission lines are intended to furnish energy also for other power purposes. The calculations show that it would be too expensive to erect only one power plant. The Nore power plant had been projected with eleven 14,750-kw turbines and two 7400-kw turbines. On account of reduced expense and for the sake of reliability several power plants are now considered preferable. It is recommended that the electrification of the railways be carried out gradually. As an experiment, at the beginning the line from Christiania to Drammen is to be equipped electrically.—*Elek. Zeit.*, Nov. 6, 1913.

*Single-Phase Traction.*—The first part of a fully illustrated description of the Spiez-Brig single-phase railroad in Switzerland, which includes the Loetschberg tunnel and is on the direct line connecting Paris with Milan. Single-phase, 15-cycle current at 15,000 volts is used on the trolley wire. The locomotives have a capacity of 2500 hp for an hour and a half at a speed of 50 km (30 miles) an hour. The article is to be continued.—*Elek. Zeit.*, Nov. 6, 1913.

### Installations, Systems and Appliances

*Correct Connections for Three-Phase Induction Motors* —E. Richter.—The normal connections between a three-phase induction motor and its controller and the three-phase supply mains are shown in Fig. 2. If the connecting wires between controller and motor are placed in iron conduit, care must be taken either to run all the wires in one tube or to put three in one tube and three in another tube in such a way that at any moment the sum of the currents in each tube is equal to zero. In order to fulfil this condition the conductors from the contacts 3, 5 and 6 must be placed in one tube and the conductors from the contacts 1, 8 and 10 must be placed in the other tube. In making the installation the mistake is repeatedly made of putting the conductors from contacts 1, 3 and 5 into one tube and the conductors from 6, 8 and 10 into the other

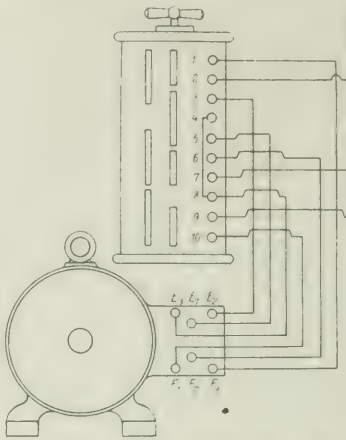


FIG. 2 —CONNECTIONS FOR THREE PHASE INDUCTION MOTOR

tube. While in this case the connections of phases 1 and 3 are correct, the connections of phase 2 are not correct since the conductors which carry the current to this phase are in different tubes. They form, therefore, a loop which must result in a magnetic flux in the iron conduit. Consequently the effect is a choking of the emf of phase 2. The longer the connections between the controller and the motor, the less work will be done by phase 2, so that the two other phases are liable to be overloaded.—*Elek. Zeit.*, Oct. 30, 1913.

*The "Point Fives."*—A long editorial on the policy of the "point fives." Any station engineer is eligible to be a member of this association "if he includes a charge of 0.5d. (1 cent) per unit as a distinctive portion of his tariff. This is the sole article of faith and is one which permits a very wide variation." The idea is apparently sometimes held that a "point five" sells electrical energy simply at 0.5d. per unit for certain purposes. This is by no means the case. Indeed, generally speaking, it is not the case at all, and the average price obtained is considerably more than 0.5d. "The important point is that the consumer having pledged himself to a certain definite expenditure per annum, is free to take as much energy as he desires at the low rate of 0.5d. per unit." The domestic consumer requires electrical energy first for lighting and second for heating and cooking. These two services are very dissimilar. They can be kept distinct by installing two meters and having separate wiring throughout. But it is much easier to adapt the rates to meet the case. The recent extended discussion between the "point fives," represented by J. F. Bowden, and the opposition, represented by A. N. Moore, is summed up. In the same issue considerable information is given on the different rate schedules used by the "point fives" in different cities. The effect of electric heating and cooking on the station load is shown in a series of interesting load-curves for the St. Marylebone station. —London *Electrician*, Nov. 7, 1913.

*Electric Heating and Cooking.*—Illustrated articles giving a review of the present status of electric cooking and heating apparatus with special reference to water-heating. —London *Electrician*, Nov. 7, 1913.

### Electrophysics and Magnetism

*Where Ohm's Law Does Not Hold.*—W. F. G. SWANN.—An illustrated paper on a case of anomalous conduction in a solid dielectric. The author's experiments have to do with the natural conductivity of paraffin wax when under the influence of no external agency except the electric field responsible for the current, and suggest that Ohm's law is not obeyed, the conductivity increasing in fact with the field. The experiment was arranged in a new way to avoid difficulties due to the high potentials used and to bring into prominence any deviation from Ohm's law. The theory and possibilities of error due to a departure from the ideal conditions of the simple theory are fully considered, and it is shown that the only likely way of accounting for the results obtained is by the assumption of a departure from Ohm's law such as corresponds to an increase of the conductivity with the field. The reasons for discarding any explanation of the phenomenon as due to soakage are discussed, and the possibility of its explanation as the result of an increase in the ionization, due to the field, is examined and found untenable. Other methods of accounting for the phenomenon are also discussed, the most likely one being framed on the lines of a modification of the theory of metallic conduction proposed by Sir J. J. Thomson.—*Philos. Mag.*, October, 1913.

*Electric Wind.*—J. R. BOON.—An account of an experimental investigation on the effect of pressure on the electric wind from a discharging point. The author describes an improved apparatus for the measurement of the pressure of the electric wind from a point-plate discharge under different atmospheric pressures. The curves of wind-pressure $p$ and the distance between the electrodes $z$ agree in form at normal atmospheric pressure with those of other observers and cut the $z$ axis at a distance $z_0$ from the origin. The results at different atmospheric pressures $P$ in air and $CO_2$ show that $z_0$ is proportional to $1/P$. This supports the view that $z_0$ is the result of intense ionization possibly brought about by radiations from the point, which are absorbed in a given gas according to a density law.—*Philos. Mag.*, October, 1913.

*Residual Dielectric Forces.*—K. W. WAGNER.—An article illustrated by diagrams developing a simple mathematical theory of residual dielectric forces (residual charge, dielectric energy losses, etc.).—*Elek. Zeit.*, Nov. 6, 1913.

*Longitudinal Thermomagnetic Potential Difference.*—A. W. SMITH.—An account of an experimental investigation, the chief results of which are as follows: The longitudinal thermomagnetic effect in bismuth decreases with rising temperature and seems to vanish at the melting point of the bismuth. Longitudinal thermomagnetic effects in graphite and monel metal were also determined by the author. The effect is positive in graphite and negative in monel metal. The longitudinal thermomagnetic potential difference in bismuth-antimony alloys shows a maximum value when the alloy contains about 9 per cent of antimony.—*Phys. Review*, November, 1913.

### Electrochemistry and Batteries

*Structure of the Atom.*—SIR J. J. THOMPSON.—It is usual to regard Planck's equation as an indication that radiant energy is molecular in structure. The present author has already suggested that the same result would follow, without any such assumption as to the character of radiant energy, if the mechanism in the atom by which the radiant energy is transformed to kinetic energy were such as to require the transference to the mechanism of a definite amount of energy, sufficient, for example, to rupture some system before the transference can take place. Planck's relation, in fact, depends on the properties of the atom, the agent by which the energy is transformed, rather than upon the existence of a structure in the energy itself. In the present paper the author describes an atom of such a kind that the transformation of radiant into kinetic energy would take place in accordance with Planck's law. The forces acting on a corpuscle in an atom are assumed to be as follows: (1) a radial repulsive force, varying inversely as the cube of the distance from the center, diffused throughout the whole of the atom and combined with it; (2) a radial attractive force, varying inversely as the square of the distance from the center, confined to a limited number of radial tubes in the atom.—*Philos. Mag.*, October, 1913.

### Units, Measurements and Instruments

*Integrating Methods in Alternating-Current Testing.*—FRED. BEDELL.—An abstract of an American Physical Society paper. An alternating current or voltage can be measured by a direct-current instrument or galvanometer of the D'Arsonval type if a synchronous commutator is interposed between the circuit and the instrument. The reading of the instrument is the integral of the alternating current for one-half cycle, the limits of the integral being determined by the setting of the brushes on the commutator. The brushes may be shifted so as to shift the half cycle over which the integral is taken. In this way successive instantaneous values may be found of one quantity the value of which depends upon the integral of the quantity directly measured. For example, if the quantity measured by means of the commutator and galvanometer is the current flowing in a condenser, the successive readings of the galvanometer are proportional to the instantaneous values of the charge $q$ of the condenser, since $q = \int i dt$. The integral readings of condenser current for any setting of the brushes gives the instantaneous value of $q$ at the moment of commutation. Since the potential $v$ is proportional to $q$, this gives a method for determining the wave-form of potential. If the potential is taken across the terminals of a non-inductive resistance, the wave-form of current is determined. This condenser-current method for determining wave-form is much more sensitive and has a much wider range than various time-honored point-by-point methods. In this and in other integrating methods variation in commutator resistance may be a source of error which may be reduced by perfecting the apparatus or may be made ineffective by choice of method.—*Phys. Review*, November, 1913.

*Measurement of Magnetic Fields by Their Damping Effect Upon a Vibrating Coil.*—P. E. KLOPSTEG.—The author derives an equation for the intensity of a magnetic field in terms of quantities readily obtainable by observations upon a suspended coil vibrating in the field with damped periodic motion. He also derives a similar equation depending upon critical damping, and an application of the term "logarithmic decrement" to critically damped motion of a moving coil. These equations are experimentally verified, and it is shown that the method depending upon damped periodic motion may be applied with an accuracy of at least 1 per cent to the measurement of fields ranging from a few lines to at least 1500 lines per sq. cm, using the same coil over the entire range.—*Phys. Review*, November, 1913.

*Low-Resistance Silver-Quartz Fibers.*—H. B. WILLIAMS.—An abstract of an American Physical Society paper. Low-resistance quartz fibers suitable for use in the Einthoven galvanometer and similar instruments are usually prepared by chemical silvering. Such deposits are rough and the amount of silver is high in proportion to the conductivity. Cannegieter has shown that smooth fibers can be produced by deposition of a cathode film, followed by electroplating. By the method here outlined fibers of low resistance can be obtained by the cathode spray alone, thus diminishing the number of manipulations and avoiding all contact with chemical solutions. The cathode is of pure sheet silver bent to a half cylinder. The fibers are held in the discharge tube on a glass frame to which they are cemented with hot shellac. The tube is several times ex-

heated to 0.01 mm and rinsed with dry electrolytic hydrogen. Discharge is maintained at 0.01 amp with a potential of from 1200 volts to 1500 volts. Direct current is supplied by two small generators with armatures connected in series and fields separately excited. Much gas seems to be occluded during the discharge and a small stream of hydrogen is allowed to leak in steadily, maintaining the current constant. The time of discharge varies with the thickness of film desired. A fiber 140 mm long, 0.002 mm in finished diameter, and having a resistance of 2700 ohms, was obtained by exposure for three hours. The fibers are microscopically smooth and the coating is very compact, uniform and strongly adherent. A liquid air block between the discharge tube and the other parts of the apparatus insures uniform success, but good results can sometimes be secured without it.—*Phys. Review*, November, 1913.

*Determining the Horizontal Intensity of the Earth's Magnetic Field.*—WALTER A. JENKINS.—A description of a new method for determining the horizontal intensity of the magnetic field of the earth. The principle of the method is the production of a known field opposite to that of the earth's and twice its magnitude. The equality of the two fields—that due to the earth and that due to the combination of the earth's and the produced one—is determined by the equality of the times of vibration of the same magnet, when the applied field is off and on. The applied field is determined by measuring the current producing it. This method is as accurate as the old familiar one and has the great advantage of involving no corrections.—*Philos. Mag.*, October, 1913.

*Cathode-Ray Oscillograph.*—H. H. BROUGHTON.—For teaching purposes it is claimed that the cathode-ray oscillograph is convenient and practical. Full particulars of the construction and operation of the instrument are given, and in conclusion a number of interesting experiments adapted for elementary students are described.—London *Electrician*, Nov. 7, 1913.

*Testing of Alternating-Current Machinery.*—This continuation of the long illustrated serial on shop testing of electrical apparatus deals with alternating-current generators and synchronous motors and relates to mechanical inspection, polarity, resistance, core loss, separate driving motor method, friction and windage, currents in bearings, short-circuit loss and impedance, no-load saturation, full-load saturation at approximately zero power factor, locked saturation, starting tests for synchronous motors, torque tests and the regulation of alternating-current generators. —*Elec. Journal*, November, 1913.

### Telegraphy, Telephony and Signals

*Telegraph Transmission Over High-Tension Lines.*—M. MEYER-MAY.—An illustrated paper describing a telegraph system recently installed on a 45,000-volt transmission line. The power-transmission circuit itself is utilized. No special source of energy is required for the telegraph system, nor is there any danger for the attendants. Operation is based on the potential difference between the isolated neutral points and earth. Normally this potential difference is zero. But if at a point of one phase an earth connection is made for a moment through a resistance, the potential difference in question assumes a certain value and an electrostatic balance is thereby effected. The details of the system are shown in a series of diagrams.—*La Revue Elec.*, Oct. 15, 1913.

### Miscellaneous

*The Vocation of Electrical Engineer.*—E. W. MERCHANT. —An abstract of his inaugural address to the Manchester Section of the (British) Institution of Electrical Engineers. The speaker considers the prospect for electrical engineers to be good. "The supply hitherto has been ample, the demand meager; now demand is overtaking supply, and the necessary consequence of an increased demand is either a worse quality of product or a higher price. It is to be hoped that the members of this institution who have it in their power will see to it that it is the latter alternative that is chosen by the electrical engineering industry."—London *Electrician*, Nov. 7, 1913.

*British Institution of Electrical Engineers.*—An article on the opening of the season. The policy of the "broader view," inaugurated by Ferranti, by which greater attention is to be paid to the non-technical interests of the Institution is to be maintained. This point was emphasized in a speech by the president, Mr. William Duddell. The chairmen of the local sections are Messrs. A. M. Taylor, Birmingham; Charles Vernier, Newcastle-on-Tyne; William B. Woodhouse, Yorkshire; H. Faraday Proctor, Western local section; J. A. Robertson, Scottish local section; E. W. Marchant, Manchester, and G. W. Harriss, Dublin. Biographical sketches and portraits of most of them are given.—London *Elec. Review*, Nov. 7, 1913.

*Presidential Address.*—H. FARADAY PROCTOR.—His presidential address to the Western Section of the (British) Institution of Electrical Engineers in Bristol. He first deals with the training of engineers and says: "It is desirable that the boy be first a gentleman; secondly, make him into a man, and thirdly, into an engineer." When the 1-watt lamp came to the fore, there was doubt in the minds of many as to its probable effect upon the sale of electricity. In 1909 a careful comparison was made of the consumption of electricity by a number of Bristol consumers who had installed 1-watt lamps throughout their premises with the consumption of the same consumers when using carbon-filament lamps. Care was taken to ascertain that the results were directly comparable, and the returns showed that the consumers increased the candle-power installed on the average about 50 per cent. With the advent of the new "half-watt" lamp the author thinks that a similar result will again be obtained. Attention must be paid, however, to the cost of running new services and to pushing electric cooking and water heating.—London *Electrician*, Oct. 31, 1912.

## Book Reviews

THE SCIENCE OF ILLUMINATION. By Dr. L. Bloch. Translated by W. C. Clinton. New York: D. Van Nostrand Company. London: John Murray. 180 pages, 5 illus. Price, $2.50 net.

This volume is a good translation from German into English of the original book by Dr. L. Bloch entitled "Grundzüge der Beleuchtungstechnik," with, however, a number of judicious and useful additions in detail, which add to the serviceability of the English version. The chapters, to the number of six, are devoted to the following topics: Fundamental units in illumination, measurement and calculation of candle-power, estimation of illumination, measurement of illumination, indirect lighting.

DIE DEUTSCHEN ÜBERLAND-ZENTRALEN UND IHRE WIRTSCHAFTLICHE BEDEUTUNG ALS KRAFTQUELLE FÜR DEN KLEINBETRIEB IN LANDWIRTSCHAFT UND GEWERBE. By Dr. Walter Straus. Berlin, Germany: Franz Siemenroth. 208 pages, illus. Central-station charts. Price, 7 marks.

A statistical inquiry into the economic conditions of generating stations and electrical development in modern Germany, with a map showing the location of the stations and their regions of influence. The four chapters of the book relate to the following subjects: German central stations and the directions of their development; comparison between electric motors with small engines; the economic importance of electric distribution in farming and in industry; résumé. A large amount of statistical material is presented

# New Apparatus and Appliances

**An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers**

## Electric Calculating Machine

The electric calculating machine made by the Ensign Manufacturing Company, Boston, Mass., and illustrated herewith, is designed to multiply, divide, add, subtract and extract square and cube roots. Power is obtained from a 1/12-hp Holtzer-Cabot motor which winds a large spring through a worm-gear and shaft connection. In order to

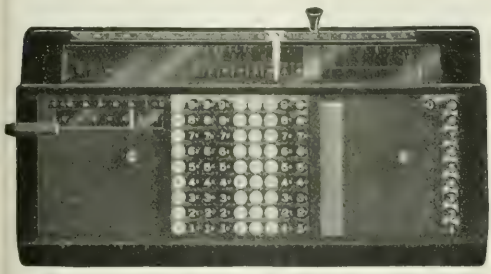


FIG. 1—KEYBOARD FOR ELECTRICALLY OPERATED CALCULATING MACHINE

wind the spring slowly so that the tension of the spring shall be kept constant, a twenty-to-one reduction is made in the worm gear with a further reduction by means of a small pinion in the circular spring box. The operating device is so arranged that the motor will wind the spring while the calculating mechanism of the machine is unwinding.

The energy supply to the motor is regulated by a snap switch which opens the circuit when the spring reaches a predetermined tension and closes it again when the spring becomes partially unwound. To further regulate and control the actual working speed of the machine a centrifugal governor is connected to the shaft. All shafts and bearings are of the roller type and are hardened and polished.

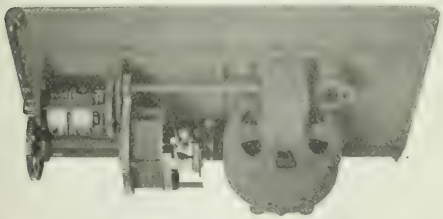


FIG. 2 MOTOR AND OPERATING MECHANISM FOR ELECTRIC CALCULATING MACHINE

A tubular-steel stand equipped with castors is furnished with the machine so that it can be moved easily from place to place. The motor and operating mechanism, shown in Fig. 2, are hung from beneath the keyboard seen in Fig. 1. The machine is designed to multiply 1 by 1 as well as 999,999,999 by 9,999,999 and any combination of figures between these amounts.

## Radial-Flow Reaction Turbine

The Brush Electrical Engineering Company, Ltd., London, England, has recently taken up the manufacture of a radial-flow reaction steam turbine designed by Messrs. Birger Ljungström and Fredrick Ljungström, of Stockholm, Sweden. Steam is admitted between two disks and in its travel from their center to the circumference passes between concentric blading rings carried alternately by the two disks. Both disks revolve, driving their shafts at equal speeds but in opposite directions. To each shaft is coupled an electric generator, and at the end of one of the generator shafts is mounted a small exciter for the fields of both machines.

Fig. 1 shows a 1000-kw Brush-Ljungström turbo-generator mounted on a condenser. The lower half of the tur-

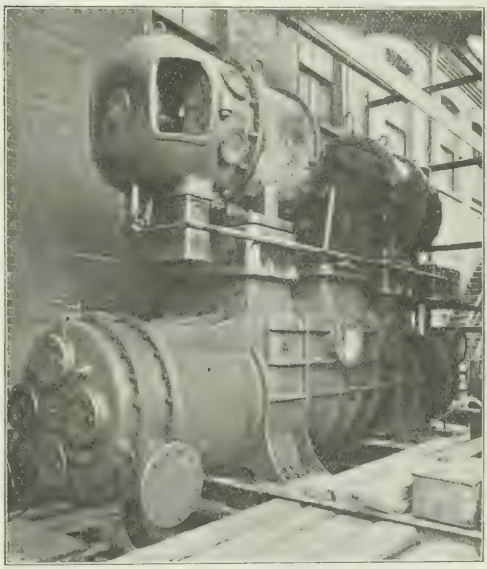


FIG. 1—1000-KW BRUSH-LJUNGSTRÖM TURBO-GENERATOR SET

bine casing is formed into an exhaust branch, which is bolted directly to the condenser beneath. Springs contained in cast-iron boxes support each generator. The turbine shafts themselves have no bearings; but each is fastened by means of a flange connection to its own generator shaft, the bearings belonging to the latter.

The turbine is very small, considering the amount of power developed, being only 27.75 in. in diameter and 20.875 in. long. Each turbine shaft is about 10.5 in. long, and the weights of the two running disks complete with blading are 265 lb. and 303 lb. respectively. In Fig. 2 is shown a 1000-kw set with the turbine removed. The two branches of the Y steam pipe can be clearly seen in this illustration.

Each turbo-set is provided with a steel cable held under

tension which holds shut an oil relief valve actuating the stop-valve and by means of which the machine can be stopped either automatically by the melting of a fusible metal plug in any of the bearings or by hand with a small lever at the stop-valve. In case this cable breaks, gets loose or is released by the overheating of any of the bearings, the turbine is automatically shut down. An excess-speed device on each generator shaft will also release the cable and cause the machine to stop.

The whole of the turbine is surrounded by exhaust space, so that there is no need, therefore, of lagging the surface of the casing, the temperature of which never exceeds that of the condenser. The absence of a split-iron casing eliminates distortion troubles, and consequently a higher superheat is practicable than is the case with the ordinary reaction turbine.

After "warming up" the machine for about ten minutes the full speed of 3000 r.p.m. can be obtained. When the speed rises to about 1400 r.p.m. the exciting current becomes strong enough to cause the two generators to synchronize themselves automatically and thereafter run electrically as one machine. The automatic synchronization of the machine can be seen by watching the behavior of the switchboard instruments. The fields of the two units are connected in series so that only a single field rheostat is

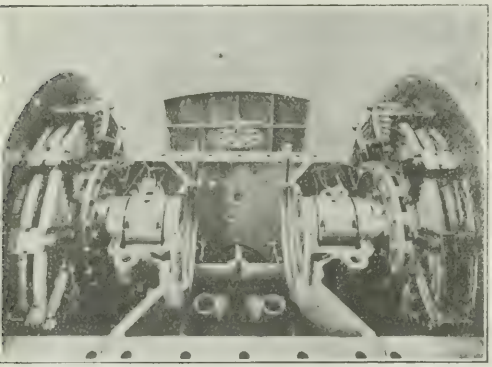


FIG. 2—1000 KW BRUSH-LJUNGSTRÖM SET WITH TURBINE REMOVED

needed. In case one of the generators becomes disabled, it can be bolted to the casing and the other generator can then be operated alone, the result being a reduction in output by one-half and a higher steam consumption per unit.

## Storage-Battery Industrial Truck

The industrial truck shown in the accompanying illustration has been designed by its maker, the C. W. Hunt Company, Inc., New York City, for conveying heavy material about manufacturing plants, shops and railroad terminals. For this use the truck can be operated with considerable flexibility since its size permits it to be run onto elevators and into box-cars with ease.

The carrying capacity of the truck is approximately 4000 lb., and with this load its maximum speed is 5 miles per hour. The storage capacity of the batteries is ample for an ordinary full day's working. Either Edison nickel-iron cells or "Exide" lead cells can be supplied. The battery is incased in a heavy steel box suspended by springs from the cross-members of the frame. The entire section over the battery box is removable, making the batteries readily accessible.

The motor has been specially designed for commercial-vehicle service and drives the wheels through a differential of cut-steel gearing inclosed in an oil-proof and dust-proof housing. Ball and roller bearings are used throughout. The operator's platform is at the front. The truck is steered by the right-hand lever, while the other lever con-



STORAGE-BATTERY TRUCK

trols the motor. The brake is actuated by the foot pedal, which is shown in the illustration. When not in operation the truck is always locked.

## Coasting Time Recorder

The Rico coasting-time recorder is an instrument for use on electric cars and multiple-unit trains recording the actual number of minutes of operation without the application of energy or brakes. It reads in "coasting minutes" and delivers a printed voucher slip to the motorman at the end of each run, showing the degree of economy he has been exercising.

The recorder consists of a recording mechanism and an electric relay. The printing mechanism is driven by a double-spring marine-movement clock designed to withstand excessive vibration and climate changes.

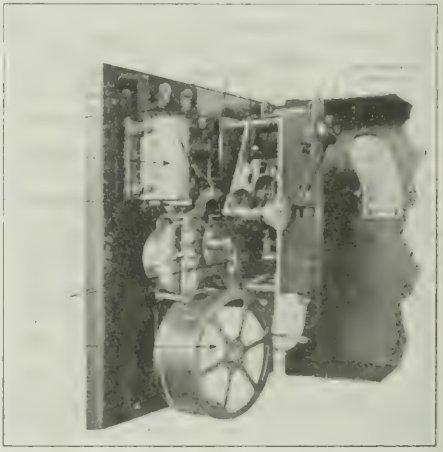


FIG. 1—COASTING-TIME RECORDER

The controlling magnet on the clock movement is energized only when the traction motors are running as generators, but when the controller is "on" no current can possibly get through to the clock magnet from the traction motors. When the brakes are applied the clock circuit is

opened. Thus it is impossible for a motorman to "coast to a standstill" and obtain a fictitious record, for the energy which operates the clock magnet ceases when the motor stops.

The relay is inclosed in a substantial steel case and can be locked or sealed as desired. On straight air-brake cars the relay is installed at any convenient place. These instruments are marketed by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., and they are designed particularly for equipment put out by this company.

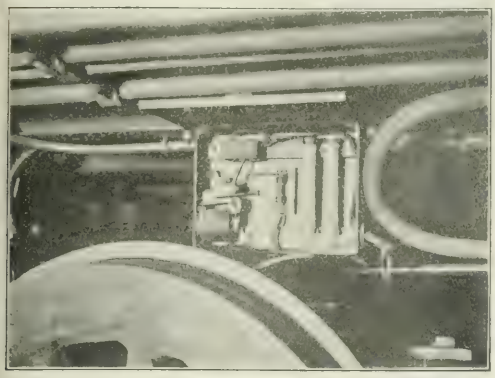


FIG. 2—COASTING-TIME RECORDER MOUNTED UNDER ELECTRIC CAR

## New Recording Hygrometer

A new recording hygrometer has been designed and put on the market by the Industrial Instrument Company, Foxboro, Mass. By means of this instrument both dry-bulb and wet-bulb temperatures can be recorded simultaneously and continuously for twenty-four hours on the same chart, the two records being kept independent of each other.

The instrument consists of two sensitive helical-tube bulbs mounted in tandem as shown in Fig. 2. The tube *B* is the dry bulb, which records the temperature of the surrounding air, and the tube *C* is the wet bulb, which is covered with a special jacket leading down into the trough *D*. The tube *C* is always cooler than *B* on account of the water being evaporated. This evaporation increases or diminishes in proportion to the amount of moisture in the air. The pen arms are attached directly to the shafts concentric with the bulbs. Taking the difference between the two records made by the pens and referring to a table which accompanies the instrument, the relative humidity can be quickly ascertained. The case is mounted on a swivel at right angles to the wall or support, giving easy access to the inverted glass bottle *A*, which serves as a water reservoir. The hygrometer is made in 8-in., 10-in. and 12-in. sizes and will record temperatures varying from 0 deg. C. to 100 deg. C.

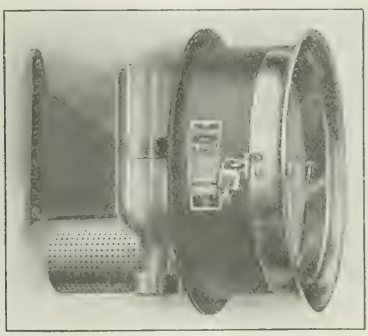


FIG. 1—RECORDING HYGROMETER

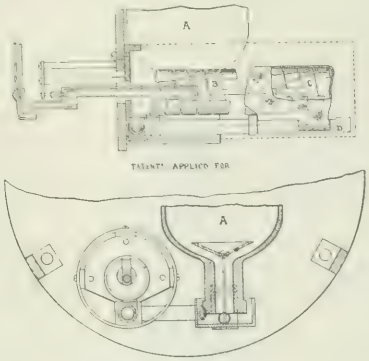
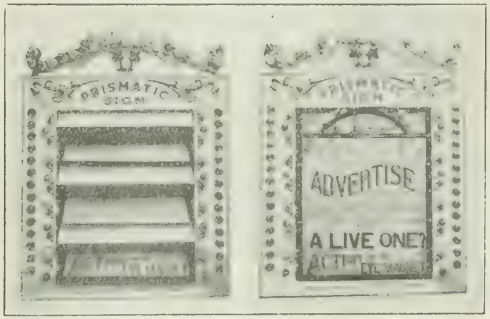



FIG. 2—TRANSVERSE SECTION AND CROSS-SECTION OF HYGROMETER

## Electrically Operated Motion Sign

The feature of the electrically operated motion sign illustrated herewith is its changing display space on which appear in succession four different legends. The apparently unbroken display surface is made up of a set of pivoted prisms, each carrying a folding leaf. As the prisms are slowly rotated by a small electric motor, different lines of advertising are brought successively to the front. During each change a flasher mechanism geared with the operating motor switches on electric lamps behind the various colored bulls'-eyes, attracting attention to the display. When the lettered surfaces are in fixed position the sign is automatically illuminated with white light from the frosted lamps shown. Any number of prisms of any desired size may be used, and reading matter may be quickly changed by substituting new prisms. Mr. J. H. LaPearl, of Los Angeles, Cal., originated this motion sign, which is being manufactured by the Day & Night Sign System, of Los Angeles.




FIGS. 1 AND 2—MOTION SIGN REVOLVING AND IN POSITION FOR READING

## Nitrogen-Filled Incandescent Lamp

The Allgemeine Elektricitats Gesellschaft, of Berlin, Germany, has developed a nitrogen-filled incandescent lamp which is the culmination of experiments carried on simultaneously, although independently, with those of the General Electric Company described by Dr. Irving Langmuir before the A. I. E. E. meeting at New York, Oct. 10.

Similar results were obtained by the two companies.

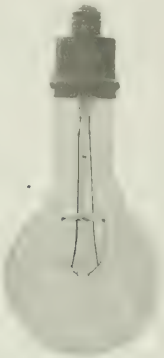


FIG. 1—NITROGEN FILLED LAMP WITHOUT REFLECTOR

The German investigators have found that filling the bulb with gas prevents the rapid evaporization of the filament, while compression of the latter into the smallest allowable space is a change essentially necessary for a lamp of higher lighting efficiency. The filament of this German "Nitra" lamp is wound in a narrow spiral and in this respect is similar to that brought out by the General Electric Company.

The Nitra lamps illustrated herewith are much smaller than the high candle-power incandescent lamps heretofore used. The globe of the 2000-cp lamp, for example, is smaller than that of the old 1000-cp lamp, being 7.87 in. in diameter instead of 9.45 in. The neck is made longer in order to serve as a cooling and condensing chamber for the gas and the evaporated particles led up from the filament

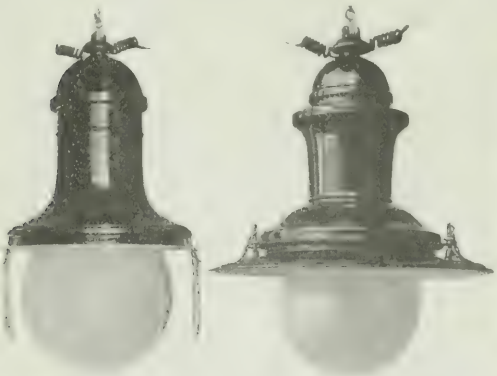


FIG. 2—NITROGEN-FILLED LAMPS EQUIPPED WITH REFLECTORS

and deposited on the glass. The lower part of the globe therefore remains clear even after long burning. On account of the larger amount of heat developed in the nitrogen-filled lamp, the socket and holder are placed at some distance from the filament to prevent their becoming excessively heated. The socket is fastened to the glass mechanically so that it cannot be loosened; the lamp, consequently, will not fall in case the cement breaks up as the result of long life.

The Nitra lamp has no glass tip. The bulbs are filled with nitrogen at an absolute pressure of approximately 9 lb. per sq. in. The spiral filament can be placed in various positions according to the light distribution desired, and its compact arrangement makes it very satisfactory for projectors and search-lamps.

The Nitra lamp is so dimensioned that it has a consumption of 0.5 watt per mean lower hemispherical cp with a clear-glass globe and no reflector. This corresponds to an average light intensity in a room of 0.65 watt per cp. By employing suitable external reflectors, the consumption of 0.5 watt per cp can be subjected to a further reduction if this is deemed desirable.

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## "Eyeball" Search Lamps for the Motor Car

In the host of electrical accessories developed in connection with automobile work, one of the most curious and at the same time useful devices is an electric lamp made by Mr. E. Cannevel, of Levallois-Perret, France. The illustrations show the method of mounting this lamp in the motor-car body, revealing resemblance to the eyeball and

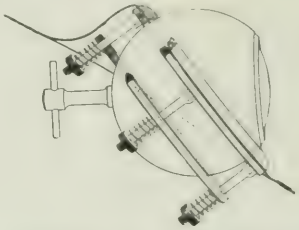


FIG. 1—MOUNTING OF "EYEBALL" SEARCH-LAMP

its orbital socket from which the lamp, of course, takes its name.

Owing to the spherical form of this lamp, its projected beam can be turned at will through an angle of about 80 deg. in both the horizontal and vertical planes. By means of small clamps it can then be locked in any position. The lamp can thus be used as a search-lantern for reading



FIG. 2—AUTOMOBILE EQUIPPED WITH "EYEBALL" SEARCH-LAMPS

signposts, mileposts, etc., while if required the shell can be taken directly out of its socket and used to investigate trouble under the car or in the engine. A handle is fitted on the "eyeball" by which the driver, after loosening the milled-head nuts which form part of the clamping device, can turn the eye in any direction.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Electric Vehicle Makers Arrange to Continue Operations.**—Rumors which have circulated as to the financial embarrassment of the Standard Electric Car Company, of Jackson, Mich., were not denied in a circular sent out recently by that concern, but it was stated that arrangements have been made for continuing the business and that new capital for this purpose has been secured. The Standard Car Manufacturing Company has been organized to operate the business of the above company, but no changes in management organization are proposed. Legal obstacles in the way of the reorganization have been removed and the company claims that the new capital available will enable it to continue operations on a satisfactory basis. It says further that at the present time it has about 300 cars in the hands of satisfied customers. This firm's specialty is a popular-priced electrical coupé.

**Prominent Automobile Manufacturer on General Business Outlook.**—Addressing the St. Louis Business Men's League recently, Hugh Chalmers, president of the Chalmers Motor Company, of Detroit, expressed the opinion that the coming year would be marked by business prosperity. Referring to the attitude of the present administration, as reflected in the currency measure, he said: "After a recent talk with Mr. Redfield, Secretary of Commerce, as to the condition of business throughout the country, I am satisfied that the administration's attitude toward business is a very fair one and that it wants to help us all it can. We are now hearing from a great many sources that calamity will follow the passage of the currency bill. I do not believe that calamity will follow its passage, and if it does it will not be due to the bill, for the chances are that when the bill does pass it will be a good one and one that every banker in the country will be willing to accept and give a fair trial."

**Growth of Electric-Service Business in Mobile.**—Since passing under the management of H. M. Byllesby & Company in 1906 the Mobile (Ala.) Electric Company has made an increase of 157 per cent in output of electrical energy. This has been accomplished with an approximate increase of 18 per cent in population and 53 per cent in number of customers. The company is the result of the combination of two companies engaged in competition before May, 1906. The following comparisons are made, the figures being as of May, 1906, and September, 1913: Number of customers, 4203 and 6595; kilowatts of lighting load connected, 4126 and 8397; connected motor load in horsepower, 1100 and 4522; total connected load in kilowatts, 4946 and 11,771. When the combination was effected in 1906 the weekly kilowatt-hour output was about 84,000, while for the week ended Nov. 15, 1913, it was 216,218. During the present year the company has installed new coal-handling and ash-handling machinery in its generating station.

**Extending Trade with South American Countries.**—Secretary Redfield of the Department of Commerce has appointed E. N. Hurley, of Chicago, president of the Hurley Machine Company, United States trade commissioner to South American countries. Mr. Hurley will go to Argentina and other countries in February with a party from the Illinois Manufacturers' Association. In giving his instructions to Mr. Hurley, Secretary Redfield laid stress on the desirability of developing commercial opportunities for the small as well as the large producer. Although the United States, he said, had made wonderful progress in acquiring foreign markets, it has been the large exporters who have reaped the harvest. "Our efforts will be devoted largely to investigating the problem of developing credit for American producers and exporters," Mr. Hurley said. "In this respect American manufacturers at present are decidedly at a disadvantage. When a German manufacturer discovers an opportunity of extending his trade in a foreign country he goes to a German bank for the money to finance his enterprise. The bank in going into the venture is backed by the German government and the band receives 25 per cent of the profits. I am opposed to this plan, under which the foreign business gets into the hands of the banks."

**Westinghouse Electric Company's Safety Campaign.**—In the prevailing effort of progressive manufacturers, transportation agencies and other employers of labor to adhere to the "safety first" principle, the electrical industries are not lagging behind. This campaign represents an endeavor to minimize the danger of accidents, to render all machines and appliances as nearly foolproof as possible, and to remedy conditions detrimental to health. In the extensive works of the Westinghouse Electric & Manufacturing Company, at East Pittsburgh, Pa., the department of safety, working in conjunction with other departments of the factory, has introduced a number of interesting, and in some cases novel, appliances to carry these ideas into effect. One of the new methods for stimulating interest in this work consists of the use of a suggestion box into which notes can be dropped by the employees, treating of any conditions which they think can be remedied and giving their suggestions for means to effect the remedies. This suggestion box scheme has been tried in all the shops of the above company and has been instrumental in pointing out and remedying many dangerous and faulty conditions. A reward of $5 is paid to the author of each suggestion adopted. This scheme might well be tried in other similar shops where the hazard of employment is large and its use would reduce claims for damages arising from accidents.

**Importance of Obtaining Design Registration System.**—A convention was held at the Hotel Astor in New York on Nov. 21 at which matters of primary importance to manufacturers in many branches of the electrical and other industries were discussed. In order to secure the exhibition of English and German products at the Panama-Pacific Exposition in San Francisco, in 1915, Congress has passed the Kahn act, which, if construed literally, is a direct menace to many American manufacturing interests, including those in several branches of the electrical industry. The fundamental purpose of this law is, however, an excellent one, and its opponents in attacking it are aiming at the same time to secure the introduction and passage of a federal design registration law which will fulfil the purpose of the Kahn measure and go a step further by providing for designs of various sorts the same protection which is now given to inventions by the patent laws and to writings and pictures by the copyright laws, familiar to everybody. A few of the electrical interests which are vitally affected by this movement are the makers of ornamental lighting posts, fixtures and glassware, household heating and cooking appliances, signs, vehicles, meters, lamps, fans and wiring supplies. The National Registration League, of Philadelphia, Pa., is making the fight for a design registration law, and co-operating with it are the Federation of Trade Press Associations of the United States, representing 271 leading trade papers throughout the country, as well as seventeen associations of business men to whose attention the matter has been called. Design piracy, as pointed out by one of the speakers at the above convention, is a force which tends to strangle all initiative and prevent all efforts to push business by advertising and sales publicity, and it is annually responsible for immense financial loss to the progressive firms in any line where trade designs have value.

**British Field for American Electric Vehicles.**—The extended use of electrical vehicles for pleasure and for commercial purposes is said to be receiving some attention at this time in the British Isles. The conviction seems to be growing there that cars of this type are the ultimate choice for urban service where frequent stops are necessary and the distances are comparatively short. The main objection to the electric car so far has been the fact that English manufacturers have failed to develop a satisfactory storage battery for use with it, but possible users are now beginning to realize that American cars can be obtained equipped with high-grade batteries. The movement toward the electric vehicle seems to have started with pleasure cars, and one British manufacturer has decided to devote a third of his plant to the making of this class of conveyances, equipping them with the Edison batteries. In the commercial field a number of large business houses have taken up the matter of electric-vehicle service with Edison batteries, and one of these has recently placed a trial order for four cars. The use of electric vehicles for ambulance, fire and central-station repair and delivery service is also being investigated, and it is thought that these cars will finally crowd out all other types for service where moderate speed and high economy are desired. In the introduction of the electric vehicle to the British trade there is necessity, however, for careful salesmanship and a study of British prejudices. The central-station interests are naturally very favorable to the growth of electric vehicle sales there and have promised to provide charging facilities as fast as the demand for them shall require. One central station has proposed to charge electric vehicle batteries between 12 midnight and 6 a. m. at a fixed rate, irrespective of the amount of energy drawn.

**Prominent Engine Builders to Manufacture Diesel Engines.**—Of unusual interest at this time is the announcement, just made, of the organization of the McIntosh & Seymour Corporation, chartered under the laws of the State of New York, to undertake on an extensive scale the manufacture of Diesel engines for both stationary and marine use. This company is backed by strong American interests and also to a large extent by Swedish capitalists who now control the Swedish Diesel Motor Company, which owns the patents covering the Hesselman type of Diesel engines. The plant and organization of the McIntosh & Seymour Company, of Auburn, N. Y., will be taken over by the new concern and the steam-engine business will be continued as heretofore. The initial capitalization of the new company is $2,200,000, half of it common and half 6 per cent cumulative and participating preferred stock. E. S. Church, formerly superintendent of the Akron plant of the International Harvester Company, is executive head of the corporation just formed, and J. A. Seymour, president of the McIntosh & Seymour Company, is vice-president in charge of engineering. The board of directors consists of Marcus Wallenberg, president of the Stockholms Enskilda Bank, Stockholm, Sweden; Frank A. Vanderlip, president of the National City Bank, New York; Thatcher M. Brown, of Brown Brothers & Company, New York; Edwin S. Church, Auburn, N. Y.; J. A. Seymour, Auburn, N. Y.; F. B. Kirkbride, New York City; Oscar Lamm, Stockholm, Sweden, and P. W. Henry, New York City. In addition to furnishing exclusive licenses for work under their valuable American patents, the Swedish interests in the new company insure their active aid and co-operation by furnishing a large part of the working capital and, furthermore, will take an active part in the actual building of the American engines. The McIntosh & Seymour Company, understanding thoroughly American conditions of manufacture, will produce an output suitable for American needs, as well as furnish a highly developed plant and organization adapted for the immediate production of Diesel engines on a large scale. This, together with the strong financial backing available, seems to assure the success of the new enterprise. The Swedish Diesel Motor Company started building engines of the Hesselman type in 1898. Many of their designs covering the most important features peculiar to the Diesel engine, such as the fuel pump, the atomizer and the piston details have been purchased and adopted by other leading European builders of Diesel engines. The McIntosh & Seymour Company has been engaged in the manufacture of high-grade steam engines in this country for many years and its engines are installed in a number of large and successful steam plants throughout the United States. It has also been active in exporting its product to various parts of the world. The move to introduce the Hesselman type engine into this country is in line with the general tendency at present among foreign makers of Diesel engines. Only a short time ago the American Krupp System Diesel Engine Company was incorporated in Delaware for the manufacturing and selling of the Krupp type engine in the United States, and previous to this event the Busch interests in St. Louis acquired the American rights to another German type of Diesel engine and laid plans for its fabrication and sale here. The principal claims made for this Swedish engine lie, as with other types of Diesel engine, in the advantages of cheap oil fuel. The field claimed for it is nearly as broad as for the steam engine and includes central stations, factory and isolated power plants, and railway service. It is said to be especially suitable for marine work, where economy of weight and space are of primary importance.

**Copper Market Conditions as a Large Consumer Sees Them.**—The National Conduit & Cable Company gives its views concerning the present condition of the copper market as follows: "The high crest of the copper market on the recent movement was reached a short time ago, and with a decrease in buying demand a readjustment in prices became inevitable. Domestic consumption has also receded from the high level of a few months ago, and it seems apparent to good judges of the situation that a further reaction in business is probable before satisfactory conditions in manufacturing lines are again established. It is not surprising, therefore, that present sentiment appears to favor the policy of buying on a hand-to-mouth basis. The weakness of the London market lately was especially remarked, and the heavy selling of future deliveries at that center influenced local buyers to hold off until the current uncertainty regarding prices and demand for the next six months required less caution. Although hesitation has become a prominent feature owing to recent developments in business prospects, we expect that this tendency will be only temporary, and with more settled conditions market activity will grow accordingly. With the situation so much confused it is not to be wondered at that the volume of business the last few weeks fell much below the normal. Strikes at mines and shut-downs at smelters helped for a while to keep copper market values high, but with more favorable conditions at producing centers there should be more liberal shipments available for consumption in the coming months. A miners' strike at the Michigan mines has seriously interfered with the production of Lake copper for nearly four months, but notwithstanding the fact that the Lake output for October was only about one-third the normal size there was an increase of 7,669,252 lb. in the total United States productions last month."

### NEW YORK METAL MARKET PRICES

| | Nov. 18 | | Nov. 24 | |
|---|---|---|---|---|
| | Bid. | Asked | Bid. | Asked |
| Copper: | | | | |
| Standard, spot* | Selling Prices | | Selling Prices | |
| | £ s d | | £ s d | |
| London, standard, spot* | 69 10 0 | | 65 0 0 | |
| Prime Lake | | | 15 00 | to 15 25 |
| Electrolytic | 15 25 | to 15 37½ | 14 62½ | to 14 87½ |
| Casting | 15 00 | to 15 12½ | 14 37½ | to 14 62 |
| Copper wire base | 16 37½ | to 16 50 | 16 00 | |
| Lead | 4 35 | | 4 35 | |
| Nickel | 40 00 | to 45 00 | 40 00 | to 45 00 |
| Sheet zinc, f.o.b. smelter | 7.50 | | 7.50 | |
| Spelter, spot | 5 30 | to 5 35 | 5 30 | to 5 35 |
| Tin, spot | 40 62½ | to 41 50 | 39 25 | to 39 65 |
| Aluminum: | | | | |
| Prompt delivery | 19 37½ | to 19 62½ | 19 00 | to 19 25 |
| Future | 19 37½ | to 19 50 | 18 75 | to 19 25 |

### *OLD METALS

| | |
|---|---|
| Heavy copper and wire | 14.00 to 14.00 |
| Brass, heavy | 9.00 to 9.00 |
| Brass, light | 8.25 to 8.25 |
| Lead, heavy | 4.20 to 4.20 |
| Zinc, scrap | 4.37½ to 4.37½ |

### *COPPER EXPORTS

| | |
|---|---|
| Total tons to Nov. 24 | 23,000 |

*From daily transactions on the New York Metal Exchange.

# Corporate and Financial

**Corning (N. Y.) Gas & Electric Company Reorganization.**—The Corning Light & Power Corporation was incorporated recently under the laws of the State of New York, for the purpose of acquiring, extending and improving the properties of the Corning Gas & Electric Company. Capital stock to the amount of $400,000 was authorized, together with an issue of $100,000 in 6 per cent ten-year debenture bonds.

**Alabama Hydroelectric Development Progressing Rapidly.**—The large hydroelectric development of the Alabama Traction, Light & Power Company, on the Coosa River, near Birmingham, Ala., is rapidly nearing completion and the company expects to furnish electricity to the Birmingham district from this station early in 1914. A capacity of between 50,000 hp and 60,000 hp will be possessed by this station when completed. At the present time the above-mentioned district is drawing energy from the steam plant operated by this company at Gadsden, Ala., since June of the present year. When the new development is placed in operation this steam plant will be held as reserve capacity.

**Federal Utilities, Inc., Passes Preferred Dividend.**—The directors of the Federal Utilities, Inc., have decided to pass the regular quarterly dividend of 1½ per cent on its $1,000,000 preferred stock outstanding, due at this time. In explanation of this action, President De Forest Candee has sent the following letter to the stockholders: "The income of your company for the ten months ended Oct. 31, 1913, has been more than sufficient to meet the dividend requirements, but owing to the depreciation in the market value of the securities and the consequent shrinkage in surplus, the directors have deemed it wise to conserve the resources of the company and defer action for the present respecting the payment of the quarterly dividend of 1½ per cent, payable Dec. 1, on your company's 6 per cent cumulative preferred stock."

**Nevada-California Power Company Consolidation.**—Announcement has been made that funds for the refinancing of the Nevada-California, and for its consolidation with the Southern Sierras Power Company, have been secured. The plans for the new concern include the issue of $5,000,000 capital stock and a bond issue large enough to care for several years' requirements. All the stock of the latter company is held by the former. The Nevada-California Power Company owns three hydroelectric generating plants, with a combined capacity of 18,750 hp, located at Bishop Creek, Cal., and has transmission lines connecting a number of towns in California and Nevada. The Southern Sierras Power Company owns hydroelectric and steam generating stations aggregating 12,750-hp capacity. It also has an extensive transmission system covering a large area in Southern California.

**Purchase of Pennsylvania Utility Approved.**—Interests associated with the Lehigh Valley Transit Company and the United Gas Improvement Company have submitted a plan for the purchase of the Lehigh & Northampton Light, Heat & Power Company, and this plan has been approved by the bondholders' committee of the latter concern. This company has outstanding $155,000 of first mortgage 5 per cent gold bonds and $214,000 of consolidated mortgage bonds drawing the same interest. The holders of $150,000 of the first-mentioned and of $161,000 of the second-named securities have assented to the purchase plan, as have the stockholders of the company. By this plan there will be paid to the committee $195,000 in cash and $107,000 of the refunding and improvement bonds of the Lehigh Valley Transit Company, which can be converted into cash by the committee. This payment will cover the entire claims of the first mortgage bondholders and a portion of those of the consolidated bondholders.

**Washington Utility Plans Increased Capital Stock.**—A special meeting of the shareholders of the Washington Water Power Company has been called for Dec. 2, at Spokane, Wash., to authorize the increase of $5,000,000 in the company's capital stock, recently decided upon by its directors. If this proposition is ratified, the capital stock will become $20,000,000. According to a recent statement by D. L. Huntington, president of the company, only part of the new stock will be issued at present, and this will be offered for subscription by the stockholders on a basis of 10 per cent of their holdings. Part of the proceeds of this financing will be used in paying for work now in progress on the Long Lake hydroelectric development. For the year ended Oct. 31 the gross earnings of the company were $3,224,136 and the net earnings, after payment of taxes, amounted to $1,594,496. Up to that time the above mentioned water-power plant had called for a total expenditure of $3,748,852.

**Detroit Edison Company's Proposed Financing.**—On Dec. 17 there will be held a special meeting of the stockholders of the Detroit Edison Company to pass on the proposal of the company's directors to increase its capital stock $10,000,000 and to issue $6,000,000 of convertible debenture 6 per cent ten-year bonds. Construction work recently completed and extensions and improvements now in progress will, it is claimed, call for the payment of approximately $3,500,000 at this time. It is proposed to issue this portion of the bonds, if authorized, within a short time and to allow the stockholders to subscribe the same at par up to 25 per cent of their holdings. Part of the increase in capital stock, it is understood, will be reserved against the convertible debenture issue and the balance will be held in the treasury for the present, so that no part of it is expected to be issued at this time. The gross earnings of the company for the year ended Oct. 31 amounted to $5,351,524, and the net earnings during the same period were $2,236,582.

**Annual Report of Large German Electrical Manufacturer.**—The report of the Allgemeine Elektricitäts Gesellschaft, Berlin, Germany, for the fiscal year ended June 30, 1913, shows that the company delivered during that period electrical equipment with a total rating of 2,533,085 kw. This output included one 20,000-kw, three 15,500-kw and four 11,500-kw turbo-generators. The total business was $15,000,000 in excess of the preceding year. The net earnings of $7,226,121 enabled the company to pay a dividend of 14 per cent on a capitalization of $38,725,000, to add $250,000 to the employees' welfare fund, to give $300,000 in premiums to officials and to make other payments, including taxes and reserve. The report states that the development of metallic-filament lamps has decreased the output of carbon lamps and arc lamps. The new ½-watt nitrogen lamp is making very gratifying progress and is now manufactured in ratings of 600 cp to 3000 cp. The electric-railway business is also very satisfactory, particularly in orders for high-tension direct-current apparatus and for single-phase heavy railway equipment. Orders are in hand for twenty-seven electric locomotives.

**Columbus Utility Merger Proposition Altered.**—Plans have been on foot for some time for the reorganization and combination of interests of the Columbus Railway Company, the Columbus Railway & Light Company, the Columbus Edison Company, and the Columbus Light, Heat & Power Company, all operating in and around Columbus, Ohio. A circular letter was recently issued to the stockholders of these companies, giving notice of the status of these negotiations and of an alteration in the original plan made necessary by the presence of an unexpected obstacle. It seems that the first three of the above-mentioned companies have responded to the request for deposit of stocks by placing with the depositary 81 per cent, 88 per cent and 93 per cent, respectively, of their total capital stocks. However, only 43 per cent of the total stock of the last-mentioned company had been deposited, owing to the fact that some of its shareholders were dissatisfied with their part in the consolidation plan. These interests had made an unsuccessful legal fight against the Public Service Commission of the State of Ohio for the purpose of frustrating this plan. The circular letter proposed a way out of the difficulty by going on with the consolidation of the three companies favorable to it, leaving out the other company, whose stockholders opposed it. The consent of the shareholders of the three first companies was asked for this alteration in the original plan of consolidation, and the time limit for depositing or withdrawing stock under the altered plan was changed to Nov. 25. Mr. S. G. McMeen, president of the Columbus Railway & Light Company, is engineering the reorganization.

## Business Notes

**The Federal Hardware & Electric Company,** whose main office is located at 164 Federal Street, Boston, Mass., and whose factory is at Waltham, Mass., is prepared to furnish switchboards, panelboards, cabinets and electrical and combination lighting fixtures, all of which lines it is manufacturing at the present time.

**The McIntosh Richards Company,** of 349 Division Avenue South, Grand Rapids, Mich., has been engaged for three months in the manufacture of electric lighting fixtures. Mr. W. F. G. McIntosh, president of the company, was formerly associated with the M. B. Wheeler Electric Company and with the Lewis Electric Company.

**The H. W. Johns-Manville Company,** of New York, has been compelled to seek larger quarters for its Baltimore (Md.) branch. A modern six-story building with a ground area measuring 47 ft. by 187 ft. is now occupied as a store, office and warehouse. This building is located at 207-213 East Saratoga Street, within two blocks of the post office, and right in the heart of the business section.

**The Automatic Train Control & Signal Company,** of 516 Scarritt Building, Kansas City, Mo., is preparing to enter the electrical field with a line of automatic electrical train controls and signals for use on both steam and electric roads. It is proposed to erect shortly in Kansas City a plant for the manufacture of this apparatus. E. E. Hairgrove is secretary, treasurer and general manager of the company, and Carl Woods is its president.

**The Keeler Battery Company** has been organized in Louisville, Ky., for the purpose of manufacturing and installing storage batteries. Quarters have been established on Third Street near Green Street. George G. Keeler is president of the company and J. W. Gross secretary and treasurer. The concern reports a growing demand for batteries, an unusual sale recently being that of two 6-volt, 200 amp-hr. batteries for the State Tuberculosis Association of Kentucky. The equipment is used for operating display devices in a demonstration car which has been taken over the State. Batteries were also furnished for lighting banners used in a "flambeau parade" in connection with the recent Perry Centennial in Louisville.

## New Industrial Companies

**The Edison Turbine Company,** of Portland, Maine, has been granted a charter with a capital stock of $1,000,000. Albert F. Jones is president, T. L. Croteau treasurer, and James E. Manter clerk, all of Portland.

**The American X-Ray Equipment Company,** of New York, N. Y., has been incorporated by John L. Clark, Pompeo M. Maresi and Robert W. Crawford, 52 Broadway, New York, N. Y. The company is capitalized at $35,000.

**The Power Transmission Clutch Company,** of Rushville, Ind., has been incorporated by O. E. Woodbridge, J. J. Striegel and J. Wiley. The company is capitalized at $30,000 and proposes to manufacture and sell power transmission clutches.

**Martins, Adams & Company,** of New York, N. Y., has been incorporated with a capital stock of $15,000 to manufacture and deal in electrical machinery, printing, publishing, etc. The incorporators are Everett L. Adams, Percival V. Martin and William P. Heineken, 6 Church Street, New York, N. Y.

**The Paige-Detroit Company,** of New York, N. Y., has been chartered with a capital stock of $50,000 to manufacture motors, machinery, etc. The incorporators are E. M. Dalley, of Larchmont; S. J. Wise, of New York, and F. W. Kolb, of Brooklyn, N. Y.

**The George Allen Mullen Company** has filed articles of incorporation under the laws of the State of Delaware for the purpose of doing a general electrical engineering business and electrical work of all kinds. The company is capitalized at $50,000, and the incorporators are F. D. Buck, G. W. Dillman and B. M. Grawl, of Wilmington, Del.

## Trade Publications

**Switches.**—In a recently issued leaflet the Railway & Industrial Engineering Company, Pittsburgh, Pa., briefly describes its simultaneously operated disconnecting switches of all ratings and voltages, for indoor and outdoor mounting.

**Telephone Material Price List.**—The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., has recently issued some loose-leaf price sheets, superseding all others, referring to its telephone construction material and supplies.

**Tube Cleaners.**—A thirty-two-page pamphlet recently issued by the Liberty Manufacturing Company, 600 Susquehanna Street, Pittsburgh, Pa., refers to various types of Liberty tube cleaners for the removal of boiler scale. Illustrations and brief descriptions are given.

**Ball Bearings.**—In a well-printed booklet of twelve pages the Hess-Bright Manufacturing Company, Philadelphia, Pa., presents a brief discussion concerning ball bearings and their application to axle generators. The railway type of ball bearings is shown, as well as a number of applications of these bearings and their constructive features.

**Motor Applications.**—"Motor-Driven Dairy, Creamery and Ice-Cream Machinery" is the title of a pamphlet issued by the Westinghouse Electric & Manufacturing Company. The book gives valuable data on its subject matter. A number of interesting views illustrate the method of mounting the motors for driving this class of machinery.

**Catalog of Gifts.**—A twenty-eight-page catalog bearing the title "Holiday Suggestions" has been issued by the Electric Appliance Company, Chicago, Ill. It is replete with illustrations of electrical household appliances, the most modern of gifts, among which are beautiful portable lamps, practical irons, washing machines and vacuum cleaners, comfortable warming-pads and other devices, as well as Christmas tree outfits.

**Pumps.**—Bulletin No. 755 of the Platt Iron Works Company, Dayton, Ohio, refers to Platt high-lift and turbine pumps for high heads, water-works, boiler-feeds, mine and similar service. The general construction and principles of operation are illustrated and described. These pumps are built for all heads and service conditions up to 700 ft. The present bulletin shows designs most applicable to ordinary conditions.

**Lamps.**—The Koerting & Mathiesen Company, 22 East Twenty-first Street, New York, has issued a pamphlet setting forth the reasons why the "Excello" flaming-arc lamp excels. It tells in an interesting manner something of the early history of the arc lamp and devotes a chapter to a discussion of the good points of the "Excello" lamp. The pamphlet is well written, is printed on dull-finished paper and has an attractive cover.

**Household Appliances.**—The Hotpoint Electric Heating Company, Ontario, Cal., has sent out a broadside addressed to dealers calling their attention to the double-page advertisement in the Saturday *Evening Post* which suggests Hotpoint appliances as ideal Christmas gifts. The poster is printed in red and green ink, and the reverse side shows the design of the "holly" paper in which all Hotpoint appliances for Christmas selling will be sealed.

**Christmas Suggestions.**—Under the title "Christmas Gift Suggestions," the Central Electric Company, 320-326 South Fifth Avenue, Chicago, has issued an eighty-page catalog with an attractive cover in colors, calling attention to the almost bewildering variety of electrical lamps, cooking and heating utensils, luminous radiators, flashlights, electrical toys and other articles suitable for Christmas presents. Prices are listed for each article, and the catalog is copiously illustrated.

**Blue-Printing Machine.**—An oblong folder has been issued recently by the Buckeye Engine Company, Salem, Ohio, bearing the unusual title of "Worry Is a Vampire—Kill the Animal." It tells in narrative form the story of the ease with which one manufacturer now makes its blueprints with the Buckeye electric blue-printing machine instead of being dependent on the sun for the operation of printing. A description of the device is given, together with an illustration and some testimonial letters.

# Personal Mention

**Mr. Henry L. Bennett,** who has been acting manager of the municipal electric plant at Chicopee, Mass., has resigned.

**Mr. E. J. Wolcott** has been elected superintendent and manager of the city light and water-works plants of Harrington, Kan.

**Mr. J. H. Sanders** has succeeded Mr. J. Stephaney as superintendent of the municipal electric lighting and water plant at Crystal Falls, Mich.

**Mr. F. H. Chamberlain,** of New York City, has been appointed general manager of the Alabama Power Company, with offices at Birmingham.

**Mr. E. S. Fletcher,** local manager of the Texas Power & Light Company at Temple, Tex., has also been appointed manager of the plant at Taylor.

**Mr. William E. G. Mitchell,** president of the Mitchell-Rand Manufacturing Company of New York, was married on Nov. 18 in Brooklyn to Miss Helen Holly Booth.

**Mr. Claude H. Cox** has resumed his position as manager of the electrical department of the Coeburn (Va.) Light & Power Company, which he resigned last April to travel.

**Mr. Dan Break** has been appointed general manager of the municipal lighting plant at Ridgetown, Ont., Can., succeeding Mr. W. H. McMachon, who formerly owned the plant.

**Mr. H. B. Corning,** who was formerly with the Mexico Light & Power Company, has been appointed commercial agent for the Havana (Cuba) Electric Railway, Light & Power Company.

**Mr. Victor T. Noonan,** of the Rochester (N. Y.) Railway & Light Company, has been appointed safety inspector for the Western New York district by the Empire State Gas & Electric Association.

**Mr. M. J. Warner,** of Branford, Conn., has been elected secretary and treasurer of the Rockville-Willimantic Lighting Company, which supplies central-station service in Rockville and Willimantic, Conn.

**Mr. H. B. Soper,** formerly superintendent of the Penn Central Light & Power Company, Altoona, Pa., has become associated with the Connecticut River Transmission Company at Shelburne Falls, Mass.

**Mr. Charles Harris,** for the last two years electrical engineer of the Salt River project of the Reclamation Service, has been appointed chief inspector of the service's power division, with headquarters at Chicago.

**Mr. E. B. Severs** has resigned as superintendent of motive power of the Tri-State Railway & Electric Company, of East Liverpool, Ohio, and has accepted a position with the J. G. White Company, of New York.

**Mr. George Service,** consulting engineer, of Toronto, Ont., has become associated with the Dominion Power & Transmission Company, Ltd., of Hamilton, Ont. He will have charge of the construction of the company's new steam turbine plant.

**Mr. R. L. Baldwin** has resigned as electrical engineer for Burns & McDonnell, a consulting engineering firm of Kansas City, Mo., to accept an appointment as electrical engineer of the Public Service Commission of the State of Missouri. Mr. Baldwin will make his headquarters at Jefferson City.

**Mr. Edward N. Hurley,** Chicago, who will sail for Buenos Aires Feb. 7, to visit South American trade centers with members of the Illinois Manufacturers' Association, as noted in our issue of Nov. 22, has also accepted an appointment as United States trade commissioner to South American countries.

**Mr. Guy E. Tripp,** chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, returned this week from a three weeks' trip abroad. Speaking of financial conditions, Mr. Tripp said that business in England is slowing down considerably and that labor conditions in that country are far from satisfactory.

**Mr. W. M. Graff,** assistant power engineer of the Edison Electric Illuminating Company of Brooklyn and a graduate of Yale, has resigned to accept the position of engineer with the Graves Engineering Company, Inc., of New York. Mr. Graff went to the Brooklyn Edison company from the Hartford (Conn.) Electric Light Company, where he had been engaged in power-cost investigations. He was at one time an instructor in power-plant testing at Yale.

**Mr. Georges Claude,** whose argon-filled tube lamp has recently been demonstrated in this country, began his career as an investigator in 1886, at which time he worked under d'Arsonval in the École de Physique et Chimie de Paris, where he continued until 1889. From 1890 to 1894 he was chief of the laboratory of the municipal electric station. In this early period his work was confined to electricity and resulted in the invention of an instrument for measuring phase difference between two currents, a method of measuring efficiency of transformers and a method of localizing faults in street railway tracks by means of high-frequency currents. According to d'Arsonval this is one of the first practical applications of high-frequency currents. Between 1896 and 1902 Claude was engineer in charge of scientific research work for the French Thomson-Houston Company, during which time he made an exhaustive series of experiments on return currents in street railway systems. Another service rendered by him to the science of electricity was the writing of a popular book on electricity of which over 36,000 copies were sold and for which he was awarded, in 1904, the Hébert prize by the Académie de Sciences. However, the most important works of Claude were in connection with practical applications of gases. In the year 1895, in conjunction with Mr. A. Hess, he developed a method of dissolving acetylene which has done much to promote the practical development of oxy-acetylene welding. Following the work of Linde in the liquefaction of air, he invented the methods of liquefaction under pressure and also the compound-stage liquefaction. The liquid air he utilized for separating oxygen and nitrogen. For this work Claude was awarded the Montyou prize in 1908 by the Académie de Sciences. The theory of the processes by which he separated oxygen and nitrogen was set forth in his book "Liquid Air, Oxygen and Nitrogen," published in Paris in 1909. Following along the same general lines many special processes have been developed, for instance, the preparation of very pure nitrogen, the manufacture of hydrogen and carbon dioxide. In the field of pure science Claude has developed apparatus for extracting neon and helium in large quantities and under conditions which permitted him to measure with accuracy the content of these gases in the atmosphere. His work along this line has been of much benefit to a large number of scientists, and he himself made practical use of neon in the production of the neon-tube lamp, one of his latest inventions. In addition to the prizes mentioned above, Claude has received the Michel Alcon prize of the Société des Ingénieurs Civils. He is a member of the Council of the Société Française de Physique, a member of the Council of the Association du Froid, a member of the Commission on Explosive Substances, and a member of the Council of the Société des Ingénieurs Civils. In 1908 he was vice-president of the first section of the International Refrigeration Congress in Paris, and in 1911 he was president of the first section of the International Refrigeration Congress in Vienna.

# Obituary

**W. E. Dunbar,** assistant electrical engineer in charge of substations on overhead lines of the Aurora, Elgin & Chicago Railroad, Wheaton, Ill., died at his home in Elgin, Ill., on Nov. 15. Mr. Dunbar and his assistant were making an inspection trip on a gasoline speeder on Nov. 6 when the car jumped the track at Ingalton, Ill., fatally injuring Mr. Dunbar and instantly killing his assistant.

**John Donovan,** formerly president of the St. Joseph (Mo.) Railway, Light, Heat & Power Company, is dead. Mr. Donovan was fifty-nine years old and was interested in a number of enterprises other than the railway and lighting company. He was credited with bringing the packing houses to St. Joseph and was president of the St. Joseph Stock Yards Company. A widow and a daughter survive him.

# Construction

## New England

NEW MARKET, N. H.—The New Market El. Co. expects to erect a [illegible] with the Amherst Gas Co. for lighting the town with electricity for a period of three years from June 1, 1913. Under the terms of the [illegible] lamps, and the arc lamps now in use are to be replaced partly with high-candle-power incandescent lamps and partly by an equivalent number of smaller incandescent lamps.

BRIDGEPORT, CONN.—Bids will be received in the office of the Board of Education, Bridgeport, Conn., for the following branches of work in connection with the Bridgeport High School, to be erected at Congress Street and Lyon Terrace: general work, heating and ventilating, plumbing and electrical work. Plans and specifications may be obtained at the office of the board, Bridgeport, or at the office of James Gamble Rogers, architect, 470 Fourth Avenue, New York, N. Y., where copies of plans and specifications may be obtained, for which a deposit of $50 will be required for general work, and $25 each for heating and ventilating, plumbing and electrical work, to be refunded upon return of same. William B. Boardman is secretary of Board of Education.

## Middle Atlantic

ADDISON, N. Y.—The Addison El. Lt. & Pwr. Co. expects to purchase within the the next 12 months one 125-hp gas engine for natural and producer gas. L. P. Zimmer is manager and secretary.

CASTLETON, N. Y.—The Schodack Lt. & Pwr. Co., of Castleton, expects within the next six months to purchase 25 poles, two transformers, 25 meters, 2000 ft. No. 2 wire, 2000 ft. No. 8 wire, 200 ft. No. 4 wire, 50 incandescent lamps and 100 tungsten lamps (from 25 watt to 60 watt). The company purchases electricity from the A. C. Cheney Piano Action Co. L. M. Lansing is treasurer and manager.

CHATEAUGAY, N. Y.—The Chasm Pwr. Co., of Chateaugay, expects to erect 5 miles of 13,200-volt transmission line, crossing the Canadian border within the next six months. W. T. Thayer is manager.

DUNKIRK, N. Y.—The Dunkirk Merchants' Exchange has appointed a committee to promote the installation of ornamental cluster lamps on the principal business streets to replace the arches now in use.

JAMESTOWN, N. Y.—Within the next four months the Jamestown Ltg. & Pwr. Co. expects to purchase one carload of poles; also within the next few months a few ornamental lamp-posts. Albert S. Price is secretary and treasurer.

LITTLE VALLEY, N. Y.—Within the next few months the managers of the municipal electric-light plant expect to purchase one 150-hp four-cylinder gas engine, one 15-hp to 20-hp, single-phase motor and one two-stage centrifugal pump for the municipal electric-light plant. Two Westinghouse constant-current regulators have recently been installed and the street-lighting system changed from arc lamps to cluster and single lamp standards, consisting of about 160 single 100-watt lamps, four three-lamp clusters (100-watt lamps), and six two-lamp clusters (100-watt lamps). G. S. Boller is superintendent of municipal electric-light plant.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, until Dec. 1, for installing electric elevators in the Bay Ridge High School, on Fourth Avenue, between Sixty-seventh Street and Senator Street. Blank forms and specifications may be obtained or seen at the office of the superintendent; also at the branch office, 131 Livingston Street, Brooklyn.

ONEONTA, N. Y.—The Oneonta Lt. & Power Co. expects within the next six months to install one 250-hp steam engine and a 250-hp boiler. G. A. Lane is general manager.

AKRON, PA.—The Akron El. Lt. & Pwr. Co. expects to purchase within the next eight months one 75-hp producer-gas engine, one 50-kva, 60-cycle, three-phase generator (257 r.p.m.), with exciter for same. A. N. Wolf is treasurer.

JOHNSTOWN, PA.—Arrangements are being made by the Dale Lt., Ht. & Pwr. Co., of Johnstown, for further extensions of its service in the city proper. Orders have been placed for 500 poles, which will be erected in the Seventh Ward.

JUNIATA, PA.—The Borough Council has granted the Raystown Wtr. Co., of Huntingdon, a franchise to furnish electricity in Juniata. Electricity will be transmitted from the plant near Huntingdon, a distance of [illegible] miles.

MEADVILLE, PA.—The People's Incandescent Lt. Co., of Meadville, Pa., has just completed the erection of a substation at Richley's Grove and has placed contract for substation, passenger station and freight station building at Edinboro, Pa. Electric equipment (consisting of a 500-kw rotary converter for each station) has been purchased from the Westinghouse El. & Mfg. Co. The company is erecting a 33,000-volt transmission line from Erie to Venango, and is also installing electric-lighting equipment at Edinboro substation and it expects to install lighting equipment at the Venango substation in the spring. Material for the above work has been purchased from the Westinghouse El. & Mfg. Co. [illegible] M. Hatch is general manager.

SHARON, PA.—The Shenango Valley El. Lt. Co., of Sharon, has submitted a proposal to the City Council offering to replace the present gas lamps with 100-watt and 150-watt tungsten lamps. There are now [illegible] in use. J. C. Chesnut is superintendent of the company.

JERSEY CITY, N. J.—A report is being prepared by Frank Hague, commissioner of public safety, showing the necessity for the installation of a new fire-alarm system. The cost is estimated at about $10,000.

NEWARK, N. J.—The Public Service Lt. Co., of New Jersey, is planning to erect a substation at Washington and Oliver Streets, Bergen town, and another on Monroe Street, Riverside, to cost about $50,000 [illegible]

PERTH AMBOY, N. J.—The installation of a new street-lighting system on State Street, from Smith Street northerly, is being considered by the City Council and property owners on State Street. It is proposed to use ornamental iron upright posts with brackets to support lamps.

SALEM, N. J.—The power house and boiler plant of the Salem Glass Works were partially destroyed by fire with other buildings on Nov. 17. It is understood that the buildings will be rebuilt immediately. Isaac Bacon is superintendent.

WILMINGTON, DEL.—Within the next six months the Wilmington & Philadelphia Trac. Co. expects to erect 4 miles of 6600-volt, three phase transmission line. J. A. Berndt is purchasing agent.

BALTIMORE, MD.—Plans are now being prepared by Robert J. McCuen, superintendent of lamps and lighting, for extending the ornamental lighting system in the residential sections. During the coming year the ornamental lamps will be installed on the second section of the Fallsway from Bath to Madison Street; also on the first section of the Key Highway, from Light to Montgomery Street, and on several other streets.

CLARKSBURG, W. VA.—Within the next few months the Clarksburg Gas & El. Co. expects to build a new power station and to purchase a 2000-kw turbine, generators, boilers and other equipment, including exciters, switches, protective devices, pumps, condensers, etc. Leonard Peck is superintendent.

WINCHESTER, VA.—The Northern Virginia Pwr. Co., of Winchester, is completing a 25-mile transmission line (three-phase, 60 cycles, 22,000 volts) connecting its lines at Martinsburg with the lines at Berkeley Springs. The company has recently purchased a 1000-hp waterwheel and generator, vertical type, for its hydraulic plant at Millville. D. M. Swink is superintendent.

WASHINGTON, D. C.—Bids will be received at office of chief signal officer, War Department, Washington, D. C., until Dec. 3, under Proposal 683, for furnishing the following supplies: (1) For eight electrical engineers' tool chests, complete, as per specification 192-D; (2) nine standard oil equipments, complete for switchboard rooms, as per specification 407. Major W. L. Clarke is disbursing officer.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 9 for furnishing at the various navy yards and naval stations the following supplies: Brooklyn, N. Y., Schedule 6055—2000 ft. desk telephone cord; 20,0[illegible] ft. twisted telephone wire, 400 ft. steel conduit, complete with [illegible] Boxes; N. Y. and Norfolk, Va., Schedule 6056—twenty-seven [illegible] electric lanterns. Newport, R. I., Schedule 6030—installing electric light[illegible] Bids will also be received at the same time until Dec. [illegible] as follows: Puget Sound, Wash., Schedule 6041—two electrically dr[illegible] ventilating fans. Schedule 6035—two arc engines and pumps. Mare Island, Cal., Schedule 6036—one 40-kw motor-generator set, complete. Schedule [illegible] 5000 lb. chloride of calcium.

## North Central

ADRIAN, MICH.—The Citizens' Lt. & Pwr. Co., of Adrian, is considering the installation of a 30-ton ice factory in connection with its electric plant. H. A. Fee is manager.

FORD, MICH.—The village officials contemplate calling a special election in the near future to vote on a proposed bond issue of $20,000, the proceeds to be used for extensions to the lighting system and [illegible] municipal improvements. Ford has not a post office.

GAYLORD, MICH.—The power house of the Saginaw Products Co. will be 100 ft. long by 40 ft. wide. The station will be equipped with two Corliss engines, a generator and a special engine to operate generator.

HOLLAND, MICH.—The Board of Public Works expects to purchase within the next 12 months material for distribution system, including [illegible] to 100 kva in transformers, one carload of poles, 12 arresters, two hundred insulators, 6000 ft. of wire and 200 meters (estimates are given as [illegible] transformers, and 25 arc lamps. R. B. Cheatham is superintendent of public works.

MARQUETTE, MICH.—The Marquette County Gas & El. Co. is contemplating extending its service to the Palmer District.

ONAWAY, MICH.—The Onaway El. Lt. & Pwr. Co. expects to [illegible] cate its power-house equipment within the next six months and to [illegible]

ase one 150-kw or 200-kw generator and waterwheel and waterwheel vernor. Herbert H. Vaughn is secretary and treasurer.

THREE OAKS, MICH.—Within the next few months the managers the municipal electric-light plant expect to purchase two engines, generator, two exciters and switchboard; also transformers for line, anging the system from 133 to 60 cycles. R. E. Schmuhl is engineer.

CLEVELAND, OHIO.—Bids will be received at the office of W. H. rby, secretary to the director of public service, 204 City Hall, Cleve- d, until Dec. 10 for distribution switchboard and equipment for the unicipal electric-light plant. Bids will also be received for steam-turbine- iven exciter set for the municipal electric-light plant. Plans and speci- ations may be obtained at the office of the engineer of construction, oom 419, City Hall, Cleveland. W. J. Springborn is director of public rvice.

DEFIANCE, OHIO.—The Auglaize Pwr. Co., of Defiance, expects to ect within the next two months 7½ miles of 33,000-volt transmission e from Neapolis to Swanton, to furnish electricity to the Swanton Lt. Pwr. Co. W. P. Wallace is general manager.

GALLIPOLIS, OHIO.—Experiments are being made with a view of stalling a new street-lighting system. Dr. Bean is chairman of the reet-lighting committee.

GRANVILLE, OHIO.—Within the next six months the managers of e municipal electric-light plant expect to build a new power house and purchase one 100-hp horizontal tubular boiler. Joseph S. Rodes is perintendent.

LA RUE, OHIO.—The Village Council has granted the Joseph anser Lumber Co. a franchise to furnish electricity for street and mmercial lighting in La Rue for a period of 10 years, the present ntract expiring Dec. 31. The company will make improvements to plant, including the installation of a new street-lighting system.

UPPER SANDUSKY, OHIO.—At an election held recently the pro- sal to issue $25,000 in bonds for the construction of a municipal elec- c-light plant was carried.

WILMINGTON, OHIO.—The property of the Wilmington Wtr. & Lt. o. has been purchased by the Dayton Pwr. & Lt. Co., of Dayton. Elec- icity for operating the local system will be supplied from the Dayton ant.

YOUNGSTOWN, OHIO.—The Mahoning County Lt. Co., recently corporated, has applied to the State Utilities Commission for authority issue securities to finance the construction of a plant.

BEAVER DAM, KY.—Plans are being considered for the installation of municipal electric-light plant, for which bonds have been voted.

LEXINGTON, KY.—The Lexington Utilities Co. expects to purchase thin the next few months its usual supply of electrical appliances and pplies, including heating and cooling apparatus, household labor vices, including vacuum cleaners, washing machines, wiring supplies, vitches, etc. J. P. Pope is electrical engineer.

LOUISVILLE, KY.—The Louisville Clothing Co. has decided to in- ease the output of its plant and expects to purchase some electric otors. M. R. Harned is president.

LOUISVILLE, KY.—The installation of an electric-light plant at e city workhouse is reported to be under consideration by the Board of ublic Safety. Rush C. Watkins is chairman.

MAYSVILLE, KY.—The city of Maysville is contemplating the instal- tion of a street-lighting system and is now advertising for bids on stallation and operating same. An ornamental lighting system is to be stalled in the down-town district. The cost of maintaining the system estimated at $10,000 per year.

SCOTTSVILLE, KY.—The local electric-light plant, owned by G. D. ead, has been leased to Mays & Schlinker, of Glasgow, Ky. It is nderstood that improvements will be made to the plant, including the stallation of an engine and generator.

NORTH JUDSON, IND.—The North Judson El. Co. within the next x months expects to erect about 12 miles of transmission line; it also xpects to purchase within the next 30 days 32 or 34 boulevard lamp- osts for five-lamp clusters. F. D. Pixa is secretary and treasurer.

ALEDO, ILL.—The Town Council has adopted a resolution authoriz- g a committee to engage consulting engineers to make investigations egarding the cost of the installation of a municipal electric-light plant; is also proposed to install a heating plant.

BELVIDERE, ILL.—The Illinois Northern Utilities Co. is reported o have purchased a site in Belvidere, upon which it proposes to erect large power plant, to cost about $500,000.

BUSHNELL, ILL.—The contract for installing ornamental street lamps as been awarded to the McComb El. Construction Co., of Macomb.

CHICAGO, ILL.—The capital stock of the Universal Utilities Co. of llinois has been increased from $50,000 to $500,000.

DANVILLE, ILL.—The Danville St. Ry. & Lt. Co., it is reported, s contemplating extensive improvements to its system, involving an xpenditure of about $250,000. The work will include the installation f steam turbine and condensing apparatus, to cost about $180,000; also ew street cars, at a cost of about $34,000.

DIXON, ILL.—The Illinois Northern Utilities Co., 137 South La Salle Street, Chicago, has recently closed 10-year contracts for street lighting in he following towns and cities: Belvidere, Harvard, Capron, Kingston, Kirkland, Earlville, Adeline and Mount Morris. It has recently completed the installation of street-lighting systems in Fulton, Amboy, West Brooklyn, Franklin Grove, Forreston, Somonauk, Leland, Sandwich and Dixon and has recently completed the installation of ornamental street-lighting systems in Amboy, Franklin Grove, Forreston, Dixon and Harvard. The company now has under way the installation of ornamental street-lighting systems in Belvidere, Sterling, Fulton, Oregon, Genoa, Plano and Earlville. Charles Bryant is general contract agent.

FREEPORT, ILL.—Plans are being prepared by the Freeport Ry. & Lt. Co. for the installation of a new lighting system to be installed at the expiration of the present street-lighting contract two years hence. Mr. Pengra is acting manager of the company.

HILLSBORO, ILL.—The Southern Illinois Lt. & Pwr. Co., of Hillsboro, will extend its transmission lines to Greenville. The equipment will include two-panel substation switchboard with voltmeter, wattmeter and oil switches, one 50-kva, 16,500-volt transformer, 320 30-ft. white cedar poles, 24 miles No. 6 hard-drawn copper wire, 100 Westinghouse meters and 30 tungsten lamps of 60 cp. B. H. Walcher is secretary.

JOLIET, ILL.—The installation of electrical equipment to operate the city water-works pumping station is said to be favored by Mayor Harvey Wood. The cost of equipping the same is estimated at $35,000.

KEWANEE, ILL.—Steps have been taken by the City Council to secure an engineer to make an estimate of the cost of installing a municipal electric plant to furnish electricity for lighting the streets and for commercial and power purposes. E. L. Brown, president of the Galva El. Lt. Co., of Galva, it is reported, is contemplating applying for a franchise to install an electrical distributing system in the city. Electricity would be supplied from the plant at Galva.

LA SALLE, ILL.—The City Council has passed an ordinance requiring all wires in the business district to be placed underground.

LA SALLE, ILL.—The Marquette Cement Co., of La Salle, contemplates the installation of a 3000-kw generator and engine in its power plant.

MATTOON, ILL.—The Central Illinois Pub. Ser. Co., of Mattoon, has filed a certificate with the Secretary of State showing an increase in capital stock from $6,000,000 to $10,000,000. The company is said to be working out a scheme for merging the public utilities in Central Illinois.

MORRISON, ILL.—The light committee of the City Council in its report advises the construction of a municipal electric-light plant.

MOUNT VERNON, ILL.—The Citizens' Gas, El. & Htg. Co., of Mount Vernon, is seeking an extension of its franchise in this city with a view of extending the lighting territory. H. E Brandli is manager.

NAPERVILLE, ILL.—Improvements are now being made to the municipal electric-light and water plant, involving an expenditure of about $30,000. Oliver W. Strubler is city controller.

PEORIA, ILL.—The residents of Hamilton Boulevard from Monroe Street to North Street have notified the City Council that they will install ornamental lamps if the city will maintain them. John E. King is interested.

SULLIVAN, ILL.—The City Council has granted permission to a number of property owners to install ornamental lamps in front of their property and has announced that the city will supply electricity for all ornamental lamps erected on the streets by individuals.

MADISON, WIS.—We are informed that the city of Madison does not contemplate the installation of an ornamental street-lighting system, as reported in the issue of Oct. 25. The merchants on one street have been trying to make arrangements to install ornamental street lamps on that thoroughfare. O. S. Norsman is city clerk.

RICHLAND CENTER, WIS.—The Managers of the municipal electric-light plant expect to erect within the next ten months an engine room to provide space for a new 312-kva, three-phase, 2300-volt generating unit (directly connected), which will be purchased within the next 12 months. R. H. Strang is superintendent.

BEMIDJI, MINN.—The Beltraimi El. Lt. & Pwr. Co., of Bemidji, expects to purchase within the next four months two car loads of cedar poles.

HUTCHINSON, MINN.—Within the next two weeks the Hutchinson Ltg. & Mfg. Co. will complete a 13,200-volt transmission line to Glencoe (17½ miles long), together with substation apparatus and synchronous condenser at Glencoe, including three generator switchboard panels and one distribution panel. The company also expects to purchase within the next six months a 250-kva generating unit, probably turbine. Thomas Pitts is manager.

WINONA, MINN.—An organization has been formed for the purpose of making arrangements for the installation and maintenance of an ornamental street-lighting system in Winona. B. A. Gernes is secretary.

DES MOINES, IA.—The City Council is considering the question of establishing a municipal electric-light plant at the market house for the purpose of supplying electricity for lighting the city buildings, most of which are located near the civic center.

INDEPENDENCE, IA.—Bids will be received by the city of Independence until Dec. 8 for two horizontal tubular boilers of 150 hp each. Specifications may be seen at the office of the city clerk. George D. Warren is superintendent of the municipal water and light plants.

ROCK RAPIDS, IA.—Steps have been taken by the Commercial Club for the installation of electroliers on the two principal streets; also to remove the electric-light and telephone poles from the principal streets

[illegible] Electric lighting system, it is expected, will be installed in the spring.

PALMYRA, MO.—The Water and Light Commission expects to purchase by Jan. 1, 1914, one [illegible] meters. Charles S. Peck is secretary of the Water and Light Commission.

PIEDMONT, MO.—Application has been made to the City Council by W. E. Barnard, of Battle Tents, for a 20-year franchise to construct and operate an electric-light plant in Piedmont.

ST. LOUIS, MO.—The Electric Co. of Missouri, of St. Louis, expects to erect within the next eight months three substations and about 50 miles of 13,000-volt transmission line; also to purchase material for distribution system, including transformers, poles, transmission towers, lightning arresters, underground conduit, distribution cable, wire, meters, etc.; about $30,000; and to purchase 200 incandescent lamps, lamp fixtures, transformers, etc.; also to expend within the next 12 months about $5,000 for electrical appliances, including heating and cooking apparatus, vacuum cleaners, washing machines, etc. J. E. Hillmeyer is engineer.

WHITE, S. D.—The White El. Lt. & Pwr. Co. is planning to install an electric-light plant here. The equipment will consist of one 20-hp and one 30-hp Muncie crude oil engine belted to a 20-kw generator and one 12-kw generator belted to the 12-hp crude oil engine. Electrical equipment has not yet been ordered. Hugh Triplett, of White, is engineer in charge, George M. Blasdell is owner and manager, and Fred Miner is superintendent.

YANKTON, S. D.—The Yankton Ltg., Ht. & Pwr. Co. has completed the construction of a new power station and has installed a new 75-kw generator directly connected to an American Ball engine, and a new six-panel switchboard. The primary voltage was changed from 1100 to 2300 on Oct. 12. Robert Ferris is secretary and treasurer.

MEAD, NEB.—The installation of a municipal electric-light plant in Mead is under consideration, and bonds have been issued for it.

OMAHA, NEB.—The Omaha & Lincoln Ry. & Lt. Co., of Omaha, within the next three months expects to purchase material for distribution system, including transformers, transmission towers, distribution cable, wire, meters, for about 20 miles of transmission line; also to purchase material for lighting system, including tub transformers, rectifiers, arc lamps, incandescent lamps, posts, etc. Arthur English is agent.

GREENSBURG, KAN.—Bonds to the amount of $30,000 have been voted for the installation of an electric-light plant and water-works system.

PROTECTION, KAN.—The city of Protection will take over the local electric-light plant. We are informed that no improvements are contemplated. H. H. Griffith is city clerk.

STOCKTON, KAN.—Within the next two months the town of Stockton expects to purchase one pump and motor (directly connected), having a capacity of 300 gal. per minute, under a 243-ft. head. Pump to be single-acting capacity. O. M. Goodrich is superintendent.

## Southern States

MOORESVILLE, N. C.—The managers of the municipal electric-light plant expect in the near future to install a regulator for lighting and to erect a three-phase transmission line to supply electricity for motors only. James L. Donald is superintendent.

MOUNT GILEAD, N. C.—The town of Mount Gilead has made arrangements whereby S. J. Smitherman and J. C. Hurley, of Troy, will furnish electricity for lighting the town from their plant on Little River, about 7 miles from Mount Gilead.

OLD FORT, N. C.—The White Coal Pwr. Co., it is reported, contemplates the construction of a hydroelectric plant on the Catawba River; also a water-works system. Daniel W. Adams, 301 Legal Building, Asheville, is chief engineer.

SCOTLAND NECK, N. C.—The Electric Light Commission expects to erect within the next two months an addition to power house (30 ft. by 60 ft.); also to purchase a 200-hp boiler, one 150-kw to 200-kw, three-phase, 60-cycle generator, with auxiliaries, and one 250-hp engine directly connected to above generator. L. R. Mills, Jr., is superintendent.

AMERICUS, GA.—The Americus Gas & El. Co. expects to rebuild and consolidate its transmission lines and those of the American Power Co. W. M. Case is general manager.

ATLANTA, GA.—Bids will be received by the Commissioners of Fulton County, Fulton County Court House, Atlanta, Ga., until Dec. 20, for furnishing steel filing devices and equipment, wood furniture and lighting fixtures with lamps for installation. Plans and specifications and other information may be obtained at the office of A. Ten Eyck Brown and Morgan & Dillon, Forsyth Building, Atlanta, Ga., upon a deposit of $20 for each item. H. M. Wood is clerk.

GRIFFIN, GA.—Within the next two or three months the Towaliga Falls Pwr. Co. expects to purchase one 1400-kw generator, one 1800-hp waterwheel, a waterwheel governor and a generator switchboard panel. Frank Mayes is superintendent.

VALDOSTA, GA.—The Valdosta Ltg. Co. expects to erect within the next two months several miles of transmission lines. W. G. Eager is vice-president.

JACKSONVILLE, FLA.—Bids will be received by the Board of Trustees for the Waterworks and Improvement Bonds, city of Jacksonville, until Dec. 4 for furnishing and erecting complete the necessary piping, pipe covering and attachments for one battery of boilers in the new power station. Plans and specifications are on file in the office of the board in Jacksonville and in the office of the Scofield Engineering Co., consulting engineers, Philadelphia, Pa. Frank Richardson is chairman of board.

KISSIMMEE, FLA.—We are informed that nothing definite has yet been decided in regard to increasing the output of the municipal electric-light plant. The city may enlarge the plant, probably next summer. J. E. Gilbert is city clerk.

OVIEDO, FLA.—The installation of an electric-light plant and ice factory in Oviedo is under consideration. P. Kaiser, of Sanford, is reported interested in the project.

GRENADA, MISS.—The manager of the municipal electric-light plant expects to purchase within the next 12 months 20 lamp standards, carrying five-lamp clusters for street-lighting. J. W. Lowry is superintendent.

HOT SPRINGS, ARK.—Plans of W. M. Kavanaugh, president of the Little Rock Ry. & Lt. Co., of Little Rock, for the immediate development of the water-power of the Ouachita River near Hot Springs by the Garland Pwr. & Development Co., it is reported, have been approved by the officials of the American Cities Co., of New York, N. Y., which controls the Little Rock Ry. & Lt. Co. and Garland Pwr. Co. The proposed plant will furnish electricity to operate the street-railway lines in Little Rock, together with the proposed interurban lines, local factories, and also for lamps and motors in Memphis, Tenn.

PRAIRIE GROVE, ARK.—An improvement district has been formed and a petition is being circulated for the purpose of issuing $50,000 in bonds for the construction of a municipal electric-light plant and water-works system. Albert C. Moore, of Joplin, Mo., is engineer.

AFTON, OKLA.—Within the next six months the managers of the municipal electric-light plant expect to purchase a motor-driven air compressor (with a capacity of pumping 500 gal. per minute); also to purchase within the next seven months lightning arresters for 2300-volt circuit, meters and other line material, and also within the next eight months some electrical appliances. W. E. Blackwell is superintendent.

ELK CITY, OKLA.—The city of Elk City is planning to install a water-works system, by driving four deep weels, to cost about $10,000. The equipment will include three pumps (capacity of 60 gal. per minute), dynamo, three motors, carload of vitrified pipe and 2500 ft. of 2-in. pipe to carry water from wells to filter basin. Carl L. Reid, of Elk City, is engineer.

LUBBOCK, TEX.—The City Council has decided to install ornamental street lamps from the Santa Fé depot to the Court House Square and up Broadway. The plans call for 36 single 100-cp lamps and nine cluster lamps.

## Pacific States

BREMERTON, WASH.—W. D. Peters, of Bremerton, representing promoters, has submitted a proposal to the City Council offering to build a light and power plant, to cost $288,000, which will be turned over to the city at the end of two years. Electricity will be brought from an outside source. Names of the promoters are not given.

KIRKLAND, WASH.—Patrick Judge, owner of a power site on the Tolt River, has recently transferred his holdings to a New York syndicate, which has organized a power and development company, which contemplates building a hydroelectric plant on the property. Plans for the proposed plant have been prepared by M. McLean, of Kirkland.

LEBAM, WASH.—A franchise has been granted to R. L. Fisher, of Raymond, for the construction of an electric-light and power plant for a period of 50 years. It is understood that work will begin on construction of the plant at once.

NORTH YAKIMA, WASH.—Plans have been submitted to the City Commissioners by George Sawyer, manager of the Pacific Pwr. & Lt. Co., of North Yakima, for the installation of a cluster-lamp lighting system on Yakima Avenue from Natchez Avenue to Sixth Avenue.

SEATTLE, WASH.—J. D. Ross, superintendent of lighting, representing the city of Seattle, has applied to the Commissioners of Kings County for an exclusive franchise to erect transmission lines over the highways of Kings County for the distribution of electricity.

SEATTLE, WASH.—The utilities committee of the City Council recently introduced an ordinance appropriating $20,000 from the light depreciation fund to be used for installing heavier electrical apparatus at the substation of the municipal electric-light plant at Seventh Avenue and Yesler Way, to meet the increasing demand for service in that district.

SEATTLE, WASH.—Contracts will be awarded by the Light Department of the city of Seattle about Dec. 1 for equipment for auxiliary steam-power plant, to be located at the foot of Nelson Place on Lake Union. The equipment will consist of boilers, two, four or six units having a total rating of 2400 hp; one 5000-kw steam turbine and one 5000-kw generator. J. D. Ross is superintendent of lighting.

SPOKANE, WASH.—A special meeting of the stockholders of the Washington Wtr. Pwr. Co., of Spokane, has been called for Dec.

to vote on the proposal to increase the capital stock of the company by $5,000,000. The proceeds are to be used for construction work at Long Lake and other extensions.

HEPPNER, ORE.—The Heppner Lt. & Wtr. Co. is building an addition to its power plant and has recently purchased two 125-hp Babcock & Wilcox boilers, one 14-in. by 36-in. Corliss engine and one 100-kw and one 150-kw generator; also all auxiliary and switching equipment with the exception of condenser and feed-water heater. The company expects to purchase within the next six months electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, etc. H. V. Gates is president.

PAISLEY, ORE.—Application has been made by C. R. Potts for a franchise to construct and operate an electric-light plant on the Chewatean River above Paisley and to furnish electricity in this city.

ALAMEDA, CAL.—Plans are being prepared by A. L. Mazuette, architect, Bacon Building, Oakland, for the erection of a group of buildings by the Alameda Baths, Swimming & Casino Co., to cost about $200,000. The plans provide for a large power house, steam-heating system and pumping plant, casino and bath houses.

CLOVERDALE, CAL.—The California Tel. & Lt. Co., of Cloverdale, has applied to the State Railroad Commission for permission to issue $100,000 in bonds and $50,000 in capital stock, the proceeds to be used for extensions to its service. The company proposes to extend its lines in the Ukiah, Coyote and Potter Valley sections to supply electricity for irrigation plants and for lamps and motors; also to furnish a telephone service.

HOLTVILLE, CAL.—The Holton Pwr. Co., it is reported, has made arrangements with one of the large coast companies to erect a high-tension transmission line to the Coachella Valley to connect with its lines. The cost of the new line is estimated at $250,000; other improvements are contemplated by the Holton Pwr. Co., which will cost as much more.

LOS ANGELES, CAL.—The South Park Improvement Association has asked the City Council for $2,500 for the installation of a permanent electrolier lighting system in South Park.

SAN FRANCISCO, CAL.—The directors of the Ocean Shore R.R. Co., of San Francisco, have taken formal action toward changing the motive power of the railroad from steam to electricity. The cost of the work is estimated at $150,000.

BRIGHAM CITY, UTAH.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 2, 1914, for construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Brigham City. Drawings and specifications may be obtained from the custodian of site, at Brigham City, or from the above office. O. Wenderoth is supervising architect.

SALT LAKE CITY, UTAH.—Application has been made to the City Commission by Robert S. Campbell for a franchise to construct and operate a central heating, lighting and power plant to furnish heat and electricity to a large section of the city. Mr. Campbell also asks permission to lay underground conduits, pipes and erect poles to distribute electricity for lamps, heat and motors to all the territory between Second East and Third West and Fifth South and Second North Streets.

BUTTE, MONT.—The City Council has authorized Mayor Duncan to sign a contract with the Montana Pwr. Co., of Butte, for the installation of a new ornamental street-lighting system. The contract is for a period of seven years and calls for the installation of 306 lamps.

ALAMOGORDO, N. M.—Within the next three months the Alamogordo Lt. & Pwr. Co. expects to purchase a 120-hp oil engine and an 80-kw., 60-cycle, 2300-volt generator complete; also within the next six months to purchase 50 meters.

## Canada

NEEPAWA, MAN.—The town of Neepawa is contemplating the purchase of two 150-hp boilers, one 150-kw, three-phase generator and switchboard within the next six months; also the erection of a smoke-stack 48 in. by 84 ft. The proposed improvements depend upon the vote of the taxpayers. J. W. Bradley is secretary and treasurer.

FORT WILLIAM, ONT.—The Kaministiquia Pwr. Co., of Fort William, expects to install within the next ten months an additional 12,000-hp turbo-generator set, with necessary switching apparatus; 19 miles of No. 00 transmission line and 25,000-volt transformer banks at each end of the line. Equipment for above has already been purchased. P. R. Barrow is superintendent.

HAMILTON, ONT.—The Dominion Pwr. & Transmission Co. is contemplating the erection of a steam-power plant in Hamilton, the initial installation to consist of two units of 10,000 hp each, with provision for the installation of two additional units with the same rating. While tentative plans have been prepared, it has not yet been decided when the work will be undertaken.

SUDBURY, ONT.—Within the next six months the managers of the municipal electric-light plant expect to purchase 100 wattmeters. R. H. Martindale is superintendent.

MONTCALMVILLE, QUE.—The City Council is considering the installation of an ornamental street-lighting system.

OUTLOOK, SASK.—The by-law authorizing an expenditure of $10,500 for extensions to the electric-lighting system has been passed.

## New Incorporations

WILMINGTON, DEL.—The Castle Lt. Co. has filed articles of incorporation with a capital stock of $50,000. The incorporators are: G. L. Townsend, Jr., of Middletown; C. F. Curley and A. M. Haley, of Wilmington.

FORT MEADE, FLA.—The Southern Ice & Pwr. Co. has been incorporated with a capital stock of $50,000 to construct an ice and electric-light plant.

AMERICUS, GA.—The Public Utilities Co. has been incorporated with a capital stock of $300,000 by Louis F. Doyle, William C. Potter and Thomas J. Brown, all of New York, N. Y. The company proposes to operate electric-light, power plant and gas works.

MOUNT CARMEL, ILL.—The Mount Carmel Public Utility & Service Co. has been incorporated by J. E. Robinson, J. M. Mitchell and G. A. Well. The company is capitalized at $300,000 and proposes to operate water, light, heat and power plants.

PORTLAND, MAINE.—Articles of incorporation have been filed for the Northwest Company with a capital stock of $200,000 to buy and develop water-power, mines, steam, gas and electric roads, steamships, etc. The directors are: Albert T. Jones, president; T. L. Croteau, treasurer; Albert A. Richards, B. M. Mazwell, A. B. Farnham, Clarence C. Trott and J. P. O'Donnell, all of Portland.

LISBON, N. D.—The Lisbon El. & Pwr. Co. has been incorporated with a capital stock of $30,000 by Frank B. Thompson and others.

ERWIN, TENN.—The Erwin El. Lt. & Pwr. Co. has been organized with a capital stock of $15,000 by T. Fred Johnson, T. H. Morris and others. The company proposes to install and operate an electric-light plant.

WACO, TEX.—The City El. Co. has been chartered with a capital stock of $10,000 by William Hodges, C. J. Hodges and J. E. Kuykendall.

WILD ROSE, WIS.—The Wild Rose El. Lt. & Pwr. Co. has been incorporated with a capital stock of $5,000 by J. A. Peterson, F. V. Johnson and others.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED NOV. 18, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,078,081. TYPEWRITER; G. B. Baker, Duluth, Minn. App. filed Oct. 3, 1912. Has hollow-type wheel containing the rotor of a small electric motor.

1,078,233. INTERRUPTER FOR IGNITION DYNAMOS; H. H. Wixon, Chicago, Ill. App. filed March 4, 1910. The primary circuit is interrupted first by one pair of contacts and then by another pair so as to distribute the injurious sparking effect.

1,078,577. TELEPHONE BRACKET; F. Fox, New York, N. Y. App. filed July 1, 1909. Parallel supporting arms in frictional engagement with each other.

1,078,619. ELECTRIC FURNACE; A. E. Greene, Chicago, Ill. App. filed Jan. 23, 1911. Solid-metal resistor forms the secondary, and the primary winding in inductive relation thereto also forms a resistor.

1,078,620. PRINTING-TELEGRAPH RECEIVER; G. S. Hiltz, New York, N. Y. App. filed March 21, 1912. "One-wire" machine requiring only one transmission circuit.

1,078,622. SYSTEM OF CONTROL; H. D. James, Pittsburgh, Pa. App. filed Sept. 19, 1910. For automatically removing resistance from the secondary of an alternating-current induction motor.

1,078,626. ELECTRICALLY OPERATED DUPLICATE TYPEWRITING MACHINE; B. Kelley, Syracuse, N. Y. App. filed Jan. 7, 1910. Combination of system of transmitter keys, a relatively smaller number of circuit closers selectively operated thereby, and a smaller number of line circuits.

1,078,627. MUSICAL INSTRUMENT; J. F. Kelly, Pittsfield, Mass. App. filed April 29, 1911. Plates of magnetic substances are vibrated by the periodic attraction of electromagnetic devices to produce musical sounds.

1,078,629. MERCURY-VAPOR RECTIFIER; J. W. Lewis, Wilkinsburg, Pa. App. filed Oct. 18, 1909. The mercury which is vaporized is confined to a small compartment or chamber within the rectifier bulb.

1,078,630. LOCOMOTIVE; M. Mahoney, Wilkinsburg, Pa. App. filed March 20, 1911. Two four-wheel motor-equipped trucks and two independent radius bars interposed between the trucks and provided with yielding connections to obviate bumping strains.

1,078,627. RAILWAY LOCOMOTIVE; M. Mahoney, Wilkinsburg, Pa. App. filed March 20, 1912. Relates to a locomotive in which the main driving wheels are mounted on a truck and provided with means for relieving it of longitudinal compression strains.

1,078,633. INSULATOR; J. E. Mateer, Wilkinsburg, Pa. App. filed Aug. 2, 1905. For cord, voltage-leads, series of overhanging insulating skirts with an overhanging metal cap at the top.

1,078,635. WORK-CABLE FOR ELECTRIC WELDING MACHINES; R. C. Pierce, Cincinnati, Ohio. App. filed Dec. 13, 1912. Vertically and swingingly adjustable supporting table.

1,078,641. MERCURY-VAPOR APPARATUS; J. C. Pole, New York, N. Y. App. filed Feb. 1, 1912. Conical valve prevents shock to the fragile containing vessel due to the shifting of the position of the fluid in the vessel.

1,078,643. TROLLEY WHEEL; J. S. Randolph, Glencoe, Ohio. App. filed Jan. 16, 1913. Manually releasable pivoted jaw carried by the trolley harp and overhanging the trolley wire.

1,078,647. ANCHOR STRUCTURE FOR OVERHEAD LINES; T. Varney, Pittsburgh, Pa. App. filed Oct. 13, 1909. For holding the terminal of the messenger wire which supports the trolley wire under very heavy tension and electrically insulated.

1,078,653. SHIP'S TELEGRAPH; F. W. Wood, New York, N. Y. App. filed June 30, 1910. A synchronous motor moves a semaphore in direct accordance with the movement of the wheel or helm, thereby to signal the ship's course to another ship.

1,078,654. ELECTRICAL SYSTEM OF DISTRIBUTION; J. L. Woodbridge, Philadelphia, Pa. App. filed Sept. 29, 1911. An electrolytic valve prevents current from flowing into the battery from the circuit, but upon an abnormal reduction of the circuit voltage permits the battery to discharge into the circuit.

1,078,656. LAMINATED CONTACT BRUSH; C. Ambruster, Roslyn, Pa. App. filed March 7, 1912. Laminations having projecting portions free for deflection and provided with beveled ends.

1,078,675. ELECTRICAL WELDING APPARATUS; J. A. Heany, Washington, D. C. App. filed July 28, 1913. A timing device actuated by the impact of the welding arms regulates the duration of the welding current.

1,078,685. TELEPHONE-EXCHANGE TRUNKING SYSTEM; A. E. Keith, Hinsdale, Ill. App. filed July 21, 1908. Automatic selection of idle trunks in a telephone exchange system.

1,078,690. AUTOMATIC TELEPHONE SYSTEM; F. Newforth, Jr., Chicago, Ill. App. filed Jan. 17, 1912. Automatic selecting and connecting switches establish the connection between the calling and a called subscriber's line.

1,078,693. LOCK ATTACHMENT FOR SNAP SWITCHES; C. D. Platt, Bridgeport, Conn. App. filed Feb. 12, 1913. A projecting center on the switch spindle assists in guiding the projections on the operating key into the seats provided therefor.

1,078,711. SYSTEM OF ELECTRICAL TRANSMISSION; J. B. Whitehead, Baltimore, Md. App. filed Sept. 15, 1910. Each leg of the circuit is made up of a plurality of separated equipotential conductor strands mounted symmetrically about a longitudinal axis.

1,078,721. ELECTRICAL SYSTEM OF DISTRIBUTION; G. Crosby, New York, N. Y. App. filed Oct. 8, 1908. Maintains a substantially constant charging current during all periods of battery charging and materially cuts down the charging current when battery has reached a proper point of charge.

1,078,746. AMPLIFYING CASE FOR MICROTELEPHONES; W. B. Oliver, Collingswood, N. J. App. filed Sept. 30, 1910. Portable case containing all the elements of a microtelephone and including also an amplifying chamber.

1,078,762. TROLLEY-POLE SUPPORT; J. M. Anderson, Boston, Mass. App. filed June 21, 1909. Aims to provide uniform upward pressure and to cushion the trolley pole in case the wheel leaves the wire.

1,078,763. ELECTRICAL CONNECTION; J. M. Anderson, Boston, Mass. App. filed March 23, 1912. High amperage plug connection for use on storage-battery charging circuits and the like.

1,078,766. SPRING TERMINAL CLIP; C. Barr, Chicago, Ill. App. filed April 5, 1913. Spaced spring arms having wire-receiving recesses adapted to register when the arms are pinched together.

1,078,772. CALL-REGISTER; H. P. Clausen and W. T. Curtis, Chicago, Ill. App. filed March 15, 1910. Registering mechanism is operated manually by the subscriber, central being notified by a signaling device associated with the register that the register has been moved one step.

1,078,782. ELECTRICAL GUN-FIRING MECHANISM; I. F. Galindez, Buenos Aires, Argentina. App. filed Dec. 7, 1912. Recoil of the gun winds up a spring motor which drives a generator for furnishing the firing current.

1,078,785. AUTOMATIC RHEOSTAT; H. M. Grossman and J. Wynn, Jr., Canton, Ohio. App. filed March 25, 1912. Pressure produced by a motor-driven fan or pump shifts a mercury column to cut in or out resistance

1,078,787. MEDICAL ELECTRIC-CURRENT REGULATOR; A. J. Hoenes, Murray, Utah. App. filed Oct. 21, 1912. Moistened sponge within a glass tube forms the resistance element and the sponge is compressed more or less to vary the current flow.

1,078,788. GALVANIC CELL; M. L. Kaplan, Brooklyn, N. Y. App. filed June 2, 1913. Of the Leclanché type, containing as a depolarizing agent dihydrated manganese peroxide in fine dense powder of grayish blue color.

1,078,813. LAMP SOCKET; C. A. Vetter, Pittsburgh, Pa. App. filed Sept. 24, 1912. "Keyless" socket in which current is controlled by rotating the lamp, holding base within its socket.

1,078,815. LIMIT SWITCH; H. J. Wiegand, Milwaukee, Wis. App. filed Aug. 27, 1908. Provides means for shifting the switch quickly when one part is operated by the slowly moving operating member.

1,078,843. PROTECTED-CABLE-TERMINAL BOX FOR TELEPHONE SYSTEMS; T. B. Farmer, Baltimore, Md. App. filed Nov. 22, 1909. Has inclosed fuse links fitting in slots formed in a carbon ground strip.

1,078,859. MERCURY-VAPOR APPARATUS; F. G. Keyes, Boston, Mass. App. filed Feb. 11, 1913. A funnel-shaped diaphragm serves to maintain the normal quantity of electrode material at the electrode.

1,078,863. AUTOMATIC SYNCHRONIZER; R. C. Leake, Lakeland, N. Y. App. filed Aug. 10, 1908. Automatically closes switch to throw the machines into circuit at about the instant when the voltage values and the alternations are approximately the same.

1,078,877. DYNAMO-ELECTRIC MACHINE; H. H. Ralston, Norwood, Ohio. App. filed March 1, 1905. Puts spacing blocks of insulating material between the commutator leads intermediate to their ends.

1,078,899. SELECTIVE TELEGRAPH SYSTEM; E. A. Burlingame, Boston, Mass. App. filed Jan. 6, 1910. Includes means for producing currents of different polarity and strength.

1,078,913. ARC-LAMP; R. Fleming and C. A. B. Halvorson, Jr., Lynn, Mass. App. filed March 6, 1905. Produces a down draft past the arcing end of the upper electrode.

1,078,922. LIGHTNING ARRESTER; J. O. Holton, Springfield, Mo. App. filed July 30, 1912. Arrester members spaced apart and having upwardly converging walls.

1,078,971. AUTOMATIC WEIGHING MACHINE; E. G. Thomas, Boston, Mass. App. filed Aug. 28, 1897. Has power-driven mechanism for opening the valve which controls the delivery of material to the scale.

1,078,978. SIGNAL APPARATUS; C. Williamson, San Francisco, Cal. App. filed Oct. 5, 1912. By which passenger, upon boarding car, may signal the motorman the street or station at which he wishes to stop.

1,078,984. SIGNALING MECHANISM; C. E. Beach, Binghamton, N. Y. App. filed June 4, 1912. Signal formulating and controlling mechanism for fire-alarm boxes, etc.

1,078,985. SIGNALING SYSTEM; C. E. BEACH, Binghamton, N. Y. App. filed May 6, 1912. Causes sounding of all the local fire alarm devices and the general or fire brigade alarm devices.

1,079,008. DYNAMO-ELECTRIC GENERATOR; G. and L. Inrig, London, Eng. App. filed July 20, 1912. For charging batteries, etc.; breaks the circuit of the dynamo when the speed falls below or rises above certain predetermined speeds.

1,079,010. SAMPLER-OPERATING DEVICE; L. E. Jones, Anaconda, Mont. App. filed April 29, 1912. The cutter of the sample is automatically reciprocated across the path of the stream of material.

1,079,013. ELECTRIC CIRCUIT CONTROLLING APPARATUS FOR TRAIN LIGHTING AND SIMILAR SYSTEMS; E. H. M. Langley and E. W. Price, Aston, Birmingham, England. App. filed July 25, 1911. Master switch for producing "no-light," "half-light" or "full-light" effects.

1,079,018. FUSE AND FUSE CARRIER; T. E. Murray, New York, N. Y. App. filed April 30, 1913. Fuse is looped over separated conducting plates mounted on a wedge-shaped insulating carrier.

1,079,028. ELECTRIC-LAMP SOCKET; M. Schwartz, Chicago, Ill. App. filed Jan. 31, 1912. Permutation lock for securing the lamp in the socket.

1,079,059. TROLLEY COLLECTOR SHOE; W. H. Miller, Emaus, Pa. App. filed July 3, 1913. Shank mounted on the outstanding arm of the supporting structure, notched at one end to fit the socket and carrying a transverse shoe at its opposite end.

1,079,066. ELECTRIC SOLDERING IRON; M. H. Rice, New Rochelle, N. Y. App. filed May 1, 1913. The soldering tip secures and locates the heating unit in the containing casing.

1,079,073. ELECTRIC-WELDING MACHINE; J. C. Swanson, C. A. Linden and C. A. Carlson, Jamestown, N. Y. App. filed Feb. 10, 1913. Has hollow-wheel electrodes.

1,079,079. PROCESS FOR THE PREPARATION OF METALLIC MAGNESIUM; R. W. Wallace and E. Wassmer, London, Eng. App. filed Aug. 18, 1913. Electrolyzes a mixture of chloride and sulphide of magnesium in an electrolytic bath.

1,079,088. FLASH-LIGHT; F. Wysocki, Chicago, Ill. App. filed May 1, 1913. Located in the handle of a cane or the like.

1,079,116. ELECTROMECHANICAL WARP STOP MOTION FOR LOOMS; J. F. Dustin, Fulton, N. Y. App. filed Feb. 2, 1911. Circuit rendered operative to stop loom by a released detector heddle in a harness when the latter is down.

1,079,130. TERMINAL CONNECTOR FOR CONCENTRIC CONDUCTOR CABLES; F. Kratz and R. Wagner, Stuttgart, Germany. App. filed May 1, 1913. Pressure-applying device forces the conductors into intimate connection with appropriate abutments

1,079,156. TELEPHONE EXCHANGE SYSTEM; W. Aitken, Liverpool, Eng. App. filed June 25, 1913. Substation meter can be set to limit automatically the number of calls which can be made to a predetermined number.

1,079,161. PRINTING PRESS; J. Bucher, Kansas City, Mo. App. filed April 25, 1912. Heater for the rotary ink plate of a press for use in cold weather.

1,079,185. ELECTRIC WATER HEATER; J. Polak, New York, N. Y. App. filed Feb. 1, 1913. Concentric heating elements with water spaces between.

1,079,213. ELECTRIC REGULATOR FOR INCUBATORS; C. C. Carter, Chapin, Ill. App. filed Dec. 10, 1912. Controls circulation of outside air to the incubator according to temperature within the incubator.

1,079,225. ELECTRIC HEATER; W. Dubilier, New York, N. Y. App. filed Dec. 19, 1912. Fastening devices which hold the sectional framework together also serve to secure the heat-radiating element in place on the framework.

1,079,239. ELECTRICALLY CONTROLLED INDICATOR; W. L. Fitzgerald, Philadelphia, Pa. App. filed Sept. 19, 1911. For indicating rise and fall of a fluid.

1,079,233. ELECTRICAL SWITCH; W. J. Gagnon, Bridgeport, Conn. App. filed July 21, 1909. Push-button pendent switch with a single push-button.

1,079,235. ATTACHMENT PLUG; G. W. Goodridge, Bridgeport, Conn. App. filed Jan. 23, 1913. Screw-shell type; wires passed through hollow rivets which secure the terminals to the insulating body.

1,079,239. INSULATOR; J. R. Harris, Crafton, Pa. App. filed Dec. 16, 1912. Two-part insulator whose parts are held together loosely by a tube through which the securing nail or screw is passed.

1,079,250. VAPOR ELECTRIC DEVICE; F. W. Lyle, Saugus, Mass. App. filed June 18, 1910. Has a refractory cap over the vaporizable cathode.

1,079,259. SYSTEM OF TRANSMISSION; H. Nehlsen, Berlin, Germany. App. filed March 20, 1911. Includes a flywheel motor generator set.

1,079,271. PUSH-BUTTON SWITCH; J. H. Smedley, Narberth, Pa. App. filed March 27, 1913. Combines a signal lamp with a door bell push button.

1,079,276. ELECTRIC MASSAGE APPARATUS; J. Thorell, Portland, Ore. App. filed Jan. 23, 1913. Heel plate of the operator make contact with floor-pad terminal.

1,079,309. SIGNAL BOX; C. E. Beach and H. W. Doughty, Binghamton, N. Y. App. filed May 25, 1911. Non-interference signal box for fire-alarm systems.

# Electrical World

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**Reformation in Patent Procedure**

Reference has already been made in our columns to the Kahn act, passed for the protection of foreign exhibitors at the Panama-Pacific International Exposition, notably on page 825, Oct. 25, and page 1131, Nov. 29. The subject is discussed in a characteristically convincing manner by Dr. L. H. Baekeland on page 1146 of this issue. The Kahn act referred to, which represents the result, on the part of persons unqualified for the formulation of such an act, of an honest attempt to protect exhibitors for a limited period, has produced much confusion and dissatisfaction by its interference with our existing patent laws, unsatisfactory as they are admitted to be. Dr. Baekeland urges the formation of a non-political commission of men familiar with the practical working and shortcomings of our patent system to investigate the patent situation and make recommendations for a proper revision of our patent laws and Patent Office procedure. Such a commission, which has already been proposed by the Inventors' Guild, as noted in our issue dated Aug. 9, 1913, would go far toward preventing the formulation of legislation of the Kahn act type.

**The Problem of the Small Plant**

The somewhat detailed account of a small central station in Windsor, Vt., to be found elsewhere in our columns is particularly instructive as representing conditions totally different from those existing in ordinary central-station practice and yet typical of many electrical developments which are of large service to the community. A little town with a few small industries and a population of a progressive turn of mind is by no means to be despised as a market for electricity. A plant in such a place cannot be "floated" with any advantage to the promoters, but it nevertheless may be made a paying investment, as this one seems to have been, through persistent effort and economical administration. The main energy-supply equipment comprises a pair of hydroelectric stations, both small, yet for most of the year quite adequate for the work of the system. One of them has only a single 75-kw generator on a single wheel, the other operates a 150-kw and a 40-kw generator. There is little water storage, yet from October to May the larger of the two plants does most of the work of distribution while the smaller is devoted to furnishing energy for running a sawmill. When the low-water season begins in May the two plants are operated in multiple through the evening and the late night load is then taken by the larger. Finally, when water grows scarce at midsummer there is not enough for a considerable period to justify running the wheels, and energy for daytime load is then purchased from a manufacturing plant to which secondary service is furnished for its advantage through the winter months when water is abundant. The night load is then carried by the steam auxiliary. Nearly all the water available in the stream is thus utilized and the period of running by steam is brief. The plants being near together and operated in a systematic manner, the force is small, consisting of only six men, including the superintendent, and at least one of these is only a temporary employee. The nature of the load is somewhat interesting. Besides the town lighting and pumping for the water-works, there is a considerable amount of miscellaneous motor service and plenty of lighting to be done. The gross receipts from this little community of 2500 inhabitants rise to $5.60 per capita, although the total number of consumers is only about 300. And withal the rates are not high, the base price for lighting being 15 cents per kw-hr. and for motor service just half that amount, with liberal discounts. The whole plant is an example of intelligent development of a small field to the great advantage of the community and on a basis that has now become a paying one. A plant under similar conditions, but with the advantage of being erected as a whole simultaneously, instead of being developed from one which had eked out a precarious existence for a number of years previously, could probably turn out energy more economically, but it could scarcely be able in so small a place to secure a materially larger volume of business. There are scores, or even hundreds, of little places with available small water-powers which might well profit by the example of Windsor. Such enterprises intelligently administered can be made good investments on a small scale and deserve far more attention than they have yet received.

**Central-Station Rate-Making**

In his letter on page 1167 Mr. L. H. Conklin says that it is surprising to find how frequently the different rate schemes of the principal companies, though they are wide apart in detail, result in approximately the same net rate. This, of course, is a very general statement and should not be taken as an indication of a belief that the average rate of central stations in different communities is the same. It is to be taken, rather, as a support of the equity and reasonableness of the theory of the variable-rate system used by central stations and a plea for the uniform expression of such rates. If electrical supply undertakings are to be successful, there must be a certain rough approximation in their average rates for energy as well as in their average cost, and the proportion of one to the other must be such as to leave a fair profit. The cost of furnishing service to a class of consumers in one community is not and cannot be the same as the cost in another com-

munity where conditions differ. The rate enjoyed by a large number of large consumers in a community which they dominate industrially is not necessarily the fair rate for a similar consumer in another district in which he is the sole representative of his class. In each community some one class of users may be sufficiently strong numerically and may require sufficient energy for their combined needs at certain periods of the day to be entitled to the rate that would be given in another community to another class of users. In neither case do the results of these particular rates determine the profit or loss of the companies. They are merged and diluted or strengthened by the income accruing from the rates covering other sources of business. If this were not so, variable rates would fail to solve the revenue-producing problem of the companies.

## Westinghouse—the Man and the Engineer

The achievements of Mr. George Westinghouse, to whom was presented the Grashof Medal during the present week, are well known and need not be dwelt upon now. What may appropriately be discussed at this time is the personality which made possible the results obtained by Mr. Westinghouse. Any man who has known him long and well appreciates that the dominant fact of his powerful individuality is the mysterious quality which may be called personal force. Where he sat was indeed the head of the table, whether among friends or foes. Men might not wish to do what he wanted, but they did it. Imagination, tradition, usage attach power of this kind to certain positions in the world, but with Mr. Westinghouse the power is an attribute of his personality. Moreover, he is indomitable. Fate cannot subdue him. The events of the last six strenuous, trying years have brought revelations of this quality astonishing even to those who had known him longest and best. Given such moral attributes in addition to a powerful mentality and a rare insight into the practical application of the laws of nature, and all the rest has followed without any mystery. It is a more or less conscious knowledge and appreciation of these facts that makes us all join with such pleasure in congratulating Mr. Westinghouse on the honor recently bestowed upon him and in wishing him many happy and prosperous years, which perhaps have in them less of endeavor than heretofore but more of leisurely dignity and public recognition.

It is not necessary for us to discuss here the relations of Mr. Westinghouse with other branches of the modern industrial field, but we may appropriately devote a few remarks to what is owed him by the various branches of electrical development. Undoubtedly his first and permanent claim to consideration is his early and swift intuitive recognition of the advantages of the alternating current. He, if anyone, was its protagonist in this country and his adoption of the Gaulard and Gibbs system, and the modification of it to American conditions and necessities, was one of the great landmarks in electrical advance and history. At an early stage, when only a very few had become awake to the opportunities presented by this addition to the resources of electricity, Mr. Westinghouse was devoting his tremendous energies and driving power to the practical utilization of the alternating current. He gathered around him talent of the first order, represented by men whose names are as familiar in our mouths as household words, and for the last twenty-five years the whole development of the central-station art and of energy transmission has very largely been influenced and determined by the impress which he thus placed upon it. No matter who became associated with him, the leadership and impetus and success rested largely, if not wholly, with him.

## Brilliancy an Aid in Good Lighting

Possibly the excessive brilliancy of the new high-efficiency, nitrogen-filled tungsten-filament lamp is a blessing in disguise because it renders imperative methods of shading the lamps and diffusing the light from such a source. There is little temptation to hang the bare lamp within range of vision, as has been so commonly done with incandescent lamps of various kinds in the past. With a lamp of such high efficiency the losses inseparable from various methods of diffusion become less important in dollars and cents. For this reason, and because of the unbearable brilliancy of the unshaded lamp, the new nitrogen-filled tungsten lamp is likely to help rather than hinder the practice of illuminating interiors in a manner safe and comfortable for the eyes of the occupants.

## The Study of Visual Acuity

Within the past two or three years it has been made very clear that the chromatic aberration of the eye, which is generally unnoticed, is sufficient to interfere with visual acuity, so that a substantially monochromatic light affords considerably better seeing at equal luminosity than does ordinary light which includes a considerable range of spectral colors. The reason for the difference is plain enough from the characteristics of the eye as an optical instrument, but so little does the ordinary man appreciate the existence of chromatic aberration in his eye that he is loath to believe that it constitutes a considerable defect which, in fact, would be very serious were it not that the extreme colors of the spectrum are of very low luminosity.

In a brief paper in the current issue Mr. M. Luckiesh drives home a lesson in applied optics very effectively by making a direct comparison between acuity with monochromatic light and that obtained either from the light of a tungsten lamp or from daylight. He finds, as was to be anticipated, the latter decidedly inferior to the former in giving sharp vision of details. There proved to be very little difference between the light of the tungsten lamp and natural or artificial daylight in the matter of acuity. It was also noted that the difference between these and monochromatic light with respect to acuity decreases as the illumination on the test object increases. The cause of this variation is not apparent, although it is not unlikely that part or the whole of it may be due to the contraction of the pupil in strong light so that all aberrations are diminished in apparent value. In any event, this work of Mr. Luckiesh should leave no doubt in the mind of anyone that so far as seeing detail is concerned monochromatic light from

middle of the spectrum gives sharper vision of black d white details than does any light having a considerable ge of spectral colors, whatever its source.

An interesting side investigation added by Mr. Luckiesh the comparison between acuity in ordinary light and that tainable by the use of protective spectacles which cut wn the spectral range to within moderate limits. He und that yellow-green glasses used in bright daylight have very marked effect in improving acuity. Part of the fference perhaps may be attributable to the general reduc- on of glaring light entering the eye from the open sky, but ubtless narrowing the spectral range of the effective light s an important factor in the result. Could one obtain nveniently glasses transmitting only a nearly mono- romatic strip in the yellow green the effects noted by Mr. uckiesh would be considerably enhanced. For the gen- al purposes of illumination monochromatic light looks eer, but it is not without its virtues and may be at times ceedingly useful.

## The President's Message

President Wilson's references to matters concerning the ectrical industry promise an effort toward needed legisla- on. Neither in word nor in spirit does the Executive in- eigh against business or business methods, but he candidly d earnestly presents the need of action in regard to con- rvation of resources and of supplemental legislation to arify the "area of debatable ground" unfortunately left en by the Sherman law for the confusion of trade and dustry. The proper settlement of both of these large uestions will promote beneficial commerce, and in view of e public and commercial interest in the matters and the ndency of discussion to crystallize upon reasonable, ac- eptable policies it cannot be doubted that there is more ope for the passage of definite interpretative legislation an at any time in the past.

Some comment was heard concerning the failure of the resident to appear at the recent National Conservation ongress in Washington. Whether or not he stayed away ecause he was not in sympathy with the strong political omplexion of the Conservation Congress it is unnecessary guess, but in the message which he delivered to the real ongress this week he showed unhesitatingly that he is in avor of conservation with use. We share his belief "that policy can be worked out by conference and concession hich will release these resources and yet not jeopard or issipate them." Such an expression of policy, recognizing common interest in the matter of development, is more kely to accelerate the fixing of a sane middle ground for egotiation and progress than the clamorous antagonistic ry of monopoly with which so many of the governmental tterances on this topic have been mixed. The President id not say, as he did with reference to the Sherman law, hat he would make conservation a subject of a special essage later. If he does not do so, he has at least given ex- ression to his idea that use with proper regulation is the olicy that should prevail and that the rights of the states nd the nation should be merged satisfactorily in the com- non purpose of utilization. If Congress takes to itself the spirit of these utterances, which do not assume at the outset that utilization is monopoly and non-utilization is beneficent, it will help to solve the problems that ought to be settled, fairly and with full recognition of the public interest, but on a business, not a political basis.

No doubt President Wilson's program, so far as the Sherman anti-trust law is concerned, is still the subject of his deep study, but there is no reason to think that he has withheld from public knowledge the lines of recommendation or action on which he has thus far resolved. His position is one of opposition to private monopoly but of outspoken desire to relieve business men of all uncertainties of law. Just how "private monopoly" is to be defined, so far as it can be defined by a statement of the Executive's opinion without legislation or judicial interpretation, the President does not now state. If he refers to the abhorrent trade practices which the Sherman law was intended by its far-reaching language to prevent, he clears the way for legislation without undue disturbance. The presidential view that the Sherman law should remain unaltered represents the sentiment generally prevailing at this time. We have then his opinion that the area of debatable ground should be reduced as much as possible. Manifestly, this is a step that cannot be taken without as clear an understanding as can be had to show what ground is debatable and what is non-debatable. Practices of business men now surrounded by a doubt that no governmental administrative body is properly authorized to settle will be definitely allocated as either infractions of the law or in conformity with it. Next to wise currency legislation, this is the most needed legislation of the times. The law and the policy of the government with respect to its interpretation should be so plain "that he who runs may read."

With an understanding of acts which are infractions of the law and of the acts which do not contravene the law there will remain that area of uncertainty which causes hesitation and paralysis of business. The government ought to rid business of this handicap. This is not a proper function for the Attorney-General, upon whom, nevertheless in the absence of a duly constituted body it has devolved so far as it has been done. It could be the function of a new Interstate Trade Commission, if such a body were created with power to act and wisdom to protect and upbuild. Such a commission could not be expected to be the final judge, but it could express its best judgment, subject of course to reversal by the courts on appeal either by the government or by the company affected. The advantage of such a commission is that it would operate to effect publicity in all matters concerning competitive relations. The disadvantage would be that the commission, unless endowed with wisdom, would fail to be that protecting, upbuilding force which all industries seeking lawful methods of management have a right to expect from the government. Certainly the time has come, if, indeed, it was not here long ago, when, if prices on competitive goods made by different manufacturers are the same, the fact ought to be recognized openly and not regarded as a secret. The President's special message on the Sherman law will be awaited both with hope and with intense interest.

# The News of the Week

**Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.**

## A. I. E. E. December Meeting

The general subject of a meeting of the American Institute of Electrical Engineers to be held in New York on Dec. 12 will be "Insulating Materials." Mr. F. M. Farmer, of the Electrical Testing Laboratories, New York, will present a paper entitled "The Dielectric Strength of Thin Insulating Materials." Further communications on this subject will be presented by Messrs. E. E. F. Creighton and F. W. Peek, Jr., of the General Electric Company, and by Messrs. C. E. Skinner, R. P. Jackson and Phillips Thomas, of the Westinghouse Electric & Manufacturing Company. At the close of the technical session a smoker will be held in the Institute offices.

## Chicago City Council Passes Rate-Regulation Ordinance

At a special meeting of the Chicago City Council held on Nov. 26 the ordinance reported by the committee on gas, oil and electric light, fixing a schedule of rates to be charged by the Commonwealth Edison Company for supplying electricity in the city of Chicago for a five-year period beginning Dec. 1, 1913, was passed by a large majority. The rates as fixed are 10 cents per kw-hr. for the first thirty hours' use per month of the maximum, 5 cents per kw-hr. for the next thirty hours' use, and 4 cents per kw-hr. for all excess. The tertiary rate of 4 cents is to be reduced to 3 cents on March 1, 1914. It is believed that Mayor Harrison will not veto the ordinance and that it will become effective. The rates are based substantially on the recommendations of Mr. Ray Palmer, the city electrician, who, assisted by Mr. A. C. King, assistant city electrician, and Mr. C. B. Willard, expert accountant for the city comptroller, made an exhaustive report on the subject. The rates in the new schedule are founded on a reduction of $654,000 a year on the basis of the 1912 business of the company.

## Laws of Wireless to Be Codified

Two commissions, one international and the other British in organization, soon will begin a series of investigations in the hope of being able to codify the various natural laws which are believed to govern wireless telegraphy. The English commission, which is known as the committee of the British Association, will devote its investigations to the qualitative phases of the problem, while the other organization, called the International Radio-Telegraphy Commission, will study the quantitative aspects of the question.

The British committee will endeavor to discover by extensive simultaneous observations at various points on the earth those regularities of phenomena commonly described as "natural laws." It is hoped that if these laws are once codified it will be possible to extend greatly the commercial possibilities of wireless by obtaining valuable information concerning the electrical conditions of the atmosphere, these having a powerful effect on the working of wireless systems.

The international commission will begin its work from a station near Brussels, and from this station on a specified date certain signals will be sent out for the reception of investigators and national committees, which are bei organized in every participating country. Measuremen will be made by the transmitting experts at Brussels and the receivers in various countries. The international co mission will compare the results of these observations, esp cially with regard to the effects of time, direction and d tance on the strength and regularity of the received signa

The objective of the work of both bodies is the elim nation of the difficulties of communication encountered d the periods of sunrise and sunset and from atmosphe conditions generally.

## Extracts from the President's Message

President Wilson, following his custom, read in pers on Dec. 2 his message to Congress. It contains referenc to conservation and the Sherman anti-trust law.

In leading up to his remarks on the subject of conserv tion the President advocated government construction a operation of railways in Alaska. How the tempting sources of Alaska are to be exploited is another matter which the President will call the attention of Congress fr time to time. This, the President said, "is a part of c general problem of conservation. We have a freer ha in working out the problem in Alaska than in the sta of the Union, and yet the principle and object are same wherever we touch it. We must use the resour of the country, not lock them up.

"There need be no conflict or jealousy as between st and federal authorities, for there can be no essential c ference of purpose between them. The resources in qu tion must be used, but not destroyed or wasted; used, not monopolized upon any narrow idea of individual rig as against the abiding interests of communities. Tha policy can be worked out by conference and concess which will release these resources and yet not jeopard dissipate them, I for one have no doubt; and it can be d on lines of regulation which need be no less acceptable the people and governments of the states concern than to the people and government of the nation at lar whose heritage these resources are. We must bend counsels to this end. A common purpose ought to m agreement easy."

Concerning the Sherman law and questions arising the from President Wilson said:

"I think that all thoughtful observers will agree that immediate service we owe the business communities of country is to prevent private monopoly more effectu than it has yet been prevented. I think it will be ea agreed that we should let the Sherman anti-trust law sta unaltered, as it is, with its debatable ground about it, that we should as much as possible reduce the area that debatable ground by further and more explicit le lation, and should also supplement that great act by le lation which will not only clarify it but also facilitate administration and make it fairer to all concerned.

"No doubt we shall all wish, and the country will e pect, this to be the central subject of our deliberations d ing the present session; but it is a subject so many-si and so deserving of careful and discriminating discus that I shall take the liberty of addressing you upon it special message at a later date than this.

"It is of capital importance that the business men of this untry should be relieved of all uncertainties of law with gard to their enterprises and investments and a clear path dicated which they can travel without anxiety. It is as ıportant that they should be relieved of embarrassment ıd set free to prosper as that private monopoly should be stroyed. The ways of action should be thrown wide ıen."

## Westinghouse Receives Grashof Medal

On behalf of the engineering profession of Germany, the nerican Society of Mechanical Engineers presented to r. George Westinghouse, the well-known engineer and ventor, the Grashof medal. The presentation took place the auditorium of the Engineering Societies Building New York last Wednesday night during the annual eeting of the society.

### The Grashof Medal

The Grashof Medal was founded by the Verein Deutscher genieure of Germany in memory of Franz Grashof, mous engineer and professor and author of many im-rtant works on the theory of elasticity, general mechanics ıd machine design. It is given by the Verein only on commendation of the council, and by unanimous vote in ıen general meeting of the Verein, to men who have ren-red pre-eminent service in the field of engineering either research or in practical activity. It is the highest honor the gift of the engineering profession of Germany.

The medal was conferred on Mr. Westinghouse at the ty-fourth annual meeting of the Verein Deutscher In-nieure in Leipzig, Germany, on June 23, the officers and embers of the American Society of Mechanical Engineers ing present. In presenting the medal at that time Dr. skar von Miller, the president of the Verein, said:

"The distinction conferred by the largest scientific and chnical society in the world is not a thing that is given vay on a festive occasion, nor one to serve as a mark of tention and courtesy; it can be won only by actual services r the good of humanity. Engineers will have no doubt at George Westinghouse, whose name is so well known roughout the world, does deserve this distinction."

### Career of George Westinghouse

Mr. George Westinghouse was born at Central Bridge, . Y., Oct. 6, 1846; his parents were George and Emeline edder Westinghouse. His father's ancestors came from ermany and settled in Massachusetts and Vermont before e Revolution and his mother was of Dutch-English ex-action. Mr. Westinghouse's father was also an inventor ıd in 1856 removed with his family to Schenectady, . Y., where he established the Schenectady Agricultural 'orks. Curiously enough the building in which young 'estinghouse received his first mechanical training is still anding, directly opposite the great works of the General lectric Company at Schenectady. George Westinghouse as one of five sons, three of whom are now dead and ıe other, Herman H. Westinghouse, is associated with his rother in his numerous enterprises. The boy attended the ıblic schools of the town and spent his leisure moments his father's machine shop. Before he was fifteen years d he invented and built a rotary engine. In June, 1863, lthough not seventeen, young Westinghouse enlisted in ıe Twelfth New York National Guard and shortly after oined the Sixteenth New York Cavalry. He was hon-rably discharged in November of the following year and month later accepted an appointment as third assistant ngineer in the United States Navy, reporting for duty on ıe *Muscota*, from which he was transferred to the *Stars nd Stripes* and detached and ordered to the Potomac otilla on June 28, 1865.

At the close of the Civil War Mr. Westinghouse entered Union College, where he remained until the end of his sophomore year, leaving to enter upon active life and to find a wider scope for his inventive genius. In 1865 he invented a device for replacing railroad cars on the track, which was manufactured by the Bessemer Steel Works at Troy, N. Y. Going to Troy one day, a delay caused by a collision between two freight trains suggested to Mr. Westinghouse the idea that a brake under the control of the engineer might have prevented the accident. His first patent for an air brake was awarded a few years after, on April 13, 1869, and the Westinghouse Air Brake Company was formed on July 20 of that year. In 1871 Mr. Westinghouse went abroad to introduce the air brake in England and between 1871 and 1882 he taxed his inventive ability to meet new conditions of railroad practice. Meanwhile he invented the automatic feature of the brake and in 1886 was awarded a patent for a quick-action brake. In 1863 Mr. Westinghouse became interested in the opera-



GEORGE WESTINGHOUSE

tion of railway signals and switches by compressed air and developed and patented the system now manufactured by the Union Switch & Signal Company.

### Formation of the Electric Company

In 1886 the Westinghouse Electric Company was formed for the manufacture of lamps and electric lighting apparatus, Mr. Westinghouse having become interested in the subject. The business rapidly developed and in 1889 and 1890 the company absorbed the United States Electric Lighting Company and the Consolidated Electric Light Company. In 1891 all these properties were reorganized into the Westinghouse Electric & Manufacturing Company, which owns extensive works at East Pittsburgh, Pa. While the company was still growing Mr. Westinghouse had the foresight to gather about him such able and talented engineers as William Stanley, Nikola Tesla, O. B. Shallenberger and others who contributed not a little to the great development his practical imagination foresaw. Mr. Westinghouse rendered an invaluable service to the industry when in spite of strong opposition he succeeded in introducing the alternating-current system of distribution. The direct-current system was then used exclusively in this country. In 1885 Mr. Westinghouse sent the late Franklin Pope, then on the consulting staff of the Westinghouse company, to England to purchase the American rights to the invention of Messrs. Goulard and Gibbs, two British electricians who experimented with what they called alternating currents. Within a month after Mr. Pope's return Mr. Westinghouse had set up a laboratory to develop the Goulard-Gibbs invention commercially. From that moment the real growth and application of elec-

tricity to lighting, manufacturing and transportation may be said to date. He backed Tesla financially and with shop facilities in developing the induction motor, and built the first ten great dynamos for Niagara Falls. The alternating current which Mr. Westinghouse fought into universal recognition has alone made possible long-distance transmission of energy and the development of hydro-electric power far remote from the point of its utilization.

Almost akin to his work for electric transmission of energy was his system for controlling natural gas and conveying it through pipe lines for long distances, thereby establishing the practicability of utilizing natural gas as fuel in homes, mills and factories. Mr. Westinghouse has also taken a foremost part in the development of gas engines and in adapting steam turbines to electric driving. Besides his genius as an inventor, Mr. Westinghouse is well known as an organizer and financier. The Sawyer-Man incandescent lamp, the Nernst lamp and the Cooper Hewitt mercury vapor lamp were all put on a commercial basis by Mr. Westinghouse.

To Mr. Westinghouse was given the honorary degree of Doctor of Philosophy by Union College in 1890, and in 1906 the Königliche Technische Hochschule of Berlin bestowed upon him the degree of Doctor of Engineering. His decorations comprise the Legion of Honor of France, Royal Crown of Italy, and Leopold of Belgium. He was the second recipient of the John Fritz medal, and is an honorary member of the American Society of Mechanical Engineers, of which he is also a past-president, the National Electric Light Association and the American Association for the Advancement of Science. He is president of a large number of corporations having an aggregate capital of over $100,000,000, the largest of which are the Westinghouse Air Brake Company, the Westinghouse Machine Company and the Union Switch & Signal Company. He is also the head of about a dozen companies abroad, the largest of which are in London, Manchester and Havre. Mr. Westinghouse was married Aug. 8, 1867, at Brooklyn, N. Y., to Marguerite Erskine Walker. They have one son, George Westinghouse, Jr., who is a graduate of Yale.

## Supreme Court Decision on Copyright-Book Prices

The United States Supreme Court rendered a decision on Dec. 1 in a suit brought by R. H. Macy & Company, of New York, to enjoin the American Publishers' Association and the American Booksellers' Association from enforcing an agreement with agents not to sell books to the Macy firm, which had been offering them to the public at prices below the retail price fixed by the publishers.

The action was begun in the Supreme Court of New York and carried to the Court of Appeals. That court held that in so far as the agreement related to books not copyrighted it was in contravention of the anti-trust laws of the State of New York, but that as to books protected by federal copyright the publishers enjoyed a monopoly by virtue of their copyright and that the injunction would not lie.

Justice Day reversed the decision in an opinion which was concurred in unanimously by the other justices and held that the agreements between the publishers and booksellers contravened the Sherman anti-trust law and that this applied to the copyrighted as well as uncopyrighted books. Justice Day said:

"No more than the patent statute was the copyright act intended to authorize agreements in unlawful restraint of trade and extending to monopoly in violation of the specific terms of the Sherman law, which is broadly designed to reach all combinations in unlawful restraint of trade and tending, because of agreements or combinations entered into, to build up and perpetuate monopolies."

Justice Day declared that the associations formed a conspiracy in restraint of trade, had practically destroyed competition, and that in some cases booksellers had been driven out of business and ruined because they sold to the Macy firm.

## Legalized Blackmail—A Sample of Ignorant Patent Legislation

By Dr. L. H. Baekeland

Do you happen to know of any old process, product, machine, composition, trade-mark or design for which it is impossible to obtain patent protection in the United States either because it is not an invention or because it is not new?

Do you wish to obtain four years of absolute monopoly for this old thing under protection of the United States government which will promptly help you in fining, confiscating, collecting damages, imprisoning and enjoining others from using the old thing? Well, nothing is easier since the Kahn bill has become a law. All that you have to do is to file a patent in one of the many foreign countries where patents are obtainable without examination by simple registration.

Select, for instance, France or, better, Belgium, where a title to your patent is delivered to you for the sum of about $4. Then afterward exhibit the patented article, trade-mark or design at the Panama-Pacific Exposition, register it there, and the trick is done.

From now on you have four years of absolute monopoly. You can exclude anybody in the United States from manufacturing or using your registered article, never mind whether or not it was in public use before. You can blackmail right and left, and the courts of Uncle Sam will help you in enforcing your easily acquired privileges, by injunction, confiscation, fine and imprisonment! This sounds rather strange, doesn't it, in a country like ours where legitimate patentees are so badly protected?

If you think all this is a joke, read the Kahn bill (H. 7595) and more particularly the following provisions:

"Sec. 3. That it shall be unlawful for any person without authority of the proprietor thereof to copy, imitate, reproduce or republish any pattern, model, design, trade-mark, copyright or manufactured article protected by the laws of any foreign country by registration, copyright, patent or otherwise, which shall be imported for exhibition at the Panama-Pacific International Exposition and there exhibited; and any person who shall infringe the rights protected under this act shall be liable—

"(a) To an injunction restraining such infringement.

"(b) To pay to the proprietor such damages as the proprietor may have suffered due to the infringement, as well as all the profits which the infringer may have made from such infringement, and in proving profits the plaintiff shall be required to prove sales only and the defendant shall be required to prove every element of cost which he claims, or in lieu of actual damages and profits such damages as to the court shall appear to be just;

"(c) To deliver up on oath, to be impounded during the pendency of the action, upon such terms and conditions as the court may prescribe, all articles alleged to infringe the rights herein protected;

"(d) To deliver up on oath for destruction all the infringing articles, as well as all means and devices for making such infringing articles.

"Sec. 4. That any person who wilfully and for profit shall infringe any right protected under this act, or who shall knowingly and wilfully aid or abet such infringement, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished by imprisonment for not exceeding one year or by a fine of not less than $100 nor more than $1,000, or both, in the discretion of the court.

"Sec. 5. That Sections 25, 26, 27, 34, 35, 36, 37, 38, 39

and 40 of the copyright act approved March 4, 1909, are hereby made applicable to civil actions authorized to be brought under the provisions of this act.

"Sec. 6. That the rights protected under the provisions of this act shall begin on the date of the arrival of the pattern, model, design, copyrighted article, trade-mark or manufactured article so imported for exhibition within the grounds of the Panama-Pacific International Exposition at San Francisco, and shall continue for a period of three years from the date of the closing of said exposition."

This bill was hastily conceived to protect foreign exhibitors at the Panama-Pacific exposition.

Evidently neither the California framer of the bill nor President Wilson, when he signed this bill, was aware of its far-reaching provisions.

Yet the legislation just passed is not much worse than some of the provisions of the pending Oldfield bill and similar patent bills which have been proposed of late.

It shows how dangerous it is for congressmen or senators who have neither experience nor proper knowledge of our patent laws to tinker with patent legislation.

Just at this time Germany has also found it necessary to remodel her patent laws so as to bring them up to the requirements of modern times. This is the second time since 1877, when the first patent law was enacted in the German Empire. However, the methods of the Germans in changing their patent laws are strikingly different from ours. We let some congressmen or senators from States where a patent is scarcely known, except by name, draw up hit-or-miss-it bills, never minding whether they may strangle the very soul of invention, which insures the most desirable kind of competition, namely, competition by improvement.

In Germany the new patent bill was painstakingly prepared by a competent commission far removed from any political influence. This commission, in studying the subject, has taken advice and information from men who by experience and training could furnish the necessary help. Then this carefully worded bill was presented for discussion. In order to make discussion easy, the bill is accompanied by necessary explanations and data outlining the reasons for the proposed reforms.

When shall we have a competent patent commission to take up the revision of our patent system—a commission not made up of politicians, but of men who know something about our patent system, its practical working and its far-reaching influence on the healthy development of our country? Or shall we go on "monkeying with a buzz-saw"?

## Settlement of General Electric Strike

A settlement between the General Electric Company and the striking employees at the Schenectady works was reached on Nov. 29. As a result the employees returned to work on Dec. 1. There was no disorder at any time and, so far as the demeanor of the men went, it remained to the last more of a "demonstration," as the men called it, than a strike. On the afternoon of Nov. 28 the employees marched peaceably to the works to get their wages in accordance with the published announcement of the company that the usual methods of pay would be followed. The announcement of the company, signed by Mr. G. E. Emmons, manager of the Schenectady works, asked the employees, "in order to avoid confusion, to be as quiet and orderly as possible." Mr. Emmons afterward expressed his gratification at the splendid showing made by the employees on this occasion.

The announcement of the committee of employees in regard to the settlement was as follows:

"As a result of the conference with officials of the General Electric Company Friday afternoon, your committee is satisfied that there was no intentional discrimination in laying off Mr. Dujay and Miss Leslie, and further that the company is not antagonistic to organized labor. We do not question the right of the company to reduce force when necessary in such manner as may be deemed best by the management. After careful consideration we believe that the action in calling a strike was largely due to a misunderstanding.

"While it is not possible to continue to employ the two individuals mentioned in their former places, the company, in its desire to continue the harmonious relations heretofore existing with its employees and to avert the distress and suffering which must necessarily follow as a result of a prolonged struggle, and as evidence of its good faith, agrees to place them within a week in other places to do work for which their experience fits them.

"We have given a pledge that such employees as remained at work shall be subjected to no annoyance of any sort, and that every effort shall be made to maintain cordial and loyal relations with the company. In return the company agrees that there shall be no discrimination against any of its employees on account of their participation in the strike.

"We recommend that all employees report for work in their usual places Monday morning. While it may not be possible to provide the entire force with work at that time, the company will make an effort to place as large a number as conditions permit."

Mayor George R. Lunn of Schenectady made a statement in which he said that he did not believe the settlement would have been possible if the bitter antagonism that generally operates in labor disputes had obtained. He complimented the strikers on the splendid order preserved during the strike.

## Electrical Service at Harvard-Yale Football Game

Although electricity played a more prominent part in the reporting of the recent world's series of baseball games than in the football season just closed, it was an important factor in the transmission of scores all over the country from the Harvard-Yale game in Cambridge on Nov. 22. About fifty telegraph operators with an expert knowledge of the game were stationed on top of the Harvard Stadium and connected by Western Union, Postal and American Telephone & Telegraph circuits with many of the principal



TELEGRAPH OPERATORS AT YALE-HARVARD GAME

cities of the East. Newspaper service hot from the gridiron was given by direct wires running as far west as Chicago, and New York, Philadelphia, Washington and other places prominent in sporting circles kept close "tabs" on the pigskin during the historic struggle for its possession. Nearly 50,000 persons attended the game, about half of whom were transported to and from the grounds by

the Boston Elevated Railway, which, in addition to a large extra surface car service, ran four-car trains on a two-minute headway in the Cambridge subway for two hours before and two hours after the game. The largest number of telegraph circuits from the field were operated by the Western Union company, which had thirty wires in commission. Two operators placed in the players' dugouts on each side of the field kept the press operators in touch with all changes in line-up. The New England Telephone & Telegraph Company operated a special talking circuit from the side lines to the Cambridge exchange, whence the scores were relayed to all offices in the Boston metropolitan district.

## Meeting of Electric-Sign Manufacturers

On Dec. 1, in the Hotel Sherman, Chicago, representatives of electric-sign manufacturers held a get-together meeting for the purpose of organizing a co-operative electric-sign manufacturers' society. The purposes of the organization, as stated by Mr. James H. Betts, New York, in his opening speech, are: the betterment of competitive conditions, stimulation of co-operation with the central-station men, endeavoring to bring about universal adoption of the rules of the Underwriters' Laboratories, urging local underwriters' boards to conform to rulings of the National Board of Underwriters in regard to electric signs, standardization of local city requirements for illuminated advertising, and the elimination of the prevailing evil of the electric-sign industry, namely, the use of competitors' designs submitted by a prospective patron. Many speakers broached the subject of co-operation with the National Electric Light Association, and the hope was expressed that at the Philadelphia convention of the association, to be held in June, some part of the program would be devoted to electric signs.

Mr. George R. Hall, of the National Electric Sign Company, Jersey City, was elected temporary chairman of the meeting and a committee was appointed by him to formulate some plan whereby the society might be organized. This committee, of which Mr. Norman B. Hickox, Greenwood Advertising Company, Knoxville, Tenn., was chairman, suggested that a committee of three, consisting of sign manufacturers from distinctly different geographical locations in the country, be appointed to draw up a constitution and by-laws for the society to be acted upon at a future meeting of the delegates. For membership on this committee the following names were recommended: Mr. George R. Hall, National Electric Sign Company, Jersey City, N. J.; Mr. H. I. Markham, Federal Sign System, Chicago, and Mr. Norman B. Hickox, Greenwood Advertising Company, Knoxville, Tenn. It was recommended that the accessory manufacturers be made non-voting members and that full membership in the society be limited to those manufacturers using the Underwriters' label service. Following the discussion on the report of this committee, letters were read from Mr. E. W. Lloyd and Mr. C. H. Jones, stating that co-operation with the sign manufacturers was assured by the National Electric Light Association.

In discussing co-operation with central stations, the electric-sign manufacturers seemed to be divided generally in two classes—namely, those doing a national business and the local manufacturers, the sale of whose products is confined to the cities in which the respective factories are situated. It was brought out during the debate that the latter manufacturers are not so favorably inclined to the central stations as are the larger firms, since on account of their higher production costs they are unable to compete in price with larger manufacturers. This has led the central-station men to lend their patronage to the larger companies and has resulted in some ill feeling between the smaller manufacturers of signs and the local central-station companies. However, in general it may be said that the average sign manufacturer recognizes the central-station man as his best salesman's auxiliary and most enthusiastic local representative. It was decided that the present delegates would meet again, in Chicago, within ninety days, at the call of the chairman of the committee of three, and that at that time each sign company would be entitled to one vote upon the acceptance or rejection of the by-laws and constitution as presented at that meeting section by section.

## Suit Under Sherman Law Against American Can Company

A suit has been brought by the Department of Justice of the United States against the American Can Company and its subsidiaries, alleging violation of the Sherman law. The brief of the government alleges restraint of trade and an attempt at monopoly. Dissolution of the combination is asked. Until this is effected the court is asked to enjoin the various defendants from voting or receiving dividends from the stocks of any corporations acquired by the company.

President F. S. Wheeler of the company made a statement in which he said:

"While the company regrets that the government has thought proper to bring this suit, it has no fear or misgiving as to the result. Neither in the origin of the company nor in the subsequent conduct of its business has monopoly or restraint of trade been attempted or attained. None of the methods commonly known as 'unfair competition' have been employed by the company. It has been party to no agreements or understandings, express or tacit, seeking to control or regulate prices, nor has it sought in any way to rule or dominate the industry in which it is engaged. It has no such share of that industry—only about one-third—as would enable it to rule or dominate it, even if it had the purpose to do so. Competition is wholly free and keenly active in that industry.

"The company will defend this suit vigorously and confidently, and it is the belief of its officers and of its counsel that neither the company nor its stockholders need feel any alarm or uneasiness as to the outcome."

## Chicago Railway Terminal Situation

After five meetings in which plans for railway terminals had been presented by Mr. John F. Wallace, Mr. Bion J. Arnold, Mr. A. H. Wacker and others acting for various civic bodies in Chicago, the terminal committee of the City Council has voted unanimously to permit the new union station to be built on the site desired by the Pennsylvania Railroad Company, namely, in the block bounded by Adams Street, Jackson Street, Canal Street and Clinton Street. Although the vote was unanimous in favor of this site for the station, six of the twelve aldermen voted aye with the reservation that the ordinance must contain many concessions.

Among the things which have been agreed upon by Mr. John F. Wallace, technical expert of the committee, and Mr. Bion J. Arnold, adviser of the citizens' committee, are: the desirability of eventually straightening the Chicago River; the opening of several streets to provide more thoroughfares to the West Side of the city; the desirability of lowering and ultimately covering all tracks north of State Street, which would necessarily mean electrification; the desirability of establishing a technical board or commission to have jurisdiction over all future matters pertaining to railroad terminal questions but so constituted that its powers would not conflict with legislative powers of the City Council or the powers of the state board of

ublic utilities, and the desirability of two general stations addition to the present Northwestern station, one of hich is to be on the lake front east of Michigan Avenue nd south of Twelfth Street, while the other is to be on ie West Side between Canal Street and the river.

The drafting of the necessary ordinances has been taken hand by a commission consisting of Chairman Geiger f the terminals committee, Aldermen Healy, Fisher, Bow-r and Donahoe, Corporation Counsel Sexton, Mr. John F. Wallace, adviser for the City Council committee; Mr. Bion . Arnold and Mr. Walter L. Fisher, representing the termi-al plans committee; Mr. Paul Lazenby, chief engineer of ie Chicago plans commission, and Mr. Robert Redfield, pecial attorney and chief engineer for the Pennsylvania ailroad Company.

## English Officials Study Railroad Electrification

As noted elsewhere in this issue, Mr. A. H. Stanley, eneral manager of the London Underground Railway, is scorting through the United States a party of officials of he Midland Railway, one of the great trunk lines of Eng-and. Some interesting particulars on the plans of this ompany and its operating conditions were obtained by a epresentative of the *Electrical World* in an interview with ir Guy Granet, general manager of the Midland company. ir Guy said that the electrification question had become n acute one with his company, partly on account of the ecent acquisition of the London, Tilbury & Southend Rail-vay, a system with some 70 miles of route. At this time he very heavy suburban traffic of the Midland interests nust be cared for on only 1½ miles of its own track, the emainder being handled over the Whitechapel and Bow xtension of the Metropolitan & District division of the London Underground Railway. The problems which his company has before it, he said, are three in number. First comes the electrification of the Tilbury line because of the very congested conditions now obtaining upon it. Second, but more remote, is the electrification of the main line of the Midland Railway from London to Bedford, a distance of 50 miles. In this instance the electrification will be undertaken chiefly to build up still further the rapidly grow-ing suburban traffic. A third proposition, and one which appears extremely attractive, is the substitution of electric for steam traction for sections with heavy freight traffic to make possible the hauling of longer trains over the heavy grades. As he expressed it, the Midland Railway passes over the backbone of England, and in the mining districts its grades are steeper than are common on British railways.

Sir Guy Granet said he had already seen the New York Central and the New Haven installations at New York and was very much impressed with them. The use of electric switching locomotives was of special interest to him in connection with his freight service. While he had come to no conclusions on the subject of system, he said, it was reasonable to suppose that the choice in each case would depend upon the kind of traffic to be served. At London, for instance, it might be desirable to choose a system of propulsion and rolling stock which could be used in connection with the local underground railways. An important quesion is that of clearances, because it would not be altogether desirable to have a class of rolling stock too large for the London tubes. However, the question of having the local underground railways serve shorter suburban sections was under consideration. The sentiment among steam railroad men in England at this time is not for the general electrification of railways, but for electrification in congested sections and for suburban lines where electric operation will permit more trains and consequent increase of commuter traffic.

It is the purpose of Sir Guy and his party to visit all the important electrifications as far as Chicago and to return to England about the end of the year. The system of which he is general manager operates more than 1400 miles of track, exclusive of 600 miles or more of a line from which the Midland Railway has running powers. Among other questions which Sir Guy will consider on this trip will be those of using steel cars in place of wooden cars, the elimination of grade crossings and the relations between the railroads and public utility commissions.

## Convention of A. S. M. E.

The thirty-fourth annual meeting of the American Society of Mechanical Engineers was held in the Engineering Societies Building, New York City, Dec. 2 to 5, with an attendance totaling 750 members and 500 guests.

At the opening session of Tuesday evening President W. F. M. Goss, dean of the Schools of Engineering, University of Illinois, Urbana, made his official address, in the course of which he discussed technical education as a factor in the development of professional ideals. The speaker made a plea for better appreciation of the responsibilities and possibilities of technical education and urged the setting of even higher standards in the curricula and plans of conducting such colleges. As long as engineers in commercial pursuits can earn as much in a week as a college professor receives in a year, it is hardly likely, pointed out Dr. Goss, that the best men can be secured for the colleges. At the present time about 1000 graduates in mechanical engineering are being turned out each year by the technical schools of America.

### Election of Officers

The report of the tellers in charge of the balloting for officers was then read, and the following were declared elected: President, Mr. James Hartness, Jones & Lamson Machine Company, Springfield, Vt.; vice-presidents, Mr. Henry L. Gantt, of New York City; Mr. E. E. Keller, president Detroit Insulated Wire Company, Detroit, Mich., and Mr. H. G. Reist, General Electric Company, Schenectady, N. Y.; managers, Mr. John Hunter, Union Electric Light & Power Company, St. Louis, Mo.; Prof. A. M. Greene, Jr., Rensselaer Polytechnic Institute, Troy, N. Y., and Mr. Elliott H. Whitlock, National Carbon Company, Cleveland, Ohio; treasurer, Mr. William H. Wiley, John Wiley & Sons, New York.

Following the announcement of the tellers, President-elect Hartness was called upon for an address and spoke briefly, emphasizing the pleasant personal relationships existing between members of the Society of Mechanical Engineers. During his own twenty years of membership in the body, he said, he had formed many sterling and warm friendships. A reception to the president and president-elect followed, after which a collation was served in the rooms of the society on the eleventh floor.

The business meeting of Wednesday morning was largely taken up with the reports of standing committees on society affairs and of the special technical committee on flanges, standard threads for hose couplings and pipe-thread gages.

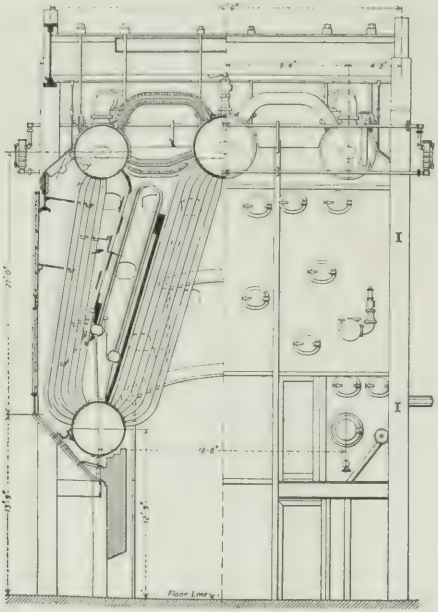
### Operation of 2365-hp Boilers at Detroit

Mr. J. W. Parker, of the Edison Electric Illuminating Company, Detroit, Mich., opened the professional program with his paper presenting further data on the operation of the large boilers at the Delray plant of the Detroit company. Nine of these 2365-hp units are now in service, the oldest group covering a period of three and one-half years. In refutation of the objection which has been urged against the use of such large boilers—namely, that a considerable part of a plant's steam-generating capability may be lost by the shutting down of a single unit—practical operating records at Delray were quoted by the author. During a given three-month run of six units it was at no time com-

necessary to put a boiler out of commission, nor was any boiler out of commission during the peak load of the day, from 4 p. m. to 6 p. m. Again, in more than a year's operation of seven boilers whose average age is two years only two tubes were replaced. Both of these faulty tubes were discovered by inspection and neither caused a shut-down.

Mr. Parker's report also discussed the methods of operating the boilers, pointing out the advantages resulting from the flexibility of these units and the extremely flat efficiency manifested. The latter is virtually a straight line from a value of 82 per cent efficiency at 60 per cent load to 78 per cent efficiency at 220 per cent load. The labor cost of firing this twelve-boiler plant is estimated at $101 per day, or 0.0076 cent per kw-hr. The watch foreman is paid 31.5 cents per hour and the fireman receives 25 cents per hour.

The closing section of Mr. Parker's paper was devoted to subjects of furnace design and stoker and brickwork maintenance. In general, the conclusions reached from




ARRANGEMENT OF GAS PRESS IN 2365-HP BOILER

practical operation of these big boilers is that in reliability they equal the turbo-generator, and that such large boiler units present possibilities of operating economy and simplicity of design which are greatly in advance of present steam-generating practice.

*Discussion*

Discussion of Mr. Parker's paper was opened by Mr. Alexander Dow, Detroit, Mich., who declared that the theory of the Detroit company management in installing large units had not only been to reduce floor space and increase efficiency but also to demonstrate that the payment of higher rates for boiler-room attendance would well warrant the improved results obtained. Mr. Dow advised reducing the number of firemen but improving the class of men secured for this work.

Mr. A. A. Cary, New York City, discussed comparative experience obtained with carbon-dioxide measurements and means of checking with steam-flow meters. Mr. I. E. Moultrop, Boston, Mass., declared that the operating engineer must look to his fire-room for efficiency, putting his best-paid men in that department. In Boston, he added, the steam-flow meter has been used with entire success. On the other hand, Mr. Moultrop also expressed doubt whether the value of the $CO_2$ recorder is as great as is generally believed. Mr. R. D. De Wolf, Rochester, N. Y., testified that he places principal reliance on steam-flow meters rather than on $CO_2$ records. Mr. Edward Uehling, Passaic, N. J., declared that $CO_2$ recorders give satisfaction if used intelligently.

Mr. William Kent, Montclair, N. J., observed that certainly at present the highest operating efficiencies are being obtained where $CO_2$ records are kept. He suggested, however, that a recorder of oxygen content be devised, as the proportion of oxygen present in the flue gases (ranging from 3 to 7 per cent) affords a more accurate index of the combustion conditions obtained than does the $CO_2$ percentage.

Mr. R. P. Bolton, New York, complimented the designers of the Delray boilers on the size of the combustion spaces provided and urged the use of a higher class of intelligence in the operating staff of station fire-rooms. Dr. D. S. Jacobus, New York, observed that a plant can be operated satisfactorily on the basis of secondary indications, provided these relations are once accurately established. Serious errors may, however, result from improper interpretation, as in the case of the engineer who maintained his $CO_2$ content high by copiously wetting his coal. Mr. Harrington Emerson, New York, criticised the tabulation of maintenance costs given in the paper.

Mr. D. M. Myers, New York, said that in the operation of power plants not used for utility service the lay management frequently knows little or nothing of fire-room conditions. By educating the fire-room staff without adding equipment, it is in many instances possible to achieve marked increases in efficiency. Mr. J. C. Parker, Philadelphia, Pa., reported that some of the early large double-ended boilers installed by the Philadelphia Rapid Transit Company are still in operation on the company's service.

### Task-Setting for Boiler-Room Employees

At the general session of Thursday morning a paper on "Task-Setting for Firemen and Maintaining High Efficiency in Boiler Plants" was presented by Mr. Walter N. Polakov. As pointed out by the author, the possibility of accomplishment of a task is governed by co-ordination of conditions and supplies with power demand and facilities; the guidance of men in their work, and the regaining of physical losses during intervals between working periods. The desirability of accomplishment of a task set within men's possibilities requires the study of physical, psychical and social stimuli. To the first group are referred payment of bonus, better surroundings, shorter hours, sanitary conditions, etc. Psychical factors include sporting spirit, confidence in records, relationship with management, and desire to study and advance. To the last-named group belong such stimuli as the attitudes of fellow workmen and members of the family, the condition of the labor market, legal regulations, etc.

In his paper "Properties of Steam," which was read by title only, Prof. R. C. H. Heck offered a new pair of characteristic equations for steam, giving the specific volume and heat content, respectively, in terms of pressure and temperature as independent variables.

### Hoisting, Conveying and Dynamic Braking

The report of the sub-committee on hoisting and conveying, of which Mr. R. B. Sheridan is chairman, presented in its report a review of existing practice and recent progress, pointing out the increase in hoisting loads to 50 tons and over; the higher speeds employed, which now exceed 2000 ft. per minute; the use of the man-trolley with self transported operator; introduction of storage-battery trucks, extension of monorail systems, etc. The committee

urged standardization in electrical machinery as essential to the satisfaction of both the manufacturer and user.

A paper on "Dynamic Braking for Coal and Ore-Handling Machinery," by Mr. Clark T. Henderson, cited how the great increase in the use of electric motor hoists for coal and ore handling has developed dynamic-brake control for lowering to a high degree of refinement. Generally speaking, explained the author, it is not good practice to figure on obtaining lowering speeds greater than 200 per cent of the full-load hoisting speed, unless special motors are employed. Lowering speeds should be held down to even one and one-half times full-load hoisting speed if possible. The commutation of standard series-wound mill-type motors is not good if operated above 200 per cent of full-load speed. Furthermore, the energy stored in their armatures becomes too great for rapid control at high speeds.

Three-phase alternating-current motors can be connected directly to the line for reverse operation and will prevent the lowering speed from exceeding the full-load hoisting speed by more than a few per cent. The motors cannot, however, be used to slow down the load, for only this one braking speed is available. On some installations attempts have been made to obtain perfect braking control by the excitation of the stator windings of the hoist motors from a source of direct-current supply. When the stator windings are thus excited the motors act as generators and the currents set up in the rotor windings serve to retard the descending load. The exciting current required is, however, so high that if prolonged for any considerable period it will cause the winding to overheat. It has been necessary, therefore, to incorporate with these alternating-current dynamic-braking systems means for varying the stator excitation in proportion to the braking effort which the motor is expected to exert.

The later technical sessions of the convention will be reported in a following issue.

### Grashof Medal to Mr. Westinghouse

On Wednesday evening before an audience that packed the auditorium of the Engineering Societies Building the Grashof Medal of the Verein Deutscher Ingenieure was formally transmitted to Mr. George Westinghouse, although the distinguished recipient was prevented by illness from being present. The actual award of the medal, as explained by Col. E. D. Meier, was made in Leipzig last summer before a brilliant company which included the King of Saxony. Geheimrat Dr. Frederick Romberg, of Cologne, Germany, as representative of the Verein Deutscher Ingenieure, made an eloquent address in his native tongue, urging that the bonds which unite American and German engineers be encouraged and strengthened. Other members of the committee representing the Verein who occupied the rostrum with Colonel Meier and Dr. Romberg were Messrs. Rudolph Hering and C. D. Waelzoldt. In the absence of Mr. Westinghouse, the medal was accepted in his behalf by President-elect Hartness.

The medal-presentation ceremony was followed by an address on "Leonardo da Vinci—Engineer and Artist," by Mr. John W. Lieb, Jr., vice-president of the New York Edison Company and past-president of the A. S. M. E. The versatility of this extraordinary savant proved to be a topic of the greatest interest, and Mr. Lieb illustrated his absorbing address with numerous reproductions from Leonardo's works, testifying to his talents as painter, sculptor, anatomist, philosopher, botanist, astronomer, mathematician, engineer and constructor.

On Thursday evening at the Hotel Astor was held the German dinner simulating one of the entertainments accorded to the society by its German hosts during the trip abroad last summer. Past-president W. R. Warner gave an illustrated lecture describing the chief events of the trip and the evening's entertainment closed with dancing in the great ballroom.

## Public Service Commission News

### Maryland Commission

The Maryland Public Service Commission has received an application from the Susquehanna Transmission Company for permission to issue $286,000 first mortgage 5 per cent bonds to be used in liquidating obligations to the Pennsylvania Water & Power Company.

The Consolidated Gas, Electric Light & Power Company of Baltimore has applied to the commission for permission to issue $743,000 general mortgage 4½ per cent bonds. The proceeds are to be used in buying property, improving plant and extending the distribution system.

### Massachusetts Commission

The Public Service Commission has issued an order requiring all corporations under its jurisdiction to file quarterly statements of general expenses in full detail, except as excused by the board in special cases, such expenses to include in particular money paid for advertising in newspapers and periodicals, for salaries and expenses of a legal character outside the regular legal departments, for services in legislative matters, and money expended to assist or influence the nomination or election of any person to public office. The reports are to date from October, 1913.

### New York Commissions

Testimony has been taken by the New York Public Service Commission, Second District, in the case involving the rates of the New York Telephone Company. Mr. A. B. Welch, commercial engineer for the New York Telephone Company, appeared as a witness on Nov. 28. He testified that 48 per cent of the business of the company was delivered to private exchanges.

### Indiana Commission

The Public Service Commission of Indiana has sent to electrical utilities the final draft of the classification of accounts and forms prescribed by the commission under the new law. Statistics prepared by the commission show approximately 350 electrical utility companies of Class C, which includes utilities in towns of less than 3000 population. In Class B, towns and cities between 3000 and 10,000 in population, the total number is fifty-three utilities, and in Class A, all cities over 10,000 inhabitants, the total is twenty-five electrical companies.

The forms apply to municipal as well as privately owned utilities, and the new system is operative from July 1, 1913. The annual reports of the companies to the commission are to be made in accordance with the forms and specifications prescribed by the commission.

The forms now prescribed will provide each utility with a means of securing cost figures, under the provisions of the statute, which requires specification of cost per unit from each company.

Classifications cannot be modified or changed in any way without permission from the commission. If, however, a utility desires more detailed information with reference to any department of its business, enlargements of the classification may be made.

No attempt was made by the commission to make up all of the small forms, such as work orders and statistical information blanks. The commission announced that to introduce an entirely new set of such forms would be impossible at this early date.

"It is needless to say that all payrolls must be properly distributed as called for in the classification," the commission announced. "Material and supplies of all kinds must be charged to the proper operating or construction account when used. When purchased, these supplies must be charged to their respective storeroom accounts. All invoices or bills for goods purchased by the utility should be checked upon receipt of the goods and the invoices marked so as to leave no doubt as to the proper accounts to which they should be charged."

# Current News Notes

Census of St. Louis Electric Employees.—The St. Louis League of Electrical Interests, Jovian Chapter, recently took a census of the employees in the electrical interests in St. Louis. About 75 per cent of the total number of electrical concerns in the city were willing to furnish the necessary data. The figures secured were as follows: Male employees, 13,311; female employees, 1839; total, 15,150; number of dependents, 32,832; number of concerns complying with request for information, 72.

* * *

Foreign Markets for Electric Devices.—Reports from a number of American consuls in foreign countries describing the present application of and probable demand for electric appliances in their vicinities are presented in No. 277 of *Daily Consular and Trade Reports*, issued Nov. 26 by the United States Department of Commerce, Washington, D. C. Among the countries reported on are Austria, Belgium, Great Britain, Greece, Italy, Norway, Portugal, Russia, Spain, Sweden, Switzerland, Turkey, Ceylon, India, China, Chile and Venezuela.

* * *

Liquefied Carbon.—According to a cable message to the New York *Tribune*, at a scientific meeting held Nov. 27 at Breslau, Prof. Lummer claimed that he had succeeded in liquefying carbon by means of a 220-volt arc lamp burning in a partial vacuum. He said that under a slight reduction of pressure the carbons became semi-liquid, and that when the pressure was further diminished they became quite fluid. If the pressure is still further reduced the phenomenon of ebullition appears, but on a close approximation to a vacuum the carbons resume their solid form.

* * *

## SOCIETY MEETINGS

Public Utility Depreciation.—A paper by Mr. John W. Alvord on "The Depreciation of Public Utility Properties as Affecting Their Valuation and Fair Return" will be presented before the American Society of Civil Engineers, New York, on Dec. 17, 1913.

* * *

Efficiency Society.—A meeting of the Efficiency Society will be held at the Aldine Club, 200 Fifth Avenue, New York, on Dec. 9, at which time addresses will be delivered by Mr. Frank A. Horne, Mr. Dean Park and Miss Margaret MacKinley. The offices of the society are at 41 Park Row, New York.

* * *

New York Section, I. E. S.—At a meeting of the New York Section of the Illuminating Engineering Society to be held in the Engineering Societies Building on Dec. 11 Mr. Frank E. Wallis will present a paper entitled "The Reasons for Styles in Architecture," and Mr. Howard E. Watkins will present one on "Periods of Architecture as Applied to Fixture Design."

* * *

Fraternity of Electrical Engineering Graduates.—The national association of Eta Kappa Nu, the fraternity of electrical engineering students and graduates, will form a branch organization at Schenectady, N. Y., on Dec. 8, with thirty charter members. The formation of the branch chapter is in response to a demand made by the rapidly increasing number of members residing in Schenectady and its vicinity. At the meeting officers and committees will be selected. A paper will be presented by an engineer of the General Electric Company. It is expected that the new branch, which includes the territory in northern New York and western Massachusetts, will become one of the most active organizations of its kind in the East.

Convention of Refrigerating Engineers.—The ninth annual meeting of the American Society of Refrigerating Engineers was held at New York, Dec. 1 and 2. Among the papers presented of interest to electrical men were the following: "Electricity for Ice-Making and Refrigeration as Supplied by the Central Station," by Mr. C. H. Stevens, Edison Illuminating Company, Brooklyn, N. Y.; "The Chemistry of Raw-Water Can Ice," by Mr. John C. Sparks, New York, and "The Sterilization of Water by Ultra-Violet Rays," by Dr. Max von Recklinghausen, Strasburg, Germany.

* * *

Electric Club of Chicago.—Officers have been put in nomination for next year's administration of the Electric Club of Chicago as follows: President, Mr. Alfred R. Bone, Chicago Telephone Company; vice-president, Mr. William C. Berry, Commonwealth Edison Company; treasurer, Mr. F. W. Harvey, Jr., *Popular Electricity and the World's Advance;* secretary, Mr. Howard Ehrlich, *Electrical Review and Western Electrician;* managers, Messrs. H. L. Judd, Public Service Company of Northern Illinois; R. I. Phillips, Pitt Engineering Company; A. R. Dean, Federal Sign System (Electric); Stephen Gardner, Westinghouse Electric & Manufacturing Company, and Fred M. Rosseland, Chicago Telephone Company.

* * *

Electrical Topics Before Coal Operators.—At the winter meeting of the Coal Mining Institute of America held at the Fort Pitt Hotel, Pittsburgh, Pa., Dec. 4 and 5, several papers presented dealt with topics of electrical interest in connection with coal mining. "Safeguarding the Use of Electricity in Mines" was the title of the paper by Mr. C. G. Brehm, electrician Oliver Snyder Steel Company, Uniontown, Pa., while "Stray Electrical Currents" was the topic discussed by Mr. W. F. Elwood, consulting chemist, Greensburg, Pa. Mr. H. H. Clark, electrical engineer United States Bureau of Mines, closed the technical program with an address on "Portable Electric Mine Lamps," an abstract of which is given elsewhere in this issue.

* * *

Testing Horizontal Low-Head Water Turbines at Elkhart, Ind.—On Nov. 24 Mr. Lucius B. Andrus, of South Bend, Ind., read a paper on "The Testing of Horizontal Low-Head Water Turbines at Elkhart, Ind.," before the Western Society of Engineers in Chicago. Results obtained were not given, but a chart presented showed maximum efficiencies of 83 per cent on one of the Leffel wheels operating under a head of about 18 ft. A partially floating rocker ring built especially for this installation in connection with the Lombard governor was sketched and explained by Mr. Andrus. The following men took part in the discussion: Messrs. D. W. Roper, Chicago; W. B. Jackson, Chicago; M. G. Lloyd, Chicago; H. E. Goldberg, Chicago, and F. G. Vent, Chicago.

* * *

Electric Cooking Facts.—At the regular Chicago Jovian Luncheon held on Dec. 1, in the Hotel Sherman, Mr. G. A. Hughes, of the Hughes Electric Heating Company, read an interesting and instructive paper on electric cooking in which he declared that the electric range is now an economic competitor of the gas and coal ranges in all cities where a cooking rate of 4 cents per kw-hr. or less is in effect. In answering the questions of the members following the reading of the paper many enlightening facts regarding the electric-cooking rates of central-station companies in various parts of the country were brought out. It was stated that within the last week the electric-service company at Jacksonville, Fla., had reduced its rates to 2 cents per kw-hr. for cooking. The record for electric ranges, it was reported, is now held by Winnipeg, where the rate is 1 cent per kw-hr. and more than 100 ranges are in use.

# Central Station Practice of Windsor, Vt.

**The development of a small progressive central-station system supplying electricity to a manufacturing and rural community in the upper Connecticut Valley**

THE attractive New England village of Windsor, Vt., situated on the east-central border of the Green Mountain State, about 140 miles northwest of Boston, has lately achieved prominence as the "port of entry" of President Wilson when en route to and from his summer home at Cornish, N. H., and as the nearest business center to the "summer capital," the home of a growing colony of residents distinguished in the larger business and professional life of the nation and the seat of varied manufactures, the town supplies a territory for the development of electric service along diversified lines. The central-station requirements are provided by the Windsor Electric Light Company, whose system, although small in rating, has lately been modernized along highly efficient directions.

The population served by the company totals about 2500. The distribution circuits cover the greater part of Windsor and extend into the adjoining town of Cornish, on the opposite side of the Connecticut River. At Windsor is the plant of the Windsor Machine Company, manufacturing the "Gridley Automatic" lathe and employing about 425 persons. The shops of this concern occupy a ground area of about 2 acres. The village also contains a canning factory, a glazing concern, a machine shop, a shoe factory, three banks, water-works and a sewerage system. Two garages are prominent consumers of electrical service, and the Vermont State Prison, situated in the town, is lighted from the company's mains. The central-station system has been in operation about fifteen years, but its modernization began about five years ago under the controlling interest of Mr. Frank A. Kennedy, of the National Biscuit Company, who resides in Windsor. About 300 customers are on the company's lines. The gross income is now about $5.60 per capita.

The company operates two hydroelectric plants and a steam auxiliary, all located near the center of Windsor on Mill Brook, a tributary of the Connecticut River draining a portion of the watershed of the Mount Ascutney region, in which the town is situated. The upper hydroelectric plant is about half a mile above the lower installation, the latter being situated within a few hundred feet of the steam auxiliary station. These last are known as the main plant of the company. Supplementary energy is derived by purchase at certain periods of the year from the Windsor Machine Company, which operates a 500-kw steam-turbine generator in its factory service. From October to May the service of the Windsor Electric Light Company can usually be carried entirely by the main plant, at which time the generating capacity in the upper hydroelectric station is utilized almost entirely by a motor-driven sawmill in its immediate vicinity. During this period no energy is purchased from the Windsor Machine Company, but secondary energy is sold to the latter at 0.5 cent per kw-hr. The main and upper plants, and also the machine company's plant, are interconnected by tie lines, but, with the exception of the sawmill service above mentioned, all distribu-

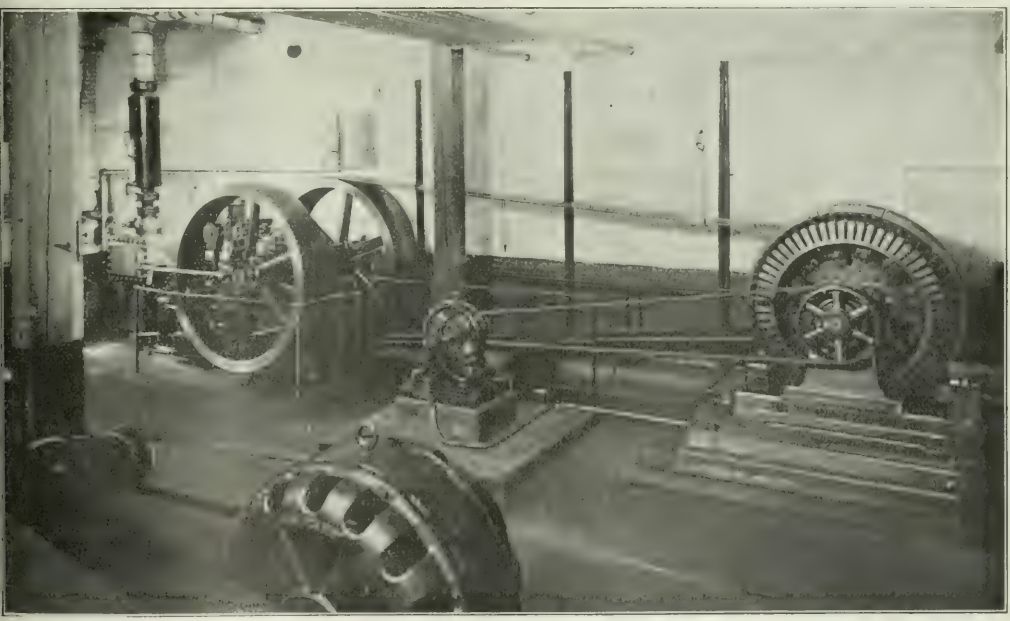
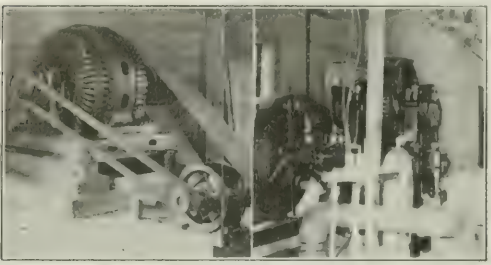


FIG. 1—AMES ENGINE AND GENERATOR, MAIN PLANT, WINDSOR, VT.

tion is effected from the main plant of the central station as a controlling point. During the period when the hydroelectric service is available at normal flow of the stream the tie line between the upper plant and the main station is usually opened, leaving the sawmill machinery operating solely upon the upper station. The Mill Brook watershed extends back about 20 miles into the lower foothills of the



FIGS. 2 AND 3—WATERWHEEL-DRIVEN GENERATOR IN MAIN PLANT, AND MOTOR-DRIVEN PUMP, WINDSOR WATER-WORKS

Green Mountains, and while there is no storage capacity worthy of the name on the stream, the flow is sufficient through the above period to enable the generating machinery to be handled efficiently and to require very little supplementary steam service. The waterwheels in both plants can be run twenty-four hours per day for about nine months of each year.

When the dry season comes, about the middle of May, the main and upper plants are operated in multiple from 6 p. m. to 1 a. m., after which the lower hydroelectric plant carries the load until morning. About midsummer the waterwheels have to be shut down, and energy is then purchased between 7 a. m. and 6 p. m. from the steam-turbine plant of the machine company at a rate of 1.2 cents per kw-hr. After 6 p. m., when the machine company's plant is shut down, the load is carried by an Ames steam engine belted to a 200-kw generator in the auxiliary steam plant of the main station until 1 a. m., when the load during the remainder of the night is carried by an Erie steam engine belted to a 60-kw generator. The system is sufficiently flexible to provide auxiliary steam power to either the main station or the machine company's plant at all times when the flow of water is too small for economical or reliable operation.

The upper plant, which was installed in 1911, contains a 75-kw generator belted to a 110-hp Rodney Hunt horizontal turbine with draft tube, operating under a 40-ft. head. Water is taken from a millpond by a 37-in. penstock leading to the wheelhouse, which is about 175 ft. below a stone dam 700 ft. long, 15 ft. thick at the base, 5 ft. wide at the top and 40 ft. in maximum height. This dam has recently been faced with concrete to a thickness of 12 in. on the upstream side and a new installation of headgates has been made. The field excitation of the generator is provided by a 3-kw, 125-volt direct-current machine. Regulation is cared for by a Lombard type "M" governor belted to the wheel shaft, and a Tirrill regulator is installed for generator voltage control. The generator and switchboard are housed in a 15-ft. by 17-ft. room, the switchboard being of the single-panel type and carrying, besides the usual voltmeter, ammeter and indicating wattmeter, field rheostat and switch, three oil switches by which the generator may be thrown upon the local bus, the main plant connected with the bus through the tie line, and the sawmill installation supplied with energy from either source. The generator rheostats are mounted on framing behind and at the top of the switchboard, and all wiring is run in conduit, with condulet outlets. A guard which completely incloses the generator belt is a noteworthy feature of the operating room. Prior to the installation of the upper plant it was necessary to open the floodgates at the dam at night in order to supply the lower station with water, losing the head now utilized. The tie-line switch is of the automatic type, operating upon predetermined overload.

The waterwheels at the main station are housed in old mill buildings which were formerly features of a mechanically driven manufacturing plant. From a stone dam near the company's office and auxiliary steam plant a 48-in. steel penstock leads to one turbine, which is 300 ft. distant, a 24-in. branch penstock supplying another turbine from a point near the lower end of the first. The waterwheels are of the Rodney Hunt design, one being rated at 200 hp and belted to a 150-kw generator and the other a 50-hp outfit belted to a 40-kw generator, the heads being respectively 40 ft. and 39 ft. The turbines are of the horizontal type, each having a draft tube, and in each case the generator is placed above the waterwheel. The larger unit is equipped with a 42-in. balanced pulley or flywheel drive weighing about 1700 lb., the smaller wheel being provided with a similar pulley weighing 1200 lb. The exciters are belt-driven and are rated at 4 kw and 1.5 kw respectively. All the waterwheels owned by the company are equipped with Lombard pressure gages with low calibrations, the instruments being piped into the wheel casing and indicating at all times the pressure conditions on the penstocks at the wheel intakes. In case an intake rack or screen at either dam becomes clogged with leaves or other débris, the drop in pressure is shown soon enough for the operators on duty to remedy the conditions, and there has been a marked improvement in service by this utilization of instruments. The company has found that the most economical use of water is to be had by operating the 50-hp and the 110-hp wheels and their respective generators at the lower and upper plants in multiple when water is scarce, and by relying upon the 200-hp wheel when it is plentiful.

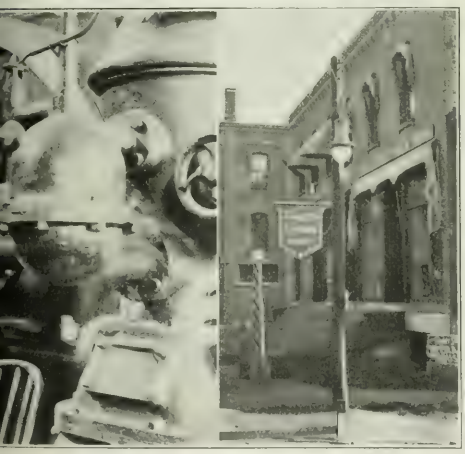
The wheels at the main plant are controlled by a single



FIG. 4 SWITCHBOARD IN MAIN PLANT, WINDSOR, VT.

Holyoke hydraulic governor, which may be connected to the gate mechanism of either turbine. This governor is placed in the switchboard room of the station, and instead of the ordinary mechanical drive from the wheel shaft is driven by belting from a 10-hp, three-phase, squirrel-cage-type induction motor of 220 volts rating on the basement

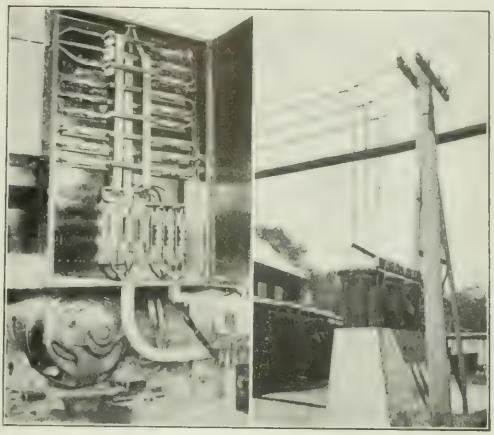
ing. Through step-down transformers this motor is nected across the station busbars, and it controls the e opening by its responsiveness to changes in frequency, latter, of course, being governed by the speed of the erators. This arrangement saved investment in two vernors and also makes it unnecessary to heat the wheel ises in winter. The gate-operating service is secured the use of the town water supply piped to a hydraulic n on the governor through a reducing valve that cuts pressure down to 35 lb. per sq. in. Tests have shown t the gates on either wheel can be opened by a 2.5-hp tor, but a 10-hp motor was used in order to avoid the p in the speed of opening the gate due to induction tor slip. The gate-operating cables are run from the in station through a tunnel to the wheels, and no diffi- ty is found in securing first-class control despite the dis- ce involved. The cables leading from each generator run directly to the main switchboard, and the water- eel units are operated almost as easily as if located in same room with the auxiliary steam-engine equipment. All the generators owned and operated by the company of the Westinghouse company's make and are wound 2300-volt, three-phase, 60-cycle service. During the t five years the system has been changed from a 133- le, single-phase installation to a 60-cycle, three-phase l single-phase property. The former waterwheel gen- tors at the lower plant were located in the building ising the engine-driven machines, and all the generating ts were driven by belts and shafting through clutches ich were constantly giving trouble and wasting energy. e betterment program which has resulted in the present tallation called for the sale of four 133-cycle generators l the purchase of four 60-cycle machines, with the elim- tion of the long shafting between the wheels and the erators. Two of the new generators were belted to engines. Under the new arrangement tests show that ce as much power can now be obtained from the water- eel driving the 150-kw generator as was available when s wheel was connected to the old line shaft leading to



S. 5 AND 6—ELECTRIC CONTACT ON VACUUM BREAKER OF ONDENSER, MAIN PLANT, AND MULTIPLE FLAME ARCS FOR TREET LIGHTING

main plant, with its incidental friction and alignment iculties. Within the past few years the company's rhead lines have also been rebuilt according to the ommendations of the committee on overhead-line con- ction of the National Electric Light Association.

The auxiliary steam plant at the main station consists of an 18-ft. by 72-in. Kendall horizontal return tubular boiler with overhung front, equipped with both butt and strapped joints and two engine-driven generators, one rated at 60 kw and the other at 200 kw. The former is driven by a 12-in. by 16-in. Erie non-condensing simple engine with throttling governor and the latter by a 16-in. by 16-in. Ames horizontal, simple condensing engine, each being



FIGS. 7 AND 8—DISTRIBUTION PANEL BOX, AND TRANSFORMER MOUNTING, BUENA VISTA SAWMILL

supplied with steam at about 85 lb. pressure. Refuse from the sawmill, supplemented by South Fork Pennsylvania bituminous coal costing $5.65 per long ton, forms fuel for the plant. The freight charges on the coal are $3.35 per ton. The company has found the use of higher priced coals the most economical practice. Tests show that this coal develops a heating value of about 14,000 heat units per lb. With the Ames engine and its generator operating at 80 kw average output, the auxiliary steam plant consumes about 6 lb. of coal per kw-hr.

The Ames engine exhausts into a Blake-Knowles jet condenser in the engine room, which is about 36 ft. by 38 ft. in dimensions. Primary and secondary heaters are located in the engine room raising the feed-water temperature to 130 deg. and 180 deg. Fahr. respectively. The Ames engine exhausts into the primary heater, which is of the Jacobs type, through an 8-in. pipe, and the condensate is discharged into the brook. The primary heater is drained by a Bundy trap. The Erie engine is piped for exhausting either into the Jacobs heater or into the atmosphere. Feed water is handled by a Knowles pump, with a Hancock inspirator for emergency service. Either the town supply or the river may be drawn upon for boiler-feed purposes. A special protective device has been installed on the vacuum breaker of the condensing system in the form of an electric contact on the valve spindle, so that if water from the pond tends to flood the exhaust end of the engine cylinder an electric gong will be rung in time to enable the operating force to prevent damage. A 23-in. vacuum is usually maintained in the plant, this being the highest economical vacuum adapted to the existing equipment combination.

The main switchboard of the system is 12 ft. long, contains six panels, and is equipped with the usual apparatus for generator and feeder control at 2300 volts. A separate panel is provided for each generator at the main plant, including the two waterwheel-driven units, and each contains receptacles by which the current can be read on a single instrument in any leg of the three-phase system, an ammeter, an indicating wattmeter and field-control rheo-

stat handle. One panel is provided with a watt-hour meter integrating the output of all the generators and motor-starting and automatic oil switches in circuit with the municipal pumping plant. The sixth panel is a tie-line panel connected with the upper station and contains, among other apparatus, a double-scale indicating watt-meter reading to 120 kw which shows the direction and

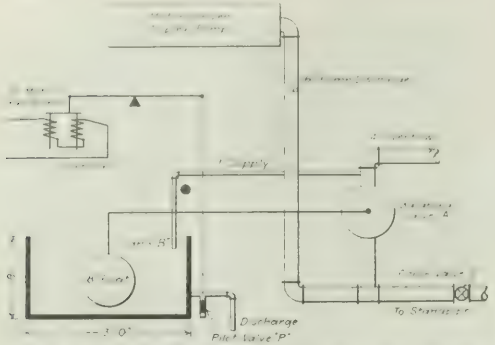



FIG. 9 AUTOMATIC REGULATION OF PUMP LOAD, WINDSOR MUNICIPAL PUMPING PLANT

amount of power interchange between the two plants at all times. The oil switches are attached to a framework at the rear of the switchboard, there being a clearance of 3 ft. at the rear to facilitate safety in working. Behind the board all wiring is insulated with flame-proof wire for 10,000-volt service. Throughout the plant the wiring is run in conduit. A single set of buses was considered sufficient for the service. The operating staff of the company consists of one superintendent, one day engineer, one night engineer, one transient fireman, one electrician, who also handles line work and meter setting, and in summer one helper on line work.

The upper and lower plant are connected by a No. 6



FIGS. 10 AND 11—SAWMILL INTERIOR, AND TYPICAL MOTOR DRIVE FROM SAWMILL BASEMENT

copper three-phase tie line, one-half mile long, and the main or lower station is connected with the machine company's turbine plant transformers by a No. 4 copper three-phase line 1500 ft. long. The two waterwheel-driven generators in the main plant are connected with the switchboard by No. 4 three-phase lines. The machine company's turbo-generator delivers energy at 550 volts to three 100-kw transformers used exclusively in the tie-line service to and from the central station.

The local distribution from the main plant consists of a single-phase No. 6 arc lamp circuit and three No. 4 three-phase, 2300-volt lines running to the center of the village for general lighting and power service. These lines are operated in open delta, the transformers for local service being balanced between the outer leads and the middle lead. So-called "rough-and-ready" service, as for electric ranges, moving-picture machines, single-phase farmers' motor applications and other demands characterized by low power-factors, are cared for across the outside legs of the system, which avoids unbalancing and greatly improves the regulation on the lighting lines taken off the intermediate leg and the corresponding outer wire. The company's standard poles are of chestnut and cedar, 25 ft. to 30 ft. long and spaced 125 ft. apart. The butts and tops are treated with carbolineum and copper for a length of 2 ft. each. On the company's lines are at present seventy transformers, representing an aggregate capacity of 321 kw. The house voltage is 110. Special attention has

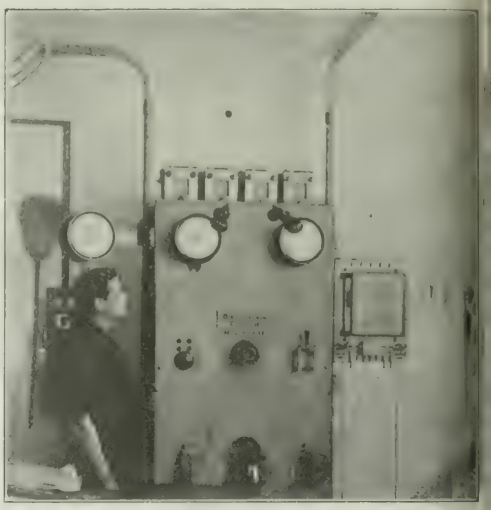


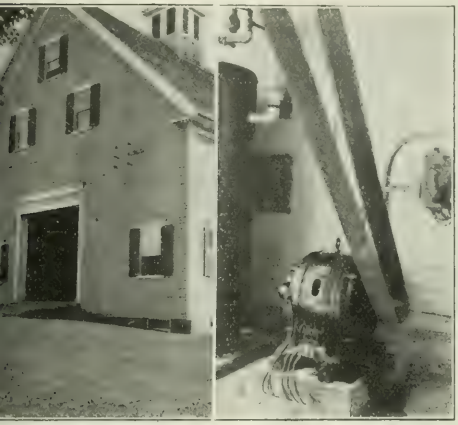
FIG. 12—SWITCHBOARD, UPPER HYDROELECTRIC PLANT

been given to utilizing diversity factors in distributing from transformers, the most striking instance being the operation of no less than seven motors in the business district from a single bank of two 5-kw transformers. These motors have a total rating of 24 hp and are listed as follows: One 3-hp, operating newspaper press, mainly afternoon service; one 2-hp, operating print shop all day; one 5-hp, running woodworking plant in all-day intermittent service; one 3-hp, operating blacksmith shop; one 3-hp, operating compressor and lathe in garage; duplicate of the last-named in another garage, and one 5-hp, operating laundry machinery in the daytime and in the evening. These transformers are connected in open delta, and the motors run off the outer legs.

The company charges 15 cents per kw-hr. up to an energy consumption of 20 kw-hr. per month for commercial lighting, with reduction in steps down to 6 cents minimum for over 350 kw-hr. The minimum service charge is $1 per month. Motor-service prices begin with a base rate of 7.5 cents per kw-hr., discounted by 10 per cent steps up to 50 per cent off for users of 2000 kw-hr. per month. The minimum charge is $1 per month per service. The company does not rent motors but sells the

holesale prices and on a three months' instalment plan. rgy for electric heating will shortly be sold at 4 cents kw-hr., notably for household tank service on a sepa- meter. A representative installation is a 15-gal. tank doctor's office, which utilizes 500 watts continuously his rate. New customers are all taken on meter serv- and the rate for electricity used in signs is the same or commercial lighting. Automobile sparking batteries charged at a price of 75 cents per cell. About 100 ric flatirons are on the system.

he company secured a contract for municipal water ping about three years ago and handles this work ctively on an off-peak basis. The town water supply erived from springs issuing from the mountain side without the village, and the distribution is effected a 275,000-gal. standpipe located about a mile away the springs. The water was formerly pumped to standpipe by a Laidlaw-Dunn-Gordon steam pump in ation at the spring site. The present equipment for orming this service consists of a 30-hp, 220-volt, three- se Westinghouse induction motor with external start- resistance at the pump house and an auto-starter at main generating plant, the motor being belted directly 7-in. by 10-in. Deane vertical, triplex, double-acting



13 AND 14—TYPICAL FARM-SERVICE ENTRANCE, AND KENNEDY MOTOR-DRIVEN PUMPING PLANT

p capable of delivering 420 gal. per minute against lb. pressure and operating at 44 r.p.m. The motor rates at 850 r.p.m. and can be started either from the p house or the power plant. Ordinarily it is started n the latter. An interesting home-made equipment is alled at the pump house to enable the load to be as- ed gradually by the pump and thus to cut down the ting current. It was found that the motor could not t the pump against the head involved, so the arrange- t shown in the accompanying drawing was provided the company's superintendent. When the operator at power house starts the motor the float in the tank *B* t the bottom and the balanced valve *A* in the pump harge line open. The solenoid *S* is energized with motor, and the movement of the cores into the coils es the pilot valve *P*. The motor begins to pump water the overflow pipe through the balanced valve, and er also flows into the tank *B* from the pump discharge ough the 1-in. supply pipe shown. The float rises dually, slowly closing the balanced valve and increasing load on the motor as water begins to flow past the ck valve *C* against the standpipe head. When the float ches its full height of travel, the balanced valve is closed, cutting off further flow into the tank and throwing the full pumping load upon the motor. As long as the motor continues in operation the solenoid plunger holds the pilot valve *P* closed, but in case the motor stops or if current is cut off the pilot valve opens, emptying the tank, lowering the float and opening the balanced valve again for a repetition of the operation described above.




FIGS. 15 AND 16—GARAGE SIGNS AT WINDSOR, VT.

The contract provides for six years' service, with optional extension by the town at the stated price for a total life of ten years. The company is required to pump 75,000,000 gal. or less in a year at a flat rate of $1,500, and all pumpage in excess of this amount is paid for at the rate of 3 cents per 1000 gal. The contract is saving the town $700 a year above the cost of operation by the



FIG. 17—PORTABLE MOTOR-DRIVEN SAW

former steam plant, and this enables the municipality to retire one five-hundred-dollar bond yearly on the water debt. The central-station company maintains the plant and owns the electrically operated apparatus. It operates the steam plant for four half days per year to keep it in proper condition. The demand of the motor service is about 30 hp, and the plant is operated on typical off-peak service,

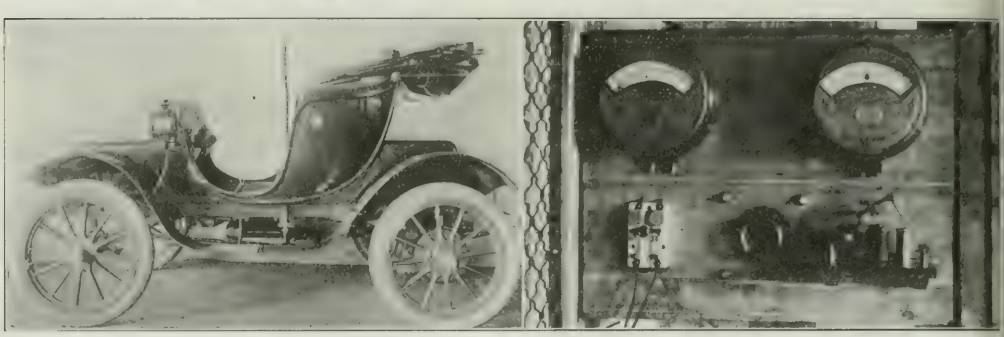
usually from 9 a. m. to 1 p. m., from 2.30 to 5 p. m., from 10 p. m. to 1 a. m., and from 5 a. m. to 7 a. m. At the standpipe float contacts are installed which ring a bell in the main generating plant when the water level approaches within about a foot of the top and when the top is reached. At the pumping station are two receiving basins of concrete with special drainage facilities, these having a combined capacity of 70,000 gal.

A number of country estates on the company's lines use electricity in pumping service. On the Evarts estate, for example, a 3-hp, 110-volt General Electric single-phase motor replaced two Olds gasoline engines operating by line shaft and belting two double-acting "Bulldozer" reciprocating pumps. The motor-driven outfit delivers water against 50 lb. pressure and is automatically controlled by a float switch. The cost of electrical service is about $7.50 per month against $10 with gasoline at 16 cents per gal. Off-peak use is made of the motor, by agreement with the company. It is frequently found in cases of this kind that the plant owner installs two gasoline engines in order to be sure of his reasonably constant service, whereas with electricity a single motor is invariably relied upon to do the same work.

On the Kennedy farm motors are used in the operation of the local pumping plant, in oat grinding, creamery service, ensilage cutting, grist-mill operation, bone, corn and vegetable grinding, the motors being flexibly arranged for diversified work. Chicken incubators consuming 100 watts each in heating service are run continuously for several weeks in the brooding season, which is between February and May. The pump house on the farm is a frame building with a concrete floor, and it contains a single-cylinder, double-acting geared Deming deep-well pump and a 4.25-in. by 6-in. Blaisdell duplex air compressor delivering air for air-lift service against a pressure of about 125 lb. per sq. in. There is a deep well with a 275-ft. lift, the water pipe being 5 in. in diameter and the internal air pipe 1.25 in. in diameter. This plant is group-driven by a 10-hp Wagner 220-volt, three-phase motor equipped with a Cutler-Hammer starter, a 2-ft. by 5.5-ft. air-receiving tank being located in the pump room. This plant pumps water four hours daily on an off-peak schedule to a 50,000-gal. storage tank, giving a head of 75 ft. for the farm service. The pumping plant has a rating of 20 gal. per minute and provides an excellent day load while it is in operation. On a representative farmers' line three farmers purchased a 10-hp Wagner motor, a 10-kw transformer and an ensilage cutter on a co-operative basis, and in utilizing this equipment they pool their labor and move the apparatus about according to immediate local needs.

The equipment of the Buena Vista sawmill, near the upper generating station, consists of 167 hp in induction motors operated on a 220-volt, three-phase secondary service from three 25-kw transformers mounted on a concrete pier. There are eleven motors in this establishment, ranging in size from 2 hp to 50 hp, and the mill runs daily from 7 a. m. to 6 p. m. The transformers are supplied with energy by a short tie line leading to the upper generating station. Their mounting is a distinct advance over the usual pole support accorded equipment of this type. The concrete pier on which the transformers stand is about 6.5 ft. high, 8 ft. long at the bottom, 2 ft. wide at the top and 3.5 ft. wide at the bottom, and it is set into the ground for a depth of 5 in. The transformers are not attached in any way to the pier, but the hangers are utilized as a support for a 3.5-in. by 4.5-in. cut-out bar to which the primary leads are brought from taps on an adjacent pole. The secondary leads to the mill are provided with a 2.5-in. by 0.875-in. wooden spreader on the mill side of the bank. The pier was made of concrete of four parts cement and one part gravel and was erected by three men and a one-horse team working two days, the labor cost being about $20 and the cost of material $10. The usual timber support rots away in a few years, necessitating early replacement, and the use of concrete is considered by the company cheaper in both first and ultimate cost. The motors at the sawmill are listed as follows: 50 hp, driving 54-in. board saw; 25-hp, S. A. Woods four-sided planer; 20-hp, lath mill; 15-hp, shingle mill; 15-hp board planer; 5-hp, gaging machine; 15-hp, edger; 10-hp small board planer; 10-hp, group drive of woodworking lathe, boring machine, buzz planer, small circular saw and log conveyor; 3-hp, cutting-off saw; 5-hp, slab conveyor; 5-hp, drag saw; 2-hp, blower, and a 10-hp motor which operates a cutting-off saw mounted on a small truck which is run around the yard and used in sawing slab wood. There are four outlets in the yard placed in pole boxes, as shown in the accompanying photograph, and this arrangement saves re-handling slabs in the mill and economizes time and labor. The motor installation at the mill cost about $2,000, of which $1,700 was the motor investment and the balance the wiring cost. It saves the Buena Vista company about $8 per day, the cost of electricity being $35 per month. Two cords of slabs were formerly burned daily by the mill for its steam service, and this material is now sold.

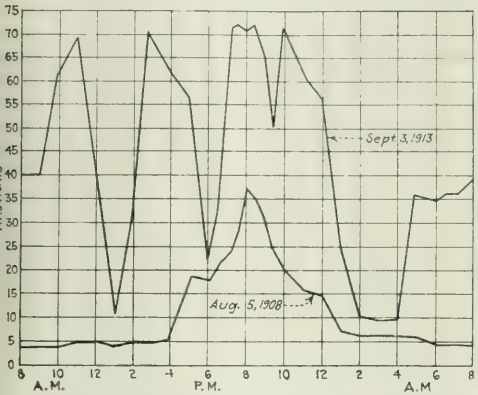
The majority of the motors at the saw mill are installed in the basement, either on the ceiling or on concrete piers. A typical installation is that of a 25-hp Wagner motor belted from the basement to a Woods four-sided planer. The motor is mounted on a wooden platform bolted to a concrete pier 4.66 ft. long, 3 ft. wide at the bottom, 2 ft. wide at the top and 3 ft. deep. A 1000-lb. flywheel



FIGS. 18 AND 19—PRESIDENT WILSON'S ELECTRIC AUTOMOBILE ON CHARGE AT LIGHT COMPANY'S PLANT, AND TEMPORARY CHARGING PANEL INSTALLED FOR IT

ounted on the arbor of the 54-in. circular saw to absorb ie fluctuations in energy demand. A view is also shown f the distribution box at the center of motor service at ie mill, with inclosed fuses and conduit wiring.

The street-lighting service includes twenty-four 500- att, 7.5-amp arc lamps of the alternating-current inclosed ype, operated 2100 hours yearly, or from dusk until 1 a. m. ightly, at a price of $50 per year per lamp. A number of ectric signs are in service, two of the more representa- ve ones being shown. The Windsor Garage sign exem- lifies the trade-mark of this concern, which is found on any highways in northern New England. It is 20 ft. igh, and is marked by a 4-ft. 6-in. arrow with ruby-glass ront and back, the interior of the arrow containing two 5-watt and five 2-cp, 110-volt tungsten lamps. The arch t the top of the sign proper contains five 25-watt lamps nd the standard six lamps of this size. The sign is 8 in. eep and is mounted on a 5-in. iron pipe set into a circular oncrete foundation in the sidewalk. It is operated nightly ntil 1 a. m. The Windsor Auto Company's sign consists f a 30-in. by 60-in. panel illuminated from above by three o-watt tungsten lamps on each border, the lamps being 5 in. apart on centers and the wiring in 0.75-in. conduit. he sign is supported by 2-in. pipe, with wire bracing and




IG. 20—LOAD CURVES SHOWING GROWTH OF BUSINESS BE- TWEEN 1908 AND 1913

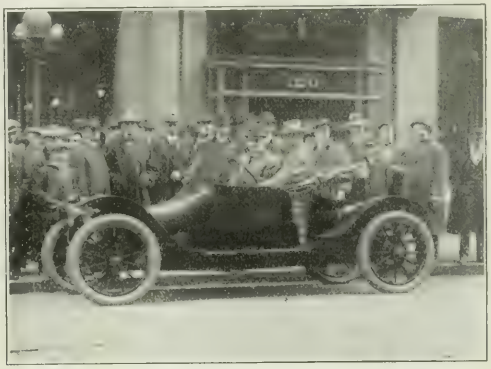
urnbuckle adjustments. A trial installation is being made f a multiple flame arc, shown in the accompanying hotograph, for street lighting in the center of the town, nd the yearly charge for this service will probably be $58.

President Wilson's electric automobile, shown in the ccompanying photograph while on charge, is cared for egularly by the company at $1.50 per charge, and to meet iis service demand a temporary switchboard panel with mmeter, voltmeter and automatic cut-out was built as iown. Practically no other electric-vehicle business has eveloped in the territory as yet but it is expected that the ood example set by the nation's chief magistrate will be ollowed in due course by other summer residents of the ommunity.

Typical load curves showing the growth of the com- any's business since 1908, when the day load was first ultivated, are reproduced. The first curve was plotted rom data taken one week after the day service was begun, nd the second, for Sept. 3, 1913, shows the influence of ie electric pumping load as carried on an off-peak basis, vhen compared with the station log sheet for the day, also eproduced. The total connected load on the system is bout 250 hp. The gross earnings of the company five ears ago were $5,000 per year, and the plant was losing ioney. By the physical improvements and progressive ommercial policies reviewed above the income has been brought to $14,000 and the concern placed on a paying basis. The officers are: President, Frank A. Kennedy; secretary, Edward Anderson; superintendent, Richard P. Osgood, all of Windsor.

## Chicago-Milwaukee Run of Electric Roadster

On Nov. 9 Mr. J. S. Codman, sales manager of S. R. Bailey & Company, Boston, made a run from Chicago to Milwaukee, using the Bailey electric roadster in which Colonel Bailey completed his remarkable tour from Boston and New York to Chicago, as reported in these columns Nov. 8 and Nov. 15. Accompanied by Mr. Harry Salvat, of the Fashion Garage, Mr. Codman left the Auditorium Hotel, Chicago, at 9:09 a. m. and arrived at the corner of Wisconsin and Water Streets, Milwaukee, at 6:17 p. m. The furious northerly gale, which was so destructive to shipping on the Great Lakes, retarded the progress of the car to a considerable extent. A small charge was given to the Edison battery at Waukegan and a charge at the rate of 200 amp for one hour was taken at Kenosha. Mr. Codman made the trip back to Chicago by himself, leaving Milwaukee on Nov. 11 at 8:25 a. m. and arriving at the



ELECTRIC ROADSTER WHICH MADE BOSTON-NEW YORK-CHICAGO RUN

Illinois Athletic Club on Michigan Avenue, Chicago, at 4:19 p. m., having covered 98.8 miles for the day. A picture of the Bailey roadster which made the Boston-Chicago run, with Colonel Bailey in the left-hand seat, is shown herewith. The photograph was taken in front of the office of the Commonwealth Edison Company at 120 West Adams Street, Chicago.

## Storage Reservoir as Adjunct to Hydroelectric Plant

The Great Northern Power Company, of Duluth, Minn., is constructing a large storage reservoir on the Cloquet River, about 20 miles north of that city, which will furnish water for its hydroelectric plant during the dry seasons. The reservoir is situated in flat, marshy country, so that, with the 40-ft. multiple-arch dam which is being constructed, a pond area of about 12 sq. miles will be obtained. Two 8-ft. tubes are being built in the dam to be used as penstocks for future hydroelectric development in this vicinity. For the time being, however, the reservoir will be used only for storage. Mr. E. S. Johnson, of St. Paul, Minn., is the contractor and Mr. Gardner S. Williams, of Ann Arbor, Mich., is consulting and designing engineer.

## Visual Acuity in White Light

By M. Luckiesh

The effect of the spectral character of light on visual acuity, or the ability of the eye to distinguish detail, has been extensively investigated by Dow, Bell, Broca and Laporte, Rice, the writer and others. It has been quite thoroughly established that the spectral character of light is a great factor in influencing visual acuity. Dr. Louis Bell[1] showed that detail appears more defined under mercury-vapor light than under that of the tungsten lamp. The writer[2] showed that acuity is greater in monochromatic light than in light of the same color and luminosity though of extended spectral character. This advantage of monochromatic light is generally conceded to be due to chromatic aberration of the refractive apparatus in the eye. In another paper[3] the writer showed that acuity is greater in monochromatic yellow light than in monochromatic light of any other wavelength, the observations having been made at the distance of 1 m and at equal luminosity. The different results obtained by some observers are no doubt attributable chiefly to the fact that they used lights which differed in spectral character and partly to the variable distances at which the observations were made. A simple lens does not focus all rays at the same point. The rays of short wave-length such as violet or blue suffer greater refraction than the red rays, hence are focused nearer the lens than those rays of longer wave-length. Thus the eye must accommodate to a greater or a less degree for lights which differ in color.

This can readily be verified by viewing a line spectrum on a ground glass. At a normal distance the eye naturally focuses for the brightest lines, which are usually in the yellow-green region. As the eye approaches the lines the red, yellow and green lines begin to blur in the order indicated, until when very close it can accommodate only for the blue rays. At a great distance red rays are more readily focused. There are other methods of showing that the eye is not achromatic.

At the time the former work was done the writer obtained some data regarding acuity in tungsten light compared to that in white light and also to monochromatic light. There seems to be no reason for expecting greater acuity in tungsten light or daylight than in purely monochromatic light, yet some have suggested such a possibility. For this reason observations were recently repeated and the results verify what would be deduced from the lack of achromatism in the eye. The green mercury line (546μμ) furnishes an especially desirable illumination in this case because of the elimination of difficulty in accommodation, as it lies at the position of maximum luminosity in a spectrum in which energy is equally distributed. The green mercury line was separated by suitable absorbing screens and one side of a wedge was illuminated by the monochromatic green light. The other side was illuminated by a tungsten lamp operating at 1.25 watts per candle. First a photometric match was made and then acuity measurements were obtained with the Ives acuity object at one meter distance. The tungsten lamp was then balanced against "artificial daylight" and acuity readings were taken. Next the acuity object was set at the mean value of visual acuity obtained under the monochromatic light and the illumination from the tungsten lamp was increased until acuity in tungsten light was the same.

The mean values of a number of different sets of observations with varying light sources are shown in the table which is printed herewith.

Visual acuity has been reduced to the Snellen scale. The equivalent brightness of the test object after allowing for its absorption (for it consists of black lines on clear glass) is shown in the last column and expressed in terms of the brightness of a white (magnesium oxide) surface illuminated by a certain number of meter candles. It is seen that at 10 meter-candles (approximately 1 ft.-candle) acuity in tungsten light is 11 per cent less than in the monochromatic light. At an illumination of 85 meter-candles the difference was found to be only 6 per cent. This result is in accord with former unpublished data which indicated a greater difference in acuity under the two lights as the illumination decreased. The second group in the table shows that the illumination required in tungsten light is 280 per cent of that required in monochromatic light for visual acuity on the Snellen scale of 1.28. In other words, the 11 per cent difference in acuity found at an illumination of 10 meter-candles disappears only when the tungsten illumination is increased by 180 per cent.

While many interesting data can yet be obtained relating to acuity and the spectral composition, the foregoing measurements close a gap left since the former work. The measurements show that there is little difference between tungsten light and artificial daylight in revealing detail. Artificial daylight which closely approximates average daylight in spectral composition was used because of the ease of controlling it.

It seems firmly established at least that when the accommodating power of the eye is not strained acuity in white light is less than acuity in monochromatic light of the same photometric brightness.

A note on the effect of yellow-green glasses in reducing glare under the open sky and in increasing the ability to distinguish fine detail may be of interest. The acuity object was set up out of doors under the open sky, the observer and instrument being shaded from the sun, which was in the rear. Acuity readings were made with the test object viewed against the sky. The observer wore no hat and the glare from the sky was of course a maximum. Alternate sets of readings were made with and without the yellow-green (Akopos) glasses which were of plane glass. Without the glasses the observer experienced painful discomfort when attempting to distinguish the fine lines of the test object.

Every reading made in this case indicated lower acuity than with the colored glasses and the readings fell off very rapidly. Acuity dropped gradually for the twenty minutes during which the observations were being taken in both cases, but when the observer did not wear the glasses the decline in acuity was much more rapid. The mean values of acuity in the two cases showed a difference in acuity of 11 per cent in favor of the Akopos glasses. Only one series of observations was taken, but the results were so definite that there can be no question as to the decrease in glare and increase in acuity under these particular conditions. The glasses also eliminate the purple and blue haze, and thus their use results in clearer distant vision.

ACUITY AND BRIGHTNESS WITH DIFFERENT LIGHT SOURCES

| Source | Acuity (Snellen Scale) | Equivalent Brightness of Test Object (MgO Surface Illumination, in Meter-Candles) |
|---|---|---|
| Green mercury line | 1.28 | 10 |
| Tungsten lamp | 1.14 | 10 |
| Artificial daylight[4] | 1.11 | 10 |
| Green mercury line | 1.28 | 10 |
| Tungsten lamp | 1.28 | 28 |

The writer acknowledges his indebtedness to Mr. A. Shapero for assistance rendered by him with the apparatus which was used in making the various tests described in this article.

[1] *Electrical World*, May 11, 1911, page 1163.
[2] *Electrical World*, Aug. 10, 1911, page 450.
[3] *Electrical World*, Nov. 18, 1911, page 1252.
[4] *Electrical World*, May 4, 1911, page 1092.

# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Exhibition Case for Drug Stores

In a large Western city the contract department of the ectric-service company proposes to place in drug stores ractive glass showcases containing small exhibits of mestic electric appliances, such as heating pads, vibra-rs, coffee percolators, shaving mugs, toasters and the like. he plan is to give the druggist a percentage on all sales ected, while the fixture provided with schowcase lighting ould add to the attractiveness of the store.

## Electric Pumping for Chickasha, Okla.

The Chickasha Gas & Electric Company has just closed a e-year contract with the city of Chickasha, Okla., for the pply of energy to operate electric pumps in the city ter-works. Squirrel-cage induction motors will be used drive Worthington centrifugal pumps. The total cost of e electrical equipment was $11,200, including buildings, ping, foundations and installation. Compared with this e outlay for the steam equipment, complete with boilers, as $17,650, showing an advantage of about 50 per cent in vor of electric drive from the standpoint of first cost. addition, savings in operating expenses, interest and preciation amounting to more than $1,800 per year are timated by Mr. C. G. Johnson, of the Chickasha Gas & lectric Company, who arranged the contract with the city.

## Central-Station Publicity at Atlanta, Ga.

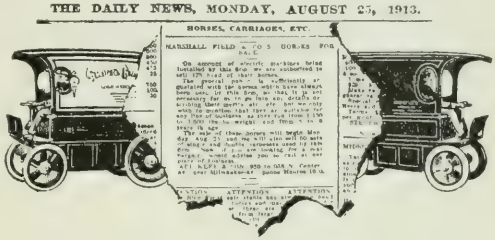
To prospective customers no better argument can be pre-nted than the successful experience of others with cen-al-station service. Effective use has been made of this inciple in shaping the local advertising of the Georgia ailway & Power Company, of Atlanta, Ga., for which Mr. ilt Saul has charge of publicity.

Recently a campaign of full-page display advertisements peared in the Atlanta newspapers describing conspicuous stitutions and enterprises using central-station service. his campaign was based on the assumption that pros-ctive customers would be impressed with the information at the larger enterprises, notable for their success in the mmercial world, had found this service the most economi-l and reliable method of obtaining power and light. The ffort was made to select a conspicuous example in each ass of industry or institution. The results obtained more an justified the expenditures for this campangn, for the rst full page had scarcely appeared in the daily papers hen several prospective customers asked to open negotia-ons, and by the time the campaign was well under way the ntract department had not only signed contracts with ese but had awakened similar desires in several enter-rises that had theretofore appeared absolutely hopeless as rospective customers. These also finally entered into con-acts for service. "It cannot be claimed, however," adds r. Saul, "that these conspicuous examples were signed up lely as the result of this newspaper advertising. To the bility and cleverness of the newspaper department the ccomplishment is principally due. The advertising merely rtilized the field, as it were. And in its final analysis is is about all that can be expected of any advertising."

This newspaper campaign is now to be supplemented by the publication of a handsome booklet describing and illustrating the principal large central-station customers' installations in Atlanta. Although it is planned to issue an impressive and expensive booklet, the latter's circulation will be restricted to quarters where it is likely to prove decidedly effective. Later the publicity department will compile literature describing the great steam and hydroelectric plants "behind" its service so that the customer may feel the fullest assurance in the operating and reserve capacity which the company has available.

## Electric Delivery Causes Sale of Horses

A Chicago firm of horse dealers advertised not long ago as follows: "Marshall Field & Company's Horses for Sale.—On account of electric machines being installed by this firm we are authorized to sell 125 head of their horses." The house of Marshall Field & Company is one


THE DAILY NEWS, MONDAY, AUGUST 25, 1913.

HORSES, CARRIAGES, ETC.

ADVERTISEMENT ANNOUNCING SALE OF HORSES

of the largest users of electric wagons and trucks in the United States, having about 200 vehicles in service or on order. The Commonwealth Edison Company, in advocating use of electric vehicles, has taken advantage of the horse sale to preach the gospel of the electric vehicle in newspaper advertising as shown herewith.

## The Power Cost in the Artificial Ice Factory

The large part played by the factor of power cost in the operation of an artificial ice factory was pointed out by Mr. C. H. Stevens, of the Brooklyn Edison company, in a paper presented by him before the recent meeting of the Eastern Ice Association in New York City. In many cases the cost of energy in ordinary manufacturing operations is as low as 1 per cent of the total cost of putting out the finished product, so that under such conditions a manufacturer can afford to give little heed to the cost of operating his power plant.

But in ice-making, where the energy cost may be as high as 50 per cent of the total, the power item is worthy of the utmost consideration, and cheap energy, therefore, becomes most important. Hence, where the manufacturer has a complete plant of his own he must devote much of his time to studying methods and means of obtaining low operating costs. This naturally diverts his attention from the actual development and extension of the ice-making business. Such condition, of course, can be bettered by avoiding the

problems of isolated-plant operation, and purchasing service from the central station. This idea had received little practical encouragement until the advent of the raw-water system of making ice, which makes it no longer necessary to use the distillate obtained from the exhaust of the engine. The central-station people are also in a position to offer special rates, provided that the ice-making plants are not operated during the high peak loads between 4 p. m. and 9 p. m. of November, December, January and February. This is a slack period for the ice manufacturer, and it is accordingly to his advantage from an economical standpoint to have central-station service.

## Brick-Plant Savings with Motor-Operated Clay Excavator

The plant of the Cherokee Brick Company at Macon, Ga., has a daily output of 100,000 common bricks and 30,000 faced bricks. Its clay mine is situated about 1.5 miles from the plant and is worked by a Bucyrus electric drag-line excavator, which has been in operation about seven months with great success.

Before the installation of the electrical equipment the clay was mined and loaded on dump cars by a steam shovel located in the clay pit, but high water frequently put this outfit entirely out of business, closing down the plant for considerable periods each year. The steam shovel required four men, two on the machine and two on the ground. Because, also, of the limited service of this shovel, two locomotives and trains were required to keep the plant supplied with clay. In addition, the presence of the shovel in the clay pit required the laying of track through the pit for the operation of trains. Upkeep of this track, with the frequent shifting required, proved very expensive.

The new electric drag-line equipment has effected some remarkable economies. The excavator is located on the bank above the clay pit and its operation is unaffected by weather conditions. The track through the clay hole has been eliminated, and in place of the eight extra track men previously required only three are now needed to keep the track in proper repair. On account of the larger capacity and greater working range of the excavator, together with its greater accessibility, one locomotive with its crew of

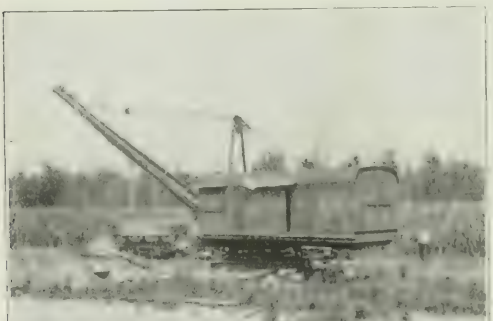


FIG. 1—MOTOR-DRIVEN DRAG-LINE EXCAVATOR

two men has been done away with, and the cars are now "placed" by means of the drag-line bucket with the aid of a snatch block. In addition, the expense of hauling coal and water to the steam shovel has been eliminated.

This particular excavator is the only one of its kind in existence, according to Mr. W. L. Southwell, of the Central Georgia Power Company, which furnishes energy for its operation. The excavator is provided with a 45-ft. boom and a 1.25-cu. yd. bucket. Its electrical equipment consists of three Westinghouse three-phase, 550-volt, 60-cycle motors. Hoisting is done by a 50-hp wound-rotor motor, while a similar 20-hp motor is used to operate the turntable and for swinging the bucket. The latter motor is equipped with a multiple-solenoid control designed for the

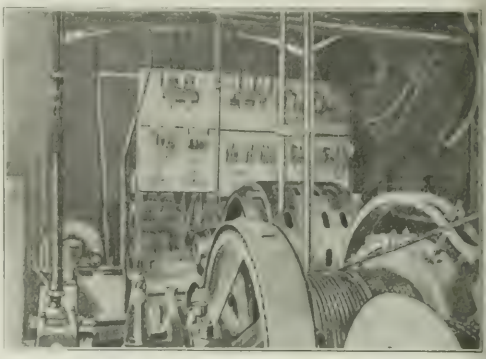


FIG. 2—MOTOR AND CONTROL EQUIPMENT IN EXCAVATOR CAB

automatic acceleration of the motor. A 2-hp squirrel-cage motor driving a small centrifugal air-compressor furnishes air for the main hoisting gear and for the brake cylinder for the bucket-tipping drum on the boom.

Energy is supplied by the Central Georgia Power Company at 6600 volts, three 20-kva transformers being employed to reduce this pressure to 550 volts. These transformers are protected by multi-gap lightning arresters, bomb fuses and air-cooled choke coils.

The record of this Macon excavator indicates an energy consumption of approximately 0.7 kw-hr. per cubic yard of clay mined and loaded on the cars. This is equivalent to about 1.1 kw-hr. per 1000 bricks manufactured. The great saving in the cost of energy, labor and maintenance and the freedom obtained from shut-down will, it is estimated, pay for the complete outfit in from one year to two years.

The Cherokee Brick Company is also using 170 hp in electric motors in the operation of its plant and has recently contracted for power and equipment for the latter's complete electrification requiring 580 hp in motor rating.

## A Stove Manufacturer's Testimonial

Electrical energy purchased from the Union Electric Light & Power Company is used exclusively in the large establishment of the Charter Oak Stove & Range Company of St. Louis. A letter from Vice-president Lester Dan of that company, telling why the company buys electricity rather than makes it, is of general interest. It reads as follows:

"The Charter Oak Stove & Range Company prefers your service to the generation of its own power, chiefly for the following reasons. The supervision of a troublesome department is eliminated. The ease with which additions or subtractions from the power equipment are made without material increase in investment is most important to us. Under the old method our greatest economy was to operate our plant to its fullest capacity. The addition of a machine which would require as little as 20 hp would under these circumstances compel a serious increase in our power equipment, while a corresponding decrease in the amount of power used would not save us anything at all. We are willing to pay for what we get, and we want to get exactly what we pay for."

## Rapid Development in Southern Minnesota

H. M. Byllesby & Company, Chicago, took over the management of the gas and electric properties at Faribault, Northfield and Cannon Falls, Minn., in December, 1909, forming with these utilities the nucleus of what is now the Faribault division of the Consumers' Power Company. At that time the total electric customers of all the properties numbered 1569. Arrangements were shortly made for the construction of a water-power on the Cannon River at Cannon Falls, having an initial capacity of 1500 hp. This was completed early in 1911, and transmission lines from it now traverse 125 miles, serving the original properties and those which have since been added.

Results in the electric department show a high degree of development, particularly in the growth of motor business. In January, 1913, the towns of Morristown, Waterville, Kenyon and Zumbrota were added to the lines of the company. The increase in population served (including the new towns) for the four years was 37 per cent, but the customers increased 82 per cent, kilowatts lighting load 90 per cent, horse-power in motors 498 per cent, and the total kilowatts for all purposes 167 per cent. There are now 73 miles of pole line, as compared with 40.2 miles in February, 1910.

There is now one meter to every 6.6 of population served, as compared with 8.9 in February, 1910. Receipts per meter have increased 20 per cent. The output for the week ended Nov. 4 was 82,420 kw-hr., an increase of 74 per cent over the corresponding week of 1911.

## Power Required for Motor-Driven Farm Machinery

Since most farm operations are essentially seasonable in character special motors are not usually required to drive each particular machine. Advantage has been taken of this diversity by a number of farm owners who have electrical

TABLE I—ENERGY CONSUMPTION TO THRESH GRAINS

| Kind of Grain | Yield per Acre: Tons of Grain and Straw | Yield per Acre: Bushels of Grain | Kw-hr. to Thresh 1 Ton | Kw-hr. to Thresh 1 Bushel |
|---|---|---|---|---|
| Oats | 1.99 | 73.6 | 2.62 | 0.070 |
| Barley | 2.27 | 49.9 | 2.36 | 0.108 |
| Wheat | 1.97 | 27.9 | 2.27 | 0.160 |

installations by mounting one or more motors on skids or trucks so that these portable units can be moved about to operate machines in the various barns, stables and fields.

TABLE II—SIZES OF MOTORS TO DRIVE FARM MACHINES

| Machines | Hp | Machines | Hp |
|---|---|---|---|
| Feed grinders (small) | 5 | Grain graders | 0.25 |
| Feed grinders (large) | 15 | Grain elevators | 5 |
| Ensilage cutters | 15–20 | Concrete mixers | 5 |
| Shredders and huskers | 15 | Hay hoists | 5 |
| Threshers, 19-in. cylinder | 15 | Root cutters | 2 |
| Threshers, 32-in. cylinder | 40 | Cord-wood saws | 5 |
| Corn shellers, single-hole | 1 | Wood splitters | 2 |
| Power shellers | 15 | Hay bailers | 7.5 |
| Fanning mills | 0.25 | Oat crushers | 5 |

The motors are provided with runs of cables ending in plugs which can be attached to fused connection blocks mounted at convenient points about the farm.

Last year at the University of Illinois Experiment Station, Urbana, Ill., tests were made, with the assistance of the General Electric Company's staff, to determine the energy consumption required to thresh various grains. The threshing machine used had a 28-in. cylinder and a 42-in. separator and was driven by a 15-hp motor. While the energy required to thresh a bushel or volume-measure of grain was found to vary greatly, the consumption in terms of tons handled was fairly constant. The results obtained are reproduced herewith in Table I.

Table II lists the sizes of motors recommended for operating standard farm machines. A single-hole sheller with a sacker attachment, driven by a 1-hp motor, requires about 0.025 kw-hr. to shell a bushel of corn, shelling at the rate of 26 bushels per hour. Test of a 25-bushel grain elevator capable of unloading 25 bushels of corn in three minutes has shown that 45 bushels can be elevated 19 ft. at an energy consumption of 0.1 kw-hr.

## Window Displays at Joliet, Ill.

A number of attractive and striking window displays have recently been exhibited in the show windows of the Public Service Company of Northern Illinois, which yearly awards a loving cup to its local office making the best exhibition. In each case the windows were trimmed by members of the commercial department, and the points taken into consideration in judging their respective merits



FIG. 1—WINDOW DISPLAYS IN JOLIET (ILL.) OFFICE PUBLIC SERVICE COMPANY

were, in order, attractiveness, originality and advertising value in relation to the company's business.

During the Hallowe'en season the Joliet office made a feature of a Hallowe'en window, displaying copper-finished electrical appliances among pumpkins, jack-o'-lanterns and cornstalks, while the slogan "Do It Electrically" appeared in miniature lamp letters in the foreground. Another window traced the evolution of lighting




FIG. 2—"THE TRAIL OF THE ELECTRIC IRON LEADS TO EVERY MODERN HOME"

from the sperm lamp of Roman times down through the different stages of the candle, oil-wick lamp and carbon-filament electric lamp to the modern tungsten unit. Another section which attracted particular interest from the passing public was a rustic scene with a glowing camp fire illuminating the imprints of an electric iron. At one side was a small sign reading, "The trail of the electric iron

leads to every modern home," and a path was shown leading through the woods to a miniature house lighted from a tiny but perfectly constructed central-station pole line.

But of all the recent window displays at Joliet the most unique and fascinating, according to Mr. Fred H. Scheel, of the company, was the window reproduction of the National Lincoln Highway. The course of the miniature road was lighted by ornamental lamp-posts each bearing the symbol of the highway. The city of Joliet was one of the first to boost the construction of this highway and during the company's window demonstration held a public parade to stimulate interest in the movement for a national road across the Illinois prairies. The window display showed an old oxen road, while a tiny electric train encircled the Lincoln Highway, passing back and forth through rock tunnels and signaling the crossing by a tap on the window. A billboard at the side of the road bore the electric company's advertisement and a realistic rail fence added interest to the collection of Lincolnia in the window.




FIG. 3—COMMEMORATING THE LINCOLN HIGHWAY AT JOLIET, ILL.

## Flood of Applications for Service Owing to Building Construction

During the last few months the Edison Illuminating Company of Detroit has received a flood of applications for service which it attributes to the increasing number of buildings, especially residences, being constructed. Ever since Detroit became prominent as a manufacturing center there has been a phenomenal growth in the central-station business of that city. Records show that about 76,000 electric meters belonging to the Detroit company were in use on Nov. 1 in all kinds of service—industrial, commercial and residential. The total connected load at that time was 136,773 kw, of which 48,400 kw consisted of motors and the remainder of lamps.

The accompanying table gives an idea of the increase in connected load so far this year. These figures represent the actual net increase in the number of meters on the lines, taking into account removals and transfers. The first column shows by months the total gain in meters connected; the second column gives the percentage of increase for each month over the same month last year, and the third contains the percentage of increase for each month over the preceding month.

INCREASE IN NUMBER OF METERS CONNECTED, EDISON ILLUMINATING COMPANY OF DETROIT

| Month | Total Gain Since Jan 1, 1913. | Per Cent Gain Over Same Month Last Year | Per Cent Gain Over Preceding Month |
|---|---|---|---|
| January | 1,133 | 71 | 71 |
| February | 2,120 | 100 | 83 3 |
| March | 3,205 | 37 2 | 65 6 |
| April | 4,713 | 54 8 | 62 |
| May | 6,097 | 15 | 48 3 |
| June | 7,483 | 24 8 | 43 |
| July | 8,931 | 38 | 42 |
| August | 10,569 | 25 | 39 |
| September | 12,517 | 28 | 37 |
| October | 14,594 | 30 | 36 4 |

In September 5214 applications and in October 5754 applications for service were received. Of these about 66 per cent were for residence lighting. The actual gain in meters installed during those months amounted to 1948 and 2077 respectively. It is estimated that there are about 92,000 residences in Detroit, and about 58,000 of these are now connected to the central-station lines.

About thirty solicitors are employed to canvass the residence districts. Besides obtaining new business in this way, many applications are also received at the main office. These applicants fill out blanks, which, twice a day, are sent to the order department where the wiremen receive instructions concerning the work to be done. In this way the applications are quickly filled and delays are avoided for the customers.

An unusual amount of rebuilding and remodeling of store fronts has taken place recently in Detroit, and such changes have generally been accompanied by extensions of the electric service.

For increasing residence consumption the Detroit Edison company favors the electric flatiron. About 10,000 flatirons were sold last year. The average income from a flatiron at the Detroit 4-cent rate is about 40 cents per month, so that the distribution of flatirons over the system is a desirable factor in increasing residence revenue.

## Utilizing Grocery Stores in Percolator Campaign

Grocery stores were utilized with good results in the electric percolator campaign recently conducted by the Commonwealth Power Company, Jackson, Mich. Along with the monthly lighting bills, 3500 descriptive folders on percolators were sent out to as many customers. Advertisements similar to the one shown herewith were also published in the newspapers. Going from one grocery store to another, a young woman demonstrator served doughnuts with coffee made in an electric percolator. All that the electric-service company had to furnish were two percolators. The demonstrator was paid by the proprietors of a local bakery as they were benefited by the increased demand for doughnuts. Each grocer's co-operation was secured by using the particular brand of coffee which he wished to push. Three days were spent in each store, and considerable interest in the devices was aroused among those who witnessed the demonstrations. Five-cup, seven-cup and nine-cup percolators were sold, each at a reduction of $1 below the original retail prices.

Advantage was also taken of the number of people visiting the central-station office during the last three days of discount on lighting bills to conduct similar demonstrations in the appliance salesrooms, thus renewing interest in the percolators, which many of the customers had previously seen demonstrated in the grocery stores.

THE OLD FAMILIAR RULE

is one heaping tablespoon of coffee for each cup wanted and ONE FOR THE POT. There is

A NEW RULE—THE ELECTRIC RULE

—which is one tablespoon of coffee to each cup and NONE FOR THE POT. Be sure to try a cup of that delicious coffee made in an electric percolator at M. & F. Lincoln's Grocery Store, 206 William Street.

THE ELECTRIC SHOP,
Commonwealth Power Company.

# Illumination and Wiring

## Portable Electric Mine Lamps

The use of portable electric mine lamps and the specifications for such lamps as suggested by the United States Bureau of Mines were the topic of an address delivered by Mr. H. H. Clark, engineer in charge of electrical investigations for the bureau, before the Coal Mining Institute of America at Pittsburgh, Pa., Dec. 5.

Portable electric mine lamps, it was pointed out, represent a comparatively new development in America, although they are already used extensively in European coal mines. As long ago as 1887 600 portable lamps were installed in a colliery in South Wales. In a recent competition held in England 195 different portable electric mine lamps were entered. At present, as well as for the last five years, American manufacturers and mine operators have been displaying great interest in the development of electric safety lamps. The Bureau of Mines advocates their adoption because of the resulting reduction in fire and explosion hazards. While actual tests have shown that the glowing filaments of electric lamps are capable of igniting explosive gas mixtures in case of globe breakage, it has also been proved that sparks at emfs less than 6 volts will not ordinarily ignite the mine gas. The bulbs in permissible mine lamps should be so protected that they cannot be broken while the filaments are glowing at temperatures sufficient to ignite explosive mixtures.

Among the general requisites suggested for a satisfactory portable miner's lamp are reliable and sufficient illumination, lightness and compactness, low cost of operation and maintenance, avoidance of spilling of electrolyte, etc. As minimum quantitative requirements for a satisfactory safety lamp, the Bureau of Mines offers the following specifications:

| | |
|---|---|
| Intensity of light at all times, cp | 0.4 |
| Flux of light at all times: | |
| For hand lamps, lumens | 3.0 |
| For cap lamps, lumens | 1.5 |
| Time of burning per charge, hours | 12 |
| Average life of bulbs, hours | 300 |
| (Not more than 5 per cent to have less than 250 hours' life.) | |
| Average life of batteries, hours | 3600 |
| Variation in energy consumption of bulbs, per cent | 10 |
| Angle of reflector, deg | 100 |

Six mine lamps were recently submitted to the Bureau of Mines for test. Of this number three were accepted and with certain changes approved as permissible for use in gaseous mines. The following are brief descriptions of the lamps tested:

The safety feature of the Ceag lamp, which is designed for hand service, consists in suspending the lamp bulb between two spiral springs, so that if either the bulb or the glass dome that surrounds it becomes broken the lamp circuit will be opened. During a number of smashing tests both the outer dome and the lamp bulb were shattered, and in nearly 40 per cent of the cases the filament remained uninjured but was prevented from igniting the surrounding explosive gas by the operation of the safety devices.

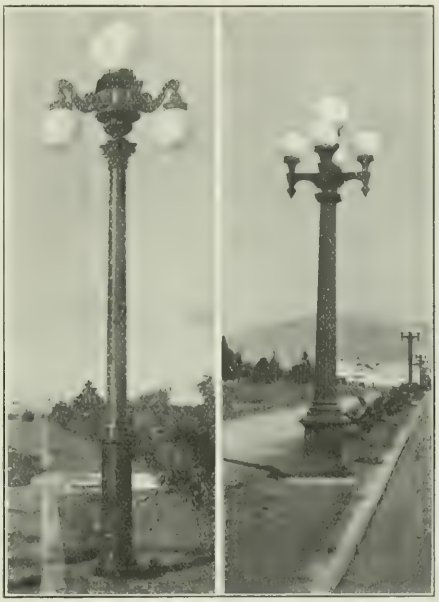
The Hirsch lamp, designed for cap service, is provided with an open-circuiting device which protects the lamp against blows from the front. A slip of glass mounted across the bull's-eye holds in closed position an open-circuiting spring which is released on breakage of the glass. Protection from other directions is afforded by constructing the headpiece of three concentric metal shells, the inner and outer being connected to the positive and the intermediate shell to the negative terminal of the battery. Any injury which could break the lamp bulb will jam these shells together, short-circuiting the battery and extinguishing the filament.

The Wico lamp, which is designed for cap service, has the bulb held in its socket by a wire stirrup against the pressure of springs, which act to eject it should the stirrup be removed or the spring broken.

In conclusion, as pointed out by the speaker it would be superfluous to suggest to mining men that anything to be used underground must be well made. Under this head should be considered, therefore, simplicity of design, strength of parts and fastenings, design of moving and removable parts, and the design and construction of electrical circuits and contacts.

## Ornamental Lighting of a 30-Mile Boulevard Near Los Angeles, Cal.

To light the 15-mile section of boulevard lying in the region of Owensmouth, Marion and Van Nuys, Cal., which are within a radius of 15 miles of Los Angeles, 375 handsome tungsten standards have just been installed. The roadway already illuminated includes Sherman Way, West Sherman Way and North Sherman Way. A fourth link of state highway will soon be finished, completing 30 miles of remarkably lighted and splendidly paved highway encircling half of the San Fernando Valley. In all 600 elec-



TUNGSTEN STANDARDS FOR BOULEVARD AND COUNTRY SECTIONS

troliers will be required, and the total cost of installation will be about $70,000.

A feature unusual in a lighting installation not within the limits of an incorporated city is that all of the circuits are installed in underground conduit. In the sections where the boulevard traverses towns or cities five-lamp standards are used with the lamps pointing upward. In the country districts three-lamp standards are employed with the center lamp upright and the two side lamps inverted. In the case of the city-type standard, the top lamp burns all night while the four side lamps are extinguished at 1 a. m. In installing the underground system no damage was done to the excellent roadway, the conduits being driven beneath the paved surface in each case.

The electroliers were furnished and installed by the Llewellyn Iron Works, of Los Angeles. The first installa-

tion contract was awarded to the Pacific Underground Construction Company, the second to the Newberry-Bendheim Company and the third to the B. F. Kierulf Company. The Southern California Edison Company both maintains and



THREE-LAMP STANDARDS ON BOULEVARD

furnishes electrical energy for the electroliers, including renewals of lamps and globes and also the painting and washing of the standards.

## Mixing Colors in Light Versus Colors in Pigments

In making his color designs the architect invariably thinks in terms of colored pigments instead of in terms of colors of light, said Mr. Bassett Jones in an address on "The Lighting of Colored and Ornamental Surfaces and Its Relation to Artificial Illumination," delivered before the New York Electrical Society Nov. 20.

Adhering still to the three-color theory in which red, yellow and green are taken as the primary colors, the average architect will define English vermilion, gamboge and Prussian blue to be the elementary tints. But, as pointed out by Mr. Jones, in dealing with the colors of pigments we are really dealing with colored light. Thus, yellow pigment may be assumed to absorb all of the blue light that falls upon it, reflecting only yellow light as well as red and green, the mixture of which produces the sensation of yellow. There is not enough yellow light in normal white light to account alone for the luminosity or brilliancy of certain yellow pigments.

Similarly blue pigment absorbs all of the red, yellow and green light falling upon it and reflects only blue light. When these two pigments are mixed together there results a broken green pigment, broken because in effect it is mixed with a large quantity of black; that is, its luminosity is greatly reduced. This effect is due to the fact that the yellow pigment in the mixture absorbs blue, while the blue pigment absorbs yellow, red and green, so that almost all of the light falling upon the mixture is absorbed and a small quantity of green reflected. Hence every step in the mixture of pigments is a step toward black, and contrariwise every step in the mixture of colored light is a step toward white. The theory of color in pigments can be explained only on the basis of the theory of color in light, which names as the three primary light colors red, green and blue, corresponding to certain definite wave-lengths in the spectrum.

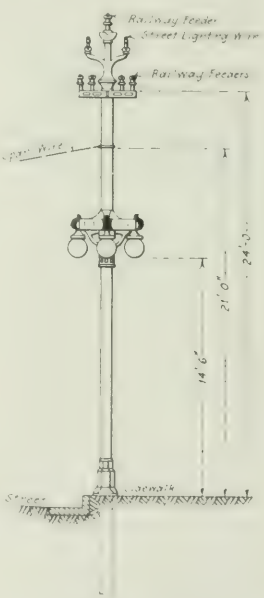
Color in light can be produced in three ways—by absorption of certain selected wave-lengths; by the additive combination of certain wave-lengths, and by the simultaneous reflection of separate selected wave-lengths. Usually any method of producing color combines all three methods. In absorption all of the wave-lengths except those required to produce the proper color are absorbed by the medium. If a medium reflects light of a certain color when white light is thrown upon it and transmits the light which it does not reflect, the color of the transmitted light must be the complementary color of the reflected light, since the two combined must produce white light.

If transparent pigments are used—and all pigments are more or less transparent—and such pigments are applied to different colored background or character of materials, a certain portion of the light falling upon the pigment is reflected. The rest is transmitted through the pigment and partially reflected from the surface upon which the pigment is applied. Here its color is again modified by absorption, and still again partially modified by retransmission through the pigment to its surface, where it is mixed with the light reflected from the surface of the pigment. Consequently, the production of color by pigments or dyes applied to materials is by no means simple, but depends not only upon pigment used but also upon the thickness of the pigment layer, the medium with which it is mixed, the color of the surface and the character of the surface on which it is applied. All of these aspects of the problem must be carefully studied if any accuracy in color balance is to be produced when the colored surface is provided with light from artificial illuminants, the light emitted from which must of necessity differ from the color of daylight.

With the proper study in the selection of color screens, artificial illuminants, dyes and materials, some exceedingly interesting color combinations and color changes can be produced. This study, practically limitless, opens up a broad field for effects in interior decoration. By varying the color of the illumination in suitable ways decorative design in color may be made to change.

## First Use of Incandescent Lamps on Denver's Business Streets

For a distance of thirteen blocks on Eighteenth Street, Denver, construction is under way to install 102 ornamental tubular-steel poles which will support the trolley-span wires, street-railway feeders and incandescent street lamps. This is the first time that incandescent lamps have been adopted for street lighting in the business districts of Denver, arc lamps being employed to light Fifteenth, Sixteenth and Seventeenth Streets. Different types of ornamental poles are used on each of these streets.




ELEVATION OF POLE

The poles and pressed-steel cross-arms for supporting the railway feeders in the case of the new Eighteenth Street installation will be furnished by the Denver Tramway Company, while the lamp brackets, elk horns and bases will be paid for by the abutting property owners. The new poles carry five 500,000-circ. mil railway cables which is in marked contrast to the old installations equipped with fourteen-position cross-arms supporting as many feeders of various sizes. The circuits for the ornamental lamps will also be strung on the elk horns.

# Letter to the Editors

## Rates for Electric Service

*o the Editors of the Electrical World:*

SIRS:—The writer begs leave to reply to some of the atements made by Mr. Percival Robert Moses in your ısue of Oct. 25, in which he criticises existing methods of harging for electrical energy as unfair and advocates a niform flat price per kilowatt-hour for all classes of busiess.

While the production and distribution of electricity is a usiness peculiar to itself, the sale of the product is gov-rned by the same general rules of merchandising as apply o the sale of other commodities, with the added compli-ation that the electric company's business is of public con-ern and the public has a right to share in its prosperity. hat there should be no unjust discrimination is conceded, ut we must not mistake the proper adjusting of charges etween classes for discrimination. The only adjustment f charges which is harmful is that which results in an njustice. Differentiating between classes and conditions loes not injure anyone, but distinctly benefits everybody.

A uniform price per kilowatt-hour would of necessity e an average price—a compromise. It would be, there-ore, too high for the big or long-hour business and too ow for the small or short-hour business. We could not *et* the first business at this average rate, nor could we fford to *take* the second at that rate.

When central stations had only the short-hour lighting usiness the prevailing rate was 20 cents per kilowatt-hour. Since obtaining the motor-service business they have been ble to reduce the rate on lighting to one-half the former harge. The motor-service customers know that the cen-ral stations are saving money for them, or the latter would ot get the business, and the lighting customers have the enefit of a 50 per cent reduction in rate. Is anyone in-ured by this so-called discrimination? How can it be tated that the small consumer is paying an excessive rate, y reason of which the central stations are able to secure ıe motor-service business at too low a rate, when the acts show just the reverse condition of affairs?

There is a price at which each class of business can be btained. If a price above that value is quoted no business esults. If that price is sufficiently above the increment cost esulting from this additional business to produce a reason-ble profit, one is justified, from every standpoint, in tak-ıg the business, even though the price quoted is below the verage cost, for the profit so obtained will result to the enefit of all.

It is apparent that a given community demands apparatus ecessary to meet its maximum requirements, with a rea-onable reserve. This apparatus, in an undeveloped busi-ess, is used for only a few hours per day, resulting in a omparatively high average cost per kilowatt-hour. It eems obvious that business which would use the apparatus hours when it would otherwise be idle will result in omparatively little additional operating expense. Mr. loses states that central stations should sell their product ı a cost basis, but were they obliged to sell energy at the ost of producing the additional energy over and above the revious costs, plus a fixed profit, then they would be quot-g a rate ridiculously low, resulting in an unnecessary rge saving to that class of customers. On the other hand, the charge were based on the average cost, plus a profit, e business could not be obtained, and hence the proper ice is somewhere between these extremes. The proper ice is just a little below what it would cost the consumer reproduce the same service, thus resulting in a saving him and a larger profit to the company. In this manner ch class contributes its full share to the profits of the mpany, but it can be done only by differential rates, the ofits from which can be shared with the public, by reduc-ing the rates to the small consumer at first and ultimately to all classes.

No business, except during the development period, should be taken at less than the increment cost to serve it, plus a reasonable profit, but each class of business should be taken at the highest price it can afford to pay. Then when all the business is obtained by the supply company each class will be served at a price which will be much lower than it could serve itself. This may or may not be unjust discrimination, but it is practised by practically every other class of business, and by Uncle Sam, too.

The public is interested only to the extent that each class gets proper value—the large consumer at less than he can produce the service and the small consumer at a price at which he can afford to use it. The extra profits over a fair return on the investment will be applied to reduce the price to the consumers.

It has been stated that central stations enjoy a monopoly, but such is not the case. While it is true they justly have a monopoly of the use of the streets, there is no monopoly of the business. They are in competition with private plants, gas, oil, etc., but, keenest of all, are selling a commodity that people need not use and for which they will not pay more than the service is worth to them. The public have a right, as consumers, to see that the rates reach that level which they would find were competition unrestricted but fair, and as partners in the business they are interested that no class be served at a lower level.

The illustration used by Mr. Moses in his legal quotation, where "A" gets 200 kw-hr. at 10 cents and "B" gets 20,000 kw-hr. at 2 cents, and the cost of producing each kilowatt-hour sold to both was 4 cents, is obviously unfair. If the conditions were identical, as he assumes, no sane central-station man would attempt to make such a distinction solely for quantity. Suppose, however, the conditions were not identical, and it could be shown that at 10 cents "A" might cause a loss and at 2 cents "B" might produce a profit, even though the average cost of serving both (with other business) might be 4 cents. In that case which customer is being served at too low a rate? The cost of serving any particular class is seldom equal to the average cost of serving all classes, so that any conclusion based on such an assumption is necessarily in error; but if the cost of service was actually used as the sole basis of charge, the present high-cost business would inevitably become higher.

Much of Mr. Moses' criticism on the great difference in the methods of charging between companies is justified, but it is so because of the present period of evolution. Much has been done to unify rates and much more will be done. It is surprising, however, to find how closely the different rate schemes of the principal companies result in the same net rate, though wide apart in detail. The demand rate has been popular, and justly so, for, as it happens, it arrives fairly close to the value of the service to the various classes and closely approaches the larger customers' costs when serving themselves, thereby fixing the value of the service rather than the cost of the service.

The diversity factor is what makes the business possible at existing low rates. Were it not for this factor the investment would be very much larger, the load factor lower, and consequently the cost very much higher.

Mr. Moses need not speculate on what would become of the business were central stations deprived of the low-priced motor-service business, for history holds abundant proof of that. The stations would inevitably be forced to charge much higher prices for the remaining business, and the communities would be deprived of a service which now promises to be well within the reach of all at lower prices than exist to-day. Classification must be allowed to accomplish this—that is, a fair and proper difference in rates between classes, but not discrimination between individuals in the same class.

*Scranton, Pa.* L. H. CONKLIN.

# Field of the Operating Engineer

**A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers**

## Electric Pumps for University Fire Protection

To provide additional water pressure in case of fire on its campus the University of Michigan has installed two motor-driven Rees Roturbo fire pumps which discharge into a network of mains supplying fire hydrants. Both pumps are in the Engineering Building, and their intake pipes connect with the 500,000-gal. marine experiment tank, which is kept filled from the city water mains. As this tank is about 300 ft. long, 22 ft. wide and 10 ft. deep, the water supply for extinguishing fires is practically independent of that delivered by the city mains.

Each pump is designed to deliver 1250 gal. of water per minute against a 306-ft. head and is driven by a 150-hp Fairbanks-Morse wound-rotor induction motor. The pumps are ordinarily operated in parallel but may be connected in series to obtain added pressure. The motors driving them operate on 440-volt, three-phase energy and are rated at 1200 r.p.m. full speed. Facilities have been provided for duplicate electric service, throw-over connection being made with both the Eastern Michigan Edison Company and the University power plant.

Starting apparatus, switching equipment and transformers for these two fire pumps are neatly arranged along one side of the mechanical laboratory.

The switchboard consists of four black slate panels, on two of which is mounted the high-tension switching apparatus for the transformers. The low-tension oil switches in the motor circuits are installed on the other two panels. Meters and other facilities for conducting tests on the

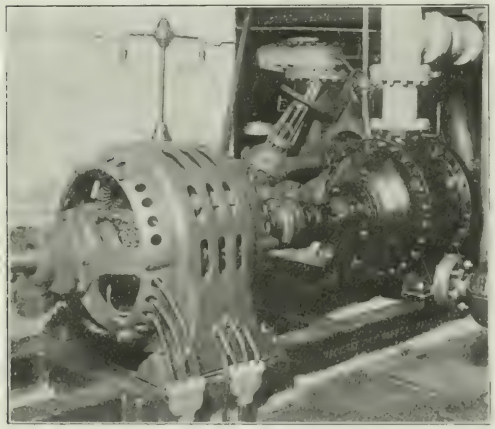


FIG. 1—150-HP MOTOR DRIVING FIRE PUMP AT UNIVERSITY OF MICHIGAN

operation of the motor-driven pumps are also provided. The low-tension buses are wrapped in black insulating material to distinguish them from the high-tension buses, which are insulated with oiled linen.

Two 150-kva, 2200-440-volt, three-phase transformers are installed at one end of the switchboard—one being used with each motor to provide flexible operation. Two speed controllers and a stack of resistance grids are installed at the opposite end of the switchboard. The grids are built up in a single vertical stack about 7 ft. long and 8 ft. high

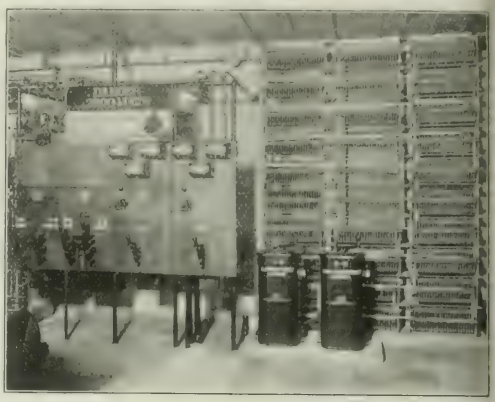


FIG. 2—CONTROL APPARATUS FOR UNIVERSITY ELECTRIC FIRE PUMPS

to economize space. The entire equipment has been erected in a very limited area, but every effort was made to arrange the parts accessibly.

## Voltage Variation in Compound-Wound Generator

A compound-wound generator that would give an absolutely flat voltage characteristic from no load to full load would cost too much per horse-power. The compounding curve of a commercial generator has a hump in it, and it is customary so to adjust the compounding that normal voltage exists at no load and full load, while at all intermediate load values the voltage exceeds normal value. In a case in mind the operator had two compound-wound generators operating in parallel. When the total load was about 375 amp the larger machine supplied about 250 amp and the smaller machine about 125 amp; when the smaller machine was cut out by pulling its switch the load current increased to about 385 amp. The operator was very much concerned as to the 10 amp increase that apparently came from nowhere.

The explanation of what to him was a mysterious phenomenon is as follows: The increased current thrown upon the larger machine by removing the smaller machine from the circuit moved the larger machine's load up to a value corresponding to the hump of its compounding curve, thereby raising its voltage a little. A glance at the voltmeter would have shown an increase in the voltage. Of course, all of the lamps were burning a little more brightly and each was taking a little more current. The operator was justified, in a way, in expecting that the current would be the same whether the current was produced by one machine or two, but a look at the voltmeter before and after removing the smaller machine would have suggested the true cause of the variation.

## Utilizing a Difficult Corner on a Switchboard Gallery

The accompanying photograph shows a chief operator's desk in a narrow corner on a switchboard gallery in a New England power station, the feature being the use of space over a stairway which appeared to be the only available site for the desk. The front of the gallery was narrow



REMOTE CORNER OF SWITCHBOARD ROOM UTILIZED FOR DESK SPACE

and had room only for a table upon which station logs are written. At one end of the switchboard and two stories above the floor of the turbine room a stairway connects the operating gallery with the rest of the station. The problem of desk location was solved by the use of angle irons supporting the desk at the stairway railing and against the wall at the left, a special U-shaped bar being placed under the right-hand tier of drawers to support this portion of the desk. The railing at the right side of the photograph protects operators on the gallery from falling down the stairs, and the compactness of the whole arrangement is even more apparent to the visitor than can be shown by a photograph.

## Heating Not Due to Motor Trouble

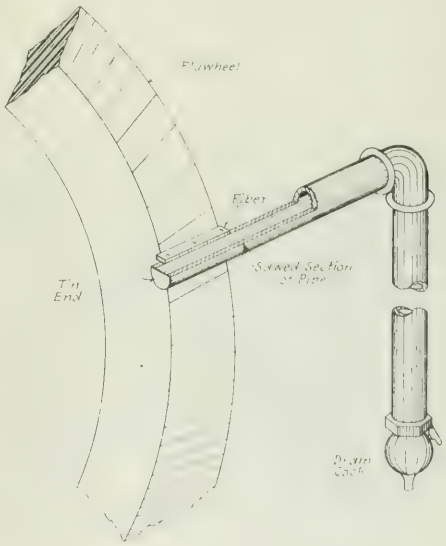
An inspector in the South was called in hurriedly to locate the trouble in a three-phase slip-ring induction motor just installed to operate the compressor of a refrigerating plant. Careful inspection of motor, wiring and compensator failed to reveal any irregularity, so the motor was put under load and thermometers were applied. While the motor was operating the inspector noticed that one of the bearing-cap bolts of the compressor crank shaft was lying upon the pedestal and further inspection showed that all of the cap bolts had been slackened. On making inquiry of the proprietor, it was learned that the compressor had developed a hot box due to a bent shaft. The cause of the motor heating excessively was now evident, but, as a matter of record, two ammeters were cut into two of the motor legs and the meter readings noted while the cap bolts were slowly tightened. With the cap bolts loose, the motor took a balanced current of 30 amp with the compressor by-passed. This was 4 amp more than the motor's full-load current rating. As the cap bolts were very slowly tightened, the current increased rapidly, finally exceeding the range of the ammeters before the cap bolts could be screwed home. The effect of the bent shaft binding in the bearings under the original conditions could hardly be estimated, but the motor was fused for four times full-load current and the fuses blew as fast as they could be replaced. The lesson of this experience is that the seat of trouble is quite as likely to be found in the connected load as in the motor itself.

## To Prevent Flywheels Throwing Oil

Sometimes an otherwise well-kept engine room presents the incongruous spectacle of an ugly line of oil stains opposite the engine flywheel. Such stains are hard to remove after they have been once deposited, but by a little care the wheel can be prevented from throwing the oil in the first place. The lubricant, of course, escapes from the bearings, and with the assistance of centrifugal force creeps out to the rim of the wheel. Here it must first collect in drops or globules before the forces of adhesion and cohesion "let go" and the drop flies off through the air to add its mite to the growing discoloration.

Almost any kind of a scraper or wiper that will remove the oil from the wheel's rim will prevent the wall stains, but an improved device for the purpose can be made out of an oblong tin can having its sides cut away to fit the curve of the wheel. The can is filled with waste which presses against the rim, wiping off the oil in a thoroughly neat and effective manner.

Another effective wiper is made of a piece of ½-in. pipe with one-half sawn away as the sketch shows, and the end




DEVICE FOR REMOVING OIL FROM FLYWHEEL RIM

closed with a piece of tin forming a trough. Fixed to the pipe by means of screws is a lip of hard fiber which projects ½ in. over the side and bears against the wheel face. Oil collected by this lip is drained through the trough into the vertical pipe which can be emptied at intervals. The flexibility of the vertical pipe serves as a spring to hold the lip in contact with the wheel.

## Quick-Firing Arrangement of Boilers to Relay Water-Power

As already noted in these columns, hydroelectric energy transmitted from the Mississippi River water-power plant at Keokuk, Ia., is purchased by the Union Electric Light & Power Company, of St. Louis, Mo., as an auxiliary to the supply furnished by the company's own large steam plant

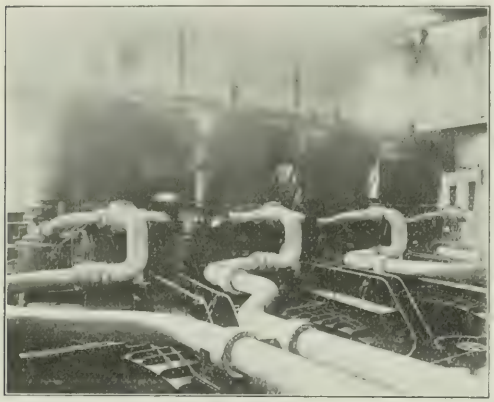


FIG. 1—12,000-KW TURBINES IN ASHLEY STREET PLANT, ST. LOUIS

at Ashley Street. To guard against interruptions in case of the possible failure of the hydroelectric system, the Ashley Street station is now being operated in such a manner as to be able to take up the entire load, both water-power and steam, in a few minutes' time.

Such emergency operation requires, of course, that extra boilers be held in readiness for use at very short notice. The present steaming equipment comprises fifty-two boilers. Of this number thirty-two are operated under continuous fire for carrying the regular steam load of the system. All of these boilers are used at the peak of the load,

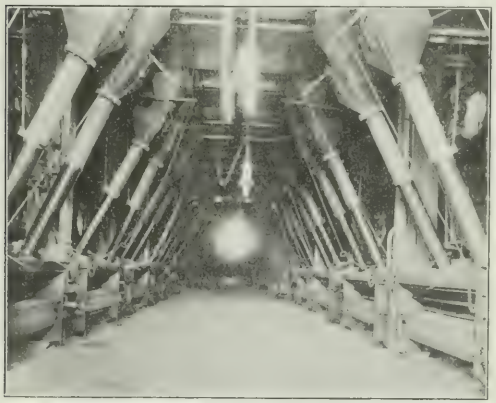


FIG. 2—INTERIOR OF BOILER ROOM, ASHLEY STREET STATION

and as each boiler is rated at an output of 1000 kw, it is possible to carry loads of 32,000 kw, which is nearly the system peak at the present time. As the load falls off after the peak has been passed, these boilers are banked one after another. For a few hours during the night only six are held on the load.

For emergency operation in case of transmission-line troubles the twenty extra boilers are at all times kept in readiness by circulating through them water at a temperature of 210 deg. Fahr., while on their grates fires are built and made ready to light at a moment's notice. The boilers at Ashley Street are located on two decks, the units of the lower deck being used for emergency service. An accompanying sketch shows how these emergency fires are laid.

The grate is first covered with a high-grade nut coal to a depth of 7 in. and three rows of oily rags are then placed in cross trenches. Another row of rags extends down the middle to carry along the flame to all parts of the grate. On top of these rows of rags is laid kindling-wood soaked in kerosene, while a few gallons of fuel oil are sprinkled across the top of the entire bed of coal. This arrangement, as may be readily appreciated, gives a hot fire very quickly. The best time made thus far in getting a boiler on the header, starting from zero pressure, is sixteen minutes. The water in the boiler at starting the fire was at 212 deg. Fahr.

But surprising is the fact that by this quick-firing method it is possible to get a boiler in on the header in about half the time it takes when the boiler has a banked fire. To

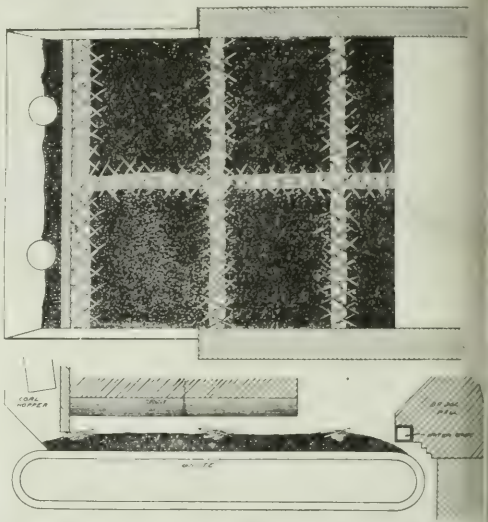



FIG. 3—METHOD OF LAYING FIRE FOR QUICK IGNITION

bank a boiler with coal and to keep the water at 212 deg. requires about 130 lb. of coal per hour per boiler. As this bank is a "short fire" on the front of the grate only, and as the grate must move very slowly to ignite the coal, a long time will be taken to get a full grate of coal and a full fire. The fastest record made in bringing such a banked boiler in on the header at Ashley Street was thirty-two minutes, or twice the time of getting up steam over the quick-firing grates.

Two blasts on a large steam whistle in the boiler house are given to inform all employees in and around the station that the water-power has failed and that the steam plant is to pick up and carry the full load. Immediately each man in the plant goes to his "emergency duty," which has been previously assigned to him through the emergency lists posted in conspicuous places about the station. Certain men report to the boiler-house engineer for igniting fires, bringing up banked boilers, barring slow fires, or any other duty that may be assigned them. Others report to the engineer in charge of the engine room for service as oilers and operators on engine and turbine units. The emergency organization is so arranged that every man shall immediately be placed to best advantage for carrying additional steam load on the station.

The method of keeping water hot in the emergency boilers, which is somewhat unique in a large power plant, is shown in Fig. 5. No additional piping or equipment was used aside from a heating coil installed in one of the two blow-off tanks in the basement. The common blow-off header connecting the twelve boilers was connected to the lower part of this tank. This header serves to bring the cool water from the lowest part of each boiler. In the tank is installed a coil through which the waste steam from one of the large steam headers is caused to flow, thus also serving to drain the header. This steam heats the water in the tanks, sets up circulation, and delivers hot water to the common pipe-line connecting with the upper part of each of the boilers. The principle is the same as that in which the heat from coal burned in a hot-water furnace in a household circulates the water and maintains the desired temperature. Hot water is thus being continually drawn away from the bottom. The water in these boilers is in this way kept at practically the boiling point, while the fuel expenditure is only 12.5 lb. of coal per boiler per day, as against 3100 lb. per boiler per day with banked fires.

Another interesting aspect of the importation of Keokuk energy into St. Louis has been the effect of water-power operation on the cost of the Union company's coal supply and on the St. Louis market generally. A year ago the Ashley Street plant burned something over 1100 tons of coal per day. This fall the consumption amounts to only 550 tons per day. The result of this falling off in coal consumption by the Union Electric company, coupled with a similar reduction by the United Railways Company of St. Louis, has been to throw a large amount of screenings on the local market, thus very effectively lowering the price of all screenings shipped from the mines in the vicinity. The prices of the larger sizes of coal for domestic use are not affected by this condition, but there is a marked decrease in the cost of screenings for power-station use from that of a year ago.

Fig. 4 gives an idea of the proportion which boiler-room

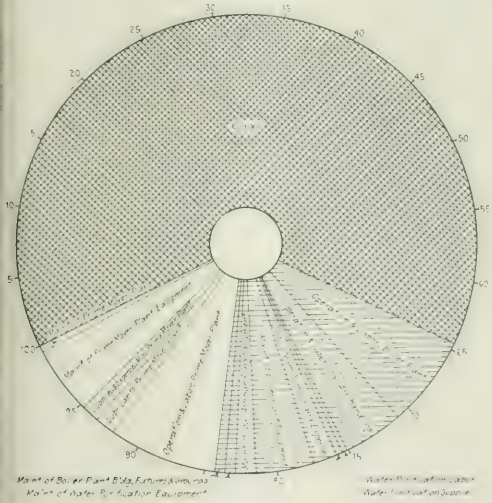


FIG. 4—DIAGRAM SHOWING ANALYSIS OF POWER-PLANT COSTS

costs in a power plant bear to the total cost of generation. The cost of fuel is here seen to be 64.5 per cent. Boiler-plant maintenance and operation bring the total up to 84.5 per cent, leaving but 15.5 per cent for the cost of prime-mover plant operation and maintenance. From this it will be obvious wherein lie the main items of cost in steam-plant operation and where the greatest attention must be given in connection with economical operation. The diagram also serves to point out the advantages achieved by water-power supply in tending to preserve one great natural resource, namely, the large quantities of coal required for electric generation throughout the country.

Perhaps the place at which the effect of importing water-power is most noticeable is in the engine room at Ashley

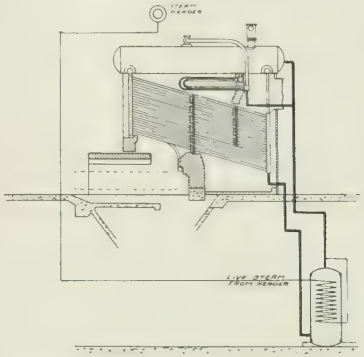


FIG. 5—ARRANGEMENT FOR HEATING EMERGENCY BOILER

Street, where it is now possible to shut down the engine units, and to carry all of the regular load of the system on the turbines there installed.

"We have been very fortunate so far in that we have had little trouble with failure of water-power," writes Mr. John Hunter, engineer of steam plant for the Union Electric Light & Power Company, "but we maintain that it is a good plan to be prepared and to hold ourselves in readiness for continuity of service, which is second to none in the country."

## Resistance of Iron Pipes

Are there any tables giving the resistance of various standard iron pipes such as are used in water, gas and sewer systems? T. G.

The resistance of iron pipe is usually expressed in ohms per pound-foot of the various pipe materials. For all practical purposes the values for cast-iron, wrought-iron and steel pipes are as follows: cast iron, 0.00144; wrought iron, 0.000181; steel, 0.00021 ohms per lb.-ft.

## Wattless Currents

What are wattless currents and how are they caused? A. W.

When the current in a circuit has a power-factor less than unity due to the presence of inductance or capacity in the circuit, it is sometimes convenient to consider the main current as being made up of two components, one of which is in phase with the emf while the other lags or leads by a phase angle of 90 deg. The current component in phase represents, of course, the power actually being delivered to the circuit which is measurable in watts. The other component, which is out of phase, represents no permanent transfer of energy and is therefore called "wattless." This wattless current circulates in the windings and does no work except to heat the conductors as any current would do. If the wattless component of the main current becomes large, as in the case of low power-factors, its heating effect may involve large $I^2R$ losses. Poorly designed induction motors carrying partial loads operate at low power-factors with relatively large wattless currents, the wattless components of the currents being practically as large at light load as at full load.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*Predetermining the Effect of Field Distortion in Direct-Current Generators.*—Alfred Hay.—An illustrated article in which the nature of the distortion produced in a continuous-current generator by the cross-magnetizing ampere-turns on the armature is briefly discussed. A simple method is explained for determining the addition to the field ampere-turns necessitated by the effects of field distortion.—London *Electrician*, Nov. 21, 1913.

*Alternating-Current Commutator Motor.*—A note on a recent British patent (No. 20,849, 1912) of the British Thomson-Houston Company and the Allgemeine Elektricitäts Gesellschaft. The stator exciting and working windings and the rotor working winding are in series, but the first is also connected in parallel with a choking-coil compensator. A point in the winding of this coil is connected to a point in the winding of the supply transformer, so that the impedances of the rotor and stator circuits are equalized.—London *Elec. Eng'ing*, Nov. 13, 1913.

### Lamps and Lighting

*Color of Light from Electric-Lamp Sources.*—L. Bloch.—A paper read before the German Illuminating Society. In order to characterize completely the color of artificial sources of light, a spectrophotometer may be used and the light of each wave-length determined separately, but this method is very complicated. Ives has already shown that any color is defined by the manner in which it is made up of the three fundamental colors—red, green and blue. The present author uses the same principles, employing for the purpose glass of well-defined colors (red filter, green filter and blue filter, made by Schott & Company). These three colored glasses are inserted as round plates, 7 mm in diameter and 1 mm in thickness, in a revolvable disk in the photometer as shown in Fig. 1, where 1 repre-

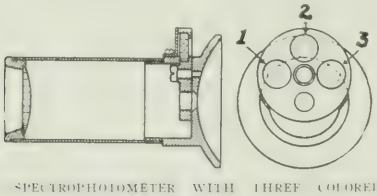



FIG. 1 SPECTROPHOTOMETER WITH THREE COLORED-GLASS FILTERS

sents the red plate, 2 the green plate and 3 the blue plate. The fourth hole is left open for making measurements in white light. Readings may be taken with any photometer. From the results of the measurement two numerical values are formed, namely, the ratio of red to green and the ratio of blue to green, corresponding to daylight with covered sky, for which both values are assumed to be 100. If the value of red to green is, therefore, 99.5 per cent and that of blue to green is 29.5 per cent (which are the characteristic values for intensive flame-arc lamps with carbons giving yellow light), it means that the light of the lamp in its richness of red light agrees almost exactly with daylight while there is a considerable lack of blue rays in the light. The author has determined these two characteristic values for all kinds of lamps and gives the results in tables and diagrams. In the diagrams the ordinates show the value of red to green and the abscissas the values of blue to green. Every lamp has, therefore, a distinct position in the diagram so that from its position on the chart there can be seen at a glance how nearly any source of light approaches daylight. Some of the values arrived at are given in the accompanying tabulation. The magnetite-arc

COMPARATIVE COLOR VALUES OF VARIOUS LIGHT SOURCES

| | Ratio of Red to Green | Ratio of Blue to Green |
|---|---|---|
| Daylight, overcast sky | 100 | 100 |
| Daylight, blue sky | 80.5 | 116 |
| Sunlight | 116 | 92 |
| Paraffine candle | 463 | 34 |
| Kerosene lamp | 408 | 36.5 |
| Illuminating gas with ordinary burner | 433 | 46 |
| Low-pressure incandescent gas lamp | 190 | 50.5 |
| Carbon lamp (3.1 watts per hefner) | 342 | 43 |
| Carbon lamp (3.5 watts per cp) | 330 | 44 |
| Carbon lamp (3 watts per cp) | 317 | 45.5 |
| Graphitized carbon lamp (2.5 watts per cp) | 305 | 47 |
| Graphitized carbon lamp (2 watts per cp) | 290 | 49 |
| Nernst lamp without globe (1.7 watts per cp) | 275 | 48 |
| Tantalum lamp (1.7 watts per cp) | 300 | 47 |
| Tungsten lamp (1.2 watts per cp) | 271 | 50.5 |
| Tungsten lamp (1 watt per cp) | 256 | 53 |
| Tungsten lamp (0.8 watt per cp) | 245 | 55.5 |
| Nitrogen-filled tungsten lamp (0.6 watt per cp) | 211 | 59 |
| Nitrogen-filled tungsten lamp (0.5 watt per cp) | 200 | 61.5 |
| Nitrogen-filled tungsten lamp (0.4 watt per cp) | 190 | 63.5 |
| Pure carbon arc lamp without globe | 160 | 71.5 |
| Magnetite-arc lamp | 113.5 | 85.5 |
| Intensive flame-arc lamp, white light | 125.5 | 63.5 |
| Intensive flame-arc lamp, yellow light | 99.5 | 29.5 |
| Intensive flame-arc lamp, red light | 592 | 74 |
| Mercury-arc lamp with glass tube | 9 | 32.5 |
| Mercury-arc lamp with quartz tube, without globe | 20 | 30 |
| Mercury-arc lamp with quartz tube and opal globe | 20 | 25 |
| Moore lamp filled with carbonic oxide | 85 | 108 |
| Moore lamp filled with nitrogen | 655 | 15 |
| Moore lamp filled with neon | 2,240 | 6 |

lamp seems to approach nearest to sunlight. All these experiments were made at the testing station of the Berlin Electricity Works.—*Elek. Zeit.*, Nov. 1, 1913.

*Photometry of Lamps of Different Colors.*—M. von Pirani.—An account of experiments made in the physical laboratory of Siemens & Halske, the object of which was to find a correct method of monochromatic comparison of lights of different colors. The principle employed involves the use of a filter which eliminates color effects but permits light to pass so that the ratio of the two intensities is the same as that of the total intensities. For ordinary incandescent lamps this is fulfilled by the use of a filter which permits the wave-lengths 570 to 575 μμ to pass. The mean values of the measurements differ from those obtained without the filter by only 1 per cent. It is therefore permissible to compare by this means standard lamps worked at low intensities and producing yellow light with those operated at high rates of output and giving bluish-white light.—*Zeit. f. Beleucht.*, Aug. 30, 1913.

*Vapor Pressure of Metallic Tungsten.*—Irving Langmuir.—An account of an experimental investigation, the chief results of which are as follows: The vapor pressure $p$ of a substance is related to its rate of evaporation in a vacuum, as follows:

$$m = p\sqrt{\frac{M}{2\pi RT}}$$

ere $M$ is the molecular weight of the vapor. In the rivation of this equation it is assumed that all the olecules of vapor which strike the surface of the metal e condensed (not reflected). No other assumptions ex- ot those that have received ample experimental verification ed be made. Experiments were carried out to determine e rate of evaporation of tungsten in a vacuum at tem- ratures ranging from 2440 deg. up to 3136 deg. K. (deg. above absolute zero). Over this temperature interval 700 deg. the rate of evaporation increased in the ratio 1 to 15,000. From the above data the vapor pressures ere calculated and were found to agree excellently with e thermodynamical relations as expressed in the Clausius- apeyron formula. The latent heat of evaporation of lid tungsten is thus found to be (per 184 grams) 17,800 — 1.8 $T$) calories, a value higher than the heat olved by any known chemical reaction. The rate of aporation of tungsten in a perfect vacuum at any tem- rature is given accurately by the equation

$$\log_{10} m = 15.402 - \frac{47.440}{T} - 1.4 \log_{10} T.$$

ere $m$ is the rate of evaporation in grams per square ntimeter per second. The vapor pressure $p$ of tungsten millimeters of mercury at the absolute temperature $T$ given by the equation

$$\log_{10} P = 15{,}502 - \frac{47.440}{T} - 0.9 \log_{10} T.$$

he vapor pressure of tungsten at 2400 deg. K., which is e temperature of the filament in a lamp running at 1 watt r candle, is about $50 \times 10^{-9}$ mm. At the melting point of ngsten, 3540 deg. K., the vapor pressure is 0.080 mm. he boiling point of tungsten at atmospheric pressure is robably very close to 5100 deg. K.—*Physical Review,* ovember, 1913.

*High-Candle-Power Lamps.*—J. SCHMIDT.—A long rticle on the high-candle-power metallic-filament lamp ersus the flame-arc lamp and the double-carbon flame-arc amp. The author emphasizes that high-candle-power etallic-filament lamps cannot completely replace flame-arc amps and describes in some detail recent improvements in lame-arc lamps.—*Zeit. f. Beleucht.,* Aug. 30, Sept. 10, 20, Oct. 20 and 30, 1913.

*The "Half-Watt" Lamp.*—R. ZIEGENBERG.—A fully illus- rated article on the "half-watt" incandescent lamp, its de- velopment and its present construction.—*Zeit. f. Beleucht.,* Oct. 30 and Nov. 10, 1913.

### Generation, Transmission and Distribution

*Water-Power Plant.*—E. FREY AND O. ALBRECHT.—The conclusion of their long illustrated description of the Wylen power plant of the Rheinfelden transmission sys- em. The gradual development of this system is described. The first two large customers were two electrochemical firms, the Aluminium Company, of Neuhausen, and the Electrochemical Works, of Bitterfeld. Later on electricity was introduced for various industrial purposes and trans- mitted to the surrounding districts. For these purposes subsidiary companies were formed. Finally, in connection with the city of Basel, the new Wylen hydroelectric plant was erected. It was possible to connect up at once a large number of new customers so that the dividends were main- tained at 8 per cent, as in recent years, in spite of the in- creased capital investment.—*Elek. Zeit.,* Nov. 13, 1913.

*Steam Boilers.*—J. W. JACKSON.—A paper on steam boil- ers in electric generating stations. The author deals espe- cially with the best position for superheaters and main steam drums, the importance of air leaks, the use of mechanical stokers, and feed-water treatment. One of the most notable advances is said to be smokeless operation with ordinary bituminous or low-grade coal.—London *Elec- trician,* Nov. 13, 1913.

*Coal Mines.*—W. H. TELFER.—An abstract of a paper read before the Scottish branches of the National Associa- tion of Colliery Managers and the Association of Electrical Engineers of Glasgow on power transmission in collieries. —London *Electrician,* Nov. 14, 1913.

### Traction

*Single-Phase Mountain Railway.*—A continuation of the illustrated description of the Spiez-Brig (Loetschberg tun- nel) Railroad. In the present instalment the electric equip- ment is described. The two motors of each locomotive are rated at 1250 hp each and are of the compensated series type.—*Elek. Zeit.,* Nov. 13, 1913.

### Installations, Systems and Appliances

*Two-Rate Schedule Without Time-Operated Control.*—H. H. PERRY.—A paper read before the Manchester Sec- tion of the (British) Institution of Electrical Engineers. The author considers it ridiculous to charge at certain

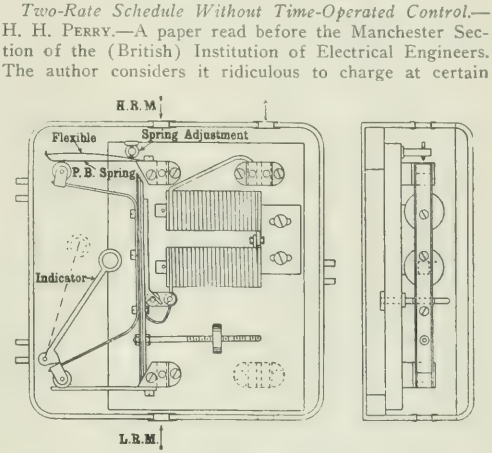



FIG. 2—TWO-RATE SWITCH

times of the day a low rate for motor service and another rate for lighting, and declares it equally absurd to exact the full penalty price from a consumer when he is using only a fraction of his maximum lighting load, assuming that no heating is in use. Mr. Perry endeavors to show that the use of electricity can be extended with advantage to both central station and consumer, by granting facilities to the latter for using lighting circuits during "off-peak" hours at a low rate, and that the multiplication of domestic power circuits, while being an advantage, is not always necessary for securing a low rate. A simple change-over switch, automatically rocked, can combine or separate the two rates at will. Such a method requires two meters and

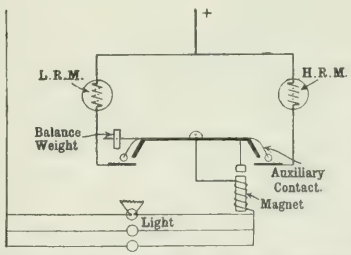



FIG. 3—CONNECTIONS FOR LAMP LOAD EXCLUSIVELY

therefore resolves itself into a two-rate system. From former systems using two meters, the present system dif- fers in that the operation of switching over is automatically performed by a magnetic change-over switch. As shown in Fig. 2, an ordinary single-pole switch is employed, one arm of which is magnetically attracted by the lighting-cir- cuit magnetizing current. It is freely pivoted about its

center, and a balance weight is provided on the other arm, the position of which is adjusted to give any proportion of the consumer's lighting between, say, 5 per cent and 25 per cent, at the low rate. In isolated cases it may be practicable to give a higher percentage. Auxiliary contacts are provided for maintaining continuity of the circuit when changing over. The connections shown in Fig.

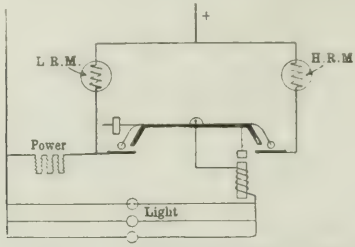



FIG. 4—SWITCH CONNECTED FOR SEPARATE POWER CIRCUIT

3 would be used for a consumer taking practically all his energy for lighting, no separate circuit being provided. All the current in this case passes through the high-rate meter (*H.R.M.*) or the low-rate meter (*L.R.M.*), and the switch is adjusted by the balance weight or by the air-gap so that all currents less than a given fraction of the maximum current (5 to 25 per cent) are registered on the low-rate meter. In Fig. 4 a separate power circuit is used, connected to the switch as shown, and two meters are, therefore, necessary under ordinary rate conditions. The low-rate meter will, therefore, register the whole of the motor load, and up to 25 per cent of that required by the lighting when the switch is on the low (or left-hand) side. When the switch is on the high (or right-hand) side, the low-rate meter will measure the power only and the high-rate meter the lighting only. With the arrangement shown in Fig. 5 the consumer has the option of these connections provided certain heating apparatus, such as a complete cooker, a system of radiators or other power, is adopted, whether purchased outright or hired. So long as the heater system is in use the low-rate meter will measure all power and any desired proportion of the lighting, since the pull of the magnet is neutralized to the required extent. Otherwise the operation is the same as in Fig. 4; that is to say, the lighting reverts to the high-rate meter after 5 to 25 per cent has been exceeded. To provide equal and opposite

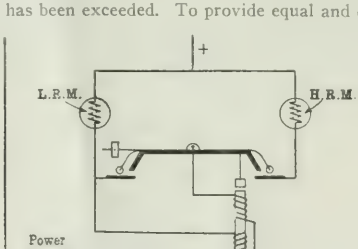



FIG. 5—CONNECTIONS FOR COMBINED MOTOR AND LAMP SERVICE

magnetizing ampere-turns with equal current flowing in each circuit would court financial ruin if the heating system were maintained over the lighting peak. It is probable, therefore, that the opposing forces would generally be designed so as not to have a greater ratio than 1:2, or even as low as 1:4, until heating apparatus reaches a very much higher point of efficiency and commands a ready sale to every consumer. Provided always that the heating peak (assuming that there is only one) does not coincide with the lighting peak in magnitude and length of time, the arrangement of Fig. 5 should undoubtedly prove acceptable.—London *Electrician*, Nov. 21, 1913.

*Synchronous Running of Motors.*—A note on a recent British patent (No. 23,669, 1912) of W. E. Lake and the Société Anonyme du Temple, France. The principle of controlling a motor from a distance by placing it on the diagonal of a Wheatstone bridge is employed. According to the present invention, two shafts, one at a transmitting and one at a receiving station, may be started and stopped simultaneously or driven at the same speed. The two shafts carry two commutator rings and a commutator for putting the controlling resistances into circuit. The resistances of the commutators form part of a bridge the diagonals of which compose the dynamo field magnets. These are set in motion as soon as there is any angular displacement between the two shafts so as to vary the resistance couples and establish synchronism.—London *Elec. Eng'ing*, Nov. 13, 1913.

### Electrophysics and Magnetism

*Efficiency of the Electromagnet.*—L. Schüler.—A translation of his recent German paper in which a method is described for calculating the coil current and the armature speed of an electromagnet at all moments from that of switching on the current to the completion of the stroke. By plotting the time-curves of these values the electrical input and the mechanical output during the stroke can be found, and thence the efficiency of the electromagnet is obtained. Different examples are given for both direct-current and alternating-current supply. It is further shown that with alternating current the working conditions are much affected by the point of the pressure-curve at which the apparatus is connected to the supply circuit.—London *Electrician*, Nov. 14, 1913.

*Theory of Gravity.*—S. B. McLaren.—A highly theoretical and mathematical paper in which the author discusses the principles of relativity and Riemann's theory of gravity and then develops a mathematical theory of gravity under the following ten chapter topics: Relativist hydrodynamics; least action in electrodynamics; time and the fourth dimension; electrodynamics in four dimensions the Newtonian potential a velocity potential; matter and "ether"; energy, momentum, and stress; positive and negative charge; magneton and electron; the electromagnetic equations in moving ether, and the limits of mechanical theory. The author's idea of the constitution of matter is that there is but one ultimate substance, a fluid whose density and motion are everywhere continuous. The substance has, however, two forms, "matter" and "ether," which are exclusive one of the other. Matter is a region where the fluid grows or decays. In this process the momentum of the ether "born" or "dying" is acquired from the surrounding ether, and all momentum is that of the one fluid substance.—*Philos. Mag.*, October, 1913.

*Radium Deposit in the Electric Field.*—E. W. Wellisch.—An account of an experimental investigation continuing former researches of the author on the distribution of the active deposit of radium in an electric field. In the present investigation the object was to determine the effect of using containing vessels of different dimensions and of mixing the emanation with gases other than air. In addition it was aimed to make a detailed investigation of the distribution when small potentials are employed. The main experimental results of the previous research were confirmed, but the fresh results obtained necessitate a modification of the theory which was formerly suggested in explanation of the phenomena.—*Philos. Mag.*, October, 1913.

*Radium.*—Joh. Harden.—An article on the Radium Institute at St. Joachimsthal.—*Metal. and Chem. Eng'ing* December, 1913.

### Electrochemistry and Batteries

*Ozone.*—A. VOSMAER.—An article on the manufacture f ozone, its properties and uses in daily life and thera-eutics and its industrial applications for bleaching, etc.—*letal. and Chem. Eng'ing,* December, 1913.

*Gas Battery.*—KARL SIEGL.—The author discusses the ssential features of the Grove gas cell and describes a new as cell for which he claims an output of 100 or even 1000 mes that of the Grove cell. This result is obtained by sing the electrodes of a special form. Platinized carbon rains of 3-mm diameter are placed in flat clay cells which the same time form the gas chambers. These also con-in the carbon plates which make connection with the xternal circuit. The clay cells are filled with electrolyte. n this way a large electrode surface is obtained. Any umber of such clay cells are placed in a container, being rranged alternately positive and negative. It is claimed iat the cost of operation and maintenance is less than with ther primary batteries.—*Elek. Zeit.,* Nov. 13, 1913.

*Electric Steel Furnace.*—E. M. SCHMELZ.—An illus-ated description of a new electric steel-casting plant at edondo, Cal. This is the first installation of an electric eel furnace of the pure Stassano type in the United States. ome differences in the design from the former Stassano rnace are pointed out.—*Metal. and Chem. Eng'ing,* ecember, 1913.

### Units, Measurements and Instruments

*Electrostatic Oscillograph.*—H. HO AND S. KOTO.—An ostract of a (British) Physical Society paper in which the uthors describe an electrostatic oscillograph suitable for ecording very high voltages. Two vertical bronze strips ass symmetrically between two parallel metallic plates alled "field plates." These are connected at their lower nds by a silk fiber which passes under an ivory pulley. n extremely small mirror is fixed to the strips. This ar-angement constitutes the vibrator, which, mounted on an onite frame, is immersed in an oil bath. To the upper xtremities of the strips are connected the terminals of a o-volt direct-current source of emf. The alternating-urrent voltage to be recorded is connected to the field lates in parallel, and in series with these plates are ar-anged two oil condensers. The electrical midpoint of the irect-current battery is connected to a point between the ondensers. The turning moment on the strips is propor-onal to the product of the momentary values of the lternating-current voltage, so that if the latter is con-ant the deflection of the mirror accurately follows the ariation of the former. Oil plays an important part in the ction of the device, not only acting as a damping agent and nsulator but increasing the instrument's sensitiveness on ccount of the oil's high dielectric constant. In cases here the voltage is low but the source of energy is so mited that sufficient current cannot be taken to actuate the rdinary oscillograph the electrostatic vibrator may be sed by applying the voltage in question to the strips, while he terminals of a high-tension battery or an influence achine are connected to the "field plates." The instru-ent may also be used for recording very small currents y replacing the oil condensers by two exactly equal re-istances, which are traversed by the current.—London *Electrician,* Nov. 14, 1913.

### Telegraphy, Telephony and Signals

*Sine-Wave Telegraph Transmission.*— H. W. MALCOLM. —The conclusion of his long illustrated mathematical serial n sine-wave transmission in submarine telegraph cables. n the present instalment the semi-period signal at the ending end and the deformation of the semi-period signal n transmission are discussed. The final conclusion of he author is that a sine wave of emf with equal conditions f maximum stress on the cable will give the same sig-als at the receiving end as the square-topped wave at resent employed. At the sending end, on the other hand, the rise in voltage due to the sinusoidal emf is a more gradual one, tending to facilitate the preservation of the duplex balance. Moreover, the sine-wave transmitter has certain characteristics which are wanting in the battery. Thus it possesses great adaptability, containing within itself both generator and transmitter. Phase relationship and wave-shape are perfectly under control, rendering it for experimental purposes invaluable. By its aid the effective values of the cable constant, particularly of the inductance, could be determined, numerical data for which are long overdue. In telephony the change has been from primary battery to secondary cell, and more recently to dynamo operation. It is not unreasonable to suppose that the same change may follow in cable telegraphy.—London *Electrician,* Nov. 14, 1913.

### Miscellaneous

*Preece.*—A long obituary, with portrait, of the late Sir William Henry Preece.—London *Electrician,* Nov. 14, 1913. Another obituary, from the pen of Sir John Gavey, appears in London *Elec. Review,* Nov. 14, 1913.

*German Commercial Statistics.*—FASOLT.—The first part of an article on the position of the electrical industries in the commercial statistics of the German government. The article is to be concluded.—*Elek. Zeit.,* Nov. 13, 1913.

*Effect of Mining on Tramways.*—NOLDEN.—The first part of an illustrated article on the deleterious effects of mining operations on street railways and buildings due to sinking of the ground. Methods of avoiding such damage are discussed.—*Elek. Kraftbetr. u. Bahnen,* Oct. 14, 1913.

*Young Electrical Engineers.*—A long editorial on the prospects of the young electrical engineer in Great Britain. —London *Electrician,* Nov. 14, 1913.

# Book Reviews

DIE FUNKENTELEGRAPHIE. By H. Thurn. Leipzig: B. G. Teubner. 128 pages, 58 illus. Price, 1.25 marks.

A handy little treatise on radio-telegraphy and radio-telephony, already in its second edition, giving an outline of the history, principles and mode of operation of Hertzian-wave communication. The book is divided into four sections, dealing respectively with the following topics: wireless telegraphy, wireless telephony, influence of radio-telegraphy on commerce, radio-telegraphy in international law. A good chapter deals with the regulations adopted at the international conventions of 1906 and 1912 on radio-telegraphy. The book will be of interest to radio-telegraphic students interested in the German point of view.

COMMON BATTERY TELEPHONY SIMPLIFIED. By Walter Atkins. New York: D. Van Nostrand Company. 164 pages, 150 illus. Price, $1.25.

A knowledge of the fundamental principles of electricity which render possible the reproduction of speech over long distances is assumed in this book. The volume is essentially one for the practical telephone man and modern student. It does not deal with the history of the science of telephony nor with the operation of magneto systems except to explain the operation of small magneto instruments often found in installations where the distance between instruments and the exchange is too great for a common-battery system to be practical. The exchange operation explained in the main portion of the book is known as the 24-volt system and is the one used in all but a few of the installations of the British Post Office. Brief descriptions are given of other types of exchanges. All wiring diagrams are presented in a simplified form. Automatic operation is not mentioned. The book contains appendices dealing with exchange cables, color scheme and measuring resistance by voltmeter.

# New Apparatus and Appliances

**An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers**

## Interchangeable Sectional-Unit Interior Sign

An interchangeable sectional-unit electrically lighted sign for window advertising has been put on the market by Stanley & Patterson, of New York. In the accompanying illustration is shown a single unit with the glass letter slide removed. Each section consists of a black-japanned metal reflector top, a cameo-glass slide, a tubular lamp and a porcelain base which has contact blades to connect it with the base of the adjacent unit. The base of each section fits in a brass channel, and spacer units are provided to separate words. The circuit wires are connected to an attachment spacer. Although primarily designed for night advertising, the sign can also be used in the daytime.



SIGN UNIT

Special fixtures are provided for making the sign multiple-line. The sign may be made larger or smaller and the number of words or lines can be changed in a very short time on account of the unit design. This feature gives great flexibility to the device.

## Window-Display Platform

The Midas "mystery" platform illustrated herewith is used to focus attention on an advertised article. It consists of an ebony case with a mirror top. The article rests on a pad or platform which is made to move to and fro on the top of the mirror by means of an electromagnet underneath.

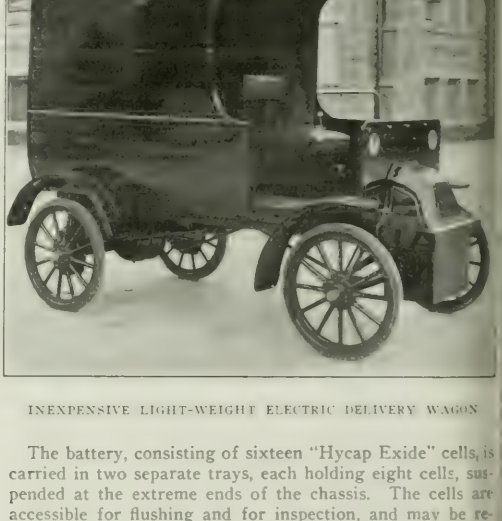


DISPLAY PLATFORM

The device is being placed on the market by the Mercantile Advertising Company, 1328 Broadway, New York, and the 1/20-hp motor used in its operation is made by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

## Light-Weight Electric Delivery Wagon

The Van Auken Electric Car Company, Chicago, is manufacturing a low-priced electric delivery wagon in which both weight and number of wearing parts have been considerably reduced, minimizing further the already low operating and maintenance expense characteristic of electric vehicles. The wagon weighs only 1625 lb., being designed for light-package service and a maximum load of 750 lb. Only one style of chassis is made at present, although two designs of bodies can be furnished—a covered type with back doors and an open wagon with stake or flare sides. Fully equipped with batteries, instruments, electric lamps and horn, the Van Auken car sells for $1,000. Where road conditions are good and the route traversed is practically level, it is declared that the batteries will give more than 50 miles per charge with a load of 750 lb. and a maximum speed of 12 miles per hour.



INEXPENSIVE LIGHT-WEIGHT ELECTRIC DELIVERY WAGON

The battery, consisting of sixteen "Hycap Exide" cells, is carried in two separate trays, each holding eight cells, suspended at the extreme ends of the chassis. The cells are accessible for flushing and for inspection, and may be removed readily as the trays clear the ground by about 15 in.

A continuous-torque motor and a rotary-type controller are employed, being placed close together to avoid using long leads. The wire used has unusually liberal cross-section, making the $I^2R$ losses low. The motor is connected with the rear wheels through a short propeller shaft, two simple universal joints and the differential gears. Under normal load there is a straight-line drive between the armature and the pinion gear. Flush-type head-lamps are installed in the dashboard.

The manufacturers declare that a battery charge for this vehicle will cost from 40 cents to 60 cents, depending on

local rate for energy. Under average conditions the st of energy per ton-mile would therefore be about 3 nts.

## Universal-Unit Battery-Charging Panels

The universal-unit charging panel shown in the accomnying illustrations has been put on the market by the ttler-Hammer Manufacturing Company, Milwaukee, Wis., d is designed particularly for electric-vehicle stations ere the charging equipments are apt to be suddenly inased, necessitating a quick change in the switchboard paratus. The panel is made up of self-contained rheoats assembled in frames in much the same way that secnal filing cabinets are put together, each panel accommoting from one to six sections. Any number of panels n be put side by side. This may be done at different nes, and the complete equipment will appear as if inlled at one time. These panels are for both two-wire and ree-wire circuits.

Each charging section is a unit in itself as shown in Fig. It consists of a slate front 24 in. by 10 in., which cares the rheostat contacts and sliding brush; a low-current rcuit-breaker on the left; an instrument switch on the ght, and a pilot lamp and grid-type resistor mounted on e back. Each section is supported by bolts to the frame d after being disconnected from the busbar can be read removed by taking out the bolts.

The low-current circuit-breaker mounted at the left of e front is interlocked with the rheostat so that it cannot closed unless the sliding brush is moved to the position "all resistance in." It can then be closed, a small mag-

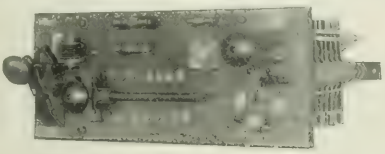


FIG. 1—INDIVIDUAL CHARGING SECTION

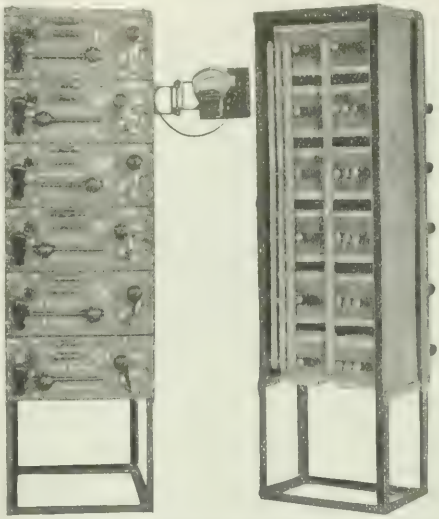
et which is in series with the charging circuit holding it this position in case the charging voltage should fall to value less than the battery voltage or the service fuses ould be blown. The breaker thus acts as a line switch.

The instrument switch is a three-position switch having pen," "closed" and "reading" positions. When in the pen" position the circuit to the battery is broken; moving the "closed" position completes this circuit, and when in e "reading" position the meter, which may be mounted on e top section or on a swinging bracket, is connected in the ttery circuit and indicates the voltage of the battery. If e low-current circuit-breaker is closed, the current is also dicated on the ammeter scale of the instrument.

A combined ammeter and voltmeter furnished with the pparatus can be used for several panels, if desired. The dicating pilot lamp is connected directly across the batry leads and is lighted whenever a battery is connected the rheostat.

A discharge rheostat is sometimes mounted on the top ction of the panel to operate in conjunction with the harging rheostat section directly below it. A single-pole, ouble-throw switch short-circuits the discharge rheostat irectly to the line. When closed to the right, the switch onnects the discharge rheostat in series with the charg- rheostat, connection being made so that the battery will ischarge when the instrument switch is closed.

In Fig. 2 is shown a front view of the panel. The rheotat is mounted adjacent to the controlling switch, thus liminating the possibility of operating the wrong rheotat. Meter readings can be made without opening the harging circuit. The voltage and current may be read at any time by moving the corresponding instrument switch to the "reading" position. Not more than one of these switches should be operated at one time, but in case any one through ignorance moves two at one time no damage will result, because the voltmeter connections are arranged in such a manner that the cross-currents resulting are made ineffective. When it is desired to stop the charge the cir-



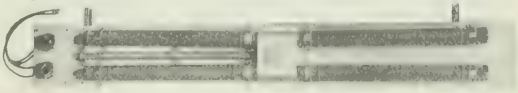
FIGS. 2 AND 3—FRONT AND REAR VIEW OF SIX-SECTION BATTERY-CHARGING PANELS

cuit is opened by moving the instrument switch to the "open" point, the arc formed on opening the circuit being taken on the auxiliary contacts which are provided with the magnetic blowout. This opening of the circuit de-energizes the low-current circuit-breaker, which opens, disconnecting the battery from both sides of the line. When the plug is removed from the vehicle the charging cable is dead.

## Static-Electricity Remover for Printing Presses

A new device for removing the static electricity that gathers on the paper of large rotary printing presses in cold weather, and at the same time drying the ink on the paper, has been designed by Mr. A. F. Allsop, of the Commonwealth Edison Company, Chicago, Ill., and is manufactured by the Chicago division of the General Electric Company. The device heats the air surrounding the paper, and the convection air currents dry the ink and carry off the static charge with the moisture.

The apparatus takes up very little space and can be attached to or removed from the press at will. It consists of a panel made of transite board, 60 in. long and 9 in. wide,



STATIC-ELECTRICITY REMOVER

upon which are mounted four resistor-type heater tubes, each 22 in. long and 2 in. in diameter. These are insulated with a special compound and are arranged in two rows. Two switches are also mounted on the panel, each controlling one row of two tubes, thus giving a variable control of the heat. The device consumes a maximum of 2000 watts, each tube being rated at 500 watts.

## Motor-Driven Coal and Ash-Handling Equipment at Pacific Mills, South Lawrence, Mass.

In the power plant of the new print works of the Pacific Mills, South Lawrence, Mass., there has been installed an unusual coal and ash-handling equipment, the operation of which is part manual and part electrical. The first part of this interesting equipment consists of a pivoted bucket conveyor which receives the coal from the railroad cars and distributes it into the storage pocket. In addition to this conveyor a motor-driven car distributes coal to sections of the storage pocket not reached by the conveyor. Charging cars and a narrow-gage railway convey coal from the storage pocket to the boiler room, and another narrow-gage railway system is used for the removal of ashes.

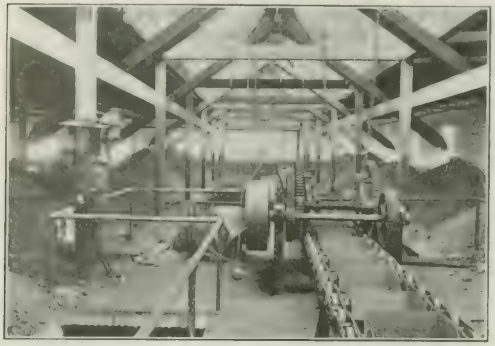


FIG. 1—BUCKET CONVEYOR WITH MOTOR-DRIVE

Coal is brought to the plant in railroad cars of the bottom-dumping type and is distributed directly into a pit under the track. It then passes into an electrically driven coal crusher. This crusher discharges through a revolving filler to a pivoted bucket conveyor which runs through a tunnel and then rises with the coal to the distributing chutes, each of which is provided with an automatic trip so that the coal can be discharged from the conveyor buckets into any chute desired. The conveyor is driven by an open-geared pawl driver located on the upper level.



FIG. 2—SWITCHING FACILITIES IN BOILER ROOM

Besides the coal pocket shown in Fig. 1, there is an auxiliary row of storage bins at the extreme left of the building. For filling these bins the conveyor can be arranged to discharge into an auxiliary hopper (Fig. 3) used for filling an electrically operated car of 2 tons capacity running on a track over the storage bins. The bins have a combined capacity of 10,000 tons of coal, but are subdivided so that the individual bins can be emptied in a few minutes in case the coal commences to heat and there is danger of spontaneous combustion.

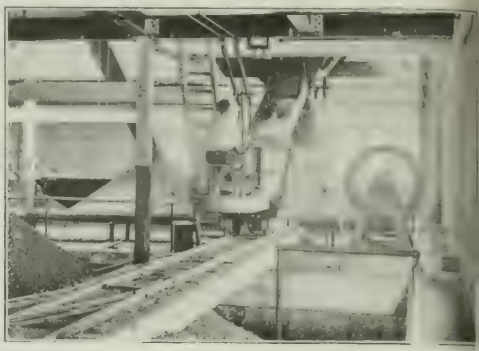


FIG. 3—FILLING 2-TON COAL CAR

From the bins shown in Fig. 1 the coal is drawn o through duplex valves into the boiler-room charging car Although these cars are of 1-ton capacity, they can b filled in less than a minute. When filled the charging ca are pushed by hand to the scales, where a complete recor of all coal burned is kept. From here the cars are take directly into the boiler room (Fig. 2). The two outsi tracks are located so that the fireman merely drops the s of the car and shovels the coal directly into the furnac The middle track provides for shunting out empties an running in full cars. As will be noted from the illustra tion, this system prevents coal from being spilt around th floor and permits of maintaining a neat boiler room. Th coal cars, being designed especially to facilitate firing t coal into boilers, are made of sheet steel stiffened w angle iron, with the corners rounded off for the wo men's hands. When the side door is let down its bott is slightly higher than the floor of the car, so that the fi man will not catch his shovel when scooping up the co These cars greatly reduce the fireman's work and increa his coal-handling ability. The cars have outside-flan

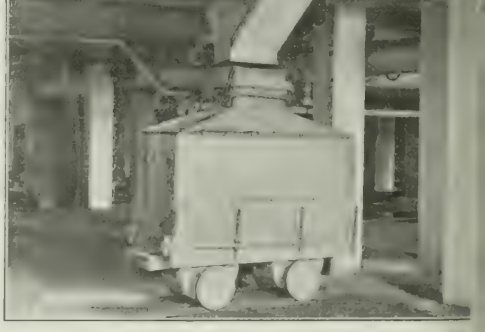


FIG. 4—DUST-PROOF ASH CAR

heels, permitting one man to push easily a 1-ton load ound a curve of 12-ft. radius, since in taking the curves e outside wheels run on their flanges so that the tread of e inner wheel and the flange of the outer one fall upon the eoretical cone of revolution. The coal-conveying equipent is capable of handling from 60 tons to 70 tons of coal n hour, which is more than ample to keep the thirty oilers supplied when running at full load.

Fig. 4 shows the method of removing ashes in the room nderneath the boilers. The ash car is interesting as it has en designed to be practically dust-proof. As soon as e car is run under the ash hopper a lever at the top of the ar is pulled down and a telescoping spout on the car enrcles the bottom of the ash hopper to prevent ashes from ying out into the room.

This coal and ash-handling system was designed by ockwood, Greene & Company, Boston, Mass., and the aparatus was supplied by the C. W. Hunt Company, Inc., est New Brighton, N. Y. The coal pockets, which are of inforced concrete faced with brick, were built by the berthaw Construction Company, of Boston.

## Suction Lifter for Use with Punch Presses

A new device for minimizing the toll of injuries to the ands and fingers of operators of stamping and punch ress machines is the suction lifter shown herewith. In aking laminations for small motors and in producing heet-metal parts of various designs, operators of punch resses often suffer severe injury by getting their hands r fingers caught in the descending dies. The suction fter illustrated is in use in the Westinghouse shops, East ittsburgh, Pa., and has demonstrated its value on many ccasions.

In manipulating this tool the operator holds his thumb ver the protruding button at the upper end of the handle rip. When the cup-shaped disk at the end of the rod is laced on the piece of metal to be lifted, pressure of the umb on the button opens the air valve in the handle and reates a suction through the hole in the center of the illed slot in the screw. The disk is faced with rubber, nsuring good contact with the metal. As long as the valve s open the vacuum in the pipe line holds the sheet metal gainst the rubber. Release of the thumb pressure on the utton immediately drops the stamping. For removing mall and irregular pieces of scrap from the plate of the achine a hook has been added at the side of the disk, as hown. A battery of three air pumps driven from the ame countershaft as the presses maintains a constant acuum on the pipe lines to all machines. Similar lifters, vorking on a system of levers, are made in large sizes for andling heavy stock.

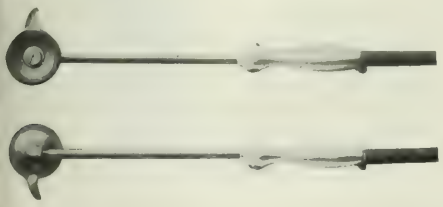


FIG. 1—SUCTION LIFTER FOR USE WITH PUNCH PRESSES

The idea of this lifter came to one of the men in the tamping room while he was watching a Hungarian workman trying to use an oiling brush to place the sheet metal eneath the die. A suggestion to the works department of afety, deposited in one of the boxes placed throughout the lant, resulted in the design shown herewith.

Following the adoption of these suction lifters on a battery of stamping machines the output was increased 20 per cent, and although no accurate data can be obtained regarding the number of injuries prevented, it is safe to assume that the number would be large. Previously the company's physicians treated crushed fingers every few days, while now it is said that such injuries are rare. To remove further the danger to the operators of these stamping machines the horizontal faces of the die holders are now beveled, as in Fig. 2, so that the only part which can actually strike the hands of the operator is the die itself.

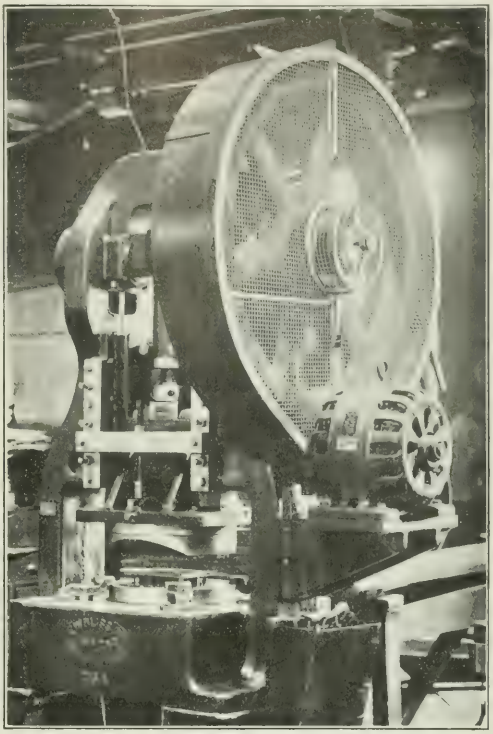


FIG. 2—PUNCH PRESS WITH CHAMFERED DIE PLATE AND PROTECTED GEARS

## Repulsion-Type Fuse

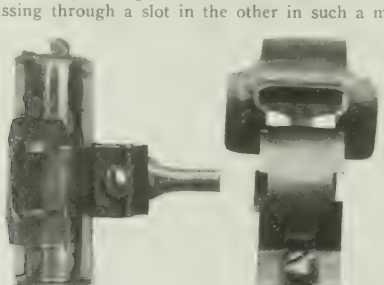
The Metropolitan Engineering Company, Brooklyn, N. Y., has developed and is putting on the market a repulsion-type fuse. This protective device consists of a porcelain base, copper contacts, a mica arc shield and a strip of fuse metal. The copper contacts are made in thin sheets and are formed so that they will slip over the outside of the porcelain base. Small clips integral with the copper sheet are bent down to hold the contacts in place. The fuse ribbon is carried over the fan-shaped piece of mica, and where it crosses the mica edge the metal section is reduced to insure rupture at this point. When the fuse blows the action of the gases repels the broken ends of the metal ribbons from the mica, separating them as widely as their length will allow and interposing the additional mica barrier. The fuse metal, however, is the only part injured by the arc, and by slipping the copper covering off the porcelain block a new piece of fuse metal may be inserted and the other parts replaced without the use of tools. The fuse

metal parts are small and of inconsiderable weight, thus making it readily possible for the workmen to carry them in their pockets.

These fuses have been approved by the National Board of Fire Underwriters and are being made in sizes ranging from 10 amp to 400 amp. Experimental work is also being done on other sizes.

## Grounding Clamp

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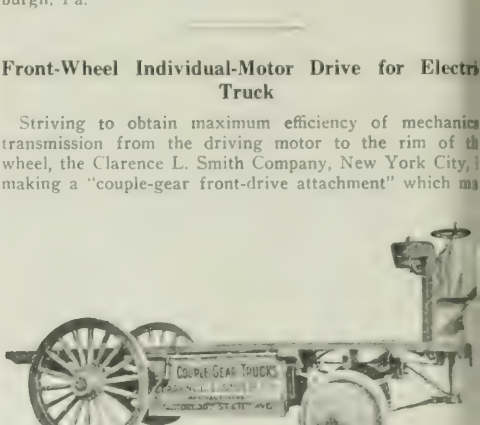



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# Industrial and Financial News

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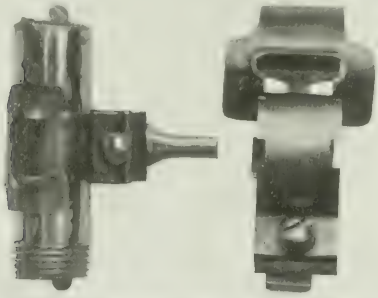
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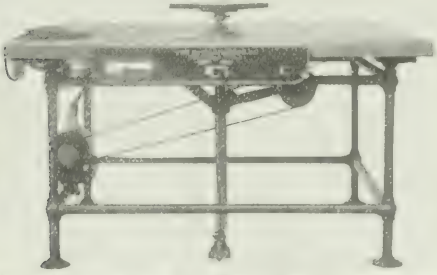


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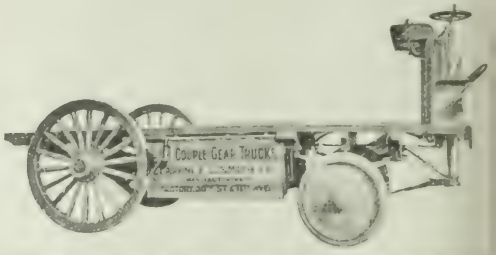



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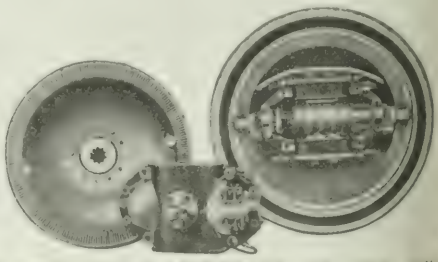


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**Samuel Insull on Business Conditions.**—In a statement requested by a daily newspaper and made public on Nov. 26 Samuel Insull, of Chicago, said that there is no doubt that there is a recession in business. This recession is due not merely to national but to world-wide conditions. Capital has been absorbed in large quantities in non-producing lines, such, for instance, as the recent war in southeastern Europe. At the same time there has been a heavy demand for capital for trade and manufacturing, with the result that a money stringency has been created in Europe and in this country. Mr. Insull said he did not believe that the situation in the United States is entirely the result of political activity, although it is not improbable that tariff readjustments and uncertainty regarding the currency have had an effect in accentuating economic conditions. Mr. Insull expressed his belief that the return to a more favorable situation would be slow but certain. "I feel," he said, "that the improvement will be more rapid in those countries where the government takes a paternal interest in the industrial affairs of the land than in those where there is an attitude of hostility on the part of those in government authority."

**New Jersey Manufacturer Increasing Generating Equipment.**—The Hyatt Roller Bearing Company is installing an addition to its power plant at Harrison, N. J., consisting of a 750-kw, 480-volt, three-phase Curtis-General Electric bleeder-type turbo-generator with auxiliaries, and has provided space for two future units. The present plant consists of several 125-volt direct-current non-condensing engine units with an aggregate capacity of about 500 kw. The turbine will utilize the exhaust steam from the present engines, together with necessary live steam from the present boiler plant. Condensing water will be supplied from a spray pond system located on the property of the company adjacent to the Pennsylvania Railroad, and this pond will also serve as a fire protection reservoir. The new equipment is to provide power for a large number of induction motors, recently installed, which are now driven by a temporary service from the Public Service Corporation. This addition is being designed and installed by Walter Kidde, engineer and contractor, of New York City, under the general direction of C. I. Shirley, mechanical engineer of the Hyatt Roller Bearing Company.

**Baker Motor Vehicle Company's Annual Sales Convention.**—From Nov. 13 to 15, inclusive, the Baker Motor Vehicle Company, of Cleveland, Ohio, held its second annual sales convention, which is regarded by that concern as the most successful session of that nature that the company has ever held. Electric-vehicle dealers from every section of the country attended. The most marked characteristic of the entire convention was the spirit of broad recognition for the dealer which has been developed in the Baker Company through the past year. Every session was a dealer session. Dealers were made to feel from the start that it was their convention, and as they were on the firing line it was their suggestions that were wanted. This one factor is held responsible for the unusual success of the undertaking, as the dealers contributed and took away with them more real good sales material than in any previous instance. Among the Baker cars exhibited were the electric coupé and the double-drive worm-gear brougham, and great interest centered around these two new models. Every dealer had an opportunity to examine the cars carefully and question the Baker engineers on any point of construction. The result was an enthusiasm for the new cars that promises great sales activity throughout the Baker organization for the coming year. In his report to the convention, George H. Kelly, secretary of the company, stated that business for the past year had increased 25 per cent in pleasure car sales and 130 per cent in truck sales. In connection with the designing of 1914 models of pleasure cars the Baker company is planning a decided innovation. The services of the French designer of women's apparel, M. Paul Poiret, have been engaged for the design of the interior furnishings of their cars, and it is expected that some of the cars produced under this novel system will be exhibited at the big automobile shows early in 1914.

NEW YORK METAL MARKET PRICES

| | Nov. 24 | | Dec. | |
|---|---|---|---|---|
| | Bid | Asked | Bid | Asked |
| | Selling Prices | | Selling Prices | |
| | | | 65 15 0 | |
| Prime Lake | 15.00 to 15.25 | | | |
| | to 14.87½ | | 14.50 to 14.75 | |
| | 14.50 to 14.62½ | | 14.37½ | |
| | 16.00 | | 16.00 | ..... |
| | 4.35 | | 4.10 | |
| | to 45.00 | | 40.00 to 45.00 | |
| Sheet zinc, f.o.b. smelter | 7.50 | | 7.50 | |
| Smelter, spot | 5.30 to 5.35 | | 5.15 to 5.20 | |
| Tin, spot | 39.25 to 39.65 | | | |
| Prompt delivery | 19.00 to 19.25 | | 19.00 | |
| Future | 18.75 to 19.25 | | | |

*OLD METALS

| | | |
|---|---|---|
| | 14.00 | |
| Brass, heavy | 9.00 | |
| Brass, light | 8.25 | 7.75 |
| Lead, heavy | 4.20 | 4.20 |
| | | |

*COPPER EXPORTS

*From daily transactions on the New York Metal Exchange.

# Corporate and Financial

**Initial Dividend of the Electrical Properties Corporation.**—An initial quarterly dividend of 1½ per cent has been declared on the $4,000,000 preferred stock of the Electrical Properties Corporation, payable on Dec. 10. The accrued dividends on the stock of the Electrical Properties Company were adjusted when the corporation succeeded it on Sept. 1, 1913.

**Generating Equipment Installed by Oklahoma Utilities.**—From Tulsa, Okla., we have received word that additional generating equipment is being provided for two of the local utility interests. At the Tulsa station of the Public Service Company of Oklahoma there are being installed new boilers and a 1000-kva Curtis General Electric turbo-alternator. The Sand Springs Railroad Company is installing a number of 250-kva gas-engine-driven generating units.

**New Hampshire Utility Purchased.**—The stockholders of the Manchester (N. H.) Traction, Light & Power Company have voted in favor of the purchase of the $600,000 capital stock of the Nashua Light, Heat & Power Company. The former concern already controls the Manchester Street Railway, the Manchester & Derry Street Railway and the Manchester & Nashua Street Railway, and has absorbed since its formation a number of electrical utilities in that neighborhood.

**Electric Merger in Missouri.**—The Missouri Public Service Commission has granted the application of the Jefferson City Light, Heat & Power Company for permission to purchase the Jefferson City Bridge & Transit Company. The purchasing company will be permitted to issue $1,000,000 in bonds for improvements and extensions of the system. This is the first Missouri property outside of St. Louis acquired by the McKinley interests, which have large public utility holdings in Illinois.

**Stock Increase for Massachusetts Utility.**—The Worcester Electric Light Company, which serves the towns of Worcester and Leicester, Mass., has made application to the Gas & Electric Light Commissioners of that State for permission to issue $200,000 additional stock. The present authorized and outstanding stock amounts to $1,000,000 and was increased from $800,000 in 1911. The increase asked for is $200,000, which is to be sold for the purpose of retiring floating debt and for improvements.

**Georgia Utility Completing Generating Station.**—Work on the Tallulah Falls hydroelectric development of the Georgia Railway & Power Company is practically completed and its full capacity is available for the company's use. The big dam under construction at Mathis, 5 miles above the falls, is expected to be finished by March, 1914. The Tallulah Falls development was started before the formation of the present company and has been about three years in building. It has been paid for by the sale of $8,315,000 of the bonds of the Georgia Power Company, under which concern work on it was started.

**United Gas & Electric Company Increases Its Board.**—The board of directors of the United Gas & Electric Company will be increased shortly from fifteen to twenty-five. The new directors will be G. W. Bacon, J. Q. Gannon, W. P. G. Harding, A. H. Wiggin A. J. Hemphill, F. M. Kirby, F. A. Sayles, R. L. Williams, F. V Hayne and S. Z. Mitchell. On Dec. 17 there will be a meeting of the stockholders of the company, in Hartford, Conn., when this plan will be brought up for approval. The acquisition of the properties of the American Cities Company recently is stated as the reason for this increase in the membership of the board.

**Southwestern Power & Light Company Growing.**—For the twelve months ended Oct. 31 the gross earnings of the Southwestern Power & Light Company subsidiaries amounted to $2,186,287 and the net earnings were $985,503. The Texas Power & Light Company, which is the principal one of these subsidiary concerns, is making many improvements in its properties at the present time. It has under construction now, at Waco, Tex., a new generating station and is building transmission lines between its various properties. The territory served by this company is growing rapidly and this growth is reflected in the increase in demand for electric energy.

**Louisville Gas & Electric Company's Initial Dividend.**—An initial quarterly dividend, payable Dec. 15, has been declared on the $10,787,800 of 6 per cent cumulative preferred stock of the Louisville Gas & Electric Company. The full quarterly rate of 1½ per cent is to be paid. It is planned to install two 5000-kw generating units in one of the gas plants recently acquired from the Louisville Heating Company, and the expjenditure of over $400,000 for this purpose has been approved by the directors. The former company expects to furnish a portion of the energy for operating the Louisville & Southern Indiana Traction Company's lines between Louisville, Jeffersonville and New Albany.

**Malvern Light & Power Company Purchased.**—The Malvern Light & Power Company, which supplies electric light and power, steam heat and ice to the towns of Malvern and Tabor, Ia., and to other small adjacent communities, has been purchased by the Continental Gas & Electric Corporation, of Cleveland, Ohio. The latter company has also acquired recently the small light and power plant at McCool Junction, Neb., and through the above properties, in addition to those held in Beatrice and York, Neb., and elsewhere, the last-named company serves in all about forty-five communities. The Continental Gas & Electric Company's capitalization consists of $1,250,000 common and $300,000 of 6 per cent preferred stock and it has outstanding $715,000 in 5 per cent bonds.

**Columbus Reorganization Plan Approved.**—The committee having in charge the reorganization of the street railway and electric light properties of Columbus, Ohio, at a meeting held on Nov. 26, 1913, declared the plan operative, as modified by the circular letter sent out on Nov. 10. Meetings of the stockholders of the various companies concerned have been called and, as a sufficient number of shares of stock have been deposited with the committee to carry out the plan, it only remains for the legal formalities to be complied with to bring about this reorganization, which has been under consideration for some months past. The plan as modified contemplates the union of the Columbus Railway Company and the Columbus Edison Company properties with the Columbus Railway, Power & Light Company property. The Columbus Light, Heat & Power Company property will be controlled under the lease to the Columbus Railway & Light Company, as it has been for some years past. Modification of the plan will cause some change in the arrangement by which the Columbus Railway & Light Company stockholders were to receive stock in the new company, on the dissolution of the former company, but the committee is working out a plan which, it is believed, will be satisfactory to these stockholders. The reorganization is expected to become effective about March 1, 1914, after the regular annual meetings of the companies affected.

**Special Meeting of the Federal Traction & Light Company.**—On Dec. 12 there will be held in New York City a special meeting of the stockholders of the Federal Traction & Light Company to vote on the following proposals: The execution of a trust agreement with the Columbia Knickerbocker Trust Company as trustee, dated Dec. 1, under which may be issued ten-year gold notes not to exceed an aggregate of $10,000,000, payable Dec. 1, 1923, bearing such interest not exceeding 7 per cent. and redeemable on thirty days' notice at such amount not exceeding 105 as may be fixed upon by the directors from time to time and designated on such notes when issued; the offering to the stockholders, for subscription at par and interest, of $750,000 of such notes, bearing interest at the rate of 7 per cent per annum and redeemable at 105 and interest up to and including June 1, 1921, and thereafter at par and interest; the execution of an agreement with a syndicate for the sale of it, at par and interest, of all of such $750,000 note issue not shall not be subscribed and paid for by the stockholders, and for the compensation of this syndicate for the above service; the issuing with the $750,000 notes of option warrants for common stock of equal par value, entitling the holders to obtain such stock at par at any time prior to Dec. 1, 1923, payment for such stock to be made in cash or by surrender of notes, issued under the above-mentioned trust agreement, which have been outstanding not less than 10 years and have not been called for previous redemption.

## Business Notes

**The Gould Storage Battery Company** has announced the location of its Detroit office, on and after Dec. 1, as Boyer Building, 88 East Congress Street.

**The Badt Westburg Electric Company,** of Chicago, Ill., has recently announced the removal of its offices from Suite 1504 to Suite 832, Monadnock Block, Chicago, a change made necessary by the lack of room in its old quarters for the handling of a steadily increasing business.

**G. M. Gest,** underground conduit engineer, has removed his executive offices from 277 Broadway, New York City, to the Woolworth Building, New York. The headquarters of the New York Pole Company, an allied corporation, have also been transferred to the same address.

**The Western Electric Company** has just announced the following changes in its organization: A. E. Beling, formerly manager of the Western Electric Company's Pittsburgh house, has been appointed manager at Cleveland to succeed H. A. Speh, resigned, and L. M. Dunn has been appointed manager at Pittsburgh, succeeding Mr. Beling. J. L. Ray has been appointed sales manager.

**The Diamond Electrical Supply Company, Inc.,** of Peoria, Ill., is the new name of the Mills Electric Company, which has been engaged in the electrical supply business in the Middle West for about eight years. The change in name was made to secure a distinctive and exclusive company name, and it has not accompanied any change in the management of the concern. H. M. Butler is president of the company; J. G. Butler its secretary and treasurer, and its sales manager is T. W. Endsley.

**The H. W. Johns-Manville Company,** of New York City, is providing increased accommodations for several of its branch offices at the present time. The Toronto branch of the Canadian affiliated company has been removed to 19 Front Street East. The Columbus (Ohio) branch is now located at 45 West Long Street. The Toledo office and warehouse have just been moved to 213 Water Street and the Cleveland branch has recently closed a long-term lease of a large warehouse on Front Street. Other Ohio offices, run in connection with the main office at Cleveland, are those at 717 National Second Bank Building, Akron; 259 Fourth Street Arcade, Dayton, and 502 Stambaugh Building, Youngstown.

## New Industrial Companies

**The Atlas Electric Sign Company,** of Chicago, Ill., has been incorporated with a capital stock of $2,400 to manufacture and sell electrical signs. The incorporators are Alonzo W. Losee, Vernon C. Thompson and Ada Husum.

**The Roland Gas-Electric Vehicle Corporation,** of New York, N. Y., has been incorporated by P. K. Dexter, R. R. Conklin and S. L. Conklin, of New York, N. Y. The company is capitalized at $200,000 and proposes to do a general automobile business.

**The Hammer-Beach Electric Company,** of Geneva, N. Y., has been incorporated with a capital stock of $10,000 to do a general gas and electrical engineering business. The incorporators are Arthur H. Page, George L. Hammer and Henry C. Palmer, all of Geneva.

**The Trioleum Power Company,** of Providence, R. I., has been incorporated with a capital stock of $10,000 to develop, manufacture and sell fuel to be used in generating power, both motor and steam. The incorporators are Harlow W. Waite, John B. Desrosiers and Harry W. Stiness.

**The Kleinschmidt Electric Company,** of New York, N. Y., has been chartered with a capital stock of $100,000 to manufacture and deal in electrical apparatus. The incorporators are B. Kleinschmidt, W. Kleinschmidt and F. Kleinschmidt, all of 429 East Fifty-eighth Street, New York, N. Y.

**The Walker Engineering Company** has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $100,000. The company proposes to do a mechanical engineering and machinists' business. The incorporators are H. Walker, G. H. Walker, of Wilmington, Del., and F. F. Slocomb, of Philadelphia.

# Trade Publications

Conduit Boxes.—A folder issued by the Chicago Fuse Manufacturing Company describes its new extension ring outlet boxes.

Flashers.—The Federal Sign System (Electric) in Bulletin No. 183 illustrates and describes its flashers. Bulletin No. 186 deals with prismatic signs.

Copper-Clad Wire.—The Duplex Metals Company, Chester, Pa., is mailing a leaflet containing a fac-simile letter from a steamship line referring to the dependability of copper-clad wire under exacting conditions. The leaflet is humorously illustrated.

Electric Heating Pad.—The H. W. Johns-Manville Company, New York, has issued a leaflet descriptive of its J-M electrotherm, a light, flexible pad composed of wires insulated and protected with asbestos, used in place of the familiar hot-water bottle.

Steam-Plant Economies.—Engineering Leaflet No. 15 of the Harrison Safety Boiler Works is entitled "Steam-Plant Economies Due to the Use of Hot Soft Water in the Boilers." It discusses the results obtained in treating the water when hot rather than when cold.

Single and Polyphase Motors.—Twin booklets recently issued by the Wagner Electric Manufacturing Company, of St. Louis, Mo., tell a lot about the latest products of that company in the line of single-phase and polyphase motors. The characteristics of these motors and their field of application are explained at length.

Insulators.—The Brookfield Glass Company, 2 Rector Street, New York, in a twenty-four-page booklet gives data on its insulators. Forty-five types are diagrammatically shown, accompanied with a brief mention of the weight, diameter of groove, number per barrel, approximate weight per 1000 and code word of each type.

Motor Applications.—"Motor-Driven Refrigerating and Ice-Making Machinery" is the title of a publication by the Westinghouse Electric & Manufacturing Company in which is given some interesting information on this subject, including specific data on motor applications, together with actual kilowatt-hours consumption for different plants.

Induction Motors.—Bulletin No. 160, recently issued by the Crocker-Wheeler Company, Ampere, N. J., refers to induction motors for general use, Form Q, 60-cycle, three-phase or two-phase. The bulletin is written for the average reader as well as for the engineer, which will insure for it a wide reading. The pamphlet is well prepared and neatly printed.

Storage Batteries.—Bulletin No. 111 of the United States Light & Heating Company, Niagara Falls, N. Y., describes and illustrates storage batteries for ignition and electric lighting. Included in the contents are useful data of storage-battery ratings, tables and formulas, which will facilitate the selection of the proper size battery for any special service.

Electric Stoves and Toasters at the Holiday Season.—The Hughes Electric Heating Company, 211-213 West Schiller Street, Chicago, has issued a holiday sheet for central stations and dealers in which it says that electric stoves, toasters and hot-plates make admirable Christmas presents. The sheet is printed in the Christmas colors and has a holiday appearance.

Wires and Cables.—The latest catalog of the National India Rubber Company, Bristol, R. I., represents an excellent example of high-grade trade literature, both as to contents and make-up. Within the 224 pages of this creditable volume are given descriptions of the various kinds and sizes of wires and cables manufactured by the company, in addition to which some valuable engineering data that will be appreciated by all wire and cable users are printed. The illustrations are exceptionally fine, notably those showing various kinds of wires, cables and lamp cords printed in the colors of the finished product. Sample strands of silk showing the many colors in which lamp cord is now made are mounted on a card for which there is a conveniently arranged pocket on the inside back cover of the catalog. There is also an excellent index. The entire character of [illegible] well [illegible] for its careful preservation.

# Personal Mention

**Mr. A. C. Moser** has succeeded Mr. J. P. Mitchell as superintendent of the Bucyrus (Ohio) Light & Power Company.

**Mr. William J. Barker,** for thirty years connected with the electric and gas industry of Denver, has been elected vice-president and general manager of the Denver Gas & Electric Light Company.

**Mr. Frank W. Frueauff,** for several years vice-president of the Denver (Col.) Gas & Electric Light Company and its predecessor, the Denver Gas & Electric Company, has been elected president, vice Mr. Henry L. Doherty, who assumes the newly created office of chairman of the board.

**Mr. John W. Cooke,** New England engineer for the Electric Storage Battery Company, delivered a lecture on Nov. 20 to the students of the department of industrial electricity at Franklin Union, Boston, Mass. Mr. Cooke showed by several experiments the fundamental principles of the lead cell and illustrated its manufacture, installation and uses by well-chosen lantern slides.

**Mr. Leroy J. Hannah** has resigned the position of superintendent of the new-business division of the Louisville (Ky.) Gas & Electric Company to engage in other work. Mr. Hannah was formerly in charge of the new-business section of the Kentucky Electric Company, and when that company was absorbed in the existing united enterprise of the Louisville Gas & Electric Company he was appointed to the place now relinquished by him.

**Mr. Jesse Scribner,** of Chicago, district manager of the lighting department of the General Electric Company, has been bereaved by the death of his wife. Mrs. Scribner died on Nov. 24 in the German Hospital and the funeral took place from the family residence in Wilmette, Ill., the next day. Mr. Scribner has been connected with the Chicago office of the General Electric Company and its predecessor, the Thomson-Houston Electric Company, since 1889. Few electrical men in Chicago are better known and better liked than he. Mrs. Scribner also was well known to the wives of many of the electrical men in the Chicago district.

**Mr. Albert H. Stanley,** formerly general manager Public Service Railway, Newark, N. J., and now managing director London Underground Railway and other traction and omnibus interests in London, is visiting the United States in company with the following officers of the Midland Railway: Sir Guy Granet, general manager; Mr. F. Tatlow, assistant general manager, and Messrs. J. Sayers and J. Dalziel, electrical engineers. The party has planned to make an extensive tour of the United States for the purpose of studying all important steam railroad electrification and other operating practices preliminary to the proposed electrification of the Midland Railway in London and vicinity. The party is making its headquarters at the Ritz-Carlton Hotel, New York, and expects to be here until the new year.

**Mr. T. C. Martin,** secretary of the National Electric Light Association, has just returned from England and the Continent, after a vacation of some six weeks, part of which was devoted to looking into central-station conditions, particularly with regard to the methods in vogue for securing a larger utilization of electrical service. A great deal of interest was shown everywhere in the work of the association, which has recently created a foreign membership and now has members in all parts of the world. Before leaving London Mr. Martin met at luncheon a number of the leading central-station managers operating in that city and spent some hours with them in an interchange of views and data. He expresses himself as impressed with the general prosperity of the industry abroad, often under conditions that companies here would find burdensome or intolerable.

**Mr. Hugh H. Harrison,** of New York City, has been elected president of the Merchants' Heat & Light Company of Indianapolis, Ind. Mr. Harrison is well known financially, being vice-president of the Ann Arbor Railroad, a director of the Empire Trust Company of New York and a director of the Colorado Power Company, one of the largest corporations of its kind in the West. He is also largely interested in a number of other enterprises and has for the

last fourteen years been engaged in organizing and financing companies of this character. He is interested in street railway companies in New Jersey, and it was largely through his efforts that the Imperial Electric Light Company of St. Louis, the Scranton Electric Light Company of New Jersey and the Lackawanna Electric Light Company and the Baltimore Electric Light Company were organized and financed.

**Mr. J. E. Latta,** for two years an associate editor on the *Electrical Review and Western Electrician,* has severed his connection with that publication and joined the staff of the Underwriters' Laboratories as special agent. Mr. Latta is a graduate of the University of North Carolina and of the Graduate School of Harvard University. At both these institutions he specialized in mathematics, physics and electrical engineering. He studied engineering for a time at the Polytechnic Institute of Brooklyn, at Stevens Institute of Technology and in the shops of the Westinghouse Electric & Manufacturing Company and of the Hoover-Owens-Rentschler Company, at Hamilton, Ohio. In 1902 he was elected general manager of the Durham (N. C.) Traction Company, but declined the position in order to become associate professor of physics in the University of North Carolina. Mr. Latta was acting head of the department of physics and applied electricity for a year and a half, at the end of which period he was appointed professor of electrical engineering. He served in that capacity until 1909, when he left the university to enter the employ of the General Electric Company at Harrison, N. J., where for seven months he had charge of the course in applied electricity and illuminating engineering given to employees of the company. Leaving that position, he was engaged in electric power plant construction and operation in the Southwest, until the summer of 1911, when he became technical editor of *Electrocraft,* then published in Detroit, Mich. When that journal was purchased by the *Electrical Review and Western Electrician* he accepted a place on the editorial staff of the latter publication. Here his attention has been confined largely to the sections of this publication devoted to electrical contracting and electrical inspection. Mr. Latta assumed his new duties Dec. 1 and will make Chicago his headquarters.

## Obituary

**Alfred H. Pease,** president of the Hart & Hegeman Manufacturing Company, Hartford, Conn., died suddenly on Nov. 27. As was his custom for many years, Mr. Pease ate his Thanksgiving dinner with his family and relatives at the Hartford Club. That evening he was seized with severe pains and died of heart failure in twenty minutes. Mr. Pease was born in Hartford forty-nine years ago, and after graduation from the high school in 1882 he entered the employ of W. F. Pelton & Company, wholesale dry-goods merchants. He left the dry-goods firm to enter the employ of the Hart & Hegeman Manufacturing Company as treasurer in 1892 and within a few years was made president of the company. During his presidency a large factory of the company on Capital Avenue with its improved grounds was built and an extensive and lucrative business secured. Mr. Pease was one of Hartford's best known business men, and his sudden death was a great shock to a wide circle of friends, who were deeply attached to him. He is survived by his widow, two sons and two daughters. Mr. Pease was a member of the Electrical Manufacturers' Club, of which he was at one time vice-president, the Hartford Club, the Hartford Golf Club, and the Farmington County Club.



ALFRED H. PEASE

**C. E. Delafield,** district manager of the Intermountain territory of the Crocker-Wheeler Company, died on Nov. 30 in Denver, Col. Mr. Delafield was associated for a number of years with the Wagner Electric Manufacturing Company, of St. Louis, Mo., and was later sales manager of the Ohio Brass Company of Mansfield, Ohio. He entered the service of the Crocker-Wheeler Company on Sept. 1, 1909, and had recently filled the position of district manager of that company's Intermountain territory, with headquarters at Denver and Salt Lake City.

**J. C. Calisch,** special agent of the railway department of the General Electric Company, died in New York on Nov. 28. Mr. Calisch was graduated from Stevens Institute in 1887 and served his apprenticeship with the Electric Storage Battery Company in Philadelphia. In 1890 he entered the New York office of Edison General Electric Company and remained with this company when it was merged with the General Electric Company in 1892. In 1895 Mr. Calisch was appointed manager of the Pittsburgh office, and in 1899 manager of the Buffalo office. In 1906 he resigned to become vice-president and general manager of the Buffalo & Lake Erie Traction Company. In 1912 he resigned from this company to return to the General Electric Company in the capacity of special agent in its railway department. Mr. Calisch was forty-six years old.

**Henry M. Richards,** chairman of the executive committee of the board of trustees of the Washington Water Power Company, Spokane, Wash., and vice-president of the Spokane & Eastern Trust Company, who was hurt in a runaway accident Nov. 9, at Springdale, Wash., died at the Springdale Hospital on Nov. 16. Henry M. Richards was born March 6, 1849, in New York. He was educated at Mount Washington Collegiate Institute at New York City and at an early age became a clerk with John P. Moore's Sons, importers and manufacturers of firearms, etc., later a salesman, and then a member of the firm. He remained actively with that firm from 1863 to 1886, when he retired from business in New York and removed to Warren, Ohio. There he remained until 1893, when he removed to Spokane, Wash., where he, with his brother, Mr. J. P. M. Richards, organized the Spokane & Eastern Trust Company. He became its vice-president, and shortly afterward he also became president of the Washington Water Power Company, which position he held from 1895 until 1910, when he became chairman of the executive committee of its board, the position he held at the time of his death. The phenomenal success of the Washington Water Power Company is largely due to the efforts of Mr. Richards. During the troublesome times following the panic of 1893 he succeeded in turning the tide of adversity by interesting Eastern capital. He became connected with the company first in 1894 as a trustee. He was elected president shortly afterward, and more than any other man was individually responsible for the friendly reorganization of the company's financial affairs, whereby the investors in the various securities of the company were saved from loss and the various sub-companies of the Washington Water Power Company were united into a concrete whole. When Mr. Richards became president of the company it had a capital of $1,500,000, and its bonded indebtedness was $1,637,000. To-day the capitalization is $15,000,000, and a five-million-dollar increase was announced only last week. The bonded indebtedness is now $5,000,000. In 1893 the street-railway system of the company operated thirteen cars; to-day it operates 120. It had then about 250 employees, to-day about 1200. Its gross revenues have grown from $200,000 to $3,000,000. During Mr. Richards' administration the greater part of all the power at Spokane has been developed, all of that at Post Falls, Idaho, and Little Falls, Wash., and the big work undertaken at Long Lake, Wash. When he became president the company was not operating outside of the limits of the city of Spokane, while to-day its lines extend nearly to the Montana line on the east and more than 100 miles to the west and south of Spokane.



HENRY M. RICHARDS

# Construction

## New England

CLAREMONT, N. H.—The Sullivan Lt. & Pwr. Co., of Sullivan, has been granted a franchise to furnish electricity in Claremont.

SHELBURNE, VT.—The Shelburne Improvement Society has entered into a contract with the Burlington Trac. Co., of Burlington, for installing a lighting system in the village. The contract provides for the installation of 30 street lamps. All the public buildings and many of the residences will be lighted by electricity.

VERGENNES, VT.—The Burlington Trac. Co., of Burlington, has acquired the property and holdings of the Vergennes El. Co. It is understood that the plant will be rebuilt and new equipment installed.

BROCKTON, MASS.—Work has just been started on an addition to the East Bridgewater plant of the Edison El. Ltg. Co. of Brockton. New equipment, including a 5000-kw turbine and two 600-hp boilers, 75-kw exciter, pumps, condenser and switching apparatus, will be installed. A. F. Nelson is manager.

CAMBRIDGE, MASS.—The Cambridge El. Lt. Co. expects to purchase within the next 30 days 109 ornamental poles and inverted tungsten lamps to be erected on Massachusetts Avenue. W. E. Holmes is treasurer and general manager.

SPRINGFIELD, MASS.—Bids will be received by the committee of the City Council on city property until Dec. 22 for electrical work, complete, in the addition to the Buckhaming School in accordance with plans and specifications prepared by B. Hammett Seabury, architect, 21 Besse Place, Springfield.

WAKEFIELD, MASS.—At a special election held recently it was voted to abandon the municipal electric plant for one year and to purchase electricity from the Reading municipal plant to operate the local system, the contract to take effect from Feb. 1, 1914. The town of Wakefield expects to purchase at once 12 iron lamp-posts for incandescent street lamps. S. I. Coles is manager of the municipal electric-light plant.

HARTFORD, CONN.—Bids will be received by the Board of Contract and Supply, City Hall, Hartford, Conn., until Dec. 16, for erecting 141 double-lamp posts and for furnishing all fixtures and lighting same with either gas or electricity for a term of years ending June 1, 1919. Plans may be seen and specifications may be obtained at the office of the Street Commissioners, City Hall. Joseph Buths is secretary of Board of Contract and Supply.

STAMFORD, CONN.—The Stamford Gas & El. Co. is now installing a 2500-kw Parsons turbine and Wheeler condenser and expects to have the same in operation by the holidays. G. B. Leland is superintendent.

## Middle Atlantic

BALDWINSVILLE, N. Y.—The Oswego River Pwr. Co., of Syracuse, has awarded the contract for the construction of a transmission line from Phoenix to Mexico, a distance of 18 miles, to the Seneca Improvement Co., of Baldwinsville. The Oswego River company will furnish electricity to the Mexico El. Co. from its Phoenix station. The company also has franchises and has secured rights-of-way for the erection of a transmission line to Cato and Meridian; also for distributing systems in the above towns.

CENTER VILLAGE, N. Y.—The Public Service Commission, Second District, has granted the petition of the Afton-Windsor Lt., Ht. & Pwr. Co. to acquire all franchises, real estate and other privileges pertaining to the construction of a large hydroelectric power plant in Center Village and the erection of distributing systems in the villages and towns of Afton and Windsor and through the town of Colesville. The cost of the plant is estimated at $100,000. C. F. Wright and W. A. Bennett, of Susquehanna, Pa., are interested in the project.

COEYMANS, N. Y.—The Atlantic Lt. & Pwr. Co., of Coeymans, has recently purchased and is now installing a 225-hp Diesel engine, a 175-kw Crocker-Wheeler generator and a General Electric switchboard. J. N. Briggs is president.

GOWANDA, N. Y.—The Keyes El. Co., of Gowanda, has completed the construction of a new concrete dam to replace the portion of its dam damaged by the floods last March. The new section is about 200 ft. long, 16 ft. thick at the bottom and averages about 16 ft. in height. This makes about 300 linear ft. of solid concrete dam, with still 150 ft. of timber construction which will eventually be replaced by concrete. An item published Nov. 1 stated that the State Conservation Commission had approved plans and specifications of the company for the construction of a dam in Cattaraugus Creek. J. G. Keyes is secretary.

MIDDLETOWN, N. Y.—Within the next few months the Orange County Ltg. Co., of Middletown, expects to purchase an open-feed water heater and boiler-feed pump for boilers of 100-hp capacity. Laurent Heaton is manager.

NEW YORK, N. Y.—The contract for installing electric wiring, fixtures and gas piping at the City Hospital, Blackwell's Island, has been awarded to Lewis H. Woods, 2355 Jerome Avenue, New York, at $17,893.

OLEAN, N. Y.—The Board of Water Commissioners has entered into a contract with the Olean El. Lt. & Pwr. Co. to furnish electricity to operate the pumping plant in South Olean for a period of ten years. The cost of installing the pump and equipment is estimated at about $4,000.

RANDOLPH, N. Y.—The Randolph El. Lt. & Pwr. Co. has recently placed an order with the Ridgway Dynamo & Engine Co., of Ridgway, for an additional generating unit, consisting of a 150-kva, three-phase, 60-cycle, 2300-volt generator and one 200-hp high-speed automatic center-crank engine (16 in. by 16 in.). The company is also contemplating the purchase of a 6-ton ice plant before the opening of another season and would like to receive data and prices on machinery and equipment for same. Woodworth & Grace are proprietors.

ROCKVILLE CENTER, N. Y.—The Board of Trustees expects to purchase within the next year one engine, a boiler and a generator. H. C. Major is chief engineer.

SODUS, N. Y.—The Wayne Pwr. Co., of Sodus, expects to erect within the next 12 months a transmission line from Atlanta to Naples (11,000 volts, three-phase, 60 cycles); also to purchase material for a complete distribution system for Naples, including poles, wire, substation equipment, street-lamps, regulator and one tub transformer for street-lighting system, etc. G. R. Mills, of Sodus, is president.

TUPPER LAKE, N. Y.—The electric light committee expects to purchase Oct. 1, 1914, material for street-lighting system, consisting of tub-transformers, rectifiers, lamps, posts, etc.

WESTFIELD, N. Y.—Within the next six months the Board of Public Works expects to purchase a car load of poles for the municipal electric-light system; also within the next 18 months it expects to purchase a 200-kva. three-phase, 60-cycle, 2300-volt turbo-generator set or purchase energy generated at Niagara Falls. Harry Mettendorff is superintendent.

GROVE CITY, PA.—New equipment has recently been purchased for the municipal electric-light plant, including one 165-hp twin-cylinder Bessemer gas engine and one 100-kw, three-phase, 60-cycle, 2300-volt Western Electric generator and standard switchboard panel for control of above equipment. Paul J. Hays is superintendent.

LEWISTOWN, PA.—The Borough Council has granted the Raystown Lt. & Pwr. Co., of Huntingdon, a 75-year franchise to erect and maintain transmission lines in Lewistown.

STATE COLLEGE, PA.—Proposals will be received until Dec. 9 for the construction of a stock pavilion at State College, Pa., including heating, plumbing and electrical work. Plans and specifications may be seen at the offices of Edwin E. Sparks, president State College; Mitchell & Alter, Park Building, Pittsburgh; State superintendent of grounds and buildings, Capitol, Harrisburg, and Day & Klauder, architects, 925 Chestnut Street, Philadelphia.

IRVINGTON, N. J.—Bids will be received by the Board of Education, corner of West Clinton and Linden Avenues, Irvington, until Dec. 11, for furnishing material and constructing a ten-room school building to be located on the corner of Halstead Avenue and Nesbit Terrace, Irvington, in accordance with plans and specifications, which may be seen at the office of Joseph B. Allen, architect, 11 Sanford Avenue, Irvington. Separate bids must be submitted for the following work: Iron and steel work, masonry work, carpenter work, plumbing and gas-fitting, electrical work, vacuum-cleaning system and heating and ventilating. Bids will be received for a reinforced-concrete building as well as for a brick building. The cost of the building is estimated at about $76,000. Edward R. Folsom is chairman of new building committee.

PARKERSBURG, W. VA.—Arrangements are being made by the Parkersburg, Marietta & Interurban Ry. Co., of Parkersburg, for the installation of an ornamental street-lighting system, material for which has been purchased. The plans provide for the erection of 105 cast-iron standards, manufactured by the Morris Iron Co., each carrying four 60-watt lamps and one 100-watt lamp, to be maintained by underground wires, Orangeburg fiber conduit being used. The company will do the work. The cost of the system is estimated at $8,500. C. C. Gallaher is chief engineer.

ELKTON, VA.—The Town Council is asking for bids for equipment for an electric-light and power plant.

FREDERICKSBURG, VA.—Within the next two months the Rappahannock El. Lt. & Pwr. Co., of Fredericksburg, expects to erect 1 mile of two-phase four-wire transmission line. [illegible] has been awarded a contract for lighting one of the [illegible] in Fredericksburg. E. C. L. Ficklen is secretary and treasurer.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 9 for furnishing at the various navy yards and naval stations the following supplies: Port Royal, S. C., Schedule 6071—25 street-lamp brackets. Brooklyn, N. Y., Schedule 6077—24 portable, electric safety lanterns, 36 carbon packing rings; Schedule 6076—one electrically driven engraving machine. Bids will also be received at the same place until Dec. 30 as follows: Puget Sound, Wash., Schedule 6071—miscellaneous electric furnaces, etc.; Schedule 6082—two pipe-bending machines.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until Dec. 13 for furnishing the following supplies under Proposal No. 685: (1) For 30,000 ft. 36-circ. mil, pothead wire, as per Specification 340-B; (2) 4000 ft. 40-circ. mil, rubber-covered fixture wire; (3) 75,000 ft. 40-circ. mil, in-

twisted-pair wire, as per Specification 340-B; (4) 10,000 ft. 64-circ. mil, rubber-covered and braided single wire, as per Specification 474-B; (5) 10,000 ft. one-pair, rubber-insulated, leaf-sheathed, galvanized flexible-steel armored cable (type 251), Greenfield type, Sprague Electric make, or equal, in accordance with Specification 546-C; (6) 1000 ft. 81-circ. mil, rubber-covered and braided copper wire, as per Specification 474-B; (7) 1000 ft. high-tension wire as per Specification 416-E. Major W. L. Clarke is disbursing officer.

## North Central

ALBION, MICH.—The City Council has decided in favor of the single-post street-lighting system, but has postponed final action on awarding contract, awaiting further estimates on cost.

BIG RAPIDS, MICH.—The contract for the construction of the power house, 25 ft. by 69 ft., one story high, at the dam has been awarded to A. J. White and Roy S. Buck.

VASSAR, MICH.—The Electric Light Commission expects to purchase within the next 12 months electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, etc. W. A. Peck is superintendent.

CAMBRIDGE, OHIO.—The car lines and electric plants in Cambridge and Guernsey County of the Midland Pwr. & Trac. Co., of Cambridge, will be taken over by the Ohio Service Co. as soon as the State Utilities Commission gives its consent. The purchase price is said to be $900,000. E. F. Pomerene is president of the Ohio Service Co.

CANTON, OHIO.—Electrical apparatus, it is reported, will be installed to double the motive power of the Knight Tire & Rubber Co.

CEDARVILLE, OHIO.—The Cedar Lt. & Pwr. Co. expects to purchase some arc lamps for street-lighting within the next 12 months. O. L. Smith is secretary.

CINCINNATI, OHIO.—Bids will be received at the office of the clerk of the Board of Education, City Hall, Cincinnati, until Dec. 29 for furnishing all material and labor, including carpenter work, structural-iron work, plumbing, painting, glazing, brickwork, concrete and cementing and electric work, to complete certain remodeling at Woodward High School, located at Sycamore and Woodward Streets, in accordance with plans and specifications on file in the office of C. W. Handman, business manager, 511 West Court Street, Cincinnati. Bidders may submit proposals for any or all the above items.

CLEVELAND, OHIO.—Plans are being considered by Mayor Baker and his cabinet for the immediate completion of the $2,000,000 municipal electric-lighting plant. About $300,000 will be required to complete the plant.

CLEVELAND, OHIO.—Bids will be received at the office of W. H. Kirby, secretary to the director of public service, Room 204, City Hall, Cleveland, Ohio, until Dec. 10 for furnishing, lighting, extinguishing, repairing, maintaining and furnishing electricity for electric lamps in the city of Cleveland for the year beginning Jan. 1, 1914. W. J. Springborn is director of public service.

DENNISON, OHIO.—The County El. Co., of Dennison, expects to purchase within the next two weeks 45 60-cp tungsten street series lamp fixtures for pole attachment. H. O. Stilgenbauer is superintendent.

GREEN SPRING, OHIO.—Within the next six months the Green Spring El. Lt. & Pwr. Co. expects to erect a concrete block or brick power house to replace the present building, which was badly damaged by fire recently; also it expects to purchase within the next two months fifty 5-amp direct-current meters. The company expects within the next month to take the agency of a guaranteed, reasonably priced vacuum cleaner and of an electric washing machine. D. M. Scott is manager.

GREENVILLE, OHIO.—Within the next three months the Greenville El. Lt. & Pwr. Co. expects to erect 13 miles of 33,000-volt transmission lines with full equipment; also to purchase within the next five months one 300-hp water-tube boiler, and within the next eight months coal-dumping apparatus for unloading coal from hopper cars. D. L. Gaskill is president.

KALIDA, OHIO.—The local electric-light plant is being remodeled and the voltage changed, which will require rewiring and remodeling a number of residences and business houses, together with considerable new work. The owners of the plant contemplate the purchase of considerable material, including electric-lamp fixtures, and would like to receive catalogs and prices on same; also estimates of cost at once on BX and BXL cable and metallic molding with all fittings. For further information address Joseph A. Murray, Kalida, Ohio.

MANSFIELD, OHIO.—The City Council has engaged H. Whitford Jones, of Cleveland, Ohio, to prepare plans and estimates for a municipal electric street-lighting plant. The plans will also provide for furnishing electricity for commercial purposes.

MARION, OHIO.—The Marion Ry., Lt. & Pwr. Co. has applied to the County Commissioners for permission to erect a transmission line to the stone quarry of the Marion Ohio Stone Co., northeast of the city. The cost of the line is estimated at about $2,000.

MOUNT BLANCHARD, OHIO.—Plans are being prepared by the Albert L. Marvin Co. for the erection of a power plant in Mount Blanchard, for which a franchise was recently granted. The proposed equipment will include gas engines and alternating-current generators (2300 volts, 60 cycles). Contracts for the above work will be awarded as soon as possible. The company has franchises pending in nearby towns, including Wharton and Vanlue, Ohio. An engineer has not yet been engaged.

NORWOOD, OHIO.—Most of the machinery in the municipal electric power plant damaged by the fire recently has been repaired and put into operation. Early in 1914 a bond issue of $104,000 will be available for betterment and improvements to the plant, which was provided before the fire. H. C. Hubbell is general manager of the water and light plants.

ORRVILLE, OHIO.—The Board of Public Affairs has engaged Frank B. Rae, consulting engineer, of Cleveland, to prepare plans and specifications for the installation of a municipal electric-light plant in Orrville.

SALEM, OHIO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 7, 1914, for construction, complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Salem, Ohio. Drawings and specifications may be obtained at the above office or from the custodian of site at Salem. O. Wenderoth is supervising architect.

ZANESVILLE, OHIO.—The City Council has passed the ordinance granting the Ohio El. Ry. Co. an extension of its franchise for ten years, under the terms of which the company is to reduce the price of electricity for lamps, to install a new street-lighting system on Main Street and to light the Y Bridge.

PADUCAH, KY.—The Electric Light Commission expects to purchase within the next four months one arc machine (50 lamps, 4-amp) and 25 4-amp arc-lamps. G. O. Keebler is superintendent.

STANFORD, KY.—Within the next six months the Stanford Wtr., Lt. & Ice Co. expects to purchase two new boilers of 200 hp. and one pump. B. F. Rout is manager.

BICKNELL, IND.—The capital stock of the Bicknell Lt. & Pwr. Co. has been increased from $10,000 to $60,000.

DANVILLE, IND.—Bids will be received by the Board of Commissioners of Hendricks County, Danville, Ind., until Dec. 19 for wooden furniture, steel furniture, decorating, electric fixtures, elevators, clock and floor covering for the new court house in Danville. Plans and specifications are on file in the office of Lewis W. Borders, county auditor.

RENSSELAER, IND.—The managers of the municipal water and electric-light plant expect to install at once one Chandler & Taylor automatic engine and American Well Works centrifugal pump with General Electric motor (directly connected) having a capacity of 500 gal per minute. Orders have already been placed for equipment. C. S. Chamberlain is superintendent.

ROYAL CENTER, IND.—The Royal El. Lt. Co., of Royal Center, expects to purchase within the next 12 months a few arc and incandescent lamps and wiring supplies. W. H. Bingaman is secretary.

SOUTH BEND, IND.—The City Council has adopted a resolution to engage a consulting engineer to report on the cost of installing a municipal electric-light plant in South Bend.

ALTON, ILL.—The City Council has granted an extension of one year's time to the Pisa Lt. & Pwr. Co. to establish a commercial lighting system in this city.

DOWNERS GROVE, ILL.—Bids will be received at the office of the village clerk until Dec. 15 for equipment for power plant, including two 100-hp, four-cycle engines, to be operated on crude and the lower grades of fuel oil; two 100-kva, three-phase, 60-cycle, 2300-volt, engine-type generators; one three-panel switchboard, two motor-driven centrifugal pumps, directly connected (300 gal. capacity), and two deep-well, motor-driven power heads. Specifications may be obtained upon application to Bert. C. White, village clerk, or W. H. Blodgett, village collector, Downers Grove.

JACKSONVILLE, ILL.—The City Council has called an election to be held Dec. 20 to submit to the voters the proposal to issue bonds to install a municipal electric plant to furnish electricity for lighting the streets of the city and also for commercial and residential lighting.

MACOMB, ILL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 27 for construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Macomb, Ill. Drawings and specifications may be obtained from the above office or from the custodian of site at Macomb. O. Wenderoth is supervising architect.

MOUNT CARROLL, ILL.—The Mount Carroll El. Lt. Co. expects to purchase some transformers, meters, lightning arresters and wire for distribution system; also house-wiring supplies. J. W. Webb is superintendent.

FLORENCE, WIS.—The Electric Light Commission expects to purchase within the next 12 months electrically operated pumps for domestic and fire purposes (direct-pressure system) and material for new street-lighting system. E. E. Wilcox is president.

MANITOWOC, WIS.—The State Railroad Commission has placed the valuation of the properties of the Manitowoc El. Lt. Co. at $137,500. In addition the city must pay for the material on hand and improvements made to the plant since Jan. 1, 1913. The appraisal was made at the request of the city.

MONTICELLO, WIS.—The Monticello Granite Co., owner of the local electric-light plant, has entirely rebuilt its distribution lines within the last two years. Richard Gessner is manager and electrician.

[illegible] MINN.—Within the next [illegible] months the manager of the mu[illegible] plant expects to purchase wiring supplies, etc. O. [illegible]

MINNEAPOLIS, MINN.—Bids will be received by Henry N. Kratt, city clerk, until Dec. 12, for lighting the city with both electricity and [illegible]

ORTONVILLE, MINN.—The Board of Public Works expects to erect within the next 12 months 2 miles of transmission line for two-phase, three-wire, 2300-volt system; also to purchase one two-phase, 2300-volt generator and engine to drive same of 150 hp, either tandem compound or four-valve, and exciter for above unit; about 25 35-ft. poles, transformers of about 25 kva, one oil switch (2300 volts), four two-phase meters, 8000 ft. No. 10 wire, 8000 ft. No. 6 wire, 6000 ft. No. 8 wire and 200 60-watt incandescent street lamps. A. H. Meyer is superintendent.

PIPESTONE, MINN.—Within the next four months the Pipestone El. Lt., Ht. & Pwr. Co. will install a 125-kva, 2200-volt generator to be directly connected to a Fitchburg engine already installed; also to purchase within the next three months 20 standards for ornamental five-lamp clusters. J. W. Campbell, Jr., is manager.

STARBUCK, MINN.—The Board of Water and Light Commissioners expects to purchase within the next three months lightning arresters, wire, meters and time switches; also within the next two months to purchase electrical appliances, including heating and cooking apparatus, vacuum cleaners, washing machines, irons, etc. Early next year the system will be changed from direct-current to alternating-current and a 24-hour service established by Feb. 1, 1914. Electricity for operating the plant will be purchased from the Glenwood Lt. & Pwr. Co., of Glenwood. The local plant will be held for use in case of emergency. A. H. [illegible] is manager.

WELLS, MINN.—The Wells Water, Light, Power and Building Commission may possibly purchase material for an ornamental street-lighting system within the next 12 months. J. A. Culshaw is secretary and superintendent.

WESTBROOK, MINN.—The installation of an electric-light plant in Westbrook is under consideration. The Commercial Club is interested.

WORTHINGTON, MINN.—Within the next 30 days the Board of Light and Water Commissioners expects to erect 2 miles of two-phase, 60-cycle, 2300-volt transmission line and within the next 12 months to purchase one 250-hp generating unit complete, one switchboard panel and quite a large quantity of material for distribution system, including transformers, poles, transmission towers, lightning arresters, insulators, distribution cable, wire, meters, etc.; also expects to purchase soon a coal and ash-handling system. W. H. Buchan is city clerk.

FOREST CITY, IA.—The Forest City El. Lt. & Pwr. Co. is erecting a new power house and has purchased one 125-kva generator, one 14-in. by 36-in. Corliss engine and a new boiler. A steam separator will be needed for engine, which has not yet been purchased. Within the next 10 months the company expects to purchase transformers, lightning arresters, wire and meters. Frank Kellogg is manager.

GLIDDEN, IA.—The town of Glidden has purchased and expects to install within the next 30 days one 100-kva alternator and four-valve engine (directly connected), and one switchboard panel for above in the municipal electric-light plant. Samuel C. Johnston is manager.

MASON CITY, IA.—The central station of the People's Gas & El. Co., of Mason City, is being entirely rebuilt (the output being more than doubled), including the installation of 1000 hp in boilers and a 2000-kw steam turbine. The reconstruction work is being carried out under the supervision of B. J. Denman, assistant general manager of the United Lt. & Rys. Co., of Davenport, Ia. M. Anderson is general manager of the People's Gas & El. Co.

MUSCATINE, IA.—The City Council has engaged Prof. J. B. Hill, of Iowa City, to investigate the feasibility of establishing a municipal electric-light plant in Muscatine.

OTTUMWA, IA.—The Water Works trustees have submitted a report to the City Council recommending an issue of $125,000 in bonds for the construction of a concrete dam across Des Moines River to develop power to generate electricity for lighting the streets and parks of the city. It is estimated that 475 hp can be developed.

WAPELLO, IA.—The Burlington Ry. & Lt. Co., of Burlington, has been granted a 25-year franchise to install and operate an electric-light system in Wapello. Under the new franchise the company must install a new street-lighting system and establish a 24-hour service within 90 days.

WASHINGTON, IA.—Within the next three months the Iowa Gas & El. Co., of Washington, expects to purchase a carload of poles; also meters and transformers, electrical appliances and supplies as needed. H. F. Darbyshire is manager.

CAPE GIRARDEAU, MO.—Franchises granted the Missouri Public Utilities Co. by the City Council for water, light and power service and a contract between the city and the company for public water service for lighting the city were ratified by the voters at an election held recently. Under the new franchises the company will have to make improvements and extensions to its plant involving an expenditure of $100,000 within the next six months. The company will purchase the street railway and build an interurban railway to several outlying towns.

JEFFERSON, MO.—The Public Service Commission has granted the Jefferson City Lt., Ht. & Pwr. Co. permission to purchase the property [illegible] issued by the commission granting the purchasing company permission to issue $1,000,000 in bonds for improvements and extensions. The present plans provide for the development of a system of electric railways in the central part of the State, to be followed by an electric trunk line connecting St. Louis and Kansas City. Lawson S. Price is president of the Bridge & Transit Co.

KING CITY, MO.—The King City El. & Mfg. Co. expects to purchase within the next 30 days a 30-kw or 37½-kw, three-phase, 60-cycle, 2300-volt generator, 3-kw exciter and tungsten lamps. Harry V. Forest is secretary and manager.

MARSHALL, MO.—The proposal to issue $70,000 in bonds for a municipal electric-light plant was defeated by nine votes, two-thirds being necessary. It is expected that another election will be called at an early date.

OZARK, MO.—The Wtr. Pr. Lt. Co., of Ozark, expects to purchase within the next six months one 100-hp, 25-cycle, 2200-volt, slow-speed motor and possibly a 75-kw, 60-cycle, 2300-volt generator. S. E. Bronson is manager.

PARIS, MO.—The town of Paris expects to purchase within the next six to 12 months two 56-in. by 16-ft. return tubular boilers for the municipal electric-light plant; also probably another direct-connected generating unit of from 75 kw to 100 kw. George C. Blakey is superintendent.

PLATTE CITY, MO.—The Platte City El. Lt. & Pwr. Co. expects to erect within the next three months one 5-ton ice machine, belt-driven, with 40 tons storage capacity; also to purchase one 60-hp boiler complete. Smith Clemmings is proprietor and manager.

RUGBY, N. D.—The Northern Tel. Co., of Minot, expects to overhaul its distribution system in Rugby this winter. C. H. Coas, of Minot, is general superintendent.

HOWARD, S. D.—The Miner County Milling & Ltg. Co., of Howard, expects soon to erect an addition to its power house to provide space for a new engine and generator soon to be purchased. The company may also purchase a condenser, depending upon the type of engine purchased. C. A. Laarson is manager.

LENNOX, S. D.—The City Council has granted H. B. Fairland and T. K. Coles a franchise to construct and operate an electric-light plant in Lennox for a period of 20 years.

PIERCE, NEB.—Within the next 30 days the Pierce Milling Co. expects to erect a new 150-kva, 60-cycle generator, replacing the 133-cycle generator now in use. This generator will be driven by water-power and a 100-hp (type T. H.) La Vergne oil engine already installed. The new flour mill of the company will be driven by electricity, and a day service will be established in this city. F. Rainbow is manager.

UNIVERSITY PLACE, NEB.—Within the next six months the Electric Light and Water Commissioners expect to purchase one deep-well pump (having a capacity of 150 gal. per minute) for the water department, one carload of poles and underground conduit, and several lamp-posts for curb street lighting. F. Harbican is manager.

ATCHISON, KAN.—The McKinley Syndicate, it is reported, is contemplating the construction of a large power plant in Atchison within the next year, to cost about $250,000. Options, it is said, have been taken on several sites. It is proposed to install a power plant to furnish electricity for Atchison, Topeka, Leavenworth and other nearby towns. H. E. Chubbuck, of Peoria, Ill., is general manager.

CLAY CENTER, KAN.—The city of Clay Center expects to install a 250-hp open-feed water heater in the municipal electric-light plant within the next two months. C. F. Rasmussen is superintendent.

LYNDON, KAN.—Within the next two months the Osage County Lt. & Pwr. Co. will erect 10 miles of single-phase, 6600-volt transmission line. T. L. Hussey, of Lyndon, is secretary.

LYNDON, KAN.—The Electric Light Commission expects to purchase within the next two months one oil switch, one circuit-breaker, one voltmeter, one ammeter (2200 volts, single-phase), one 20-kw meter and one switchboard panel (24 in. by 54 in.). Roy W. Wright is superintendent.

NEODESHA, KAN.—The managers of the municipal electric-light plant and water-works system expect to purchase on Jan. 5 one 200-kw, three-phase, 60-cycle, 2300-volt engine-type alternator, with exciter and engine, and one switchboard panel for above generator. Charles M. Kimball is superintendent.

PRATT, KAN.—The Pratt Ice & Lt. Co. is contemplating extending its transmission lines to adjoining towns and to the farming districts surrounding Pratt. If the lines are extended, it will be necessary to enlarge the plant to furnish the additional service.

## Southern States

CLINTON, N. C.—Within the next 12 months the Sampson Pwr. Co., of Clinton, expects to purchase an engine and generator and auxiliaries, including transformers, poles, meters, incandescent lamps, etc.; also some cooking apparatus, vacuum cleaners, etc. G. E. Petty is secretary and treasurer.

GREENVILLE, N. C.—Within the next six months the Water and Light Commission expects to install one 500-kw steam turbine or engine [illegible] and exciter and condenser [illegible] to purchase [illegible]

250-hp water-tube boilers, 175-lb. working pressure; one three-stage pump, having a capacity of 1000 gal. per minute, directly connected to a three-phase, 2300-volt motor. H. L. Allen is superintendent.

STATESVILLE, N. C.—The City Electric Light and Power Department expects to erect, within the next six months, about 2 miles of three-phase, 2300-volt transmission line. J. D. Cochrane is superintendent.

ATLANTA, GA.—Bids will be received by the Commissioners of Fulton County, Fulton County Court House, Atlanta, until Jan. 20, 1914 (extension of date from Dec. 20, 1913), for furnishing steel filing devices and equipment, wood furniture and lighting fixtures with lamps for installation. Plans and specifications and other information may be obtained at the office of A. Ten Eyck Brown and Morgan & Dillon, Forsyth Building, Atlanta, Ga., upon a deposit of $20 for each item. H. M. Wood is clerk.

LAWRENCEVILLE, GA.—The city of Lawrenceville has contracted with the J. B. McCrary Co., of Atlanta, to furnish electricity from a large hydroelectric power plant in Anniston, Ga. The work will include the construction of dam, power house, installation of waterwheels and generator, and switchboard; also the erection of a transmission line 30 miles long, passing through the towns of Logansville, Grayson and Snellville. Edward Tarpley is superintendent.

McDONOUGH, GA.—Within the next six months J. G. Smith, owner of the local electric-light plant, contemplates the erection of 1 mile of distribution line and installing electrically driven pumps for water-supply service. Mr. Smith is installing a new street-lighting system, consisting of 44 series tungsten lamps.

SAVANNAH, GA.—Plans are being prepared by local architects for remodeling a three-story building at 110-112 State Street West for a power plant and office building for the Savannah Ltg. Co.

TALLAHASSEE, FLA.—The Board of Public Works is extending the distribution lines of the municipal electric-light plant to parts of the city now without electrical service. D. R. Swing is superintendent.

WINTER GARDEN, FLA.—The Winter Garden Lt. & Wtr. Co. is now erecting a three-phase transmission line connecting with the town of Ocoee (2½ miles long) for the purpose of furnishing electricity for lamps and motors. M. L. Calvin is secretary and treasurer.

ZOLFO, FLA.—A committee has been appointed by the Zolfo Board of Trade to investigate the feasibility of installing an electric-lighting system in Zolfo. The committee will ask the Wauchula Mfg. Co. to submit an estimate on extending a transmission line here to furnish electrical service in this town.

OPELIKA, ALA.—The managers of the municipal electric-light plant have recently purchased one 225-hp Ball engine and one 150-kw Fort Wayne (Wood system), generator. Charles Shaefer is superintendent.

TUPELO, MISS.—The city of Tupelo expects to purchase within the next six months one new boiler. E. R. Chisholm is superintendent.

ARKADELPHIA, ARK.—The property of the Arkadelphia El. Lt. and Wtr. Companies has been purchased by H. C. Couch, of Little Rock, and associates. The new owners, it is understood, will expend from $10,000 to $15,000 for improvements to the water and light systems.

RUSSELLVILLE, ARK.—The Russellville Wtr. & Lt. Co. expects to erect within the next 12 months steel towers to carry transmission lines across the Arkansas River (span 200 ft.); also to purchase within the next six months a 350-kw to 400-kw, three-phase, 2300-volt generator directly connected to engine. Arthur E. Hecker is manager.

WOMBLE, ARK.—The town of Womble is contemplating the installation of a water-works system, the water to be secured from Caddo River. The development of the water-power of Caddo River is under consideration and an electric-lighting system may be installed.

CROWLEY, LA.—The City Council, it is reported, has ordered a 300-hp engine and a 200-kw generator (to cost about $18,500) for the municipal electric-light plant. Other improvements to the plant are under consideration.

NATCHITOCHES, LA.—Within the next 12 months the managers of the municipal electric-light plant expect to purchase one 50-kw generator directly connected to steam engine, 50 hp in motors and appliances for line. Walter E. Aymond is superintendent.

BARTLESVILLE, OKLA.—The Bartlesville Gas, El. & Ry. Co. expects to erect within the next 30 days a 2300-volt transmission line from Bartlesville to Dewey, a distance of 4½ miles. L. G. Coleman is general manager.

GRANDFIELD, OKLA.—The Southern Oklahoma Lt. & Pwr. Co., of Grandfield, is installing an electric-light plant to furnish electrical service here. The equipment will include one 40-hp Muncie crude-oil engine and one 30-kw, three-phase, 60-cycle Western Electric generator and switchboard. The street-lighting system will consist of 47 tungsten lamps. The company is doing the work. Lee E. Edwards is engineer and J. A. Brabham general manager.

BROWNWOOD, TEX.—Plans are being considered for the installation of a large power plant in Brownwood. The company contemplates the erection of a number of arc lamps.

FARMERSVILLE, TEX.—The Farmersville Mill & Lt. Co. has recently purchased and is now installing new boilers, an engine and a 60-cycle generator. When the installation is completed the old equipment will be discarded. J. B. Honoker is superintendent.

MISSION, TEX.—The city of Mission would like to receive from reliable parties or firms proposals for the installation of an electric-light plant and water-works system in the city, for which a liberal franchise will be given. For further information address S. A. Pipes, secretary and treasurer of Chamber of Commerce.

TERRELL, TEX.—The city of Terrell has recently purchased two switchboard panels, voltage regulators, tub transformer and 36 cast-iron posts for street lamps. E. V. Miller is city secretary and Samuel Krebs is superintendent.

## Pacific States

SPOKANE, WASH.—The contract for installing an ornamental lighting system on Riverside Avenue has been awarded to the Washington Wtr. Pwr. Co., at $25,500. C. M. Fassett is commissioner of public utilities.

TACOMA, WASH.—E. F. Gregory and others, of Tacoma, are contemplating the construction of an electric-power plant on Clover Creek for the purpose of furnishing electricity to a truck-gardening district about half a mile from the city limits. Application has been made to the Commissioners of Pierce County for a franchise to erect a transmission line to the colony.

CLATSOP, ORE.—The City Council has granted the Seaside Pwr. & Lt. Co., of Seaside, a franchise to extend its transmission lines into this city to furnish electrical service here. Post office address, Seaside, R. F. D. Gearhart.

DURHAM, CAL.—The Durham Lt. & Pwr. Co. expects to purchase within the 12 months transformers, 2200/110/220 volt, 6600/110/220 volt, 100 poles and No. 6 copper wire; also flatirons, toasters, etc. J. A. Foster is manager.

FRESNO, CAL.—Estimates are being prepared for the Board of Trustees of the cost of installing ornamental lamps on Tulare, K, Merced and other streets in Fresno.

LOS ANGELES, CAL.—The City Council has authorized the city engineer to prepare plans for an ornamental lighting-system on Wilshire Boulevard, from Parkview to the west city limits.

RIVERSIDE, CAL.—The Nevada-California Pwr. Co., First National Bank Building, Riverside, expects to build within the next 12 months one 10,000-kva hydroelectric power plant, four substations, aggregating 4000 kva, 150 miles of 60,000-volt transmission line; also to purchase two 5000-kva, three-phase generators, two 6000-hp waterwheels, two 150-kw exciters, two waterwheel governors, two 87,000-volt lightning arresters, four 33,000-volt arresters, one six-panel switchboard and miscellaneous equipment; also four 3350-kva, 87,000/2200-volt step-up transformers, 4000 kva in 33,000/2200 transformers, 1000 kva in 2200/110/2200-volt transformers, miscellaneous sizes, six tub transformers with brackets, lamps, etc., for series incandescent systems. The company also expects to purchase within the next 12 months electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, switches, etc., amounting to approximately $20,000. C. O. Poole is chief engineer.

SAN DIEGO, CAL.—Within the next three months the San Diego Consol. Gas & El. Co. expects to purchase a 4000-kw turbo-generator set with necessary boilers. H. H. Jones is manager.

SAN FRANCISCO, CAL.—Plans have been prepared by Frederick H. Meyer, Bankers' Investment Building, San Francisco, for foundation work for a large power house for the Pacific Gas & El. Co., to be erected on Commercial Street, west of Montgomery Street.

VISALIA, CAL.—An announcement, it is reported, has been made that the Mount Whitney Pwr. & El. Co. will expend $1,600,000 within the next 14 months on improvements and extensions to its service. Work on the Wolverton dam, located back of the giant forest and power plant No. 5, will be rushed to completion and extensive improvements will also be made to the Visalia steam generating plant. New substations are to be erected at Woodville, Terra Bella, Goshen, Strathmore and Elimart, and the stations at Delano and Exeter will be enlarged. John C. Hays, of Visalia, is president and general manager.

MALAD CITY, IDAHO.—The Evans Lt. Co., of Malad City, expects to erect within the next 12 months a new power house and a pipe line 10,000 ft. long and to purchase two generators, waterwheel, exciters, switches, waterwheel governors, transformers, poles, etc. J. H. Campbell is manager.

EPHRAIM, UTAH.—The Electric Light Commission expects to purchase within the next 12 months 50 meters and material for reinforcing 100 poles. J. H. Jensen is city electrician.

SALT LAKE CITY, UTAH.—The Board of Education has decided to install an electric generating plant at each district school building.

GRAND JUNCTION, COL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 6, 1914, for construction, complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Grand Junction. Drawings and specifications may be obtained at the above office or from the office of the custodian of site at Grand Junction. O. Wenderoth is supervising architect.

LAS CRUCES, N. M.—Within the next 10 months the Las Cruces El. Lt. & Ice Co. expects to purchase a boiler having a rating of about 200-hp. (considering vertical water-tube type). D. W. Morgan is manager.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED NOV. 25, 1913

Procured by Kenyon Starr Allen, 16 Exchange Place, New York, N. Y.

1,079,332. ALTERNATE-CURRENT MOTOR; V. A. Fynn, London, Eng. App. filed June 12, 1911. Induction shields prevent any inductive transfer of energy between the end windings of the primary and secondary members.

1,079,341. METHOD OF STARTING ELECTRIC-LIGHTING APPARATUS; P. C. Hewitt, New York, N. Y. App. filed March 23, 1901. Produces an arc springing from one of the electrodes and causes the [illegible] to extend [illegible] a high-resistance conductor to the other electrode.

1,079,342. ELECTRIC GAS OR VAPOR LAMP; P. C. Hewitt, New York, and N. W. Rogers, Mount Vernon, N. Y. App. filed March 23, 1901. The main arc is started from a supplementary arc.

1,079,343. ELECTRIC LIGHTING; P. C. Hewitt, Ringwood Manor, N. J. App. filed April 5, 1900. Plurality of vapor electric devices operated in parallel; inductance used for starting.

1,079,344. ELECTRICAL PRODUCTION OF LIGHT; P. C. Hewitt, Ringwood Manor, N. J. App. filed April 29, 1899. Excess of accumulated mercury is returned to the lower electrode through a return tube separate from the vapor path.

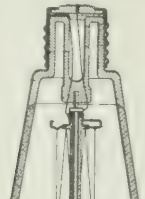
1,079,346. METHOD OF MAKING STORAGE-BATTERY ELECTRODES; H. C. Hubbell, Newark, N. J. App. filed Nov. 23, 1910. Electro-deposits nickel upon one side of a filament-shaped portion of nickel active material and masses together a plurality of the resulting filaments.

1,079,352. VACUUM-TIGHT SEAL; F. G. Keyes, Boston, Mass. App. filed March 6, 1913. Absorbing material embedded in a pulverulent material, interposed between the interior of the container and the metalic member.

1,079,377. METHOD OF PURIFYING AND STERILIZING LIQUID; G. W. Swinburne, East Orange, N. J. App. filed June 21, 1910. Frees chlorine and oxygen by electrolytic action.

1,079,379. OUTFIT FOR ALTERNATING-CURRENT VAPOR LAMPS; P. H. Thomas, Montclair, N. J. App. filed Sept. 27, 1905. Locates the ballast or other regulating device in the lead of one or more of the positive electrodes.

1,079,380. CIRCUIT INTERRUPTER; P. H. Thomas, Montclair, N. J. App. filed Dec. 24, 1906. Indentation in the cylindrical container divides the mercury into two parts upon rotation of the container about its axis.



[illegible] Lamp.

1,079,386. MOTOR CONTROLLER; T. E. Barnum, Milwaukee, Wis. App. filed May 13, 1909. An adjustable member on the controller arm determines the contact point at which the controller arm will stop.

1,079,389. ELECTRIC-RAILWAY TRUCK; W. L. Boyer, Kingston, N. Y. App. filed Jan. 25, 1913. Motor frame or casing serves in part as the truck frame.

1,079,400. CAR-LIGHTING SYSTEM; W. Cooper, Pittsburgh, Pa. App. filed Sept. 10, 1909. Electric car provided with a booster set to maintain constant the energy in the lighting circuit.

1,079,401. CAR-LIGHTING SYSTEM; W. Cooper, Pittsburgh, Pa. App. filed Oct. 13, 1909. A single dynamo-electric machine operates the air compressor and supplies lighting current.

1,079,407. AUTOMATIC WEIGHING DEVICE; J. Grimes, Los Angeles, Cal. App. filed Jan. 9, 1913. Has electromagnetically controlled feed gate.

1,079,408. TROLLEY GUARD; M. Guariglia, Morgantown, W. Va. App. filed Feb. 3, 1913. Arms normally closing the open side of the guard are retracted by tapering bars.

1,079,410. CIRCUIT-BREAKER; P. C. Hewitt, New York, N. Y. App. [illegible] Mercury [illegible].

1,079,413. IGNITION APPARATUS FOR HYDROCARBON ENGINES; R. Huff, Detroit, Mich. App. filed Dec. 22, 1906. Transformers in the battery and generator circuits and means for simultaneously adjusting the spark-control contacts for both the battery and generator.

1,079,427. APPARATUS FOR ELECTROPLATING PIPES; D. H. Murphy, Pittsburgh, Pa. App. filed July 8, 1912. Pipes are positively rolled through the plating solution.

1,079,428. APPARATUS FOR ELECTROPLATING PIPES; G. H. Murphy, Pittsburgh, Pa. App. filed May 9, 1913. Inflated compressible tube contacts the pipes and rolls the same.

1,079,445. SUPPORT FOR CONDUIT CABLES; E. H. Smith, Cleveland, Ohio. App. filed Feb. 24, 1913. Wall bracket carrying insulating cable-supporting rollers.

1,079,451. AUTOMATIC CAR-STOPPING DEVICE; J. S. Strickland and C. H. Beach, Tacoma, Wash. App. filed June 26, 1909. Magnetically operated trip device in the circuit of the danger signal.

1,079,467. SEARCH-CALL APPARATUS; A. F. Boardman, Arlington, Mass. App. filed Sept. 26, 1912. For sending distinctive signals simultaneously to a plurality of different signal devices for the purpose of locating a person desired, as in a factory.

1,079,480. MOTOR-CONTROL SYSTEM; J. Eaton, Schenectady, N. Y. App. filed Oct. 7, 1912. Motor brought to rest by dynamic braking and then started in opposite direction.

1,079,483. ELECTRICAL SIGN RECEPTACLE; E. H. Freeman, Trenton, N. J. App. filed May 17, 1913. Telescopic socket parts engaged in hole in the supporting element or "sign sheet."

1,079,502. DYNAMO-ELECTRIC MACHINE; W. Linke, Westend, and L. Dreyfus, Neider-Schönhausen, Germany. App. filed June 23, 1911. To render the phases symmetrical both in phase position and in magnitude.

1,079,526. TYPEWRITING MACHINE; C. H. Vogel, Vancouver, B. C., Canada. App. filed Aug. 22, 1910. Electromagnetically operated type bars.

1,079,532. ADJUSTABLE TIMING APPARATUS FOR ELECTRIC IGNITION SYSTEMS; A. Zahringer, Stuttgart, Germany. App. filed Aug. 1, 1912. Adjustable connection between the timing lever and the cam ring.

1,079,533. TELEPHONE SWITCHING SYSTEM; W. Aitken, Liverpool, England. App. filed June 9, 1913. Switch is held in operated position and is automatically restored to normal when the disconnect signal is given.

1,079,538. AUTOMATIC DISINFECTANT HOLDER FOR TELEPHONE MOUTHPIECES; A. B. Buckland, Rochester, N. Y. App. filed Feb. 24, 1913. Hollow antiseptic-containing ring removably clamped to mouthpiece.

1,079,554. BRUSH HOLDER FOR DYNAMO-ELECTRIC MACHINES; J. H. Holmes, Newcastle-Upon-Tyne, Eng. App. filed June 28, 1913. Feeds the brush in a rectilinear path and with substantially constant pressure.

1,079,588. ELECTRIC RETORT FURNACE; J. Bally, Grenoble, France. App. filed July 5, 1912. Parallel retorts grouped around a central space with an inductor rotating in said space.

1,079,601. WRAPPING AND UNWRAPPING MACHINE; C. Kuentzel, Akron, Ohio. App. filed Oct. 31, 1912. Particularly for wrapping and unwrapping tires for shipping purposes or for covering and uncovering wires and cables.

1,079,621. THERMO-ELECTRIC COUPLE; E. Weintraub, Lynn, Mass. App. filed Oct. 27, 1909. One element of the couple is fused boron.

1,079,629. RESISTANCE RING FOR ROTORS; J. M. Barr, Indianapolis, Ind. App. filed Dec. 6, 1912. An opening is provided to reveal the integral union of the conducting bar with the resistance ring of a squirrel-cage rotor.

1,079,649. ELECTRIC BELL; A. Jackson, Fruitvale, Cal. App. filed June 2, 1913. Magnets supported on standard with pivoted armature above and contact stop above that.

1,079,651. PLATFORM INDICATOR; C. J. Kintner, New York, N. Y. App. filed Feb. 14, 1913. Cars automatically close circuit for a "Watch your step" phonograph or lights beneath the edge of the station platform.

1,079,660. INCANDESCENT-ELECTRIC-LAMP SOCKET; E. A. Olley, Syracuse, N. Y. App. filed July 25, 1912. Base engages the rear side of a support, and the socket seated in the opening engages the front side of the support.

1,079,667. ELECTRIC FIRE-ALARM SYSTEM; J. G. Schlüchtner, Brooklyn, N. Y. App. filed Jan. 4, 1913. For indicating the location of the fire to a "central" point, such as underwriters' headquarters.

1,079,708. VAPOR-ELECTRIC LAMP; O. O. Kruh, Schenectady, N. Y. App. filed June 22, 1903. Impresses a high voltage upon a main electrode and one of the starting electrodes.

1,079,727. PROCESS FOR BLEACHING AND THICKENING OILS AND FATS; O. Scherieble, Esslingen, Germany. App. filed Feb. 14, 1913. Passes high-potential current through the oil in the presence of oxygen.

1,079,740. PULL-SOCKET SWITCH; F. Barr, New York, N. Y. App. filed July 20, 1911. Chain guide held in place without attachment to the switch block.

1,079,760. ANSWERING AND RECORDING TELEPHONE; C. J. Gustafson, Aberdeen, S. D. App. filed March 22, 1913. Phonograph records and reproduces the telephoned speech.

1,079,777. MANUFACTURE OF INCANDESCENT BODIES OF METALLIC TUNGSTEN OR MOLYBDENUM FOR ELECTRIC INCANDESCENT LAMPS; A. Lederer, Atzgersdorf, Vienna, Austria-Hungary. App. filed Aug. 25, 1906. Mixes powdered tungsten with amorphous sulphur, shapes by pressure and heats.

1,079,804. FILAMENT LAMP; M. Sidon, New York, N. Y. App. filed April 27, 1911. Bulb made in separable sections and filament frame removably engaged on a combined supporting and terminal rod.

1,079,851. CHANGEABLE SIGN; B. Fried, Budapest, Austria-Hungary. App. filed June 28, 1911. Monogram sign having flaps operated by selectively controlled solenoids.

1,079,895. ELECTRIC HEATER; I. F. Talbot, Boise, Idaho. App. filed Dec. 20, 1912. Heating element electrically connected with a transformer inclosed within a heat-transmitting medium.

1,079,926. ELECTRIC-VAPOR APPARATUS; C. O. Bastian, London, Eng. App. filed Dec. 19, 1905. Heat-dissipating capacity of the cathode chamber bears the same relation to the corresponding heat-dissipating capacity of the anode that the heat generated by one of said electrodes bears to that generated at the other.

# Electrical World

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**Anti-Trust Legislation**

The present unrest in business is plainly disconcerting to the administration at Washington. It is more disconcerting because of the disposition of the country to hold the party in power responsible for any reaction in business which follows tariff tinkering. President Wilson has an ambitious program of legislation and there are many about him to aid in promoting passage of the laws which they think the country needs. In the consideration of the pending currency measure there has been an evident disposition to disregard counsel from the bankers on the ground that they are too much concerned to give disinterested advice. It was not easy for bankers to get a hearing. The new Congress will have before it bills that are just as far-reaching in their effect on industries as currency legislation. Among the most important of these will be measures looking to the interpretation of the Sherman anti-trust law. It is expected that Mr. L. D. Brandeis and Mr. Samuel Untermyer will present their solutions of the problem and that the President's plan will be plainly earmarked so that the wishes of the administration may be clearly understood by all. It is equally important that industries affected by government legislation or agitation on this subject should have ample opportunity to present their views. It is a fundamental fact in our form of government that the governed have a voice here. In a matter so intimately affecting prosperity as will the proposed trust legislation the voice of all concerned should be sought and welcomed. The opinions of officials of manufacturing industries should be asked; but if they are not sought they should be advanced anyway through channels that are not closed to presentation of views on business when they come from the business men most vitally affected. The proponents of radical legislation will be on hand clamoring to be heard. The conservative business interests of the country should be equally insistent in favoring a course that will protect and promote legitimate industry.

**Expansion n Exports**

The returns of the Department of Commerce for September, 1913, bear evidence to the continued expansion in electrical export trade that is rather surprising for such a season of the year and at a time when business generally has been at a low ebb owing to tight money, political uncertainties, wars or rumors thereof, and the closing up of good markets, such as Mexico, by internal troubles. It appears that the total export of "electrical machinery," a grouping that includes a great deal of material for other articles than machinery—such as lamps and telephones—as no less than $2,254,254 for this September as compared with $1,852,400 in the same month of the previous year. This maintains previous gains, as the nine-month period in 1913 shows $21,203,489 as against $16,677,495 in 1912 and $14,162,107 in 1911. Just how all this exported material divides up it is hard to say, as out of the $21,000,000 about $12,000,000 is grouped as "all other," and there is now no indication in the returns as to where it goes. Moreover, some electrical apparatus or supplies are still excluded from this electrical class. But some data given are interesting, as, for example, the fact that 4877 fans were shipped away in September, or more than twice as many as went out a year ago. On the contrary, we exported in comparison fewer metal-filament and more carbon-filament lamps, which is curious, to say the least; and the total of the metal-filament lamps was only 85,954, valued at $20,235. When one looks at the enormous quantities of such lamps exported from some of the countries in Europe, he realizes that we are not yet "in it" in any kind of way worth mentioning, though the subject is certainly worth discussing, especially when it is noted that during the same month 645,082 metal-filament lamps were imported, or nearly twice as many as in September, 1913. That is a respectable figure, even if it does not represent a very large proportion of our consumption. Possibly 7,500,000 metal-filament lamps would be 15 or 20 per cent of those used annually in the United States. All of which makes us wonder as to why in the face of this we import so many, and why we cannot export more and import fewer.

**German Central-Station Enterprise**

Somehow it is hard for the American engineer fully to realize that he has not in effect a monopoly of huge central-station enterprises. Ours has been the country of great transmission systems and of colossal central stations to an extent that naturally overshadows a great deal that has been done elsewhere. Yet the brief account in our columns this week of a distributing plant in eastern Germany far over toward the Russian frontier and far off the beat of the tourist ought to awaken a sudden sense of appreciation. The interesting feature of the system is that it is a great network of underground cables supplied with energy from two large steam-driven stations, one of them already of 40,000-kw rating and the other of 25,000. In the principal plant, at Chorzow, there has just been installed a 20,000-kva horizontal turbo-alternator which is large even to the view of the most blasé central-station man, and another of these machines will be added to the equipment within the year. Energy is distributed at 6000 volts, with high-tension circuits wholly of underground cable, although the local secondary circuits are usually placed overhead.

In some of the larger industrial plants 6000-volt motors are in operation, receiving energy directly from the primary circuits, but the standard secondary pressures are 120 volts and 240 volts. The motor service of the system is on a very liberal scale. One rolling mill in the vicinity is equipped with six 2500-hp, three-phase motors, for example, and others are not far behind. The total output of the Silesian company's system for 1912 rose to 126,000,000 kw-hr., certainly a figure to command respect in a territory where there are no cities of the first rank. It would be extremely interesting to know the economic side of this 6000-volt underground distribution, the methods of construction used and the continuity of service obtained. In American practice for such service use would generally be made of a much higher voltage applied to overhead circuits, but there are not a few engineers who believe that with suitable precautions the underground service is more reliable. To these the Silesian system should be an object lesson worthy of further investigation.

## British Municipal Undertakings

A correspondent in our columns this week discusses once more the much-mooted question of the central-station and railway enterprises carried on by municipalities in England. As everybody knows, there has been a tremendous lot of humbug about municipal enterprises both in America and England. Here a few municipal plants have succeeded, but many of them are merely unpleasant reminiscences. For a long time it was popularly believed that the British enterprises were much better managed and led to highly satisfactory results. That they have been better administered in the sense of being on the whole better able to keep predaceous politics out of the game there is little reason to doubt, yet, as our correspondent makes painfully evident, there is something to be said as to municipal methods which is not exactly complimentary. Our correspondent particularly points out that, as time has gone on, depreciation has become more and more a matter seriously to be reckoned with, and that adequate provision for this has, in some cases at least, not been made. The investigation carried out a few years ago in behalf of American interests brought out this fact in a very striking manner, and the result of a decade of experience has on the whole been to reduce the enthusiasm for municipal enterprises in Great Britain. Yet there is no discounting the fact that while municipal enterprises are, as our correspondent shows, somewhat handicapped, in the freedom with which they can go about their business, by parliamentary requirements, they have yet been able, not always but frequently, to make a good showing for economy of operation.

In this connection it should be noted that British municipal plants not only have to pay interest on their indebtedness but universally maintain a sinking fund for the repayment of loans that stand against the property. In other words, they are proceeding to put themselves in a position where they are able to write off the investment as the securities mature, and they very generally show over all of this a surplus which can be put to such use as the municipality sees fit. Similar private enterprises in this country, as everybody knows, usually do not maintain a sinking fund for that or any other purpose, and the accrued profits of the British enterprises which may be set off against depreciation are not to be despised. Perhaps, the British municipal plant is quite as scrupulous in charging off depreciation as is the ordinary privately owned central station in this country. If private plants had to make rigorous provision for taking care of their bonded indebtedness by a sinking fund instead of going on in the cheerful hope of increasing the bond issue when depreciation looms large, fewer plants than now would show comfortable profits for the stockholders. But, with all this, we are far from believing that municipal plants here are to be advised or fostered.

## Roentgen-Ray Interference Phenomena

A salient phenomenon of wave motion is periodicity, or rhythmic repetition. It is possible, of course, to have a single wave, solitary and lonesome, like the sound-wave in air produced by striking an anvil once, and once only, with a hammer. But in the ordinary self-regulation of natural phenomena wave groups and wave trains are more frequent than single waves. Waves seem to prefer the company of their fellows and, like sorrows, come not as single spies but in battalions. This rhythmic characteristic quality of wave motion manifests itself both in time and in space. The former gives rise to the concepts of wave period and wave frequency, the latter to the concept of wave length.

One of the prominent features of wave length is that, with the aid of any source of phase difference, such as reflection from a barrier, waves of different phase, steadily arriving at a point, can be made to interfere. If we excite a tuning fork and rotate it slowly about a vertical axis of symmetry near one ear, a position can ordinarily be found at which the sound disappears, because the waves reaching the tympanum from one prong are in opposite phase to those coming from the other.

The capability of producing interference as above outlined becomes a critical test of the existence of wave motion. Thus incident light has been believed to be due to and transmitted by, a wave motion, ever since Young and Fresnel first discovered the phenomenon of interference between rays of light. Prior to that discovery, light was supposed to be a direct emanation. If the corpuscular theory of light is ever revived, an explanation must needs be given by it for the accompanying wave motion.

When Roentgen rays were discovered various attempts were made, without success, to obtain experimental evidence of interference with them. It was then supposed that they were transmitted by wave motion, but that the waves were not rhythmic. Not following in orderly procession they failed to show interference. Thus sound waves carrying pure musical notes can be made to reveal interference phenomena. But sound waves carrying pure noise, or non-rhythmic acoustic disturbances, baffle attempts to reveal interference. Interference is a by-product of orderly succession and of serried ranks. It will not consort with rabble.

Quite recently, however, careful experiments in Europe have led to the discovery of interference phenomena in

Roentgen rays, so that our ideas concerning them have to be modified. It now seems that they are periodic and are not merely isolated pulses of ultra-ultra-violet light. Only their frequency is yet more bewildering to the quantitative imagination than that of light. The frequency of mid-spectrum visible light is apparently about six hundred millions of millions per second, so that if we represent the millionth of a meter by the symbol μ, the mid-wave length of visible light is about 0.5μ. But, judging from the new interference phenomena of X-rays, the frequency of these rays is perhaps fifty thousand times as great as the above, or about thirty millions of millions of millions per second. If we use another μ to represent another millionth subdivision of a meter, so that 1μμ shall represent the millionth of a millionth of a meter, then the X-ray wave length comes out about 10μμ.

The interference phenomena produced have been revealed photographically both by filtering Roentgen rays through thin sheets of crystalline substance and by reflecting them from crystalline surfaces. Some of the photographs thus secured are of great beauty and interest. They bear promise of leading eventually to an unraveling of the mystery of molecular structure in crystals, but the experimental and mathematical difficulties in the path of this inquiry are numerous. The experiments are described in the papers and discussions of the eighty-fifth Natural Science Convention of Europe, which was held in Vienna last September, as published in the *Physikalische Zeitschrift* of Nov. 15, 1913.

## Where Holding Companies May Lead

As recent financial conditions have resulted in a cessation in the growth of holding companies, now is a good time to consider the directions which this movement may take. That the movement will be started again when the money market favors the use of capital for such purposes is warranted prophecy. The opportunities for economy in consolidated operation are too inviting to be ignored. It is, therefore, reasonable to assume that representatives of large holding interests are studying independent properties in order to be ready to make purchases when the money and securities markets are in the psychological state necessary for the flotation of stocks and bonds. The strength of the holding company movement lies in the promise of securing better and more economical results from a group of operating companies than those properties can give if operated as individual units. The weakness lies in the temptation to use these undeniable operating advantages as a cloak to cover the issuance of more securities than the properties should be required to support. The dangers of the movement should be clearly understood, because to understand them means to realize that there is a responsibility for the avoidance of them that no syndicate can refuse to accept. These dangers are not materially different in kind from those that exist in individual central stations, but they are different in degree. As there is opportunity for defects in service and for losses due to improper financing in small plants, so there is the same opportunity for these fundamental errors, but in a scale involving widespread disaster, in aggregations of plants. Likewise, where there is a chance for small profit on a small plant there is a correspondingly increased chance for a large profit in many plants combined, and this is further increased by the benefits of consolidation.

The basis of the holding company's excuse for existence is the individual operating plant. A single plant may be subjected to just as much mismanagement in the hands of local capitalists as in the more remote hands of a central holding company. In either case the business may be exploited unwisely and unduly. The apparent profits reported may be inconsistent with the amount of business done. If so, examination may show that they are made up in part of sums which should have been applied to maintenance and that if full allowance were made for maintenance the operating surplus would be greatly reduced. Because of the greater experience which it has with the life of physical property and with market prices of materials, the holding company should be better able to determine a fair ratio for operating expenses than the single plant. If, in spite of its knowledge, it deducts from income a sum for operating expenses that is insufficient to care for all elements of maintenance, it may present an unreal surplus. If the impropriety of such a surplus is disregarded, it appears to be available for distribution. We think, however, that there is fully as much opening for the misuse of surplus in the independent company as in the syndicate-controlled company. In both cases the payment of dividends based on an improperly determined book surplus gives a fictitious value to the capital stock on which the dividends are declared. The management of a small company which has been guilty of this policy may plead, sometimes truthfully, that it was ignorant and did not know its error. The holding company is not entitled to make such a plea. It ought to be scrupulously exact in its calculations of profits. Because it is, in effect, an "absentee landlord" and may at some time be forced to incur the public feeling that might develop where that relation exists, it ought to be even more careful in the financial policy of its subsidiaries than the home directorate of an independent company would be under the same circumstances.

We are aware that these matters have not always received consideration in the development of systems of holding companies. We appreciate the fact that the physical success of some of the large consolidations necessarily comes, if it comes at all, from the complete destruction of existing inadequate plants and the use of modern apparatus and methods to take their places. Such improvements, however, should not obscure the issues. The capital accounts should be protected and the revenues should not be required to meet dividends on unjustifiable capitalization. If the holding company is made an agency for the exploitation of properties and the sale of more securities than are warranted by the value and business of its underlying operating properties, it will do the industry more harm than good and its end should be decreed. If, however, it is an agency for the proper economical management of groups of plants on a closer basis than they can be operated separately and its practices technically and financially are sound, it will be a great and welcome factor in the sure development of the industry.

# The News of the Week

**Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.**

## Congress Passes Hetch-Hetchy Bill

The Raker bill, giving the city of San Francisco water supply and power rights in the Hetch-Hetchy Valley of the Tuolumne River, Yosemite National Park, was passed by the Senate on Dec. 6 at midnight. The bill had previously passed the House of Representatives in identically the same form and is now in the hands of the President. San Francisco receives its water supply from a private water company, and if the Raker bill is signed by the President it will enjoy unlimited pure water owned by the city and brought from the Yosemite, 142 miles away. The Hetch-Hetchy project will also enable the hydroelectric generation of 300,000 hp. Wide opposition to the measure has been manifested.

## Co-operation with Electric Garage Owners

A joint meeting of the Chicago Section of the Electric Vehicle Association and the Chicago Garage Owners' Association was held on Dec. 2. There was considerable discussion relating to co-operation between the electric-vehicle men and the garage owners, and a resolution offered by Mr. W. J. McDowell, secretary of the Chicago Section of the Electric Vehicle Association, was adopted. This resolution recites that the Chicago Section of the Electric Vehicle Association approves the excellent work done by the Chicago Garage Owners' Association in bettering garage conditions in Chicago and affirms further that the Chicago Section does not hold itself responsible for statements made at its meetings.

## Safety Conference in New York

The first annual conference of the American Museum of Safety, which is being held in connection with the International Exposition of Safety and Sanitation, began Wednesday in the Chemists' Club, New York City. Mayor Kline was unable to be present to preside, and Mr. George McAneny, president of the borough of Manhattan, took the Mayor's place and delivered an address. Dr. William H. Tolman, director of the American Museum of Safety, delivered an illustrated lecture on "Safer Shops." He had thrown on the screen pictures of industrial conditions in Europe and America.

Mr. Arthur Williams, president of the Museum of Safety, succeeded Borough President McAneny as chairman of the meeting. He presented the next speakers, Messrs. Don C. Seitz, of the New York *World;* J. F. Conner, assistant manager claim department United Gas Improvement Company; Mrs. Florence Kelley, secretary of the National Consumers' League; H. F. J. Porter, and others. The morning session closed with motion pictures from the Bureau of Mines, showing methods of rescue work. The slides were explained by Mr. J. R. Fleming.

Dr. Charles A. Doremus was chairman at the afternoon session on Wednesday, when the general subject "Accident Prevention and the Public" was discussed. Mr. R. H. Newbern, superintendent insurance department Pennsylvania Railroad, was the first speaker, and he was followed by Dr. William O'Neill Sherman, chief surgeon Carnegie Steel Company, who talked on "Care of Injured Employees."

Dr. Lucian W. Chaney, of the Bureau of Labor Statistics, Department of Labor, spoke on the subject of "Taking Chances."

Mrs. Rose Pastor Stokes, known as a social worker, speaking of the movement for safety on the part of the great industrial corporations, said the greatest danger lies in the measure of speed with which desired ends are attained. What is called "industrial efficiency" is merely speeding up to rapidity and accuracy at such a pace that those affected are not able to endure it for many years.

Other speakers at Wednesday's session were Messrs. Marcus A. Dow, general safety agent of the New York Central Lines; James O. Fagan and Edward Bunnell Phelps. Following the addresses, Dr. Richard Kearney exhibited lantern slides showing public-health service.

The conference was continued through Thursday and Friday and ended with a dinner and presentation of medals at the Waldorf-Astoria on Friday night.

## Report of Attorney-General McReynolds

Attorney-General McReynolds, in his annual report to Congress, says that violations of the anti-trust law are being reported constantly and that an organization is being perfected through which substantial complaints may be investigated promptly and violations of the act dealt with speedily and vigorously.

There are now pending forty-nine cases under the Sherman law, thirty-seven civil and twelve criminal. Of these six were brought under the present administration.

The Attorney-General declares his adherence to the principle laid down in the Union Pacific Railroad case to the effect that the separate parts of an unlawful combination must not be allowed to remain under the control of the same set of men.

## Meeting of Executive Committee of Commercial Section, N. E. L. A.

The executive committee of the Commercial Section of the National Electric Light Association met in the main building of the National Electric Lamp Association at Nela Park, Cleveland, on Monday of this week. Reports were received from committees on electric merchandising and advertising, development of non-peak load, wiring of existing buildings, membership, education and publications. The detailed report of the latter committee showed that during the month of November the Commercial Section disposed of the largest number of publications. According to the report of the membership committee, more than 100 applications have been received since the last meeting in October. Chairman T. I. Jones appointed a committee from the Commercial Section to act jointly with the lamp committee appointed by President McCall of the parent body to draw up a report to be read at the commercial session on the development and use of incandescent lamps as viewed from an executive and commercial standpoint, together with a report on the results of the companies' policy in placing on a free-renewal basis tungsten lamps of 100 watts rating and over.

The new constitution of the Commercial Section was approved at the Cleveland meeting. It was announced that the revised Electric Salesman's Handbook will be issued shortly after the first of January and will contain data on 1000 installations. Through the courtesy of the General Electric Company, a complete directory of all members of the Commercial Section will be issued shortly. The committee was entertained at luncheon by the National Electric Lamp Association.

## Brooklyn Edison Company to Continue Profit-Sharing

At a meeting of the Brooklyn Company Section of the National Electric Light Association on Dec. 9 Vice-president and General Manager W. F. Wells, of the Edison Electric Illuminating Company of Brooklyn, announced that the directors of the company at their last meeting had voted to continue for the present year the policy of profit-sharing which had been in force for three years previous. This involves the distribution among over 900 employees of approximately $60,000. The profit-sharing is made on a basis of years of service, the employee who has been with the company two years receiving 2 per cent of his annual salary and the employee of five years or more 8 per cent, with varying percentages between. This year more than 400 employees will receive 8 per cent on their salaries.

Much of the employees' profit shares of previous years is invested in the Edison investment fund, conducted by the company without any administrative charges, and it has been paying employees 6 per cent compounded quarterly. This fund, with the profit-sharing of 1913 added, will exceed $300,000, the property of approximately 1100 employees.

The speaker at the meeting Tuesday night was Mr. Andrew McLean, editor of the *Citizen*. Mr. McLean gave an address on "Relations Between Employee and Employer, Between Capital and Labor, from Historic, Economic and Social Viewpoints." His address delighted the 500 members of the section present and at its close he received a rousing vote of thanks.

## Meeting of the Alabama Light and Traction Association

The annual meeting of the Alabama Light and Traction Association was held on Nov. 21, 1913, at the office of the Mobile Gas Company. Mr. R. L. Ellis, manager of the Selma Lighting Company, was elected president of the association; Mr. T. K. Jackson, manager of the Mobile Electric Company, was elected vice-president, and Mr. H. O. Hanson, assistant manager of the Mobile Gas Company, was re-elected secretary and treasurer. The names of the members of the executive committee of the association elected at the meeting follow: Messrs. A. H. Ford, manager of the Birmingham Railway, Light & Power Company; C. C. Henderson, the former president of the association; C. E. White, manager of the Montgomery Light & Water Power Company; R. L. Rand, manager of the Anniston Electric & Gas Company, and A. R. Smith, general manager of the Demopolis Electric Light & Power Company.

The session of the association was concluded with a banquet on the evening of Nov. 21 in the Cawthorn Vineyard, tendered to the delegates by the officers of the Mobile Electric Company and the Mobile Gas Company. After the address of Mr. C. C. Henderson, of the Henderson Light & Power Company of Greenville, president of the association, Mr. R. H. Smith, manager of the Greensboro Water & Light Company, read a paper on "The Operation of a Power Plant in a Small Town." Mr. T. K. Jackson introduced the subject of "Some Pertinent and Impertinent Questions." Mr. R. L. Ellis read a paper on "The Oil Game."

## New York Electrical Credit Men Hold Annual Meeting

The annual meeting and banquet of the New York Electrical Credit Association was held on the evening of Dec. 9 at Fraunces' Tavern, New York. There were ninety-five present at the meeting, which proved enjoyable and helpful. Mr. N. S. Colby, president of the American Ever Ready Company and retiring president of the association, was chairman of the meeting and Mr. F. E. Wurzbach acted as toastmaster. The program included addresses by Messrs. J. H. Tregoe, secretary of the National Association of Credit Managers; C. M. Wilkins, president of the National Electric Credit Association; W. E. Rice, credit manager of the Western Electric Company, and Franz Nielson, secretary of the association. At the business session Mr. J. H. Dale was elected to the board of managers and Messrs. J. W. Smith, of the General Electric Company, and James Goldmark were chosen for vacancies in the board of directors. The officers elected for the ensuing year were Messrs. W. F. Irish, president; G. E. Chapin, vice-president, and Franz Nielson, secretary and treasurer.

Since its inauguration this association has given warnings to its members of 10,500 persons who have proved unworthy of credit or delinquent regarding the settlement of bills or disputes of a commercial nature. During the past year the association has handled for its members 3066 accounts, involving $331,383, and has secured adjustments in the case of 2887 of these accounts, representing $250,367.

## Public Utility Regulation

Mr. John M. Eshleman, president of the Railroad Commission of California, in an address before the California Bar Association at Los Angeles recently laid down the following principles on public utility regulation, which, coming from such an authoritative source, and in view of the renewed general interest in public utility legislation, are worthy of close consideration:

"All men should have the right to the acquirement at least of the necessities on reasonable terms, and no man shall be permitted to indulge his selfish inclination to get as much as he can for his commodity or his service in such a manner as to deprive his fellow of the opportunity to get the necessities of life on reasonable terms.

"Monopoly in some form is essential to constitute an agency or a public utility.

"Agencies become public utilities independent of a desire of the owners of such agencies and irrespective of any voluntary devotion of their property to public use.

"Owners of public utility property hold such property by a tenure different from that of other owners.

"The amount of money wisely invested in a public utility property is the best evidence of value for rate-fixing purposes and is the controlling element in determining the amount on which a utility should be permitted to earn.

"If we put a restriction upon public utility business and clouds upon public utility property, public authority has a reciprocal duty to protect these utilities and their property from injustice on the part of their patrons.

"Such being the fact, the public has a right to expect the business to be carried on at reasonable terms, and the public should not give any more reward to these private agencies carrying on this public business than is necessary to get the business done. If public utility business is to be done by private capital, the public should hold out only

[illegible] inducements which are required to get the necessary amount of capital into the business. If it is required to hold out excessive inducements, then the doing of this business by private capital is too expensive, and unless there are corresponding disadvantages which more than offset this expense, then it certainly would be better for the state to do this business for itself. The issue between private and public ownership of utilities will be fought out right here, and the wise public utility manager who does not believe in public ownership of public utilities should see to it that private enterprise performs the service as adequately and at as reasonable rates as public authority could hope to do.

"Fair play and sound financial practices on the part both of the public and of the public utility are absolutely necessary for the permanent welfare of the utility as well as of the public. I am fully of the opinion that public authority should assume an attitude of helpfulness and co-operation, and if it be determined that rates of the great railroad systems, for example, must be raised, then let us raise them and apply the remedy. But if, on the other hand, after careful and impartial study, we find another remedy needed, let us with equal firmness apply it, even though it be less palatable to the patient."

## Public Relations Discussed by New York Electric Railway Association

The quarterly meeting of the New York Electric Railway Association, held at the United Engineering Societies Building, New York, on Dec. 9, was devoted entirely to the subject of public relations. Several papers were presented, and in addition there was a full informal discussion of the topic.

The first speaker was Mr. Edward E. McCall, chairman New York Public Service Commission, First District, who welcomed the delegates and expressed his realization of the fact that meetings of this character necessarily tend to bring about beneficial results. He said that the old order of events has come to an end and a new and wiser method is in vogue. Under the present laws publicity is practically compulsory. A fair, upright treatment and recognition of the rights of all concerned will be the guiding rules in the disposition of cases before the commission.

Mr. J. H. Pardee, president J. G. White Management Corporation, said that after many costly trials of municipal ownership the public has found that the most expedient and practical means of control of the public service corporations lies in their development by private capital, together with proper and fair commission regulation representing the public interest. Unreasonable regulation can, in the long run, harm no one but the public itself, for it automatically increases the rate at which money can be drawn into this field of investment and hence the rates which the public must pay for service.

Mr. J. C. De Long, president Syracuse Lighting Company, said that a great many of the difficulties concerning relations with the public arise from a lack of knowledge on the part of the public of the peculiar conditions under which the business must be handled. One difficulty often encountered is a feeling on the part of employees in their treatment of the public that the company is always right. This is a wrong frame of mind for employees to have. Where public utilities are in the wrong the best thing to do is to confess it and clear up the situation.

Mr. C. Loomis Allen, of Allen & Peck, Inc., defined good public relations and bad public relations and outlined the methods of publicity which a company should follow in order to effect a public understanding of their problems. He advised that a creed be adopted to represent the attitude of the association and its member companies on the general principles of public policy. In taking steps to establish good public relations the company must have first of all the facts in relation to its business. It must be willing to state the facts frankly and in terms that the public understand.

Among others who spoke were Messrs. C. S. Sims, J. P. Barnes, Frank Hedley, William H. Hyland, A. K. Baylor, L. S. Storrs, E. F. Peck, Ernest Gonzenbach, H. W. Blake, H. H. Vreeland, E. S. Fassett, S. P. Smith and J. J. Dempsey.

## Postmaster-General on Government Ownership of Telephone and Telegraph Lines

Postmaster-General Burleson announced in Washington on Dec. 9 that he had discussed with President Wilson that day the general subject of ultimate government control of telegraph and telephone lines. He said that he and the President were open to conviction as to the justification for federal acquisition of these lines, but that at present it would seem to be unwise to make plans for this multiplication of the functions of the Post Office Department.

He added that until the valuation of railways had been finished, or at least until a sufficiently comprehensive and accurate preliminary report had been provided upon which to base calculations of income and expenditures, only the barest tentative position could possibly be taken by the authorities.

Mr. Burleson said that to assimilate the telephone and telegraph business would mean the taking over of properties worth more than $200,000,000 and possibly approaching $300,000,000.

Mr. Burleson was quoted as follows: "The Democratic party has always approached big questions cautiously. It is essential that we make haste slowly. The President and I both believe that a thorough and exhaustive study should be made, not only in this country, but abroad, before we undertake to decide upon anything definite.

"Already such an investigation has been started by the Board of Physical Valuation, and recently I had two long conferences with Mr. Herbert Samuels, head of the English postal system, regarding the government-owned telegraph lines in that country. The systems in other European countries must also be studied."

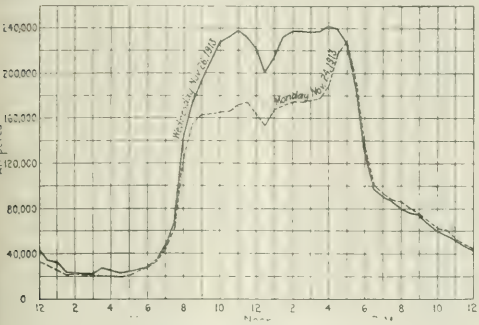
Representative Lewis, of Maryland, is preparing a bill providing for government ownership of telegraph and telephone lines.

## Effect of Chicago's Recent Dark Days on Edison Load Curve

During the last week of November a heavy black cloud of fog and smoke hung over Chicago, making the days almost as dark as the nights. In consequence many electric signs were in operation on the streets, and all day long the lighted windows in the Loop office buildings shone through the murky atmosphere. The effect of this sort of day on the business of the Commonwealth Edison Company is shown in the accompanying load curves of the low tension district. On Nov. 24, a clear day, the combined lighting and motor-service load on the low-tension downtown distribution system reached a peak value of about 230,000 amp late in the afternoon, but on Nov. 26, when it was very dark, the load on this portion of the system rose to approximately 240,000 amp in the morning, remaining at that value throughout the day except for the customary noon-hour depression. Since both curves contain the motor-service portion of the load it will be seen that the increase was due almost entirely to the heavy lighting load on the dark day.

Although the output of the electric-service company

stations was high on Nov. 26, the record peak for the fall business occurred on Nov. 11 as the result of the heavy railway load supplied. Here also weather conditions were a factor in the results. Nov. 11 was a fair day, but its prevailing low temperature necessitated the operation of electric heaters in the railway cars for which the Edison company sells service. To this railway-heating load is there-




DARK-DAY AND NORMAL LOAD CURVE IN CHICAGO LOW-TENSION DISTRICT

fore attributed the credit of producing the largest kilowatt-hour output for any day of the fall season.

## Opportunities for Electrical Development Discussed

One hundred and fifty representatives of the central-station, contracting, jobbing and electrical manufacturing interests in New England convened at the American House, Boston, on Dec. 5 to discuss plans for larger co-operation in the development of the industry, Mr. James D. Andrew, of the Boston Edison company, being in the chair.

### Industrial Power Market

Mr. S. St. John Morgan, of the Westinghouse Electric & Manufacturing Company, Boston, presented a paper on the industrial power market in America, pointing out that in 1910 there were 22,000,000 total mechanical hp in use in the United States, of which 22 per cent was supplied by electric motors. It is estimated that by 1920 a total of 44,000,000 hp will be in use and that 60 per cent of this will be electrical. The opportunities in a single city like Fall River, Mass., where 120,000 mechanical hp are in use in the textile mills, are most attractive. In this one moderate-sized city the possible load for electrification exceeds the total power load of many of the largest central-station systems. In the Boston metropolitan district there remain to be electrified at present 186,000 mechanical hp, despite the fact that three central stations in this district now have a combined connected motor load of 103,000 hp. The writer advocated a larger co-operation on the part of motor manufacturers and jobbers in the direction of insuring correct installations as regards power-factor and load-factor. Motor selection directly affects central-station investment.

### Lamp Renewal Policies

Mr. E. R. Davenport, Narragansett Electric Lighting Company, Providence, R. I., read a paper vigorously advocating the better education of electrical salespeople and contending that the free supply of lamps of any kind should be discontinued as a practice of the Dark Ages. The author averred that the public's willingness to purchase gas mantles should be transferred to the electrical industry and made the point that there is no logical reason for free lamp supply other than the time-honored explanation "We have always done it." Central stations would be more popular if they sold energy for lighting at a lower price per kilowatt-hour and charged the customer separately for lamps. Mr. Davenport thought that there was not the slightest cause for worry on the part of the central stations as to the effect of 10-watt and 15-watt lamps in residential service, the result of cheaper energy always being to increase sales. He condemned the policy of running tungsten lamps at sub-normal voltage to increase their life. An analysis made by the Providence company of lamp policies in Wisconsin gave the following results: Eighteen companies provide free initial installations and fifty-eight do not; twenty-three give free renewals and fifty-nine do not; sixty-seven companies charge from 20 cents to 25 cents each for carbon-lamp renewals; four supply tungsten lamps below cost, twenty-five supply these at cost, and forty companies charge customers something more than cost. In Cleveland and Minneapolis free renewals are not allowed, and among thirty companies operated by H. M. Byllesby & Company, of Chicago, in 200 municipalities, only about half give free renewals, the idea being ultimately to enforce a charge for all lamps.

### Co-operative Movement

Other speakers were Mr. F. S. Price, Pettingell-Andrews Company, Boston; Mr. A. J. Hixon, Hixon Electric Company, Boston; Mr. H. T. Sands, general manager C. H. Tenney & Company, Boston; Mr. C. D. Williams, Simplex Electric Heating Company, Cambridge, Mass., and Mr. J. M. Wakeman, general manager Society for Electrical Development, New York. The last speaker pointed out that less than 20 per cent of the residences in the United States in reach of central-station service are wired for electricity and that but 1 per cent of the homes of the country are fully wired. He described the plans afoot for the development of the market for electricity, including an educational advertising campaign in the popular magazines, articles in trade papers by experts on the development of motor service in particular industries, moving-picture films showing electrical applications in factories, homes and on the farm, and the use of an electrical demonstration car illustrating the "house electrical." Mr. Wakeman pointed out that a campaign of this kind can be conducted only through some large national organization such as the Society for Electrical Development, Inc. He urged the formation of a local luncheon club or similar organization to work in conjunction with the Society for Electrical Development.

## Report on National Civic Federation Model Public Utility Law

Mr. Emerson McMillin read a report before the National Civic Federation in New York on Dec. 11 as chairman of the department on regulation of interstate and municipal utilities. He outlined the various steps taken in the compilation of the model public utility bill of the federation.

That the regulation of public utilities is necessary is no longer a debatable question, Mr. McMillin said. The business which they conduct is closely related to the public welfare. The best interests of the public will be conserved ordinarily by the conduct of such business only as a monopoly. Managers of public utilities no less than other members of the public realize that without recognition of the common interest in the conduct of such business conditions might eventually become intolerable; in fact, it has come to be generally believed that regulation of public utilities is the alternative to public ownership and operation. No one of the important public utilities has reached a point where in the interests of the public it can dispense with the initiative, zeal, enterprise and courage which in the past have characterized American business methods.

Accordingly the bill which the department prepared is an

indorsement of the principle of state regulation of public utilities. It stands squarely for the public interest in these matters. The commission may investigate and fix absolute rates. It may prescribe absolute standards of service and require adherence thereto. It is required to provide uniform accounting and statistical methods, and companies are obliged to make such reports to it as the commission may desire. It is charged with the responsibility of approving issues of stocks and bonds and the transfer of property and franchises from one company to another. These powers and others are conferred on the commission in the firm belief that their exercise is required under a system of adequate regulation, but with the belief that their abuse will be as destructive, ultimately, to the public interest as it may be immediately to the private interests of the companies regulated.

Mr. McMillin added that the bill provides for a single state commission to undertake the regulation of all utilities within the State. This plan is believed to be eminently preferable to any scheme of divided jurisdiction whether on territorial lines or on business lines. Municipal regulation of local utilities must necessarily be expensive and probably inefficient. Utilities no longer are confined to the limits of municipalities. Of even greater concern, however, is the difficulty, if not impossibility, in a majority of cases of obtaining through a municipal regulating body the degree of scientific accuracy and judicial impartiality and fairness which is necessary to a proper solution of public utility problems.

Continuing, Mr. McMillin said that the bill throws about existing investments the protection from competition offered by the requirement that a certificate of public convenience and necessity issue from the commission before a new enterprise is begun in competition with an old one. This provision summarizes the experience of a number of states. Competition in a field which lends itself naturally to a monopoly is economically and socially wasteful. The rule applies as well whether the proposed competitor is a private company or a municipality. So long as an existing agency is furnishing adequate service at just and reasonable rates in all respects in compliance with the provisions of the public utilities law, there can be no justification for the introduction of competing agencies.

The bill strikes a blow at another abuse which has cost the people of this country humiliation, political disease and the propagation of graft, which results from the short-term franchise requiring renewals at periodical intervals. A modification of the Massachusetts plan with respect to new franchises granted after the passage of the act and slightly less extreme than the Wisconsin plan with respect to franchises existing when the act takes effect—the bill takes a long step in the directon of sanity in the adjustment of the important franchise relationship.

Mr. McMillin called attention to the fact that an important feature of the indeterminate franchise principle is the provision made for the termination of franchises by municipal purchase. Full opportunity is afforded to municipalities to purchase the property of utilities operating under indeterminate grants for a price and on reasonable terms and conditions determined by the commission. Municipalities are authorized either to operate public utilities so acquired or to contract with private companies for their operation. Every municipality that owns a public utility is required to keep uniform accounts prescribed by the commission and to report to the commission as private companies are required to do.

The model bill as submitted is the result of arduous and long-drawn-out investigation and consideration, said Mr. McMillin in conclusion. It is of necessity a compromise production. Each and every member of the council objects to some feature of the bill, but, as a whole, it has finally received the vote of the entire council, with one single exception.

## The Physics of Lighting

Dean F. L. Bishop of the engineering department of the University of Pittsburgh presented a paper on the "Physics of Lighting" before the Pittsburgh Section of the Illuminating Engineering Society, Nov. 28.

Various methods of producing the physiological effect of light were discussed by the speaker, who defined the normal eye as being equally sensitive to red, blue and green light. A black body heated to 6000 deg. C., he said, gives these light values in equal proportions, producing white light, but such a temperature is not commercially practicable. The color composition of some familiar light sources are presented in the following table:

| | Red | Green | Blue |
|---|---|---|---|
| [illegible] | 37.2 | 32.2 | 35.8 |
| [illegible] | 34.6 | 33.9 | 31.5 |
| Afternoon sun | 37.7 | 37.3 | 25.0 |
| Hefner candle | 55.0 | 38.8 | 6.2 |
| [illegible] | 51.3 | 40.4 | 8.3 |
| Mercury-vapor lamp | 29.0 | 30.3 | 40.7 |
| [illegible] | 31.3 | 31.0 | 37.7 |

Curves exhibited by Dean Bishop showed the changes in the color of light accompanying rise in temperature. At 2000 deg. C., for example, red light is produced, while at 8000 deg. C. blue results. Recent theories of the fundamental nature of light production were touched upon by the speaker, who outlined the character of the electronic vibrations occurring within the atom and giving rise to luminous phenomena. Such electronic vibrations may be set up by electrical, thermal or chemical means. The simple physics of light reflection and refraction were also discussed, and the speaker closed with a historical sketch of various illuminants, traced down to the modern high-efficiency units in which selective radiation plays an important part.

Mr. G. D. Kammer, of the Standard Chemical Company, Pittsburgh, who was then introduced by Chairman C. J. Mundo, described some of the properties of radium, the propagation of the alpha, beta and gamma rays, the logarithmic decay of radioactivity, etc. The speaker also exhibited samples of radio-active and phosphorescent materials.

## The Fire Hazard in Turbo-Generators

A paper on "The Fire Hazard in Turbo-Generators" was read by Mr. G. S. Lawler, electrical engineer for the Associated Mutual Fire Insurance Companies of Boston, Mass., at the Dec. 5 closing session of the New York winter meeting of the American Society of Mechanical Engineers, the earlier sessions of which convention were reported in our issue of Dec. 6.

The chances of electric generators of the older engine-driven type being seriously injured by fire in the event of failure of insulation is very slight, said Mr. Lawler. Occasionally arcing ignites their insulation at some point, but seldom does the fire spread before it is extinguished. In the newer turbo-alternators, however, there exists a great hazard that serious fire damage will follow arcing. The reasons for this are the large amount of exposed, concentrated, combustible material in the generator insulation, the large amount of energy usually involved in a short-circuit of such a large machine, the quantity of oxygen being blown into the machine with the cooling air, and the inaccessibility of the burning parts. Such arcing may occur in turbo-alternators from a variety of causes, among them distortion of stator coils and injury to insulation caused by

heavy current rushes. Generators provided with sufficient reactance to limit the current flow may not give trouble until near the end of their life, when short-circuits from ordinary causes may be expected.

To reduce the possibility of fire damage, Mr. Lawler proposed that all exposed coils be provided with non-combustible outer coverings, that the cooling air be filtered to free it of oily vapors, and that in case of fire the blast be automatically cut off by the closing of dampers released by fusible links, while at the same time carbon dioxide or other inert gas be introduced into the machine to extinguish combustion. Carbon dioxide, it was suggested, might be kept ready in liquid form, being piped through valves, expansion tanks, etc., to the generators for emergency use.

*Discussion*

Mr. B. F. Lamme, Pittsburgh, Pa., transmitted a written discussion, read by Mr. H. W. Flashman, in which approval was expressed of the ideas contained in the paper, while emphasis was laid on the fact that fires in turbo-generators have been found to occur with much greater frequency in large machines and in those operating at high voltages. This percentage of relative damage persists even in spite of the fact that most of the smaller machines are older than the large units and have therefore had more time to undergo insulation depreciation. Mr. Lamme reported experiments in which attempts were made to delay combustion by the use of asbestos coverings, but he declared that where the arc was sufficient to gasify the insulation the fire was found to spread about as rapidly with as without the non-burning cover. Asbestos tape, in fact, he said, is now believed to introduce a positive element of danger. Taking up Mr. Lawler's suggestion that dampers be arranged to shut off the cooling air blast, Mr. Lamme questioned whether the percentage of leakage remaining even under the best conditions of damper closure might not still be sufficient to fan the flames. A small quantity of $CO_2$ would have little effect in smothering fires of this kind. Improper action of automatic devices might actually result in the exact damage to the turbo-alternators which these devices were designed to prevent. For example, large turbo-generators require a large continuous supply of cooling air, and in the case of even momentary interruptions to this supply such machines quickly overheat. In the event of accident to the fusible links proposed by Mr. Lawler, the dampers would automatically close, at once interfering with the normal cooling action and causing the machines to overheat, possibly with dangerous results. Mr. Lamme suggested that the blower motors be operated from the turbines which they cool. This arrangement would always insure the operation of the blower as long as its turbine was in service, while in case of either an external or an internal short-circuit the blower would be automatically shut down, shutting off the air supply.

Mr. I. E. Moultrop, Boston, Mass., referred to the rapidity with which trouble in a turbo-alternator may spread. He declared that the present topic was one for electrical engineers to treat, and that the A. S. M. E. should restrict itself to discussions in its own field.

Mr. P. S. Lincoln, Pittsburgh, Pa., told of the difficulty he had encountered in attempting to get the Underwriters to insure the windings of generators against damage from fires originating within themselves.

Mr. F. E. Cardullo, New York, suggested that steam be introduced into the generator casing to stifle fires in the windings, since this fluid in large quantities is always immediately available at the turbine. As wet steam would be more advantageous than the superheated vapor he suggested bleeding the extinguishing supply from one of the later turbine stages.

Mr. H. G. Reist, Schenectady, N. Y., pointed out that there is little to be expected from putting fire-resistant material on the windings, since in any case these soon become soaked with combustible matter. To show how readily an incombustible material can contribute to combustion, Mr. Reist cited an instance in which an oil-soaked cement floor burned as fiercely as other wooden parts of the same building. He recommended that if the blast cut-off were used the automatic damper be arranged both to close the blast inlet and at the same time short-circuit the outlet, thus leaving inert air to be circulated within the machine.

Mr. Albert Blauvelt, Chicago, suggested that completely burned chimney gases, previously cooled, might be admitted to the turbo-alternator casing to drown out an incipient fire.

Mr. R. D. DeWolf, Syracuse, N. Y., observed that, regardless of the oxygen supply in the surrounding atmosphere, the insulation inside the machine might easily be destroyed if the heat were great enough.

Mr. George I. Rockwood, Worcester, Mass., commented briefly on the proposals to turn high-pressure steam and chimney gases into the casings of turbo-alternators.

Mr. Selby Haar, New York, reminded the audience that good fire-resistant materials are almost invariably poor thermal conductors and that therefore this use will be objected to by electrical designers who aim to have their machines operate with the greatest possible free radiation.

In closing the discussion, Mr. Lawler said that the proposed use of non-combustible coverings would not be intended to prevent the spread of fire but to retard it until other means of extinguishing the destruction could be brought into play.

## Public Service Commission News

### Wisconsin Commission

Upon the recommendation of the Wisconsin Railroad Commission, the Madison Gas & Electric Company has reduced its rates for electric lighting in Madison. The new schedule, which goes into effect immediately, is as follows: Primary rate, 10 cents per kw-hr. instead of 12 cents; secondary rate, 6 cents instead of 8 cents; excess rate, 2 cents instead of 4 cents. The recommendation was originally submitted to the company nearly a year ago with the understanding that the reduction would not go into effect until assurance had been received from the Common Council that the pending contract for street lighting would be settled in a manner satisfactory to the company and the commission. This is the third material reduction which has been made in the electric rates of the Madison Gas & Electric Company within about three years.

The commission has ordered the Clinton Telephone Company and the Bergen Telephone Company to make joint use of certain toll lines and has reaffirmed its previous decision concerning the rates for joint toll service. The decision notes that the Bergen Telephone Company is furnishing service to a small number of subscribers in the city of Clinton and orders the practice stopped.

### Indiana Commission

The Public Service Commission of Indiana will receive a petition soon from the Central Union Telephone Company asking permission to increase rates on practically all telephone service in Indianapolis.

Citizens of South Bend have petitioned the commission to decide whether the terms of a proposed new contract with the Indiana & Michigan Electric Company by the city authorities for furnishing street lights for South Bend are reasonable. They contend that the rates are not reasonable and that individual lighting bills are too high. A general revision of rates and the prevention of the proposed ten-year city lighting contract are asked in case the commission finds the charges excessive.

The commission has been informed that the Princeton Water & Lighting Company desires to surrender its franchise and take an indeterminate permit.

# Current News Notes

Engineer for Illinois Commission.—The Illinois Society of Engineers and Surveyors has presented a petition to Governor Dunne asking for the appointment of at least one engineer on the Public Service Commission, which is to take office the first of the new year.

* * *

Engineer for Interstate Commerce Commission.—The American Institute of Consulting Engineers through Mr. Alfred Noble, the president, and Mr. Eugene W. Stern, the secretary, has addressed a letter to President Wilson asking for the appointment of some able and experienced engineer to fill one of the vacancies on the Interstate Commerce Commission.

* * *

Bill for Regulation of Interstate Hydroelectric Properties.—A bill has been introduced in the House of Representatives by Mr. William L. Igoe, Congressman of Missouri, which is designed to give the Interstate Commerce Commission regulation of the rates of hydroelectric companies engaged in interstate business. Congressman Igoe made a statement in connection with the introduction of the bill in which he said that the expected reduction in price of electric energy had not ensued as a result of the hydroelectric development at Keokuk.

* * *

## SOCIETY MEETINGS

Pupin Before New York Electrical Society.—Dr. Michael I. Pupin will deliver a lecture before the New York Electrical Society in the Engineering Societies Building on Dec. 18 at 8 p. m. His subject will be "The Science and Art of the Pupin Coil."

* * *

Atlanta Meeting, A. A. A. S.—The mid-winter meeting of the American Association for the Advancement of Science and affiliated societies will be held at Atlanta, Ga., from Dec. 29, 1913, to Jan. 3, 1914. The president of the association is Dr. Edmund B. Wilson, Columbia University, New York. The permanent secretary is Mr. L. O. Howard, Smithsonian Institution, Washington, D. C.

* * *

Jovian Theater Party at Philadelphia.—Philadelphia members of the Jovian Order will give a theater party Dec. 18 to witness a performance of "The Ghost Breaker." Mr. Washington Devereux is chairman of the committee in charge of the event. At the Jovian luncheon held at the Hotel Bingham Dec. 4 Statesman George L. Thompson was scheduled to deliver a talk on "How to Finance a Large Corporation."

* * *

Southern California Jovians.—All records for attendance at the meetings of the Jovian Electrical League of Southern California were broken Dec. 3, when 120 members assembled at Christopher's, Los Angeles, and enjoyed an entertainment program of vaudeville acts. At the annual election in November the league elected the following officers: Chairman, Mr. J. N. Colkitt; vice-chairman, Mr. T. E. Burger; secretary-treasurer, Mr. K. E. Van Kuran, and executive committee, Messrs. J. G. Pomeroy and J. H. Pieper.

* * *

New York Jovian League.—At a meeting of the Jovian Order in New York on Dec. 10 Statesman C. L. Hight announced that a movement is under way to organize a New York Jovian League to be conducted under the auspices of the Jovian Order. The executive committee of the league will be made up of the chairmen of the various local committees of the Jovian Order. Tentative plans and a constitution will be submitted for discussion at a later meeting. The chief speaker at the meeting was Dr. C. B. Meding, who took as his subject the effect of eyesight upon character. Hereafter meetings will be held on Wednesday of each week at the Hotel Martinique.

* * *

New York Companies' Section, N. E. L. A.—The New York Companies' Section of the National Electric Light Association will hold a meeting on Dec. 15 at the Edison Auditorium, 44 West Twenty-seventh Street. Two papers will be presented, one on "Personal Initiative Within Corporate Enterprise," by Mr. J. W. Eaton, of the New York Edison Company, and another on "Instrument Maintenance," by Mr. S. E. Boyland, also of the Edison company. Arrangements have been made for presenting several reels of moving pictures of special interest to the electrical industry. Mr. F. C. Henderschott, 124 West Forty-second Street, New York, is executive secretary of the New York Companies' Section.

* * *

Commonwealth Edison Company Section of N. E. L. A.—The first 1913-1914 "get-together" meeting of the Commonwealth Edison Company Section of the National Electric Light Association, held Dec. 2 in the Insurance Exchange, Chicago, was an altogether successful affair. There were no speeches and no formality, but good fellowship was expressed by singing, cheering and social intercourse. The company orchestra furnished instrumental music and refreshments were served. The attendance was very large, about 1100 men being present. The next meeting of the section will be held on the evening of Dec. 16 in the Hotel Sherman. Mr. F. S. Peabody, of Chicago, the well-known coal operator, will give a talk on "Coal Mining," illustrated by motion pictures.

* * *

Meeting of Yonkers Division of New York Companies' Section, N. E. L. A.—The second monthly meeting of the Yonkers Division, New York Companies' Section, N. E. L. A., was held on Dec. 8 at the station of the Yonkers Electric Light & Power Company, Mr. G. B. Cornell, Jr., chairman, presiding. Mr. Edward J. Reilly read a paper entitled "The Corporation and the Man." Miss Mary A. Naylor gave an interesting talk on "The Electric Iron in the Home," and Mr. H. J. Otto addressed the members on the subject of voltage regulation of alternating-current feeder circuits, illustrating his remarks with lantern slides. Mr. Leslie Sutherland, general manager and vice-president of the Yonkers Railroad Company, also spoke. It was decided to hold a "ladies' night" either in January or February.

* * *

Electric Club of Chicago.—At the meeting of the Electric Club of Chicago on Dec. 4 officers were elected for the year 1914, the men chosen by the nominating committee being selected. On the evening of Jan. 8 there will be a "get-together" meeting at which the new administration, headed by Mr. Alfred R. Bone, commercial superintendent of the Chicago Telephone Company, will take charge. A gold watch fob was presented to Mr. George C. Keech, the president now in office. Mr. Bone, the new president, and the other newly elected officers spoke briefly. Mr. A. A. Gray gave an address on "Developments in the Electrical Field During the Year." He spoke of the commercial aspects of the industry, the consolidation of electrical properties, the increase in number of regulatory commissions, the notable accomplishments of the year in an electrical sense, the output of electrical energy in Chicago, the improvement in the out-door type of transformers, and the technical developments in electric lighting. Mr. Gray made the assertion that there has been a 26 per cent increase, approximately, in the value of the output of the electrical industries during the year 1913. He said, however, that owing to price shrinkage this represented a 35 per cent increase in volume of output.

# The Central Station Idea in German Silesia

**Mines, mills, factories, railways and general lighting service supplied from modern steam stations—Underground transmission at 6000 volts—Use of 20,000-kva turbines**

SILESIA from a historical standpoint has long been one of the most interesting districts of eastern Europe, and now again the modern German province of the same name is attracting a measure of attention quite disproportionate to its mere physical size. The cause this time lies in its recent rapid electrical development, for within the borders of this mountainous section some very interesting experiments are being worked out in the application of central-station energy to industrial uses.

One of the most extensive of these central-station systems is the network of the Silesian Gas & Electric Company, whose headquarters are at Breslau. This company supplies service for lighting and motor drive over a large region in Upper Silesia, which is the mountain district, and operates two generating plants, located at Chorzow and Zaborze, having a combined rating of nearly 8000 hp. These stations, situated within 7 miles of each other, operate in parallel and form the center of the underground distribution system which covers the whole industrial region of Upper Silesia.

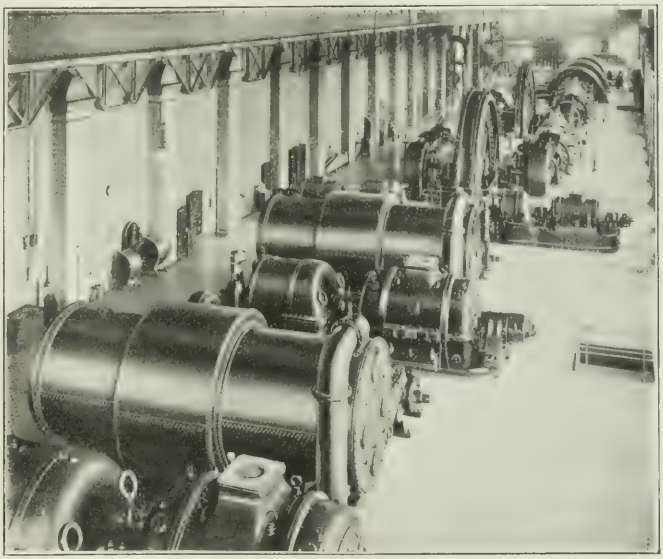


FIG. 1—THE CHORZOW CENTRAL STATION OF THE SILESIAN GAS & ELECTRIC COMPANY, UPPER SILESIA, GERMANY

Begun on a small scale in 1897, the Chorzow and Zaborze plants have undergone frequent additions until their present rating is many times the initial capacity. The first units installed were 400-hp engines, although later 1000-hp, 2000-hp and finally even 4000-hp reciprocating sets were added. In recent years turbine equipment has been installed exclusively, although the earlier engine sets still remain intact. In the foreground of Fig. 1 are seen some of the Chorzow steam-turbine units with the cylindrical shells of their surface condensers mounted on the same engine-room level. At the rear a number of earlier engine-driven alternators are shown. To-day the Chorzow station has a total rating of 40,000 kw and the Zaborze plant one of 25,000 kw.

The last prime-mover set to be installed at Chorzow was a 20,000-kva turbo-alternator of the horizontal type built by the Allgemeine Elektricitäts Gesellschaft. At 80 per cent power-factor this machine is rated for an output of 16,000 kw. The rotor, which runs at 1000 r.p.m., weighs approximately 50 tons. Blowers deliver 70,000 cu. ft. of filtered air through the generator parts each minute.

Steam is admitted to the turbine through eight valves, the first of which is set to pass quantities up to an amount corresponding to 5000 kw of load. The next six valves admit 2000 kw each, and the last valve, used principally during overloads, is designed to pass 4000 kw. Exhaust from this 20,000-kva turbine is received by two condensers each of which has a cooling surface of 64,500 sq. ft. Normally the condensers are connected in parallel. During the coming year a second 20,000-kw turbo-set will be added to the equipment of this station.

Attention is also directed to the very modern and well-designed switching equipment which characterizes the Chorzow installation. For example, the cells inclosing the oil switches are closed with iron doors. In case of fire or explosion of one switch the burning oil is prevented from spreading the fire to neighboring cells and thus extending the damage. Three triple-pole oil switches, arranged in parallel, serve to connect the large turbo-generator. Each of these switches is capable of rupturing the full-load current, so that in case of injury to any one of the trio operation can be continued with the others. Another interesting feature of these Silesian power plants is the extensive use made of reinforced concrete for many and varied purposes, some of which are quite foreign to the usual applications of this serviceable material.

From the viewpoint of American practice, doubtless, the feature of chief interest in connection with the Upper Silesian system is the scheme of distribution by means of 6000-volt underground cables. The 6000-volt, 50-cycle, three-phase output of the alternators is transmitted directly at its generated pressure and is reduced to the desired secondary voltage by transformers installed at the points of consumption. In the case of a number of industrial installations, 6000-volt motors are employed operating directly on the line without step-down transformers. These high-

tension primary motors are used chiefly in the service of rolling mills, blast furnaces, mines, etc. For lighting in the towns and cities included in the company's territory 120 volts and 240 volts have been selected as the standard secondary pressure.

At the present time the Silesian company's central stations are also supplying direct current for operating the



FIG. 2—MOTOR DRIVE IN ROLLING MILL AT JULIENHUTTE, GERMANY

greater part of the Silesian narrow-gage railway. Later three-phase, 6000-volt alternating current will be purchased from the system for transmission to substations along the railroad's right-of-way. In these substations the alternating-current supply will be converted into 600-volt direct current for energizing the trolley.

Aggressive new-business methods have characterized the policies of the Silesian Gas & Electric Company, and as the result of this progressive attitude in the making of rates when disposing of energy in large quanities the central station now includes on its lines many of the largest manufacturing plants in this important industrial region. Already, indeed, a strong disposition exists to use central-station service extensively in the mining and metallurgical fields wherever possible. Practically all of the newer installations and works use electric drive exclusively.

In the field of residence and smaller commercial business the company has been no less successful through its institution of reasonable rates of advantage to the small consumer. Although the high-tension lines are placed underground throughout the district, most of the low-voltage distribution circuits are of the overhead type common in this country. Tables reproduced herewith show the con-

TABLE I—CONNECTED LOAD OF SILESIAN GAS & ELECTRIC COMPANY SYSTEM

| Year | Customers' Lighting, Kw | Street Lighting, Kw | Industrial, Kw | Total, Kw |
|---|---|---|---|---|
| 1909 | 8,282 | 262 | 13,719 | 22,287 |
| 1910 | 8,910 | 321 | 16,710 | 25,941 |
| 1911 | 10,681 | 316 | 20,682 | 31,649 |
| 1912 | 10,980 | 323 | 34,152 | 45,455 |

nected load and kilowatt-hour consumption of the system during the last four years, as divided among various classes of customers.

During 1912 the Silesian company's system output was 126,000,000 kw-hr., with a maximum load of 41,600 kw.

In Fig. 2 is shown an electrical installation of considerable interest recently completed at the Julienhütte iron works, at Gleiwitz, in Upper Silesia. It is one of the numerous plants of its kind in this district in which electric motors supply practically all the power. In the background of the illustration are seen the direct-current reversible motors for driving the mill rolls. These motors are of the Allgemeine-Ilgner type. At the right is a group of machines making up a pair of Ilgner motor-generator sets

TABLE II—ENERGY CONSUMPTION OF SILESIAN SYSTEM IN THOUSANDS OF KILOWATT-HOURS

| Year | Customers' Lighting | Street Lighting | Industrial | Street Railway | Total |
|---|---|---|---|---|---|
| 1909 | 14,639 | 947 | 52,184 | 4,326 | 72,08 |
| 1910 | 11,183 | 1,063 | 67,661 | 4,135 | 84,042 |
| 1911 | 12,372 | 1,105 | 80,686 | 5,918 | 100,081 |
| 1912 | 14,328 | 1,187 | 103,097 | 7,627 | 126,240 |

which take three-phase, 6000-volt alternating current from the supply mains and furnish direct current for the rolling-mill motors above mentioned. The equipment is assembled in two similar halves, each composed of a three-phase motor coupled to a direct-current generator, with a 28-ton flywheel mounted on each connecting shaft. The two halves can be operated separately or together, depending upon the needs of the mill. Normally, however, the two generators are coupled in series and supply current to the two rolling-mill motors (each rated at 1800 hp), which are also connected in series. Other examples of the use of large motors for rolling-mill work are the three Allgemeine 2000-hp direct-current motors installed in the Bismarckhütte tube mills, and a set of six 2500-hp three-phase motors in operation in a large structural-iron rolling mill in the same vicinity.

Another of the large central-station networks in Silesia is operated by a local enterprise known as the Provincial Union, whose lines supply such centers of distribution as Lauban, Greiffenberg and Haynau. The shorter lines, as a general rule, are operated at 10,000 volts, while the circuits supplying Löwenberg and Haynau operate at 30,000 volts. At each of these centers transforming and switching substations are located near the city limits. The prac-

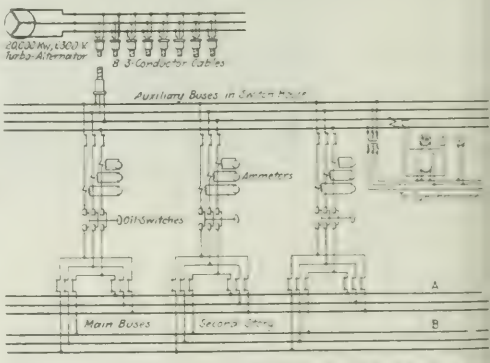



FIG. 3—ARRANGEMENT OF BUS CONNECTIONS FOR 20,000-KW TURBO-ALTERNATOR

tice has been to run the high-tension lines in closed loops, each of which includes a certain number of localities.

The total length of high-tension lines of this system is now about 400 miles, and the company is operating at the present time in the five cantons of Lauban, Löwenberg, Hirschberg, Bunzlau, Goldberg-Haynau and Schönau, with a total population of 365,000.

# Municipal Electrical Enterprise in England

**A discussion of the relative merits of municipal and private operation of electrical supply undertakings in England. By A Briton**

FOR years it has been the practice of the English government to set apart enterprises which municipalities are free to carry on for the benefit of the community. "Municipal trading," as it is compendiously called, has thus become a feature of English life, and among the industries which have been much favored by the attention of town councils and other local bodies electric lighting and traction are by no means the least prominent. It is safe to say that in most English towns where electricity is used for lighting the plant is run by the borough council or corporation, while so far as traction is concerned most of the electric railways are in the hands of local authorities.

The reasons and arguments which led the English government to favor municipal as against private control are comparatively simple. It was thought that as cheap light and traction are essential to the well-being of every citizen there should be no monopoly in their use, and that whatever profit should be made ought to be devoted to the reduction of local taxes and not to the enrichment of individuals. Thus when a large profit was made on the year's operation of a municipal electrical undertaking it was thought that the money could be used to reduce the taxes or to reduce the price per kilowatt-hour or per ride.

To sum up the whole matter, a municipality goes into business under certain restrictions which are clearly and exhaustively defined by act of Parliament. If it has power to run electric railways on the overhead system, it cannot, without fresh authority from the English Parliament, adopt the underground system. If it finds the competition of motor buses exigent, it cannot scrap its plant and start business on new lines. Again, if an English corporation has power to supply electric light it cannot supply lighting fixtures without special dispensation. In these circumstances, hampered at every turn, it cannot make a profit; and unless a business can be run at a profit it is an elementary principle of political economy that it cannot be run at all.

When the craze for indulging the mania for reducing the taxes by municipal enterprise was at its height ten years ago, the various English technical papers did what they could to point out that the practice of reducing the taxes out of profits was financially unsound, unless adequate allowance was made for depreciation. At the time, of course, the warning fell upon deaf ears, but the school of experience has now taught a lesson which the technical journals wholly failed to inculcate. For a variety of reasons little notice has hitherto been taken of this most vital point, and it is only now that persons concerned with local government in England are beginning to find out that this is the rock upon which the ship of the municipal trader runs most chance of being wrecked. It is a rock which at the best of times is but faintly visible to the average borough councilor and is wholly concealed from the taxpayer. It is of no concern to the man who is elected a member of a corporation for a period of three years or less that ten years afterward the municipal enterprises which he has pledged himself to support will be hopelessly insolvent. By that time he will probably have withdrawn from the din of municipal politics. "Take no thought for to-morrow" is a maxim which appeals to the minds of the municipal politician. He is not, of course, to be greatly blamed. He is not paid for his services. In nine cases out of ten he has honestly given freely of his time and experience (such as it is) for the benefit of his fellow-citizens. It is not his fault that his services are worth no more than he was paid for them. It is the fault of the system under which unqualified persons are permitted to rush into various enterprises for which they have no experience and to spend capital drawn from the pockets of persons who are compelled by law to provide it, but to whom is given hardly any articulate voice in its disposition.

To point the moral, it is necessary only to refer to the English electric railway enterprise. It is now many years since it was strenuously urged by the politicians—municipal and other—that street locomotion of this type was eminently fitted to be controlled and owned by the taxpayers. As a result municipal electric railways are to be found in many parts of the country. In some places, no doubt, the railway is still, on paper, a self-supporting institution. If not making large sums of money, the town councilors in many cities are able to show a reasonable profit. But what about repairs and renewals? How large is the scrap heap at the tramway depot? What is the state of the track? Are the flanges of the wheels as good as they were?

The truth is, of course, that when a kind of limited monopoly was conferred upon the local authority that body, content generally with the magic word "monopoly," asked for—and got—nothing more. To take an illustration: When the London County Council obtained railway powers the motor bus was not thought of. Many—perhaps most—of those who held power in the County Council thought that the last word had been said in the solution of the problem of street traffic. It did not concern the Parliament of London that other vehicles might run in competition with their rolling stock. Events have proved that the views so held were fallacious and that the monopoly which was so proudly vaunted by the first local authority in England could now hardly be sold in the market.

There is one aspect of the failure of this form of municipal trading in London which appeals forcibly to those who, in their business as engineers, have often been harassed by the tax collector. The London County Council levies taxes with no sparing hand. And, strange to say, through the glaring imperfections of the English taxing system it cannot collect taxes on any adequate scale from the omnibus companies which cover the streets with their cars. Machinery in a factory or mill is for all practical purposes taxable, but a gasoline engine in a motor bus adds practically nothing to the taxes.

The result has been that in many parts of England people are coming to the conclusion that the best course for the municipal trader would be to acquire parliamentary power to sell out and thereby eliminate his loss. The private electric railway or lighting company, stimulated by certain restrictions as to minimum fares and meter rents, can do all that is required by the public. If the directors of a railway company find it is impossible to cope with the increasing needs of the public by railways alone, they are at liberty to supplement the service with motor buses. This is merely one example of the manner in which private enterprise can undertake what is practically impossible for municipal enterprise.

# Varied Uses of Electricity in a Modern Hotel

**Central-station service for lighting, motor drive, ventilation, water pumping, refrigeration and certain heating applications in the million-dollar Hotel Ohio at Youugstown, Ohio**

INASMUCH as entire reliance on central-station electrical supply is still the exception rather than the rule in the case of hotels, the example of the new Hotel Ohio in Youngstown, Ohio, is interesting and instructive. This hostelry, which has just been opened, is very modern, and all energy for lighting, motor drive and some heating appliances is furnished by the electric-service company. In this respect the house ranks with the Hotel Sherman, of Chicago, and the Hotel Statler, of Cleveland.

Standing on the corner of Boardman and Hazel Streets in Youngstown, rather aside from the main current of street traffic, the Hotel Ohio has resorted to an extensive individual street-lighting installation in order to attract the traveling public to its doors. Youngstown boasts no "white-way" illumination, but the hotel's ornamental posts make Boardman Street one of the brightest thoroughfares in the city. In addition, therefore, to advertising the hotel this private lighting installation is thus of real value to the community.

The main portion of the hotel measures 156 ft. by 120 ft. and rises to a height of 127 ft. from basement to roof. A southeast wing of the building is but three stories high and measures 77 ft. by 107 ft.

In lighting, heating, ventilation, sanitation and safety the Hotel Ohio seems to represent the latest advances in hotel construction. The control of all of its various systems is centered in the switchboard room in the sub-basement, as shown in an accompanying illustration. The switchboard itself in the background consists of six marble panels, which, enumerated from left to right, carry the control apparatus for the alternating-current motor-service circuits on the first panel, the elevator circuits on the next three, the alternating-current lighting circuits on the next, while the last is a battery panel for controlling an emergency storage battery charged from a small motor-generator set in the switchboard room. The alternating-current service enters the building through an underground duct and is conducted directly to a bank of four 40-kw, 2200/220/110-volt transformers in a room back of the switchboard. The low-voltage taps are taken from these two-phase transformers to the alternating-current panels of the board.

The 9-in. by 14-in. ammonia pump serving the refrigerating system is shown in the center of the illustration. This unit is driven by a 40-hp Western Electric induction motor operating on a 220-volt circuit at 514 r.p.m. The ice plant of the hotel is capable of producing 25 tons of ice a day if forced to the limit of its capacity. Circulation of the brine is accomplished by two 5-hp, 220-volt Triumph induction



FIG. 1—MACHINERY AND SWITCHBOARD ROOM, HOTEL OHIO, YOUNGSTOWN

motors operating at 1720 r.p.m. A 3-hp induction motor belted to a countershaft is arranged to drive either an ice crusher or an ice saw for cubing the congealed liquid for use on the table.

The vacuum-cleaning system for the entire hotel is shown at the right of the compressor. This outfit, which was furnished by the McCrum-Howell Company, of New York City, is driven by a 10-hp, 220-volt induction motor operating at 1200 r.p.m.

### Heating, Ventilation and Sanitation

In an adjacent room have been placed two boilers supplying low-pressure steam for the steam tables, the laundry and the Van Auken heating system. Water for these boilers is supplied by two automatically operated 10-hp motor-driven boiler-feed pumps. One of these units is kept in reserve at all times. Both operate at 600 r.p.m. For the general water-supply system of the house a 75-hp Western Electric motor drives a 5-in. by 6-in. triplex pump lifting water to a tank on the roof of the building. To insure sanitation and to relieve the hotel of all waste water a 5-hp motor-driven pump has been installed to maintain a vacuum on all drainage lines leading from the building.

A motor-driven suction fan in the roof takes in fresh air from above the surrounding buildings and delivers it to an



FIG. 2—LIGHTING UNITS IN LOBBY AND ABOUT CLERK'S DESK

air washer for purification. The washer is capable of cleansing 28,600 cu. ft. of air a minute, and this amount it is said will change all of the air in the principal rooms of the hotel at the rate of once a minute. The air is heated to the desired temperature as it is passed through the washer. Burglar alarms and fire alarms are installed in the halls on every floor of the building.

### Electric Service in Laundry and Kitchen

The laundry is equipped with electric drive throughout. In the background of the illustration showing this department may be seen the three large automatically reversing motor-driven tubs in which the linen of the hotel is washed. The tubs are driven by individual 3-hp General electric motors which are reversed by contactors mounted on a group of panels within the wire cage at the right of the tubs. Two centrifugal driers driven by 3-hp induction motors operating at 1200 r.p.m. remove the water from the wet linen as it is brought from the tubs. An automatic safety device on these driers prevents starting while the lid is raised. The big Troy five-roll mangle in the foreground, used for finishing all flat pieces, is driven by a 2-hp General Electric induction motor operating at 900 r.p.m.

In the kitchen liberal use is also made of central-station energy, for there the dishes are washed in a motor-driven washer, ice-cream freezers are electrically operated, and a small motor-driven buffer is used for polishing the silver.

### Lighting

The general lighting of the main lobby is furnished by two large ornamental units suspended from the ceiling by chains. Each of these fixtures carries sixteen 60-watt tung-



FIG. 3—MOTOR-DRIVEN MACHINERY IN LAUNDRY

sten lamps with frosted bulbs. Auxiliary illumination is supplied by the tungsten units suspended in diffusing bowls in the center of each bay under the mezzanine floor. Four upright standards illuminate the clerk's desk. The lobby is finished in Canadian marble and the natural warmth of the predominating gold and cream blend with the yellow of the tungsten lamps to take away the sense of coldness often present where marble is used extensively.

Figs. 4 and 5 show two representative types of lighting used in the five dining-rooms of the hotel. The main dining-room (Fig. 4) has been finished in a dignified French gray and trimmed with gold. Mirrors about the sides of the room reflect images of the clusters of frosted lamps and



FIG. 4—LIGHTING OF MAIN DINING-ROOM

add to the effective illumination. The hanging lanterns shown in the rathskeller, Fig. 5, harmonize with the Old North style which has been followed in this room, and the light from their yellow panels lends a warm glow to the surroundings.

The guests' rooms, of which there are 217, are each equipped with a 110-volt electric ceiling fan and adequate

lighting equipment. A representative bedchamber is shown in Fig. 6. A single 60-watt tungsten lamp in a Holophane reflector, suspended over the foot of the African-mahogany bed, provides the general illumination for the room. Smaller shaded lamps over the dressing tables are installed for local illumination. Additional flush-plug receptacles are

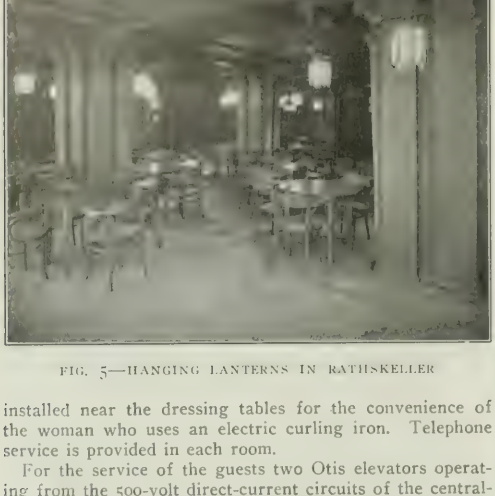


FIG. 5—HANGING LANTERNS IN RATHSKELLER

installed near the dressing tables for the convenience of the woman who uses an electric curling iron. Telephone service is provided in each room.

For the service of the guests two Otis elevators operating from the 500-volt direct-current circuits of the central-station company ply between the main floor and the eighth. Those portions of the hotel frequented by the hotel employees are designed so that it is unnecessary for the servants to enter the guests' quarters except for cleaning. Three motor-driven elevators in the rear of the building are for the use of the servants exclusively in traversing the distance from the machinery room in the sub-basement to the electrically operated laundry on the third floor.

The construction and equipment of the Ohio Hotel cost

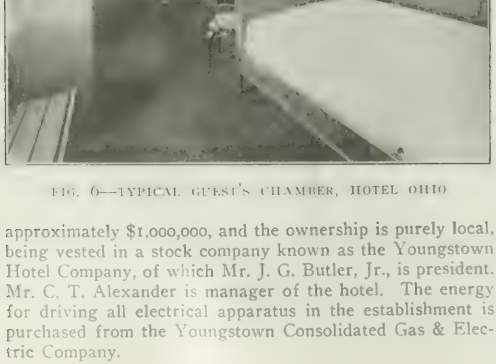


FIG. 6—TYPICAL GUEST'S CHAMBER, HOTEL OHIO

approximately $1,000,000, and the ownership is purely local, being vested in a stock company known as the Youngstown Hotel Company, of which Mr. J. G. Butler, Jr., is president. Mr. C. T. Alexander is manager of the hotel. The energy for driving all electrical apparatus in the establishment is purchased from the Youngstown Consolidated Gas & Electric Company.

## Transmission-Line Service to Central Kentucky Towns

Several small towns and rural districts in Kentucky which have never before enjoyed the conveniences of electric service are now being supplied with energy from the transmission lines of the Kentucky Utilities Company which has its main offices at Lexington. This company is a subsidiary of the Middle West Utilities Company, of Chicago, and is following the example of the parent corporation in furnishing electric service to towns which have never before had it, in a number of cases operating small plants twenty-four hours a day. At present the company supplies energy to seventeen towns, some of which have their individual generating stations, while others are fed over transmission lines from central points. Generating plants are located at Shelbyville, Richmond, Winchester, Elizabethtown, Somerset, Middlesboro and Pineville.

Some electricity is being purchased from the Lexington Utilities Company and is transmitted at 33,000 volts to Versailles, from which it is distributed to several small towns in the surrounding territory. Several large distilleries are located in these places, which never had electricity before. At Tyrone the Kentucky River Sand & Gravel Company operates the largest rock crusher in the

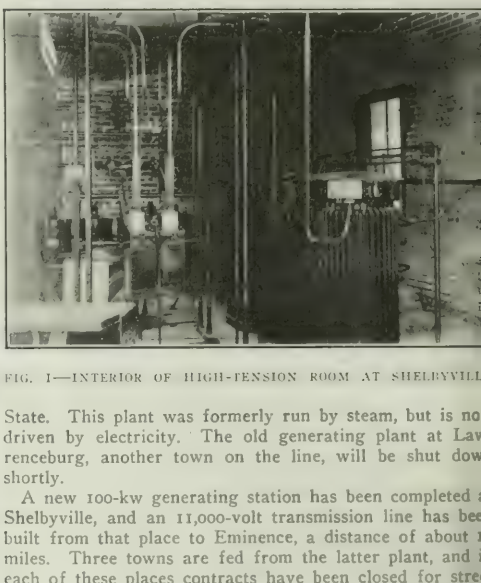


FIG. 1—INTERIOR OF HIGH-TENSION ROOM AT SHELBYVILLE

State. This plant was formerly run by steam, but is now driven by electricity. The old generating plant at Lawrenceburg, another town on the line, will be shut down shortly.

A new 100-kw generating station has been completed at Shelbyville, and an 11,000-volt transmission line has been built from that place to Eminence, a distance of about 15 miles. Three towns are fed from the latter plant, and in each of these places contracts have been closed for street series incandescent-lamp lighting.

Down in the southeastern part of the State, in the town of Middlesboro, is a 150-kw generating station which supplies its entire output to coal mines in the vicinity. A generating station which supplies energy for similar purposes is situated at Pineville.

The largest separate generating plant opened by the company up to the present time is being built at Somerset. This station will have a rating of 200 kw and will furnish energy to Somerset and to Burnside, a town about 15 miles to the south. The Kentucky Utilities Company is also contemplating the erection of a large station at Winchester which will be used to feed the town of Mount Sterling as well. Elizabethtown has a new generating plant which is about completed and will furnish twenty-four-hour service to the community. A contract has been secured in that town for pumping the city water, and a 20-hp pump has been installed which will supply 1,000,000 gal. of water

per day. Contracts for supplying energy to motors having a total rating of 60 hp have also been closed. In addition to the industries mentioned, others to be supplied with energy by the Kentucky Utilities Company are lumber mills, cotton mills, motor works and mines. In four of the towns water is pumped, in three ice plants are operated, and in



FIG. 2—EMINENCE GENERATING PLANT USED AS SUBSTATION

Shelbyville and Somerset gas plants and street-railway systems are managed in conjunction.

Most of the transmission lines connecting the central generating stations with the smaller outlying towns are 11,000-volt, three-phase, 60-cycle circuits. Where a rural community desires service the line is constructed at its expense and 25 per cent of each consumer's monthly bill is refunded as payment on the amount expended for line construction. As the project progresses attempts are being made to standardize the rates. The form of contract used by the Commonwealth Edison Company of Chicago is being used wherever business agreements are entered into.

In each town in which the company operates it has opened up a small electric appliance office which is superintended by the agent in charge of that district. On the day before the opening of such an appliance office, advertisements are published in the local newspapers informing the people of the new service and announcing prizes which will be given away on a certain date. Each person expecting to draw a prize is expected to fill out a coupon which accompanies the advertisement. Several questions are asked



IG. 3—APPLIANCE ROOM AND OFFICE AT SHELBYVILLE, KY.

n these coupons which furnish valuable data when the me arrives to solicit contracts.

Very few of the plants which were purchased by the entucky Utilities Company had offices which were pleasit for a woman to reach. The new appliance-sale offices hich have since been instituted have therefore proved ry attractive to the women and make the new electric service a much-talked-of subject in the towns. To earn the good will of the people, advertisements have appeared in the newspapers offering, upon request of a physician, to furnish free electric-fan service to any patient who is unable to pay for such a convenience.

Pole-top substations are used in several of the towns which are supplied with energy from a transmission line running through them. Transformers, disconnecting switches, regulators and Anderson time switches are installed on many of these substations. Where street lighting is furnished arrangements are made with town marshals in many cases to wind up the clocks on the time switches. All of the towns in a certain district are under the supervision of a district agent, who has an automobile so that he can go around and inspect the different installations periodically. The agent is often responsible for the reading of meters and the collection of bills. About once a month the district superintendents meet at the main office of the Kentucky Utilities Company in Lexington, where they discuss operation, maintenance and the securing of new business.

The officers of the company are: President, Mr. Martin J. Insull, Chicago, and vice-president, Mr. Harry Reid, Lexington, Ky. Mr. C. J. Eaton, Lexington, is manager of

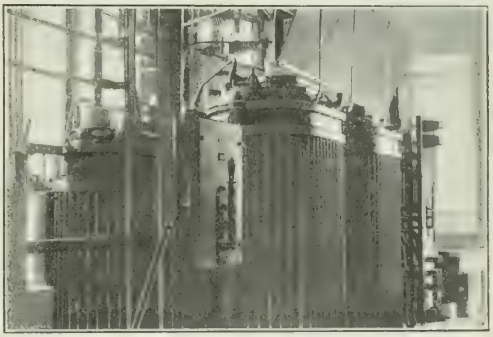


FIG. 4—TRANSFORMERS IN VERSAILLES SUBSTATION

the commercial department, and Mr. C. C. Hyde, Chicago, is supervisor of construction.

## Electricity at $111 per Kw-hr.

The central-station customer who thinks he is paying a high rate for his electricity might with profit follow the calculations sent us by a correspondent who has figured $111 per kw-hr. to be the cost of the energy consumed in the average pocket flash-lamp. Such a flash-lamp is sold at 50 cents, while a renewal of the three miniature dry cells usually costs 25 cents. The little filament takes about 0.25 amp, and the battery supplies 3 volts. Used daily such a battery will be found to be exhausted in, say, two months, or after a total of 180 minutes or three hours' operation. The output of the cells has therefore been 3 volts $\times$ 0.25 amp $\times$ 3 hours, which equals 2.25 watt-hours. At this rate of 25 cents for 2.25 watt-hours, the cost of a kilowatt-hour would be 11,100 cents, or $111—which is more than a thousand times the average rate paid for central-station electricity.

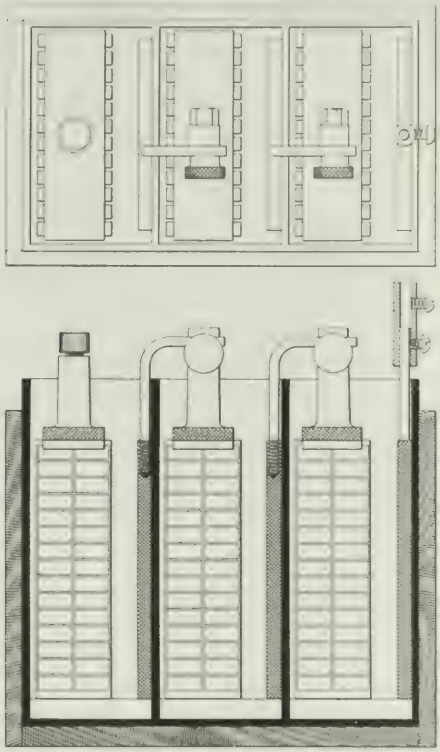
Applying the same scheme of careful calculation to the service performance of a pair of dry cells used for door-bell ringing, an even higher cost per kilowatt-hour will be obtained, for here the draft of current taken from the battery is smaller while the extremely short periods of use result in a distressingly low "load-factor."

## Battery for Experimental Use

By Harry J. Dey

Many engineers, draftsmen, machinists and others scientifically inclined have felt the need of a battery that could rest on the shelf for periods of six months or a year and yet, when the occasion arose, would be ready for immediate use. Primary cells of the removable-zinc type do not have high enough discharge rates, besides exhausting very quickly. Those of the sal-ammoniac family also display too low outputs. Dry batteries run down on the shelf, while neither their capacity nor their discharge rates are up to the requirements. The lead-storage cell, while meeting all the other conditions, will not retain its charge for any long period and goes to rack and ruin if not kept charged.

For his own convenience, therefore, the writer, finally



PLUNGE-TYPE BATTERY FOR EXPERIMENTAL USE

solved as follows the problem of obtaining a cell of the desired characteristics:

A hard-rubber jar divided by two partitions into three compartments, each measuring 2.25 in. by 4 in. by 6.25 in. deep, was purchased. This container provided space for three cells. Next six storage-battery positive plates of the lead type were obtained and cut crosswise into strips 1.375 in. wide by 4.75 in. long, the latter figure being the original width of the plate.

After scraping one end of each plate and its adjacent edges, the plates were grouped into sets of twelve, placing together their flat sides separated by a 0.0625-in. sheet of wood, completely filling the space. Berry boxes furnished this spacing material. The plates are tied together with twine, while a wall was built up around the cleaned end with plaster of paris. A standard pillar-post connector was then set in the center of the basin thus formed. After giving all the cleaned surfaces a liberal sprinkling with resin, the space within the walls was filled with melted lead that had been heated to the point of redness. A lead-burning outfit would have been preferable, but with proper judgment and care the pouring of overheated lead makes a fairly good substitute.

By thus joining together the twelve small segments (comprising two standard plates) a thick plate, 3.75 in. wide by 4.75 in. deep and 1.375 in. thick, was produced. The wood separators were then removed and the plaster carefully washed off, leaving the spaces between the sections open for circulation of the electrolyte. While this design is not precisely ideal for extremely high discharge rates, it will nevertheless take care of 100 amp to 200 amp for short periods. Three of these thick plates were made, one to serve as the positive electrode in each compartment. For the negative plates 0.25-in. rolled zinc was purchased from an electrical supply house and cut into plates approximating 3.5 in. by 4.75 in. in size. At one end these were drilled and tapped to receive copper rods about 0.1875 in. in diameter, to serve as terminals. Two of these rods are bent at right angles, reaching over to be clamped by the pillar-post thumb-nuts on the positive plate in the adjacent compartment, while the one on the end plate remains straight. This arrangement provides a quick and convenient method for making connections, for the zincs are to be removed whenever the battery is not in use.

The zinc plates were amalgamated by being dipped into the electrolyte and then being rubbed with mercury. The electrolyte is a mixture of one part sulphuric acid with three to four parts of water. The regular lead-battery electrolyte, although slightly stronger, will answer the purpose very well, for a wide range in strength of the solution is permissible. When mixing the acid and water, pour the acid slowly into the water, stirring continuously. Never pour the water into the acid, or the results may be disastrous to eyesight, good looks and clothing. Use a stone or porcelain vessel as the receptacle during mixing, for glass is liable to crack, owing to the heat generated.

This battery had a rating of about 60 amp-hr., with an emf of 7.5 volts. The extra 1.5 volts over the emf produced by the same number of lead cells is due to the zinc, which gives an extra half volt per couple.

The battery, including the outside wood case, weighs about 25 lb. When the zincs are consumed they have, of course, to be replaced with new ones. As a pound of zinc will give over 200 amp-hr., this item is negligible.

The battery is used in the same manner as any plunge cell of the primary type. It is, in fact, a sort of compromise between a primary and secondary battery. When not in use the zincs are to be removed and then absolutely no action can take place; meanwhile the lead positives may remain in the electrolyte, being unaffected thereby. The writer's battery has stood for periods of fifteen months between charges, and although it had in the meantime been used many times for operating a spark coil and running a motor drawing sometimes 20 amp to 30 amp, it still contained apparently plenty of life at the end of this period. The battery is now two and a half years old and has been charged only twice, in addition to the original charge. It is now apparently ready for any emergency, judging from a recent test, although about eight months have elapsed since it was last charged. There is probably no limit to the time that such a cell can be kept upon the shelf and still be ready for work as soon as the zincs are immersed.

While the construction described provides a very compact battery, a good substitute (and probably an easier construction) would be to use two full-sized standard lead positives, with a zinc plate removably placed between them as commonly used in the Grenet type of bichromate-of-potash plunge battery. Such a battery could be made up in compartment or individual cells as desired. Such construction, however, would have the objection that only one face of the

positives would discharge, which, besides lessening the capacity, might cause buckling.

When recharging, the zincs may be left in the cells and the zinc will go from the solution back to the plates. The cycle, however, will be incomplete, for a considerable quantity of the zinc will remain in the electrolyte. For this reason it is good practice, if the best results are desired, to replace the electrolyte with a new solution after charging the battery.

## Electric Coal Mining in Central Illinois

The O'Gara coal mine in Sangamon County, Ill., has now been operating with electric drive exclusively for several months. From 800 to 1000 tons of coal is being produced daily at an average cost of $400 per month for electrical energy, according to data obtained from the Springfield Light, Heat & Power Company, of Springfield, Ill., which furnishes the electricity. According to this figure, the mining company is operating at approximately the cost of its former coal bill, without the attendant inconveniences met with in the winter from heat radiation and freezing of water, besides avoiding the additional labor required with steam operation.

Electrical operation of the mine has eliminated the use of mules, horses, coal, waste, packing and firemen. Water obtained in this district is unsuitable for boiler feed except when treated with some boiler compound. The two major

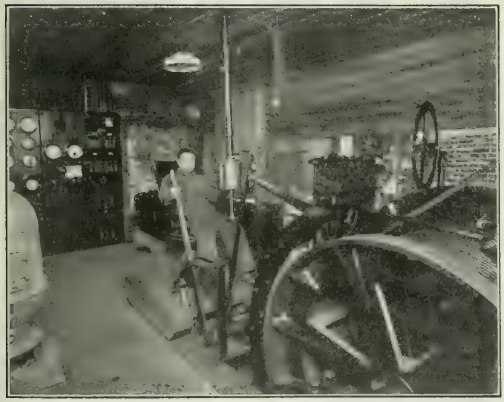


FIG. 1—HOISTING ROOM, SHOWING SWITCHBOARD AND CAGE HOIST

advantages of electrical drive in this instance are the elimination of heat radiation from steam pipes and the fact of doing away with the use of mules. To care for a mule costs 75 cents a day, and the wages of the drivers are $2.83 a day.

Some coal-mining companies in Sangamon County have been backward about installing electric drive, as it requires an outlay which they were not certain was warranted by the results. To meet this argument the local electric-service company agrees to install the apparatus, the payments on which are made on instalments. The electric-service company in Springfield estimates that a 1000-ton mine in Illinois can be equipped above and below ground for electric service for about $15,000. This includes the cost of installing, rebuilding, bonding rails and running trolley wires for locomotives. It is stated that the equipment will pay for itself in four years whether the mine is operating or not. Electric service shows its greatest saving over steam operation when the mine is not running. This is a considerable item where strikes are prevalent and the mine is shut down, as the gases and water have to be kept out of the mine whether it is in operation or not. The additional advantage of being able to increase the output of a mine without replacing apparatus or making numerous changes in pipe lines should not be overlooked in any estimate of the merits of electric service.

The rate earned is determined by the maximum demand and the energy consumption. As two voltages are used in

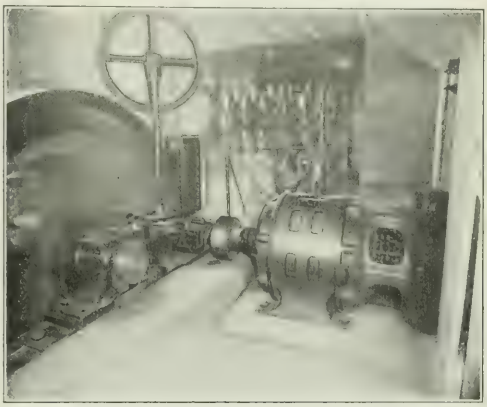


FIG. 2—HOISTING MOTOR IN O'GARA COAL MINES

the mine, separate printometers are employed to record the consumption of energy. From the records kept since the installation of electric drive, about 1 kw-hr. of energy has been consumed per ton of coal mined.

Electrical energy is delivered to the O'Gara mine over a 6600-volt, three-phase transmission line. The connected motor load aggregates 405 hp. All of the wiring is run through conduit to the point where it is delivered to the various motors.

Contrary to the situation encountered in Eastern coal mines, the mines in Illinois are fairly dry and practically

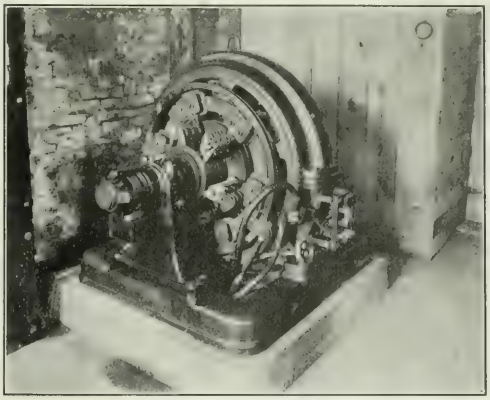


FIG. 3—ROTARY CONVERTER SUPPLYING ENERGY TO MINE LOCOMOTIVE

devoid of dangerous gases. Faults in the structure of the earth are prevalent, however, and the shafts are lined with concrete to prevent slides. The interest on the investment for constructing such shoring and benching in the different levels counterbalances the cost of pumping in wet mines.

Two vertical shafts are installed in the O'Gara mine at

[illegible] for delivering fresh air to the mine and the other for the removal of coal. Each shaft is provided with a 210-cu. ft. sump pit for collecting the small amount of water which seeps into the mine each day. Both sumps are emptied by a single automatic electric pump, which is required to be operated only about one hour each day. The [illegible] for emptying the sumps consists of a two-

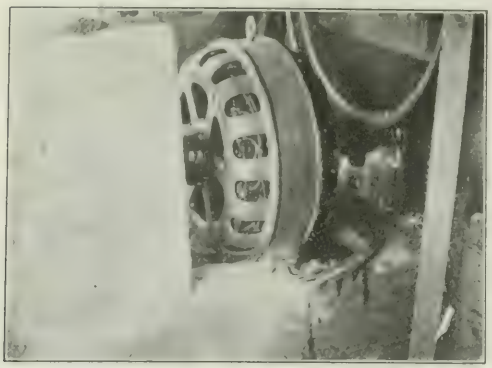


FIG. 4—VENTILATING FAN MOTOR INSTALLED IN O'GARA COAL MINE

stage, horizontal, centrifugal pump, direct-connected to a 220-volt, three-phase Westinghouse squirrel-cage motor. Operating at 1700 r.p.m., the pump is capable of delivering 50 gal. per minute.

In this Illinois field coal is obtained from strata about 200 ft. to 300 ft. deep. In this particular mine the coal is lifted a total distance of 300 ft. The old steam-operated cage hoist formerly used has been replaced by an electrically driven Lidgerwood hoist. A maximum rope speed of 800 ft. per minute is obtainable on this hoist and a round trip is completed in thirty seconds., Eight seconds is required for accelerating the car to full rope speed; eleven seconds

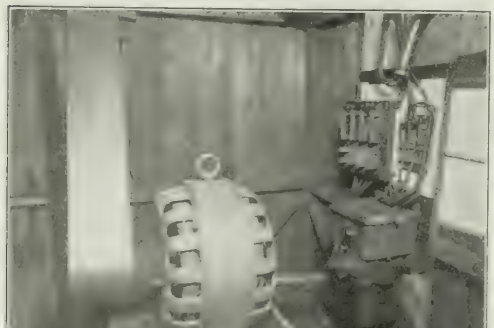


FIG. 5—[illegible] MOTOR OPERATING SHAKING SCREENS IN COAL MINE

elapses with the car in uniform motion; five seconds is required in retarding the car, and six seconds is required in dumping and caging. Each car is capable of carrying 1.5 tons to 2 tons. The two cars are balanced on the opposite ends of the hoisting cable and are driven by a 150-hp wound-rotor Westinghouse motor, which is connected to the hoisting drum through one reduction of herringbone gears. An operator at the top of the shaft controls the hoisting motor and brakes.

The coal is lifted 30 ft. above the ground and dumped into shaker screens where the different sizes of coal are sorted. These screens are 8 ft. wide, 2 ft. deep and from 12 ft. to 25 ft. long. A two-speed Westinghouse squirrel-cage motor operates the screens. Two speeds have been chosen in operating the shakers, as it has been found that when the quantity of coal in the shaker is considerably lower than the normal amount the screens are shaken to pieces by vibration.

In new mines in this district experience has shown that 20,000 cu. ft. of air per minute is sufficient for ventilation. As the mine grows older and more veins are opened up, the liability of stagnation increases and as high as 150,000 cu. ft. of air per minute is required. The ventilating fan in the O'Gara mine is geared to a 50-hp, two-speed, squirrel-cage Westinghouse motor. During the eight hours of the

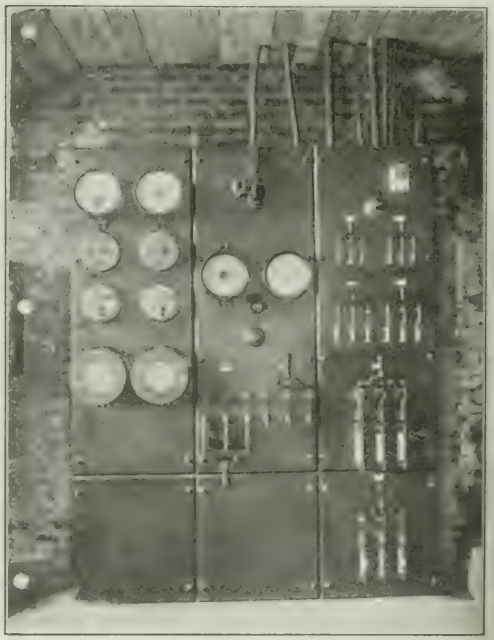


FIG. 6—SWITCHBOARD INSTALLED IN HOISTING ROOM OF COAL MINE

day when the men are working the fan is operated at full speed; at other times it operates at half speed.

As the coal is mined it is loaded into cars which are pulled to the hoisting cage by a Morgan-Gardner electric locomotive. This locomotive is operated from a 270-volt trolley wire and is capable of pulling an 8-ton load. The highest pressure of any exposed conductor in the mine is 300 volts.

In the blacksmith shop is a 5-hp Westinghouse squirrel-cage motor which operates a blower furnishing a draft for the forges. This motor is run at an operating speed of 1130 r.p.m.

Alternating current is used for most of the motors in the mine, but the locomotive requires direct current. A 100-kw rotary converter is installed in the hoist operator's building on the surface for furnishing 250-volt to 275-volt direct current. In the same building with this rotary converter are the hoisting motor, the control apparatus and the switchboard.

# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Reciprocity in Advertising

Mr. D. H. Howard, advertising manager of the Commonwealth Edison Company, in a recent issue of *Printers' Ink*, calls attention to an example of reciprocity in advertising. He speaks of a street-car card of the National Biscuit Company bearing the words "Refreshing Uneeda Biscuit" and illustrated by a picture of an electric fan running full blast. The idea of the fan and its refreshing breezes is conveyed no less prominently than the merits of the crackers. Mr. Howard thinks that this street-car advertising is no doubt responsible for the sale of many electric fans. The advertising department of the Commonwealth Edison Company, to show its appreciation, thereupon represented a box of Uneeda biscuit on a dining table in one of its newspaper advertisements exploiting the use of the electric fan.

## Revenue from the "Turn-Down" Lamp

The Fort Wayne & Northern Indiana Traction Company, which supplies energy for lighting and commercial purposes in Fort Wayne, Ind., is making a special campaign in "turn-down" lamps for residence use, advantage being taken of the window display loaned by a lamp manufacturer. This display consists of a miniature theater with a revolving stage and shows toy figures operating two-filament turn-down lamps as the curtain rises and falls upon the four different scenes.

The new-business department of the Fort Wayne company believes that these lamps are a material help in increasing customers' monthly bills and in filling out that part of the early morning load curve which is invariably low. Tests made with a turn-down lamp show that if it is operated ten hours each night, a rather large estimate, the monthly bill of the customer will be increased 12 cents. The company sells the lamps for 45 cents and is giving its patrons the privilege of renewing them at an additional cost of 30 cents each.

## Increasing Sign and Show-Window Lighting Revenue

The Commonwealth Power Company, Jackson, Mich., is making a general canvass for sign and show-window lighting business. In eight days at Jackson, with the assistance of representatives of the Federal Sign System (Electric), contracts were closed for ten signs, which will increase the monthly revenue about $150. These signs were purchased outright by the customers and are lighted and maintained by the electric-service company at a flat rate which is very reasonable. This charge also provides for washing the signs, replacing burned-out lamps, and switching the lamps off and on. This company does not urge the use of transparent signs, as illuminated lamp-letter signs demand more energy.

Along with the sign campaign the company is endeavoring to secure long-hour show-window lighting business. Formerly the majority of the local show-window lamps burned from dusk until 9 p. m., but in four days of the campaign fifteen merchants were induced to keep their lamps lighted until 11 p. m. For the latter service the rate at monthly rate of 75 cents per 100-watt tungsten lamp and 50 cents per 60-watt unit is made. This charge includes also lamp renewals and the patrol service of the men who turn the lamps off and on.

## Delivery Service with Electric Truck

The accompanying illustration shows the electric truck used by the Republic Railway & Light Company, of Youngstown, Ohio, for conveying supplies to its storeroom and electric shop and for delivering to customers purchases made in its retail display rooms. The truck is attractively finished in white enamel and bears on its side the legend "Electric Shop, Everything Electrical." On the dashboard appear the words "We do wiring."




ELECTRIC DELIVERY TRUCK, ELECTRIC SHOP, YOUNGSTOWN, OHIO

## Youngstown's Electric Shop

The Republic Railway & Light Company, which controls the Youngstown (Ohio) Consolidated Gas & Electric Company and several electric-railway properties operating in and about Youngstown, has established an electric shop in connection with the railway ticket office of the company. All ticket purchasers are thus obliged to go to the electric shop if they wish to save money by avoiding cash fares. Lighting and motor-service bills are also paid here. Fig. 1 is an exterior night view of the Stambaugh Building, in which the electric shop is located. The situation of the building on the main square of the city gives a place of prominence to the electric-shop sign. Light from the ornamental lighting posts in front is also reflected from the white walls of the building, making it stand out clearly against the darker background.

The sign on the corner spells and flashes the words "The Electric Shop," while the zigzag border in red and white tungsten lamps simulates a lightning discharge about the edges of the sign. Four large panels of the display window immediately adjoining the corner are occupied by timely exhibits of electrical merchandise. The flasher for the

large electric sign holds a permanent place in the corner of these show windows and furnishes a never-ending source of attraction to persons gazing at the displays. It was originally thought that the flasher would be kept in this position only temporarily, but the arcing contacts on the revolving drum have proved of so much interest to the public that a change has never been deemed advisable.



FIG. 1—EXTERIOR NIGHT VIEW OF YOUNGSTOWN'S ELECTRIC SHOP

Fig. 2 shows the front portion of the large room occupied by the electric-service company, and it is this part which is properly known as the electric shop. At the rear of this room a row of ticket-sellers' cages, an information desk and a counter screen the office from the sales and demonstrating space. No price-cutting competition marks the sale of appliances from the electric shop, for in all cases standard retail prices are maintained, approaching as nearly as possible those of the local supply dealers. Demonstrations of appliances are given on request. The



FIG. 2—CIRCULAR DISPLAY COUNTER IN ELECTRIC SHOP, YOUNGSTOWN, OHIO

desk of the lady demonstrator may be seen within the circular display counter (Fig. 2).

Many forms of advertising are utilized by the company to call attention to the features displayed at the electric shop. A weekly electrical page in a local newspaper carries stories of popular electrical interest clipped from the technical press. About these short articles are grouped advertisements telling of the devices on sale at the electric shop. Other display advertisments are run daily. During holiday periods billboard advertising is used extensively.

Mr. J. Hartshorn is lighting contract agent of the Youngstown Consolidated Gas & Electric Company and manager of the electric shop.

## Securing Full-Schedule Business from Present "Breakdown-Service" Customers

The isolated-plant owner who is already buying insurance against breakdown in the form of a readiness-to-serve arrangement with the central-station's system often constitutes one of the salesman's best "prospects" for full-schedule central-station business. To shut down such an isolated plant altogether it should be necessary only to show the owner how heavily his power service is costing him, when he adds to the plant costs per kilowatt-hour the flat charge made by the company for what it denotes its "breakdown-service connection." This flat monthly or annual breakdown-service charge is properly distributable over the total number of kilowatt-hours actually generated by the isolated plant, so that one may consider the breakdown insurance element of the total cost in terms of so many cents per kilowatt-hour of isolated plant output, even though the

RELATION BETWEEN LOAD-FACTOR AND UNIT COST OF "READINESS-TO-SERVE" UNDER BREAKDOWN

| Load-Factor, per Cent | Cents per Kw-hr. | Load-Factor, per Cent | Cents per Kw-hr. |
|---|---|---|---|
| 5.0 | 5.48 | 40.0 | 0.69 |
| 7.5 | 3.65 | 50.0 | 0.55 |
| 10.0 | 2.74 | 60.0 | 0.46 |
| 15.0 | 1.82 | 70.0 | 0.39 |
| 20.0 | 1.37 | 80.0 | 0.33 |
| 25.0 | 1.10 | 90.0 | 0.30 |
| 30.0 | 0.92 | | |

central station's lines may never be called on for relay service.

Obviously, also, the magnitude of this "breakdown" charge entering into the total cost of a given kilowatt-hour will depend upon the load-factor under which the customer's plant is operating, being inversely as the number of hours of service. If the salesman can quickly estimate this "breakdown" element from the customer's conditions of connected load, load-factor and "breakdown-service" rate, the result, added to the admitted or proved cost of isolated-plant output, will usually show a total cost per kilowatt-hour much in favor of straight central-station service. Especially is this true if the customer's load-factor is comparatively low, since then the small unit output of the plant has to be saddled with the entire "readiness-to-serve" insurance cost.

A certain Eastern central station makes a "breakdown-service connection" charge of 10 cents per month per 50-watt equivalent connected, which expressed in other terms is $2 per connected kw per month. In a given plant the actual number of hours' use per day will be represented by the product of the load-factor and 730, the number of hours in the average month. For each kilowatt-hour of isolated-plant output the unit insurance charge against breakdown will therefore be

| Breakdown charge per kw | $2.00 | $0.274 |
|---|---|---|
| 730 × load-factor | 730 × load-factor | load-factor |

Hence, under the two-dollar rate quoted, dividing 27.4 cents by the load-factor of the installation gives the in-

surance charge to be shared by each kilowatt-hour of isolated-plant output. Thus it becomes possible to convert any table of load-factors, such as those given in the N. E. L. A. Solicitors' Handbook, to a table detailing the probable unit cost of breakdown service to these different classes of customers. Scrutiny of such figures will then suggest to the central-station salesman where his chief opportunity lies and whether the rate schedule available offers any advantage for the isolated-plant customer to use straight central-station service. The accompanying table shows the unit insurance cost of "breakdown readiness-to-serve" per kilowatt-hour of isolated-plant output for various customers' load-factors. In these figures a breakdown readiness-to-serve charge of $2 per connected kilowatt is made, but no central-station energy is assumed to be used.

## Pittsburgh's Solution of the Small Customer Problem

The Duquesne Light Company, Pittsburgh, Pa., at present has connected to its circuits some 2800 customers receiving service through excess indicators on flat-rate contracts. Of these customers 60 per cent are commercial and 40 per cent are residential patrons who have been secured during two and one-half years of constant co-operative soliciting by the central-station company and the manufacturer of the indicators.

The methods used in securing this business may be outlined as follows: Solicitors in the employ of the Excess Indicator Company were supplied with such information regarding prospective customers as was available and were provided with blank contracts under the lighting company's name. The size of the contract which these men could attack was limited, however, by the fact that the indicators are regularly made in ratings only up to 10 amp and on special orders to 20 amp. The lighting company specified that no contracts should be closed calling for a connected load of less than 100 watts. For commercial customers a gross rate of 1.35 cents per watt connected was quoted, 0.1 cent discount being given for payment of bills before the tenth of the month. Residential patrons, on the theory of being short-hour users, received a rate of 1.1. cents per watt connected, with a 0.1-cent discount for prompt payment.

In almost no case has the company taken contracts for wiring new houses, it having relied upon the contractors to handle this business. However, eight solicitors are hard at work most of the time in securing contracts for wiring existing buildings. The friendly relations which have been maintained with the contractors have gone far in aiding the company to secure the small customer.

Viewed from the customers' standpoint the electrical energy purchased on this flat-rate contract is inexpensive. In the average commercial installation the lamps are operated nine hours each day for twenty-six days in a month, making a total operating period of 234 hours. Assuming that the connected load is 1 kw and the net price is 1.25 cents, the monthly bill will be $12.50, indicating a rate of approximately 5 cents per kw-hr. As the hours of operation are increased the kilowatt-hour rate to the customer is made to appear more favorable, until, upon reaching the maximum monthly period of operation, 720 hours, the rate becomes about 1.4 cents per kw-hr.

From the viewpoint of the company the flat-rate offer is also extremely attractive. A 1000-watt installation brings to the company's treasury each month $12.50, or $150 annually. When it is considered that many companies earn less than $50 per connected kilowatt per year the desirable nature of such business will be readily apparent. There are other advantages accruing from the use of the indicators which cannot so readily be estimated in dollars and cents. For instance, a considerable reduction in transformer ratings has been noticed in communities where the majority of customers are using the indicator, for although each customer may have installed on his premises a large number of lamps, he can operate only a limited number at any time.

No trouble is reported in Pittsburgh from customers endeavoring to use electrical appliances of high wattage ratings on circuits connected for light indicator loads. The experience there has been that as soon as the customer is educated to the point where electrical appliances are desired his business can be obtained on a metered basis.

The 2800 flat-rate customers on the Pittsburgh company's circuits have added in round numbers 500 kw of connected load to the system. Thus these are really the small customers, as the average connected load per customer is about 180 watts, and the average monthly bill is something over $1.90.

Another form of contract much in use by Pittsburgh's householders requires that the patron pay a "fixed charge" of 15 cents per month for each room and main hall on the first floor, 5 cents per month for each room on the upper floors and 2 cents for each lamp outlet on the premises in excess of fifty. Upper halls and bathrooms are not charged for. In addition, the customer agrees to pay an energy charge of 6 cents per kw-hr. for all energy consumed. It is specified that the minimum fixed service charge shall be 65 cents per month. Data collected by the company show that this charge averages about 75 cents. This contract was introduced for the advantage of the residential patron whose monthly bill was more than $1.50, and it is recommended to those wishing to withdraw from the flat-rate contract. Although at the time of introduction of this contract it was feared that the revenue of the company would be decreased, the effect has been found to be in the opposite direction.

## Detroit Crematory Using Electric Blower

The Woodmere Cemetery Association of Detroit is using a motor-driven compressor to furnish air for operating the oil jets in its crematory and for concentrating the flames on the body being consumed. Air from this compressor is

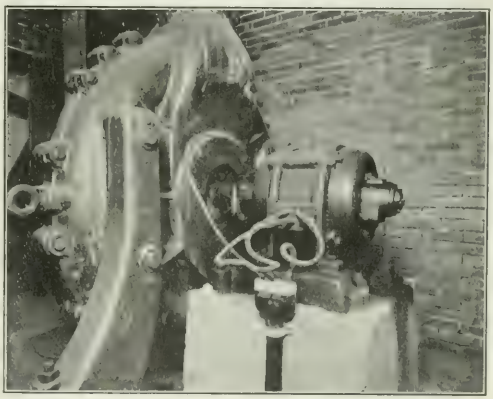


FIG. 1—MOTOR-COMPRESSOR SET USED IN CREMATORY

also utilized to separate the human ashes from the wood ashes of the casket. Two incinerators are now installed in the same building with the chapel and catacombs, while the air compressor is located in an outbuilding about 100 ft. distant.

Apparatus for controlling the compressor motor is installed in the crematory where it can be operated by the

in charge of the cremation. Service wires leading to the station motor are run in underground conduit. In Fig. 1 is shown the combination General Electric compressor-motor set, which is capable of delivering 1600 cu. ft. of air per minute against a pressure of 2 lb. per sq. in. A blast gate in the air-intake pipe is used to throttle the air entering the compressor to meet the requirements of the crema-

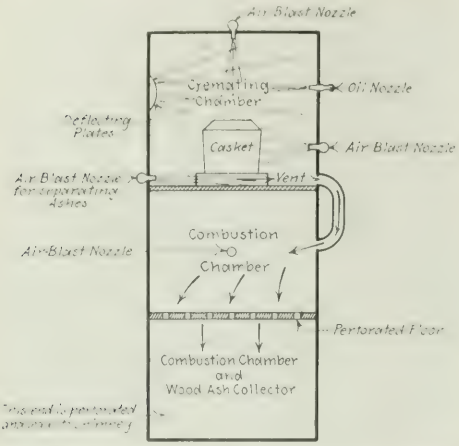



FIG. 2—CROSS-SECTION OF INCINERATOR IN DETROIT CREMATORY

tory. The impeller in the compressor case is overhung on its shaft, the entire revolving unit being supported by the motor bearings.

From the compressor the discharge pipe runs underground to the crematory, where a vertical riser connects it with a horizontal pipe supported from the ceiling. Fig. 3 shows the two incinerators installed here. In the center of this room the discharge pipe divides into three branches—one leading to each of the two incinerators to provide air

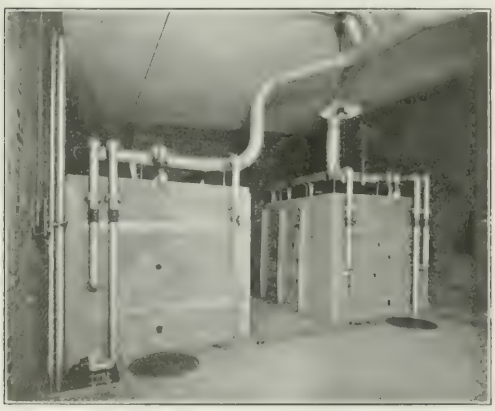


FIG. 3—INCINERATORS IN DETROIT CREMATORY

for oil jets and air blasts, and the third to a vent in the roof. Valves in these pipes, which are operated by chains shown hanging from the center of the ceiling, regulate the total amount of air delivered to each incinerator and allow the excess to escape through the vent in the roof.

Each incinerator unit consists of three compartments grouped as shown in Fig. 2. The arrangement of oil jets and air blasts to cremate the body and to separate the human and wood ashes is of special interest. Three oil jets along one wall of the upper chamber spray ignited oil against the deflecting plates on the opposite wall, while air blasts on the two side walls and ceiling concentrate the flames on the coffin. As the casket and body are consumed the ashes from both are mingled and in falling to the floor are intercepted by a horizontal draft of air which carries the lighter wood ashes through vents into the combustion chambers below. The human ashes, which are denser than the wood, drop to the floor of the upper chamber where they remain until raked into urns. Contrary to the familiar practice of power-plant furnaces, the path of the gases is downward as indicated by the arrows in Fig. 2. The two lower chambers are equipped with air blasts and baffles which cause complete combustion of the gases given off during reduction of the body, thereby eliminating disagreeable odors.

Before a body is placed in the incinerator the chamber is heated for twenty minutes. The casket is then slid in on rollers and a temperature of 3000 deg. Fahr. maintained. In these incinerators the time of cremation is reduced to one hour and twenty minutes. The Detroit crematory has been in operation since April, and up to Nov. 6 twenty-four bodies were cremated with an average oil consumption of 30 gal. per body. Experiments are being conducted to find the effect which preheating the air blast will have on the oil consumption.

The motor-driven compressor is especially suitable for this purpose, as it can be placed in an outbuilding without attendance and can be controlled by the person in charge of the cremation.

## Local Activities in the Electric Vehicle Field

Some interesting reports of the work done in encouraging electric-vehicle sales by local sections of the Electric Vehicle Association of America were presented at the recent Chicago convention of the association. Mr. Homer E. Niesz reported for the Chicago Section, Mr. J. A. Hunnewell for the New England Section, Mr. Harvey Robinson for the New York Electric Vehicle Association, and Mr. Day Baker for the Electric Motor Car Club of Boston.

The work of the New York Section is carried on largely through committees. Its committee on charging stations establishes new stations where needed and keeps electric-vehicle owners informed of the location of all stations. The committee on traffic and service runs arranges electric-vehicle parades and other public demonstrations. For gathering data on relative costs the committee on operating cost has been appointed. All laws affecting traffic are investigated by the committee on legislation. Another committee has been seeking to establish a co-operative garage and service station to be supported by all the local vehicle interests.

During the past year the New England Section has instituted a sales and advertising convention and has employed a permanent business secretary. In addition to carrying on publicity campaigns this section has also taken an interest in traffic regulation and recently secured the abandonment of the Massachusetts motor-truck fee bill. During the coming year an aggressive membership campaign will be launched.

The Chicago Section has held weekly meetings during the entire year, the enthusiasm of its members remaining at a high pitch throughout the summer months, when most organizations suspend their usual activities. It is reported that the "second-hand car bugaboo," still a nemesis of the trade, will soon be made the point of attack in a well-defined movement designed to bring about a solution of this troublesome problem. The section has taken advantage of

many holiday celebrations in and about Chicago in arranging demonstrations to promote publicity of the electric vehicle.

Mr. E. E. Witherby, of Chicago, urged pleasure-car men to "get into the game" and push their product as the commercial-vehicle men have done. Mr. W. J. McDowell, of the same city, spoke of the fight made by the Chicago Section against an ordinance reducing the period of curb stops from sixty to thirty minutes. As a result of this effort, action on the ordinance has been deferred. Mr. F. W. Smith, of New York, declared that if more garage facilities were available the demand for pleasure vehicles would exceed that for commercial wagons.

During the winter of 1912 and 1913 the Electric Motor Car Club of Boston held fortnightly meetings, the dates of these sessions being arranged to coincide with the monthly meetings of the New England Section of the Electric Vehicle Association of America. The members of the club are drawn from among vehicle owners and those interested in the trade who reside within 50 miles of Boston. The club has carried out a series of co-operative advertisements in the Boston *Transcript* and other daily papers. To indicate the results of the concerted advertising and co-operative efforts the accompanying table is given, showing electric-vehicle registrations in Massachusetts on Aug. 1, 1912, and Aug. 9, 1913.

NUMBER OF ELECTRIC VEHICLES IN MASSACHUSETTS

| | 1912 | 1913 | Gain | Per Cent Gain |
|---|---|---|---|---|
| Passenger | 425 | 557 | 132 | 31 |
| Commercial | 210 | 384 | 174 | 82.8 |
| Total | 635 | 941 | 306 | 48 |

President F. W. Smith read a communication from Mr. Joseph E. Baker, of Spokane, Wash., in which the writer offered to organize a Pacific Section with Spokane as its headquarters.

## Experiments in Electroculture Near Dayton, Ohio

By Dr. Herbert G. Dorsey

At Moraine Farm in the fertile valley of the Miami River, about 4 miles south of Dayton, Ohio, experiments have been carried on during the last year to discover the effect of electricity and artificial illumination on the growth of vegetation. In the preliminary tests a number of small plots were marked off for exposure to different kinds of electrification, the idea being to carry out later on a larger scale those methods which offered the greatest promise. In order that the soil should be uniform in the test plots, the top earth was first collected, thoroughly mixed and sifted, and then laid to a uniform depth of about 7 in. over the entire test area.

Plot No. 1 was excited by high-frequency currents from a small Tesla coil. A transformer stepped the 110-volt, 60-cycle alternating current up to 5000 volts, charging a condenser of tinfoil and glass plates which discharged through the primary of the Tesla coil and a spark-gap. A network of No. 30 B. & S. gage wire stretched about 15 in. above the plot was connected to one terminal of the Tesla coil, the other terminal being led to a wire screen which was buried in the earth. The transformer and coil took about 130 watts and were operated one hour morning and evening. The potential difference between the soil and overhead wires was about 10,000 volts and the frequency perhaps 200,000 cycles per second.

### Extending Illumination by Artificial Means

Plot No. 2 was illuminated by a 100-watt tungsten lamp with ruby bulb three hours daily, beginning at sundown. Plot No. 3 was illuminated by a Cooper Hewitt mercury-vapor lamp three hours per day, beginning at sundown. Plot No. 4 received no artificial stimulation, but was used as a "control" so that comparisons might be made between the plots receiving excitation and one receiving none.

In plot No. 5 was buried a wire network connected to the negative terminal of a 110-volt direct-current circuit. The latter's positive terminal was led to a small sprinkling can having a carbon electrode in the middle insulated from the can itself which could be connected to the negative side. The can being filled, the water was first subjected to electrolysis for about three minutes. During this time the temperature of the water would rise from about 70 deg. Fahr. to 90 deg. Fahr., becoming filled with gas by the evolution of oxygen and hydrogen. While still bubbling, the negative terminal to the can was opened and the plot sprinkled, the idea being that current might flow from the can through the streams of water to the soil.

Plots Nos. 6 and 7 were subdivided into four individual boxes, 2 ft. square, each separated by porcelain insulators and arranged with carbon electrodes at opposite ends. To these electrodes were applied both alternating and direct current taken from commercial-lighting sources and from



PLOT FOR HIGH-FREQUENCY ELECTROCULTURE EXPERIMENTS AT MORAINE FARM, NEAR DAYTON, OHIO

dry cells. Some of the boxes were excited only after germination. The currents flowing were found to vary from 0.0003 amp to 0.0700 amp depending on the moisture present. All such current-flow results were, however, uniformly negative, germination being retarded and growth stunted.

The plots tested were planted with radish and lettuce seed, samples of which had previously been tested for germination. No stimulation was attempted on plots Nos. 1 to 5 until after germination. The seeds were planted Jan. 16, and on Jan. 29 stimulation was begun on Plots 1, 2, 3 and 5. About three weeks later ten plants each of radishes and lettuce were selected at random from the five plots and weighed as shown in the accompanying table.

From this table it will be seen that the plot subjected to the high-frequency current showed a greater increase in yield than any of the others. Ruby light ranged second for radishes, while violet light was second for lettuce. The electric-sprinkling system apparently proved worse than no stimulation at all. Comparing the high-frequency plot with the control plot, the edible portion of lettuce grown is 75 per cent greater than under natural conditions.

An attempt was next made to repeat the experiments, using tomatoes and cucumbers, but the investigators were prevented from getting any results because of interruption by the Dayton flood.

The results obtained from the high-frequency tests seemed, however, sufficiently encouraging to warrant starting work on a larger scale. A 2-acre plot of good soil in a flat field was accordingly selected to be used as a house garden and was arranged to be sprinkled by an overhead system of pipes supported from a catenary suspension system 14 ft. above the ground. The pipes ran east and west

RESULTS OF TESTS IN ELECTRIC STIMULATION OF VEGETABLES

| | Plot 1, Tesla | Plot 2, Ruby Light | Plot 3, Mercury Vapor | Plot 4, Control | Plot 5, Electric Sprinkling |
|---|---|---|---|---|---|
| Radishes (ten plants selected at random): | | | | | |
| Total plant weight, grams | 265.70 | 137.80 | 109.50 | 180.00 | 78.50 |
| Edible portion, grams | 149.50 | 57.40 | 40.90 | 79.40 | 31.00 |
| Edible portion, per cent | 51.15 | 41.68 | 37.34 | 44.11 | 39.49 |
| Tops and leaves, grams | 120.50 | 75.70 | 65.90 | 95.00 | 41.50 |
| Tops and leaves, per cent | 45.35 | 54.92 | 60.18 | 52.77 | 55.66 |
| Roots, grams | 9.80 | 4.70 | 3.20 | 5.60 | 6.00 |
| Roots, per cent | 3.50 | 3.43 | 2.48 | 3.12 | 4.85 |
| Lettuce (ten plants selected at random): | | | | | |
| Total plant weight, grams | 67.00 | 52.60 | 56.50 | 46.10 | 31.30 |
| Edible portion, grams | 60.70 | 47.30 | 50.20 | 41.80 | 28.20 |
| Edible portion, per cent | 90.59 | 89.92 | 88.85 | 90.67 | 92.10 |
| Roots, grams | 6.30 | 5.30 | 6.30 | 4.30 | 3.10 |
| Roots, per cent | 9.41 | 10.08 | 11.15 | 9.33 | 7.99 |

a distance of 200 ft. and were spaced at 50-ft. intervals north and south for a distance of 400 ft. In the northeast corner of this garden seven wires of No. 12 B. & S. hard-drawn copper were stretched north and south 200 ft., the wires being 9 ft. above ground and 15 ft. apart. The ends of the wires were attached to insulators on top of 4-in. gas pipes set in concrete, and at the middle they were supported by suspension insulators from one of the sprinkling pipes. The insulators used had been built for 60,000-volt work. The wires were elevated sufficiently for the soil to be plowed with horses. It should be noted that the high-frequency system was independent of the sprinkling system. Occasionally the two were run at the same time.

At the eastern edge of this plot was built a small transformer house in which a 7.5-kva transformer stepped up 220-volt, 60-cycle energy to 11,000 volts. A choke coil was placed in series with the primary. The secondary was connected to a spark-gap and shunted across this was the condenser in series with the primary of the Tesla coil. The primary of the Tesla coil was made of eight turns of No. 0000 wire and the secondary consisted of seventy-five turns of No. 14 B. & S. gage on a wooden drum 15 in. in diameter and 18 in. high. Both primary and secondary were immersed in a 50-gal. stoneware jar filled with transformer oil. The lower end of the secondary was connected to the pipes of the sprinkling system which furnished a ground connection, and the upper end was led out through a 60,000-volt bushing to the middle of the antennas. The spark-gap was formed of two rectangular boxes of thick copper with two faces parallel but separated by 0.25 in. The boxes were hollow and filled with water and gave excellent service as a stationary spark-gap.

### Difficulties in Beginning Operation

Considerable difficulty was experienced in getting the system to work properly. Condenser plates were continually breaking down until the condenser was built of old photographic plates 8 in. by 10 in., using two glass plates and then a sheet of tinfoil. Two boxes containing about 300 glass plates, each filled with transformer oil, gave a good condenser of about 0.1 mf capacity. Such a condenser did not break down, and it was not even necessary to remove the coating from the plates.

It was the latter part of July before the system could be considered in perfect working order. At that time a pressure of 50,000 volts was being given as measured by the needle spark-gap between the antennas and earth. The garden was then electrified daily from 6:30 to 9.30 a. m. and from 1:30 to 3:30 p. m.

The frequency of the oscillatory currents was estimated to be about 30,000 cycles per second, and at 50,000 volts sufficient energy was radiated from the lines to give to birds attempting to light on the wires a shock that felled them to the ground partially stunned. None, however, was actually killed. The total energy consumed from June to Sept. 1 was 221 kw-hr. Of this amount probably half was wasted in the inefficient choke-coil.

The accompanying illustration shows the garden in early summer. No attempt is made to indicate comparative sizes of the vegetables. The transformer house appears in line with the gardener's dwelling.

Because of the delay in getting the system in good working order, only qualitative rather than quantitative data are available. However, it was very apparent that almost all the vegetables grown under the wires were better than those not electrified. The plants stimulated included radishes, lettuce, beets, cabbage, cucumbers, turnips, muskmelons, watermelons, tomatoes and parsnips. Little or no difference could be observed in beans and peas. The gardner in charge, however, picked almost all the others at least two weeks earlier under the wires than in the unelectrified portions.

All these different vegetables were planted in rows running east and west so that one-half of the row was electrified while the other half was not. Actual weights were obtained only in the case of tobacco. One end of a row was cut under the wires and the plants averaged 1687 grams each. One week later the other end of the row was cut and the plants averaged 1632 grams per plant, so that electrification may be credited with a gain of 55 grams per plant, or an increase of 3.35 per cent. But since the most rapid growth of tobacco occurs during the last two weeks, it is estimated that the increase in weight had both ends of the row been cut at the same time would have been about 20 per cent.

No satisfactory theory is at present offered to explain the increased yield due to high-frequency electrification. It is felt that insufficient data are yet at hand to form any theory or to determine whether such experiments will be successful from the financial standpoint or not. In the present case the expenditure was much greater than the increased yield gained. Several questions arise which it is hoped will be answered some time during the next year, among them: Is the effect due to the potential gradient between the wires and earth, or simply to the total potential difference? Does the effect depend on the frequency of the current, and, if so, what is the best frequency? What is the best amount of stimulation? If any of these problems can be solved during the present winter in the greenhouse, the results will be utilized in the larger experiments during the next summer.

## "Mechanical Man" as Show-Window Attraction

When the Consolidated Gas, Electric Light & Power Company, of Baltimore, Md., opened its offices and show rooms in the building at the corner of Park Avenue and Liberty Street, it secured the services of a young man who had been posing in local windows and moving-picture shows as a "mechanical man." As mentioned in these columns a the time, the crowds which he drew were very large Since then the interest manifested by the public in the poser's unusual skill has continued so great that the company has now retained his services altogether for more than six months. The mechanical man is at present being used to demonstrate the electrical appliances which the company has on sale. He adopts a different "make-up" for each demonstration and his female impersonations have aroused particular interest.

# Illumination and Wiring

## A Jeweler's Push-Button Lighting Scheme

Next to the plan of having continuous adequate illumination of his store to attract the attention of the passing public, a novel scheme devised by a Western retail jeweler has secured for him a measure of publicity quite out of proportion to its cost. This dealer has had all the lamps in his store wired to a switch which can be operated by a push-button outside the entrance. Over the button is mounted a sign reading, "You can see our store by pushing this button." Many of those who pass during evening hours yield to their curiosity and push the button. The lamps are cut off automatically as soon as the switch is released. This scheme has caused considerable local comment.

## Bracket-Type Arc Lighting at Niagara Falls, N. Y.

A handsome ornamental installation of 224 magnetite-arc lamps has just been inaugurated on Falls Street, Niagara Falls, N. Y. There are 112 tubular-steel poles each carrying a double bracket which supports two General



BRACKET-TYPE MAGNETITE-ARC LIGHTING AT NIAGARA FALLS, N. Y.

Electric inverted-type magnetite-arc lamps. The posts, which are installed at intervals of 70 ft., are made up of standard 7-in., 6-in. and 5-in. tubing and also serve to support the trolley span wires. Series circuits feeding the lighting installation are carried on overhead brackets at the peaks of the poles. Provision has been made, however, by leaving slots in the pole butts below the ground line, so that at some future time the wires may be placed underground in conduit. The poles and brackets are provided with the Electric Railway Equipment Company's positive cut-out. With this it is not necessary to remove the cover portion of the bracket in order to operate the cut-out, as a chain and ring below the brackets serve this purpose.

Energy to operate the Falls Street lighting system is furnished free of charge by the Hydraulic Power Company and the Buffalo & Niagara Falls Power Company, while the poles were erected by the International Electric Railway Company, whose trolley spans the posts support. The installation was carried out under the supervision of Mayor Laughlin of Niagara Falls and Mr. M. J. Donohue, city electrician.

## Support of Long Transmission Span by Messenger Cable

After the completion of the Eastern Michigan Edison Company's hydroelectric plant at Ann Arbor, Mich., an unexpected market for energy opened up in two towns, to the north and west respectively. To transmit energy to the latter place by the shortest practicable route, it was



FIG. 1—1000-FT. SPAN SUPPORTED FROM MESSENGER CABLE

necessary to string the 23,000-volt conductors across the pond above the dam, requiring a span of about 1000 ft. Figured for tension, No. 0 hard-drawn copper wire was found to have just sufficient strength to be used safely on this span. However, while a jumper from the station high-tension bus was being soldered onto one of the span wires the heat of the solder annealed the hard-drawn copper, so far reducing its strength that the conductor broke under its own tension.

To avoid using the larger wire needed to withstand the tension, the construction shown in diagram Fig. 2 was then adopted. H-shaped wooden frames, as shown in Fig. 1, were built and erected on each side of the pond as dead-end towers. Back of each on its land side another H-shaped frame was erected to help withstand the horizontal pull of the long span.

The main dead-end towers are constructed of 45-ft. poles with 8-in. tops and are provided with two cross-arms, as shown in Fig. 2. Attached to each arm are three 30,000-

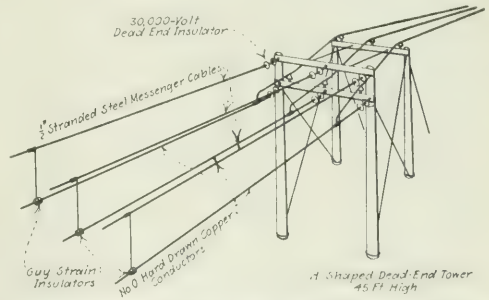



FIG. 2—LONG TRANSMISSION SPAN SUPPORTED BY MESSENGER CABLES

volt dead-end strain insulators, and crossing the pond between the insulators on the upper arms are strung three 0.5-in. stranded-steel messenger wires. Suspended from the messenger wires at points dividing the span into three parts are hangers which support ordinary guy strain insulators. Through these pass the main copper conductors, which are dead-ended on the lower set of insulators. This

particular span was erected in July and a 20-ft. sag was allowed. Minor details, such as the guying of poles, connection of jumpers to span wires, etc., are shown in Fig. 2.

The line transmits energy at 23,000 volts to Dexter, Mich., where it is transformed to a lower potential and used in street and residential lighting. Energy for operating a sand and gravel pit is also supplied by this line. The general practice along the right-of-way has been to use 35-ft. poles with 175-ft. spans.

## Water in Inclosed Flame-Arc Lamps

By W. R. Mott

It is well known that poor inclosure of flame lamps caused among other things by cracked, chipped or poorly seated globes is deleterious to the best burning conditions because it permits the inrush of excess air, thus deranging the natural ventilation system for the condensation of the fumes and allowing the arc to burn under more or less open arc conditions, which greatly shortens the life of a trim. The writer knows of no published data on the effect of water in the globes, and the results of such tests should therefore be interesting as showing the disastrous effects of even a small quantity of moisture.

### Theoretical Consideration

Water vapor at high temperatures reacts with the carbon of the electrodes according to the following formula: $C + H_2O = H_2 + CO$. The free hydrogen thus formed is from an operating standpoint, because, in combining with the oxygen, explosions are extremely liable to occur which will often break the globes. Other points will be observed in connection with the test figures shown below.

As a counter-action to the formation of hydrogen, a few tests with carbon tetrachloride and similar materials have recently been made. The hydrogen combines with it as fast as formed according to the formula $2H_2 + CCl_4 = C + 4HCl$, but the hydrochloride acid thus formed would attack the metal of the lamp parts and this process cannot in its present form be considered commercially possible.

### Tests

To obtain quantitative figures, tests were made on alternating-current series white-flame lamps, using two standard grades of white-flame electrodes called A and B below. In each case 1 liter of water was placed in the globe at the start and the lamp operated to the end of the trim. The amount of water then left was ascertained and the next test started with this quantity as a basis. This method was repeated until no water was left in the globe.

### Discussion of Tests

In examining the results from the above test it will be noticed that the quality of the light emitted, at first a dim deep yellow, gradually improved as the water was expelled until a normal white was obtained when no moisture remained in the globe.

Poor inclosure in extreme cases will cause slag outages due to excess air alone, but this trouble seems to be greatly augmented by the presence of a large amount of water,

DATA FROM TESTS ON ALTERNATING-CURRENT SERIES WHITE-FLAME LAMPS

| Test | Electrode | Water Present | | Light | Dots | | Points | Explosions, Pick-up | Globe Condition | Hours | [illegible] | | Arc Length |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | At Start | At End | | Slag | Sticking | | | | | Upper | [illegible] | In. |
| 1 | A | 1 liter | 230 cu.cm. | Dim deep yellow | 2 | 1 | Poor | [illegible] | Good except at water edge | 14 | 2.95 | [illegible] | 0.5 |
| 5 | A | 230 cu.cm. | Very small | At start deep yellow | 1 | [illegible] | Poor | Very bad | Heavily coated. Some slight etching at water edge | 48 | 8.20 | 9.90 | 0.4 |
| [illegible] | A | [illegible] | None | At start yellow, then good white | 0 | 0 | Good | Two first ten hours only | Good. Some carbon dust. No etching | 126 | 21.00 | 30.80 | 0.3 |
| 4 | A | None | None | Excellent brilliant white | 0 | 0 | Good | None | Good. Some carbon dust. No etching | 180 | [illegible] | 33.80 | 0.1 |
| 5 | B | 1 liter | 135 cu.cm. | Dim deep yellow | 0 | 3 | Fair | ? | Heavily coated and etched | 14 | [illegible] | 4.80 | |
| 6 | B | 135 cu.cm. | None | Dim deep yellow | 0 | 0 | Good | Very bad | Heavily coated, badly etched | 48 | [illegible] | 10.40 | 0.5 |
| 7 | B | Trace | None | Pink pearl white | 0 | 0 | Good | None | Coated. Some carbon dust. Apparently no etching | 102.50 | 18.50 | 24.50 | 0.4 |
| 8 | B | None | None | Good white | 0 | 0 | Good | One very slight | Coated. Some carbon dust. Apparently no etching | 114.25 | 20.60 | 28.50 | 0.1 |

what causes the most trouble. Having not only the highest specific heat but the highest conductivity of any of the common gases, it rapidly conducts heat away from the arc. Moreover, in the immediate neighborhood of the arc, the water vapor may be directly broken down into its constituents, hydrogen and oxygen, with the loss of their great heat of reduction. From these two causes the temperature of the arc is greatly reduced, and the light given off, instead of being of a brilliant white color (using white flaming electrodes), will be a poor dim yellow of low candle-power. Another objectionable feature of hydrogen is its ability to recombine with any oxygen present to form more water. This may assume the form of a regular cycle. The water is broken down into hydrogen and oxygen at the high temperature of the arc, taking its heat of reduction from the arc, with the further loss of heat due to the conductivity of the hydrogen. This hydrogen now passes out of the immediate vicinity of the arc to the condensing chamber where the temperature is low enough to permit of its recombination with any free oxygen present and there gives up its heat of combination where it is of no benefit but an actual detriment. The water vapor then travels back to the arc, and the cycle is repeated. Aside from illumination considerations, the presence of hydrogen is bad

Outages due to sticking of the electrodes in the holders were also observed, accounted for by the moist condition of the deposit. It will be noticed that these outages are of such a character that the lamp would not start again of its own accord. During the test a man started the lamps after each outage, but if such a condition occurred in practice, the lamp would remain inoperative until the repair crew arrived. With the electrodes used these phenomena occurred only when much water was present.

The condition of points speaks for itself.

Passing now to the occurrence of hydrogen-oxygen explosions, a question mark is found opposite tests Nos. 1 and 5 where the quantity of water present was large. Apparently any explosions which occurred were damped by the large volume of water vapor so as to be undistinguishable. The critical point seems to be between 50 and 150 cu. cm. where they were frequent and violent. They may, however, cause considerable trouble below this lower value.

The remarks under "Globe Condition" are self-explanatory. Apparently in test No. 8 there was some moisture in the form of vapor still in the lamp, causing the slight explosion noted and the rather poor globe condition.

It is in the life of the trim that the effect of moisture stands out most significantly. Under dry conditions the

ife was 139 in test No. 4 as against 14 in test No. 1. The ain is nearly as striking between tests Nos. 5 and 8.

The electrodes taken by different lamps are of different engths, and a trim of one lamp will therefore last longer han one from another lamp, so in order to obtain a air basis of comparison the rate of consumption is neasured in terms of hours of burning per inch length f carbon. The figures under these headings will be n approximate proportion to the life of the trim. Test No. 4 shows about the normal rate of burning under good onditions. The length of the upper and lower electrodes f a lamp is determined by their relative rate of burning o that both will be consumed in the same time. The pres-nce of water changes this burning ratio, causing an abnor-nally rapid consumption of the lower, so that the arc moves lownward. Should this continue, the lower will be entirely consumed before the end of the normal life of the trim and he lower holder will be burned.

### Conclusions

The conclusions from this test are self-evident. One hould keep the lamps in such shape that rain cannot enter he globes, and in trimming he should keep the electrodes lry because even a trace of moisture is detrimental. Finally oil or grease should not be permitted to get on the lectrodes or in the lamps, for oil is a hydrocarbon which vill break down into carbon and hydrogen under the action f the intense heat of the arc, with all the bad effects of the ydrogen from water.

## Using Electricity in Tuberculosis Campaign

A determined struggle against the ravages of the "white plague" is now being waged at Fort Wayne, Ind., and the combating forces, headed by Dr. Eric Crull, have resorted to many interesting "kinks" in their attempt to raise funds from the sale of Red Cross stamps during the holidays. The little house shown in the illustration has been placed in a conspicuous position on the lawn near the post office, and, as the lettered sign explains, with each thirty-second interval at which the 25-watt lamp in the center of the gable is




BOOTH USING ELECTRIC LAMP TO ATTRACT ATTENTION

flashed on and off a death from tuberculosis occurs somewhere in the civilized world. The lamp is operated by a clockwork mechanism mounted just behind it on the wall inside.

Electricity for operating the lamps in this exhibit is supplied free of charge by the Fort Wayne & Northern Indiana Traction Company.

## Recent Telephone Patents

Mr. A. E. Pool, of Wheeling, W. Va., is the patentee of a harmonic selective system. In this system the harmonic selection is accomplished by a harmonic relay having reed vibrators. All bells are operated by currents of the same frequency, and both the bell currents and the harmonic currents are introduced on the line simultaneously, except at the first station. The bell circuits are carried through the harmonic relays. For the first station bell current alone is introduced on the line, and all harmonic relays are inoperative. The bells at all other stations are shunted so that they fail to ring. For the second station the harmonic current introduced simultaneously with the bell current operates the reeds of the harmonic relays so that all save the desired bell are left shunted or open. For the other stations similar methods of operation are used.

### Lockout System

In order to prevent interference on party lines, Mr. E. Bowman, of Elmwood, Ont., has devised a party-line lockout system. According to this system, after a connection has been effected, the calling party may lock out all other stations on the line by manipulating a key. However, in order to avoid abuse of this privilege, another key is provided at each station, by means of which anyone desiring access to the line may signal for the exchange operator, so that she may listen in and discover whether or not the parties talking are holding the line too long.

# Letter to the Editors

## Some Historical Inaccuracies

*To the Editors of the Electrical World:*

Sirs:—The beginning of an academic year offers a suitable opportunity for calling attention to some inaccuracies, mainly of a chronological character, which have found their way into textbooks on physics and which appear as regularly as edition follows edition. Though they may be considered of little moment, it will be conceded, nevertheless, that they are blemishes, and as such it is proper that they should be eliminated from the pages of manuals intended to serve as reliable guides for the student of physical science.

An early instance occurs in a well-known and widely used college textbook, in which it is said that the term "pole" as applied to magnets was first used by Gilbert in his Latin treatise "De Magnete," published in London in the year 1600. Three centuries before that date, however, the term *polus lapidis* (pole of the lodestone) was used not once but time and again by Pierre de Maricourt in the no less remarkable work of his, entitled "Epistola de Magnete," which was dated from the trenches of Lucera, in southern Italy, Aug. 8, 1269.

The author was what would be called to-day a military engineer, one who outside of his warlike duties, found time to investigate the properties of the lodestone by numberless experiments. His treatment was so systematic and thorough that little was added to the philosophy of the lodestone for more than three centuries until Gilbert had toiled over his magnetic theory for some twenty years in his workshop in the quaint Essex town of Colchester.

Pierre de Maricourt is frequently referred to as Petrus Peregrinus, or simply Peregrinus (the Pilgrim), probably from his having taken part in one of the crusading expeditions of the time.

In expounding "The Principal Facts Relating to the Earth's Magnetism" a writer of eminence says that Peregrinus does not explicitly state the fact that "like poles repel each other." This nevertheless is what appears in Chapter VI of the "Epistola": "Should you bring the

north pole of one lodestone near the north pole of another, the one you hold in your hand will seem to put the floating one to flight. If the south pole of one is brought near to the south pole of another, the same will happen. This is because the north pole of one seeks the south pole of the other and, therefore, repels the north pole."

Surely, this is a clear, unequivocal description of the repulsion that takes place between the similar poles of a lodestone or magnet.

Again, in the textbook on physics already referred to, the reader is informed that magnetic declination was known as early as the thirteenth century. No authority is given for this statement and none could be given except that of Peregrinus himself, who was the only writer on magnetism of the thirteenth century. An examination of his "Epistola" shows that he believed firmly in the fidelity of the magnet to the pole, for in Chapter V he says: "When a lodestone is placed within a floating basin it will turn the basin round until its north pole lies in the direction of the north pole of the heavens and the south pole of the stone points to the south pole of the heavens." No such thing as magnetic declination was known to Peregrinus, to his contemporaries, or to his successors for a period of 200 years. It is true that a passage was found in the manuscript copy of the "Epistola" which is preserved in the university town of Leyden and which states that at the time and place of writing the needle declined 5 deg. east of north.

There are twenty-eight manuscript copies of the "Epistola" preserved in European libraries, and in none of them is the "declination" passage found save in the one kept in Leyden—a very significant fact indeed. A critical examination of the manuscript by competent authority was naturally called for, and when this was made the passage referred to was shown to be an interpolation in the manuscript made sometime in the early part of the sixteenth century.

The earliest record which we have of magnetic declination on *land* is that made by Hartmann in Rome in 1510 and described by him in a letter written to a Prussian nobleman in 1544, which letter remained practically unknown to the world until it was published in 1831.

Dr. Hellmann, of Berlin, found a few years ago ("Rara Magnetica," 1906) an earlier recognition of this magnetic element on a pocket sun-dial fitted with a compass on the face of which the declination was indicated. The instrument bears date 1451 and was probably made in Nuremberg, the home of the sun-dial makers. This curio may be seen in Innspruck, where it is kept in the Museum Ferdinandeum.

The discovery of magnetic declination on *sea*—the variation of the compass—was made in 1492 by Columbus, who further discovered and recorded its change with change of place, two observations of fundamental importance in the science of terrestrial magnetism.

In the textbook above quoted Boyle is held to have introduced the term "electricity" into our scientific nomenclature. Boyle was admittedly the first to write an English work on the subject, a work which appeared in 1675 under the title "Experiments and Notes About the Mechanical Origine or Production of Electricity." Previous writers on the subject, few in number, had written their tomes in Latin; and it should be observed that they did not use the noun *electricitas*, but contented themselves with the adjective form in such expressions as *motus electricus*, *corpora electrica*, etc., which adjective form was introduced by Gilbert and used by him in his monumental work, "De Magnete."

In 1650, that is a quarter of a century before the publication of Boyle's tract, the English term was used by Charleton in his translation from the Latin of Van Helmont's famous "Ternerary of Paradoxes." The passage reads: "The phansy of amber delights to allect strawes, chaffe and other festucous bodies by an attraction, we confesse, obscure and weake enough yet sufficiently manifest and strong to attest an *electricity*."

But we may go back further still; for in Sir Thomas Browne's "Psuedodoxia Epidemica," which was published in 1646, the term occurs in the singular number on page 51, where appears the statement: "The concretion of ice will not endure a dry attrition without liquation; for if it be rubbed long with a cloth it melteth, but crystal will calefy into *electricity*, that is a power to attract strawes or light bodies."

A few pages further on (page 79) the term is used in the plural number in a paragraph in which it is said of certain kinds of salts such as sal gemma, alum and talc that "if gently warmed at the fire and wiped with a dry cloth, they will better discover their *electricities*."

So to the London physician rather than to the philosopher of Lismore must be given whatever credit may be due for the coinage of the English term "electricity" and for its first use in print in the year 1646.

It is a notable fact that though Gilbert in 1600 added greatly to our knowledge of electrical phenomena, he failed to detect electrical repulsion because he likewise failed to detect electrical insulation. Not a few writers inform us that this fundamental property of electrified bodies was first described by Otto von Guericke in his "Experimenta Nova," published in 1672. But this again is incorrect, for this repulsion did not escape the keen eye of Cabeo, professor of natural philosophy in the schools of Ferrara. That Italian Jesuit describes the phenomenon very minutely in his "Philosophia Magnetica," which was published in 1629. On page 194 of that ponderous volume he notes how iron filings and grains of sawdust are first attracted by an electrified body and then suddenly and violently repelled to a distance of three or four finger-breadths. "Repellantur procul ad distantiam trium aut quattuor digitorum" are his words.

The last instance of inaccuracy here to be noticed refers to current electricity. That there should be some connection between electric and magnetic phenomena was suspected soon after the invention of the Voltaic pile in 1800. In 1802 Romagnosi, a physician of Trent in the Tyrol thought that he had detected the mysterious relationship; as did also Mojon, professor of chemistry in Genoa in 1804. It is known, too, that as early as 1807 Oersted of Copenhagen had the matter well in mind; but it was not, however, until the summer of 1820 that he succeeded in making the experiment which brought him world-wide fame.

In the textbook referred to the year 1819 is given as the one in which the cardinal discovery in electromagnetism was made. It is true that the Danish physicist, while lecturing on "electricity, galvanism and magnetism" in the university during the winter of 1819, attempted experiments on the subject which he has the candor to say were not "sufficiently conclusive." He missed the effect in 1819 because he placed the wire conveying the current athwart the magnet and un-philosopher-like contented himself with his failure. Some time later, however, having at his disposal a powerful battery of twenty "troughs," he returned to the experiment, when, on stretching the wire lengthwise over the magnet, the response of the latter to the energy of the passing current was prompt and decisive. This was on July 21, 1820.

Realizing the theoretical importance of his discovery Oersted lost no time in informing the academies and learned societies of Europe of his good fortune. The Latin memoir of four pages in which he describes the experiment was dated July 21, 1820, the day on which the discovery was made. The year 1820, and not 1819, must therefore be taken, in accordance with accepted usage, as that of the discovery of the magnetic effect of the electric current.

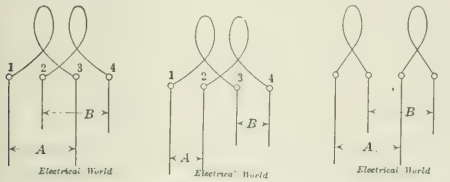
BROTHER POTAMIAN.
*Manhattan College, New York City.*

# Field of the Operating Engineer

**A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers**

## Two-Phase Motor Connections

Fig 1 illustrates the order in which the internal phase-coil leads of many two-phase induction motors are connected to the motor terminal blocks 1, 2, 3, 4. Here one phase of the supply circuit must be connected to terminal blocks 1 and 3 and the other phase of the supply circuit to terminal blocks 2 and 4. Under this condition, each




FIGS. 1, 2 AND 3—DIAGRAMS OF CONNECTIONS FOR TWO-PHASE MOTORS

phase of the supply circuit may be considered as independently applied to an isolated motor coil. The independent currents reach their maximum values at different times and in different places around the stator, thereby producing the rotating magnetism that causes the rotor to turn. In Fig. 2 the internal motor connections are correct, but supply wires have been brought to the terminal blocks in the wrong order. In Fig. 3 the supply wire connections are correct, but the internal motor leads have been brought to the terminal blocks in the wrong order. In either of the latter cases the result is to superimpose the two-phase displaced supply voltages upon each other in the same circuit, thereby giving a single-phase resultant. The motor would be unable to start, but once started would operate as a single-phase motor. Before connecting a two-phase motor to the supply lines it is well to ring out the terminal blocks; then, assuming the connections to be of the type indicated, the correct supply wire connection can always be obtained.

## Overload Due to Lack of Lubrication

A monorail induction motor-driven crane that had been operating continuously for a year or more began to get sluggish in action and its two driving motors were heating so badly that it was necessary to favor them. The crane was starting on the third and fourth notch, whereas it ordinarily started promptly on the first notch, and the maximum speed had decreased so much that production was impaired. Heating of the rotor rheostats suggested resistance trouble, but inspection and test of the rheostats showed them to be free from fault. Apparently hot rotors suggested that they were rubbing the stators, but the air-gap gage soon disproved this diagnosis. Application of two voltmeters and of two ammeters showed that the voltage at the motors was normal and that all voltages and currents were balanced, but that the motors were much overloaded. It was improbable that there would be anything wrong with the motor connections or windings, for the ammeters would have shown unbalancing. Furthermore, the chances of the two motors being similarly defective electrically were small, especially in the light of their having operated smoothly for so long a time.

The inspector was nonplused and was inclined to give up for the night, and to resume the investigation the next morning, when the mill foreman, passing on his way out, called to the crane man, who, it seems, had been on the job for only two days, to be sure to oil his crane before he went home. "Sure," said the crane man, who then turned to the inspector and sought information as to the location of the crane parts that should be oiled. This was indeed a welcome clew to the inspector, who immediately set to work and found that all of the bearings on the crane were as dry as a bone and that the only reason that they had not run babbitt was that they were made of brass. Fifteen minutes after oiling the bearings, which had had no oil for three days, operation was almost normal and the crane went freely through a curve through which it could not pull previous to the oiling. In an hour the inspector withdrew, a sadder but a wiser man—wiser because he realized that the best way to ascertain whether or not a piece of machinery has been oiled is to look.

## Alarm-Clock Control for Street Lighting

The street lighting of the little city of Leetonia, Ohio, is controlled by a home-made time switch, the principle of which is shown in the accompanying sketch. The alarm clock in the upper right-hand corner of the drawing operates the entire mechanism. A circular piece of metal soldered to the alarm-winding key wraps the heavy cord about it as the alarm rings and, with the knife switch acting as a lever, withdraws the sliding bar from beneath the weight, allow-

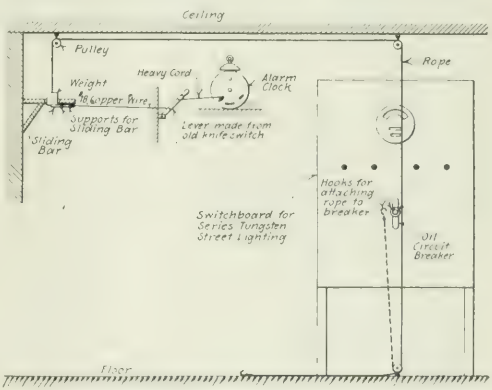



DIAGRAM OF ALARM-CLOCK CONTROL

ing the latter to drop. Falling through the opening in the supporting platform, the weight jerks the rope and trips out the breaker. If it is desired to light the lamps with the same time switch it is necessary only to attach the hook shown in dotted lines to the breaker and the action of the clock at the appointed time closes the switch.

In the early part of each day, when Mr. E. H. Geithel-

who acts as superintendent, contract agent and chief engineer. On the necessary visits the station, he winds the clock and sets the alarm at the proper hour for switching the lamps into the circuit. It is then necessary only to make another trip to reverse the hooks and reset the alarm for extinguishing the lamps at daybreak.

## Power-Plant Repair Complaint and Work-Order Blanks

A simple yet comprehensive method of reporting complaints on defective power-plant machinery, assigning jobs to workmen and tabulating the costs of labor and material required for repairs is in use by the Louisville (Ky.) Gas & Electric Company. In many plants where defective conditions are reported verbally to the operating engineer, delay often ensues either because the matter slips someone's memory or because the complaints failed to state the extent of the repair work required. Mr. A. F. Wilson, operating engineer of the Louisville company's Waterside station, makes use of two forms of reports printed on cardboard 3.25 in. wide and 7 in. long. The station complaint report is a red card and the work-order report is white. Copies of each are shown in the accompanying reproductions. A stock of the complaint cards is kept at the place where the men fill out their time slips so that they will not be delayed in looking for the cards.

On one side of the complaint card blanks are left for filling out the name of the apparatus needing attention, its location, condition, and the work and material required for its repair. On the reverse side are spaces for filling in the work order issued, when the work is completed, and the cost

WORK ORDER ISSUED

Time M. Date 191.

Work Completed

M. Date 191.

Total Labor
Total Material
Total Cost
Charged

M. Date

Operating Engineer

STATION COMPLAINT
Kentucky Electric Co.
Louisville

The Company will appreciate any ... made by the employees ... All ... operating must be reported at once. Use this card.

To Operating Engineer: The machine, apparatus or part described below is in bad order and requires repairs or changes as follows:

Work Necessary, Material Required

FIG. 1—FRONT AND BACK OF STATION COMPLAINT BLANK

of making the repair is summarized under labor and material. As these cards are filled out the clerk in the office collects them from a drop box, makes a note of their receipt in his journal, and turns them over to the operating engineer, who fills out a station work order blank and has it placed in the hands of the foreman in charge of the men familiar with such work.

On the front of the work-order blank is entered the name of the man in charge of the job, followed by a detailed account of the work to be done. On the reverse side the foreman fills out the names of the men employed on the job, and the amount of time which each man works. In addition to this, a detailed list of material used is recorded.

STATION WORK ORDER
Kentucky Electric Co.

WORK COMPLETED

Material

Charge to Order No.
When Required....
Signed.
Operating Engineer

Time.....M. Date

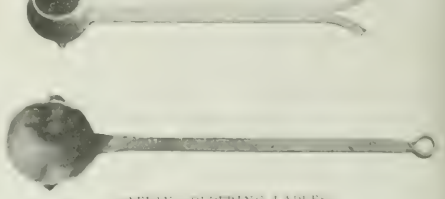
Time. M. Date.....191.

FIG. 2—FRONT AND BACK OF STATION WORK ORDER

This card is returned to the clerk on completion of the job, and the rate paid each man, the total amount due to him and the cost of the material used are all entered in their respective places.

## Safety Soldering Ladles

Burned fingers seldom incapacitate workmen, but such injuries reduce efficiency and if left unattended may lead to serious results from infection. In the departments of one large manufacturing plant where a great deal of soldering of coils and cummutator leads is done accidents have been reduced to a minimum by the introduction of non-



SAFETY SOLDERING LADLES

splashing ladles for pouring the solder. As shown in the illustrations, these safety ladles consist of the regular stock ladles with an additional rim or a pouring nozzle. A further practical advantage gained by the use of such ladles is that all solder is poured from the bottom so that the slag which floats on the molten metal does not interfere with the work.

## Comparative Costs of Operating Ice Factory by Oil Engines and Electric Motors

By C. E. Rose

The plant of the Arkansas Cold Storage Company, at Little Rock, Ark., produces refrigeration for a cold-storage warehouse of 100,000 cu. ft. capacity, a street pipe-line of 42,000 cu. ft. capacity and two freezing tanks, each having an output of 40 tons of raw-water ice per day. The refrigerating machinery consists of two vertical duplex Frick gas pumps each rated at 50 tons of refrigeration per twenty-four-hour day when running at 77 r.p.m. with standard refrigerator and condenser pressures. In addition to this equipment, 100 hp is installed in various motor units of from 2 hp to 25 hp, used to drive the circulating-water and brine pumps, air compressors, agitators, etc.

Ice is made by the raw-water system, using artesian water purified by being passed through two quartz filters and one paper filter. Very clear ice results therefrom, as the accompanying illustration of a cake shows. A pressure of 2 lb. per sq. in. is carried on the air-agitation lines in the ice cans, and each 300-lb. can requires 1 cu. ft. of free air per minute to produce the best results.

### Initial Use of Oil Engines

There were first installed in this plant two 120-hp vertical, three-cylinder Diesel oil engines, but much trouble was experienced from these units gradually and continually dropping their load when most needed. The travel of the fuel valves on the engines was very small and a very slight wear was found to produce a marked effect in the power of the engines. For best results the valves should be set so that the explosion takes place with a "lead" adjustment of 6 in. on the circumference of the flywheel; but unless the Little Rock engines were checked continuously it was found that they would shortly be operating with a "lag" and consequent loss in compression and in power. Again, many small shutdowns were required owing to the crystallization of valve-rod springs and safety-valve springs and to similar small troubles. Much difficulty was also experienced with the three-stage, high-pressure air compressors, the trouble being principally with the rubber ferrules in the first and second receivers, since at the high

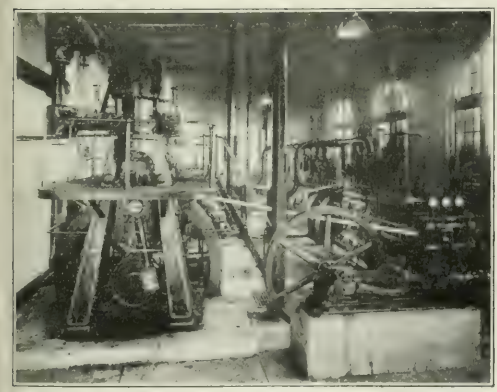


FIG. 1—REFRIGERATING MACHINES DRIVEN BY OIL ENGINES

pressures used (300 lb. to 600 lb. per sq. in.) the rubber deteriorated and deformed very rapidly.

A view of the engine room is presented herewith in Fig. 1, showing the oil-engine installation, which required five men for its operation and maintenance with both engines running fully loaded twenty-four hours a day.

In Fig. 2 is shown a similar view of the same plant following replacement of the engines with two 100-hp adjustable-speed, 2200-volt induction motors. With this adjustable-speed control a very even time-temperature curve is maintained on the freezing tanks, in the warehouse and on the street pipe-line, whereas with the former practically constant-speed oil engines it was necessary to run at full speed or stop, and the time-temperature curves presented continually rising or descending slopes.

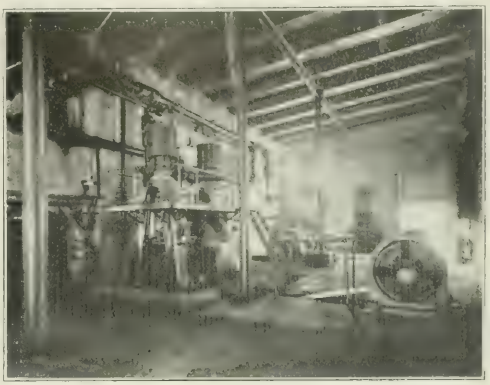


FIG. 2—SAME AMMONIA COMPRESSORS OPERATED BY ELECTRIC MOTORS

In the following discussion all figures are based on the unit "ton of refrigeration," which represents the abstraction of 284,000 lb.-Fahr. thermal units. All unit costs and revenues are calculated, therefore, with tons of refrigeration as the units of manufacture.

Each oil engine, in addition to being belted to one ice machine, was arranged to drive through another belt from the opposite flywheel a three-phase alternating-current generator, which supplied 240-volt, three-phase, 60-cycle energy for the operation of the auxiliary motors. The actual electric load was thus 38 kw.

### Comparison of Operating Costs

For the year ended Oct. 1, 1912, during which oil-engine drive was used, the books of the company showed the following:

| | |
|---|---|
| Tons of refrigeration manufactured | 13,123 |
| Kilowatt-hours produced | 497,608 |
| Kilowatt-hours per ton of refrigeration | 37.9 |
| Fuel oil for power, per ton of refrigeration | $0.124 |
| Wages for power per ton of refrigeration | 0.170 |
| Lubricating oil and waste per ton of refrigeration | 0.074 |
| Water per ton of refrigeration | 0.030 |
| Electricity purchased per ton of refrigeration | 0.012 |
| Maintenance of oil engines per ton of refrigeration | 0.013 |
| Maintenance of refrigerating plant per ton of refrigeration | 0.008 |
| Maintenance of electric equipment per ton of refrigeration | 0.013 |
| Maintenance of auxiliary equipment (pumps, air compressors, etc.) per ton of refrigeration | 0.007 |
| Total engine-room expense per ton of refrigeration | $0.451 |

Not enough refrigeration was produced, however, to handle satisfactorily the company's business, and it was imperative that some drastic change be made. The Merchants' Lighting Company, of Little Rock, proposed that the Arkansas Cold Storage Company replace its two oil engines with 100-hp adjustable-speed motors. The central station also offered its regular primary rate of $1 per kw of maximum demand plus an energy charge of 1 cent net per kw-hr. for the electricity consumed by the motors, provided that the refrigerating plant would not run during the company's peak load. The cold-storage company, after carefully considering the terms of the offer, accepted the proposition of the lighting company and installed the

motors as suggested, selling the oil engines at a very fair price.

Following is the statement of operation of the Arkansas Cold Storage Company's engine room for the year ended Oct. 1, 1913, during which period electric-motor drive was employed:

| | |
|---|---|
| [illegible] | [illegible] |
| [illegible] | [illegible] |
| [illegible] | [illegible] |
| [illegible] | [illegible] |
| Lubricating oil and waste per ton of refrigeration | 0.030 |
| [illegible] | [illegible] |
| Water per ton of refrigeration | [illegible] |
| Maintenance of electric plant per ton of refrigeration | 0.010 |
| Maintenance of refrigerating plant per ton of refrigeration | 0.035 |
| Maintenance of auxiliary equipment per ton of refrigeration | 0.024 |
| [illegible] | [illegible] |

Comparison with the preceding figures for oil-engine drive shows a decrease of 6 mills per ton in favor of electric operation. Incidentally, however, the tons of refrigeration manufactured by the company were increased 50 per cent, and the warehouse and pipe line were maintained without complaint or trouble. During even the hottest days of summer 40 tons of clear marketable ice was produced without difficulty.

The figures for the total kilowatt-hours manufactured in the case of the oil-engine equipment were calculated from

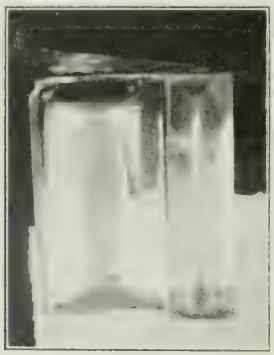


FIG. 3—CAKES OF RAW WATER ICE

weekly indications of the ice machines and from the kilowatt-hour output generated by the small alternators carrying the electrical load.

### Advantages Resulting from Electrical Drive

Even in the days of engine drive it was necessary to have central-station service in the building at all times, for it not infrequently happened that both oil engines would be shut down for a few minutes at the same time. The circulation of the brine through the pipe line and brine coolers could never be permitted to stop, as sufficient time would not be allowed to pump out the liquid ammonia in the brine coolers, and such ammonia, if not pumped out, would continue to boil, freezing up the brine in the coolers and finally bursting them.

Again, each engine shut-down caused a temporary suspension of the air pressure on the freezing tanks, resulting in a consequent white line in the ice. Interruptions for even five minutes would completely ruin cakes of ice which were just beginning to freeze, since the white line would then be near the outside of the block, causing the entire cake to have a white, opaque appearance.

The costs tabulated above represent the manufacturing expense in the engine room; but, owing to the larger divisor of units manufactured, the total cost (including the above and the general expenses and fixed charges) for the oil-engine equipment amounted to $1.22 per ton of refrigeration. With electric drive these charges were but $0.956 per ton, a saving of $0.264 per ton of refrigeration over the oil-engine figures.

During the first year the Arkansas Cold Storage Company paid expenses, fixed charges and but very little more. With the electric drive, however, it earned for the year ended Oct. 1, 1913, an 8 per cent dividend and also passed several thousand dollars to surplus.

The increase in refrigeration capacity was obtained by speeding up the ice machines from 77 r.p.m. to 116 r.p.m. Some of the operators declared that on account of the high speed very little would be gained in weight of ammonia compressed in a given time. Indicator cards have, however, shown that while at this high speed of 116 r.p.m. the area of the card is slightly reduced, there occurs nothing like the increase in volumetric displacement of the machine in a given time. The net gain in refrigerating capacity was 24 tons per day, giving the plant a rating of 148 tons of refrigeration, and not 100 tons as with the oil-engine equipment at its best condition.

## Universal Motor

I have a window display to drive which requires a motor of from 0.0625-hp to 0.0833-hp rating. I wish to put several of these equipments on tour in the larger cities of the United States where both alternating and direct current are used for lighting. After some correspondence with one manufacturer of alternating-current and direct-current motors such as are used for vacuum cleaners, he refuses to guarantee the satisfactory operation of his motors when changed from direct to alternating current. Would you advise the use of two independent motors, space and weight being important factors? C. A. S.

For the use described you should have no difficulty in finding a "universal" motor which will operate satisfactorily on both alternating and direct current. Such motors are usually of the series type, and while operating directly across the alternating-current circuit, are arranged to have a fixed resistance cut in series when running on direct current. Universal motors are in satisfactory operation even in the largest sizes. We know of one crane installation equipped with 15-hp motors which is in use in a shop having its own direct-current generating equipment but purchasing alternating-current central-station energy from outside. As a result of the peculiar load conditions this motor is operated by direct current during the hours the private plant is running and is then transferred to the alternating-current mains during the peak hours, as well as for overtime service.

## Lightning Troubles at Generators

During the last three years we have been operating [illegible] alternator and have experienced much trouble from lightning. This season, for instance, several generator coils were burned out. Prior to 1910, however, we had in use a belt-driven machine and were never troubled with lightning beyond the blowing of a few fuses on the transformers. Is there any evidence that direct-connected waterwheel plants are more subject to lightning disturbances than belt-driven machines? H. E. O.

We think your increase in lightning troubles—if not due to the especially severe disturbances of the past season as experienced in some sections—must be traced to a difference in line conditions, arrangement of your lightning protection or characteristics of the windings of the waterwheel generator as compared with those of the belted machine. In any case the frame of a belted generator would, for practical purposes, doubtless be as effectually grounded, either intentionally or accidentally, as would that of a direct-connected waterwheel unit, so that this factor should not be held accountable for the damage. Perhaps the dry weather of the past season removed most of the moisture from the sand and gravel ground connections of your lightning arresters, thereby invalidating the customary discharge paths.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*Direct-Current Machines with Interpoles.* — Oskar Szilas.—Although interpole machines are now being generally used, faulty operation sometimes occurs in practice as the result of wrong positions of the brushes or wrong connections of the interpole windings. The author describes in detail a great many experimental methods and "kinks" by which the correct operation of such interpole machines may be assured. He points out that the important object is to determine the exact location of the neutral zone. The operation of the machine will be faulty if even a small error is made in the position of the brushes. The author then shows why for the determination of the neutral zone the method of voltage maximum is not sufficient, and describes a more satisfactory method as follows: The direct-current machine is driven as a dynamo without load, at constant speed and excitation. Two auxiliary brushes, separated by a distance of 3 mm to 4 mm from each other and connected to a voltmeter with a 3-volt scale, are moved on the commutator in a tangential direction until the voltmeter reading is zero. The same distance must always be maintained between the auxiliary brushes; the position of the auxiliary brushes, which corresponds to the zero reading of the voltmeter, will then indicate the neutral zone. An important condition for the correct use of this method is that the machine be producing no current. For instance, the test could not be used for unloaded motors, since the interpole flux due to the no-load current would cause the zero reading of the voltmeter to occur outside of the neutral zone. The method is entirely correct only if the regular brushes of the machine be taken off the commutator. After the neutral zone has been fixed it is important to determine experimentally the quality of commutation under different conditions. Various methods are described for accomplishing this purpose.—*Elek. u. Masch.* (Vienna), Nov. 9, 1913.

*Amortisseurs.*—P. Boucherot.—The first part of a long and highly mathematical paper giving theories of the damping of the oscillations of alternators operating in parallel and of the use of amortisseurs (damping coils). The author begins with the elementary condition of parallel operation of two alternators and applies it to the case of very long oscillations—long enough to permit neglecting the amplitudes of the emfs, while considering only the phase. He then gives the complete theory for the oscillations corresponding to any frequency occurring in practice, taking into account variations of speed and of the induced currents in the amortisseurs and in the primary circuits. The calculation is made in two steps, first, under certain simplifying assumptions, and later in more rigorous form. The paper is to be concluded.—*La Lumière Elec.*, Nov. 8, 1913.

*Self-Excitation of Saturated Polyphase Commutator-type Series Machines.*—A. Scherbius and H. A. W. Linkhamer.—In discussing means for suppressing the self-excitation of polyphase commutator-type series motors two actions must be taken into consideration. The first is the effect which the saturation in one axis of the machine has on the other axis by purely magnetic action. The second is the effect of one saturation axis on the other due to magnetic flux superposition. The first effect has been investigated in detail by Binder and Dyhr, who have developed a simple formula for the value of the protective resistances. The present authors emphasize the point that it is sufficient to take care of only one of these two effects, and they therefore deal in detail with the second effect mentioned. Another formula is derived which represents the required condition for suppressing the self-excitation. Protective resistances calculated from this formula have smaller values than those computed with the formula of Binder and Dyhr.—*Elek. Zeit.*, Nov. 20, 1913.

*Winding Diagrams.*—G. Moores.—An article, illustrated by diagrams, in which the author shows that alternating-current winding diagrams may be made much simpler and more useful for practical shop purposes than at present through the extended use of the "group" type of diagram. The methods of using and constructing these diagrams are described, together with a discussion of their advantages.—London *Elec. Review*, Nov. 21, 1913.

*Theory of Alternators.*—Johann Lisner.—The first part of a highly theoretical paper on the theory of alternating-current machines without commutators.—*Elek. u. Masch.* (Vienna), Nov. 23, 1913.

*Measuring Phase Difference in Synchronous Machines.*—W. Tolwinski.—An article illustrated by diagrams describing a stroboscopic method for measuring the phase angle between the voltage at the terminals and the induced emf in synchronous machines.—*Elek. u. Masch.* (Vienna), Nov. 23, 1913.

*Insulation of Electromagnet Coils.*—B. Duschnitz.—An illustrated review of methods of insulating magnet coils to render them unaffected by high temperatures.—*Elek. Zeit.*, Nov. 20, 1913.

### Lamps and Lighting

*German Tungsten Lamp Patents.*—After protracted proceedings, extending over two or three years, the German Patent Office has decided definitely, despite the opposition of sixteen firms, in favor of the fundamental patent for drawing tungsten wire for metallic-filament lamps. It will be remembered that the General Electric Company of the United States, after experiments which were spread over a period of years, succeeded in devising the particular system whereby it was possible to draw tungsten wire of a convenient thickness, or rather thinness, for lamp filaments. As a result of the interchange arrangements existing between the General Electric Company and the Allgemeine Elektricitäts Gesellschaft of Berlin, the German patents for the new process were vested by the former in the latter, and the special agreements between the two companies permitted of the patent rights also being exercised by the Siemens & Halske Company and the German Incandescent (Welsbach) Gas Light Company, while the Bergmann Company was subsequently also brought within the field by the grant of a license. As the Patent Office has now given a decision in regard to the patents, these four firms will likely benefit from the result. On the other hand, other concerns have not been slow in coming forward to declare that they are not affected by the action of the Patent Office. The Julius Pintsch Company, for instance, states that the decision is of no importance in the case of Sirius lamps, which are made according to the company's own patented process. Voigtlander & Lohmann point out that any firms are permitted to manufacture incandescent lamps with tungsten wire as long as the wire is not made on the basis of the patent to which the de-

cision refers but is produced by some other method.—London *Elec. Review*, Nov. 21, 1913.

*Metallic Filaments.*—A note on a recent British patent (No. 19,006, 1912) of H. Kast. Metals and metallic oxides are obtained in a minutely divided state by heating the metallic salts of the nitro-phenols until the metal or oxide separates itself. Before heating the salts may be diluted with indifferent substances or mixed with oils, fats, tars, etc.—London *Elec. Eng'ing*, Nov. 20, 1913.

### Generation, Transmission and Distribution

*Electricity as a By-product.*—R. J. Spencer-Phillips.—A paper read before the (British) Institution of Municipal Engineers. The author endeavors to show that other interests besides central-station companies may find it profitable to sell electricity, especially mills which need electric power for their own purposes and by erecting a larger plant can run more economically and sell their surplus energy as a by-product at a profit. An added reason lies in the recent development of back-pressure and reducing turbines. The author thinks that mills and factories, especially those that require steam for their own processes, are in a position to generate electricity much cheaper than are central stations. The same subject is also discussed in a long editorial—London *Electrician*, Nov. 21, 1913.

*Pressure Rises.*—W. Duddell.—An abstract of an experimental lecture given before the (British) Institution of Electrical Engineers. The author first discusses the pressure rises due to resonance and shows that resonance at the fundamental frequency is rare but very dangerous when it does occur. Resonance of an upper harmonic is much more frequently observed, but with the good wave-forms of modern turbo-alternators the amplitudes of the upper harmonics are so slight that their resonance does not generally produce any dangerous pressure rises. The author then takes up pressure rises due to switching and to arcs and sparks.—London *Electrician*, Nov. 21, 1913.

### Traction

*Single-Phase Traction.*—A continuation of the long illustrated description of the Spiez-Brig (Loetschberg tunnel) railroad. In the present instalment detailed drawings are given of the electric locomotives and electrical connections, with data on the controller equipment, etc. The normal pressure at the trolley wire is 15,000 volts, the frequency is 15 cycles per second, and the maximum grade is 2.7 per cent. The total length of each locomotive is 16 m and the total weight is 107 tons, of which the mechanical part weighs 47.3 tons and the electrical part 59 tons. The adhesion weight is 78.2 tons. The rating for continuous operation for an hour and a half is 2500 hp at a speed of 50 km (30 miles) per hour. The maximum speed is 75 km (45 miles) per hour and the maximum starting effort is 18,000 kg.—*Elek. Zeit.*, Nov. 20, 1913.

*Starting Traction Motors.*—Conrad Iranyi.—An article illustrated by diagrams in which the author emphasizes the troubles due to rapid starting of traction motors and shows graphically the advantages of maintaining certain time intervals between the different starting steps.—*Elek. Zeit.*, Nov. 20, 1913.

### Wires, Wiring and Conduits

*High-Tension Insulators.*—F. W. Curt Brecht.—An illustrated article on the evolution of American high-tension insulators in their electrical, mechanical and commercial aspects.—*Elek. u. Masch.* (Vienna), Nov. 23, 1913.

### Electrophysics and Magnetism

*Roentgen-Ray Interference Phenomena.*—M. von Laue and W. Friedrich.—Two papers read before the annual convention of German Naturalists and Physicians. Laue discussed the general principles of Roentgen-ray interference with respect to recent experimental investigations and pointed out how conclusions may be drawn from these phenomena concerning the structure of crystals. Friedrich outlined conceptions, based upon similar interference phenomena, as to the Roentgen rays themselves, their spectrum and their wave-length.—*Phys. Zeit.*, Nov. 15, 1913.

### Electrochemistry and Batteries

*Storage-Battery Plates.*—A note on the method of H. T. Hannover for the production of porous storage-battery plates. The process is based upon the fact that the predominating metal in an alloy solidifies first and leaves the eutectic disseminated for a time in liquid form throughout the mass. Conversely, during reheating, the eutectic melts first and may be removed by centrifugal force or other means, thus leaving a honeycombed mass of metal of high porosity. The lead-antimony eutectic contains 13 per cent antimony and 87 per cent lead, so that in a 96 per cent lead alloy 27 per cent of the lead will go to form the eutectic, which solidifies at about 228 deg. C. The small percentage of antimony remaining in the lead matrix after expulsion of the molten eutectic is said not to affect the electrochemical capacity of the plates, but appreciably increases their strength. After trying various other methods, Hannover found that the best method of expelling the eutectic is by whirling. Cakes of the alloy are mounted in suitable frames carried by the arm of a whirling machine, and the discharge side of the plate is covered by gauze backed by a grating. To prevent cracking of the surface of the plate, it is necessary to tighten up the mold clamps as the eutectic is expelled. This adjustment is ef-

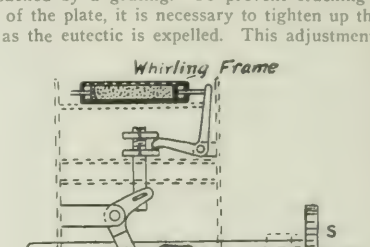



FIG. 1—APPARATUS FOR PRODUCING POROUS ACCUMULATOR PLATES

fected by the link work shown in Fig. 1 and actuated by hand wheel on the spindle. If the molds be filled while in the whirling machine, with a view to expelling the eutecti during cooling instead of after reheating, the molten meta runs through the gauze, but it should be possible to over come this difficulty. Tests made in the shops of the Danish State Railways on Planté plates prepared by this proces show the maximum safe charge and discharge rates to b increased considerably, making the Hannover plates espe cially suitable for automobile and submarine use. It i easy to prepare plates of more than 50 per cent porosit by the above means, and assuming the number of pores t average 13,000 per square inch (as found by microscopica examination) and to be of circular section and perpendicu lar to the surface of the plate, the total surface of th latter is about 130 times its natural superficial area in th case of a plate 5.5 in. by 3.25 in. by 0.25 in. Though porou metals prepared by the Hannover process have been ap plied only to the manufacture of accumulators as yet, it hoped that they will also prove applicable to metallic filter self-oiling (honeycomb) bearings, catalyzers, solderin sticks and various classes of ornamental work.—Londo *Elec. Review*, Nov. 21, 1913.

*Zinc.*—A symposium of papers on the present status an future prospects of the metallurgy of zinc. G. C. Ston discussed the development of the retort process and gav details of the great progress made in recent years. W. F Ingalls discussed electric zinc smelting, which he said i

still much in its infancy. J. W. Richards discussed electrolytic zinc. In the discussion W. McA. Johnson spoke of the progress made by him in electric zinc smelting.—*Metal. and Chem. Eng'ing,* December, 1913.

*Electric Furnaces.*—Woolsey McA. Johnson and George N. Sieger.—In the present instalment of this illustrated serial on electric furnaces, their design, characteristics and commercial applications, the authors deal with the subjects of buildings for an electric-furnace plant, foundations for electric furnaces, electrical connections and voltage regulation, essentials of electric-furnace transformers, and construction of water rheostats.—*Metal. and Chem. Eng'ing,* December, 1913.

*Electric Ore-Reduction Furnace.*—F. Louvrier.—An illustrated description of an electric furnace of the resistor type in which the furnace charge forms the resistor. The electrodes are embedded in the side walls opposite each other, being arranged in several sets one above another. Temperature regulation is obtained by switching on or off sets of electrodes. The applications of this furnace to the reduction of iron ores and the treatment of lead ores, and especially to the reduction of zinc ores, are described.—*Metal. and Chem. Eng'ing,* December, 1913.

*Passivity of Metals.*—An account of a symposium of papers delivered before the Faraday Society on the passive state of metals. A paper by G. Senter presented an introduction to the theory of the passive state of metals. G. Grube discussed anodic and cathodic retardation phenomena; D. Reichinstein discussed the electrode-volume constant-sum hypothesis; H. S. Allen photoelectricity and passivity; M. LeBlanc passivity and reaction velocity; G. S. Schmidt the hydrogen theory of passivity; E. P. Schoch the anodic oxygen-film and oxide-film hypothesis, and G. Schulze passivity and electrolytic valve action.—*Metal. and Chem. Eng'ing,* December, 1913.

### Units, Measurements and Instruments

*Astatic Electro-Dynamometers.*—J. T. Irwin.—A note on a recent British patent (No. 27,348, 1912). Two coils on the horizontal axis are so connected that the fluxes oppose. In the resulting radial flux is mounted a coil with its center on the axis of the two coils and with its plane vertical and free to rotate about a vertical axis. This coil is wound so that the currents pass the same way up the sides and down at the center. The torque can be measured in any well-known way.—London *Elec. Eng'ing,* Nov. 20, 1913.

*Watt-Hour Meters.*—S. H. Holden.—A paper read before the Birmingham Section of the (British) Institution of Electrical Engineers on the British standard specification for consumers' watt-hour meters. The author recommends various modifications to bring these specifications up to date.—London *Electrician,* Nov. 14, 1913.

*Laboratory and Testing Room.*—Leon Lichtenstein.—An English translation in abstract of his German paper on the laboratory and testing rooms of the Siemens-Schuckert Cable Works.—London *Electrician,* Nov. 14, 1913.

*Composite Waves.*—K. Fischer.—An illustrated description of an apparatus which permits the superimposition of one or more higher harmonics upon a sinusoidal wave so that the curve obtained represents the composite wave.—*Elek. Zeit.,* Nov. 13, 1913.

*Determination of Radium in Radio-Active Substances.*—A. L. Fletcher.—An illustrated description of a new method which is a modification of that of Strutt. The author employs what he calls a micro-furnace. It consists of a brass drum sliding on a slate cylinder which is perforated from below to allow of the passage of two wires connected to terminals on the upper face of the cylinder. These terminals clamp a thin rod of arc carbon which is heated by the passage of an electric current of about 10 amp per square millimeter of cross-section (maximum). The brass drum which slides on the cylinder may be adjusted in any position and the size of the chamber varied accordingly. This chamber is inclosed above by a plate of glass or transparent silica cemented to a brass frame resting on the rim of the drum. In these experiments the upper rim was lubricated with vaseline and the lower rim covered by a rubber band to prevent leakage. The arrangement of the apparatus is shown in Fig. 2. A small splint-

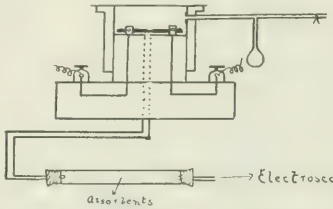



FIG. 2.—APPARATUS FOR DETERMINING AMOUNT OF RADIUM IN A SUBSTANCE

ered and weighed fragment of the mineral or salt (say, 0.01 gram to 0.0001 gram) is placed in a hollow in the carbon rod, and the cover glass adjusted. The current is passed through the rod, which is heated to a temperature between 2000 deg. C. and 3000 deg. C., for from ten to thirty seconds. If the mineral decrepitates it should be covered with a fragment of carbon to prevent its escape. The small rubber balloon (about 100 cu. cm capacity) allows for the expansion of the air and the production of carbon dioxide. This latter combined effect is, however, very small. The electroscope, after having been exhausted, refilled and observed, is then again exhausted and filled through the chamber and through calcium chloride, soda-lime, phosphoric oxide and a plug of cotton-wool to absorb the ions generated in the furnace. These tubes require refilling only at long intervals of time. Hence the apparatus is always ready for a determination which may be made completely in from twenty to thirty minutes. A length of capillary tubing is inserted to protect the leaf and to insure uniformity in the rate of filling. The collapse of the leaves is then observed in the usual way.—*Philos. Mag.,* October, 1913.

### Telegraphy, Telephony and Signals

*Fire Alarms.*—An illustrated article on the fire-alarm systems of a German company which makes two types—

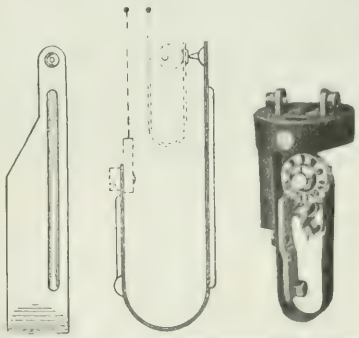


FIG. 3.—MAXIMUM-TEMPERATURE FIRE ALARM

maximum-temperature alarms and differential-temperature alarms. The essential part of the maximum type of alarm system is shown in Fig. 3. It consists of a U-shaped piece made of two metal strips welded together but having different coefficients of elongation. When the temperature changes the strip bends so that when a certain maximum temperature is reached a circuit is opened or closed. The

metal strip with the contact device and adjustment wheel is mounted on a frame of insulating material. By means of the adjustment wheel the alarm may be set to any maximum temperature between 40 deg. and 90 deg. C. While this type of alarm operates at a certain maximum temperature the differential type of alarm is independent of a maximum temperature. As shown in Fig. 4, it consists of

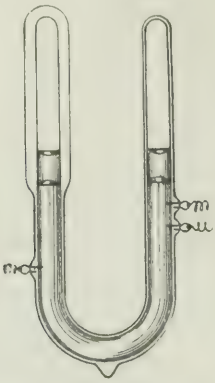


FIG. 4—DIFFERENTIAL-TEMPERATURE FIRE ALARM

a U-formed glass tube both legs of which are half filled with mercury. Above the mercury each leg contains a small quantity of a liquid which evaporates easily. One leg is made of thick glass, the other of thin glass. When the temperature rises quickly the first leg is not heated so rapidly as the second leg so that in the latter the liquid above the mercury evaporates first, producing a vapor pressure which presses the mercury down and interrupts the circuit. This type of alarm is usually furnished in combination with a maximum alarm as above described so that the differential alarm will operate when the temperature rises quickly, while the maximum alarm can be depended upon to detect a slowly developing fire by indicating when a certain maximum temperature has been reached.—*Elek. Zeit.*, Nov. 20, 1913.

**Miscellaneous**

*Commercial German Statistics.*—FASOLT.—The conclusion of his article, illustrated by diagrams, on the representation of electrical products in the official German commercial statistics. Diagrams show the development of the electrical export trade of Germany during the past seven years.—*Elek. Zeit.*, Nov. 20, 1913.

# Book Reviews

ELECTRICAL ENGINEERING FOR MECHANICAL AND MINING ENGINEERS. By H. J. S. Heather, B.A. London: The *Electrician* Printing & Publishing Company, Ltd. 332 pages, 184 illus. Price, $3.50.

A series of lectures to mechanical and mining engineers in order to introduce the principles of electric energy distribution to their acquaintance. The chapters of the book are well arranged in sequence for the purposes kept in view. The treatment is clear, definite and systematic. The chapters representing the twenty successive lectures relate to the following subjects: The electric circuit, resistance, alternating currents, recapitulation, electric measurements, continuous-current dynamos, continuous-current motors, alternating-current generators, synchronous motors, transformers, polyphase systems, polyphase transformations, induction motors, abnormal conditions. The mathematics in the book is judiciously reduced to the simplest essential formulas. The symbols and notation employed are, however, not up to date; thus *C* is used to represent current in Ohm's law, whereas all over the world *I* is now recognized as the international symbol. Probably this will be corrected in subsequent editions. The book should be very serviceable to engineers not well versed in electricity.

COURS D'ÉLECTROTECHNIQUE GÉNÉRALE ET APPLIQUÉE. By R. Swyngedauw. Paris: Librairie Polytechnique, Ch. Béranger. 309 pages, 135 illus. Price, 10 francs.

This textbook on the principles and design of direct-current dynamo machines is intended to be followed by a second volume devoted to alternating-current machines. The book has the distinct advantage of presenting at the outset a table of the symbols employed and adhering to this notation throughout the text. Still better would it have been if a corresponding degree of precision had been established and maintained as to the magnitude of the units connoted with each individual symbol. In the text, for example, one finds it not always easy to discover whether the value of electromotive force attaching to some of the equations is expressed in terms of the abvolt or the volt. The same symbol appears for both, without specific distinction. The treatment is clear and well explained, as befits a volume intended for a college textbook, although the subject matter might with advantage be further illustrated by arithmetical examples. The chapters of the book relate to the following topics: Electric currents, electromagnets, emf in a bipolar ring armature, ring-armature windings, drum armature, closed windings on drum armatures, the magnetic circuit of the dynamo, magnetic characteristics, toothed armatures, armature reactions, commutation, mechanical armature reactions, generator characteristics, motor characteristics, constant-potential motors, power and efficiency of dynamos, transmission of power, etc. The book will be useful to students of dynamo-electric design from the electrical point of view.

THE ELECTRIC-VEHICLE HANDBOOK. By H. C. Cushing, Jr., and Frank W. Smith. New York: H. C. Cushing, Jr. 356 pages, 161 illus. Price, $2.

Unusual care has been taken to insure the completeness of this useful treatise on the operation and maintenance of electric vehicles. Passing from an adequate discussion of the subjects of batteries, motors, controllers and other parts of the car proper, a number of the pages of the work have wisely been devoted by the authors to charging apparatus, rectifiers, motor-generator and converter sets, instruments, meters, charging resistors, etc. Logically conceding that the uninformed vehicle operator should give the greatest care and attention to his storage battery, the section devoted to this important subject appropriately occupies the first pages of the book. Both lead-sulphuric-acid and nickel-iron-alkaline cells are described and illustrated, with complete discussions of their respective characteristics in service. Following the section on batteries logically comes material describing charging methods, with a discussion also of the special applications of each type of equipment to the duty imposed. The chapter on measuring instruments is brought up to date with an account of the use of ampere-hour meters and special instrument connections. Recognizing that the tires of an electric vehicle constitute one of the most important factors in both its easy riding and its efficient operation, the compilers have included a thirty-two-page discussion of solid and pneumatic types, with tables of carrying weights, air pressures to be used, methods of vulcanizing, etc. Motor parts, controllers, frames, transmissions, steering gears, etc., occupy the closing pages of the volume except for the appendix, which includes cost and operating data on the use of commercial electric trucks compared with horse traction. Principles of accounting to be applied to electric-vehicle operation are given in the final chapter, which is a valuable one.

# New Apparatus and Appliances

**An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers**

## Electric Starters for Motorcycles

In the Nov. 15 issue of the *Electrical World* a description was given of the electric starters for motorcycles exhibited by the Hendee Manufacturing Company, Springfield, Mass.,

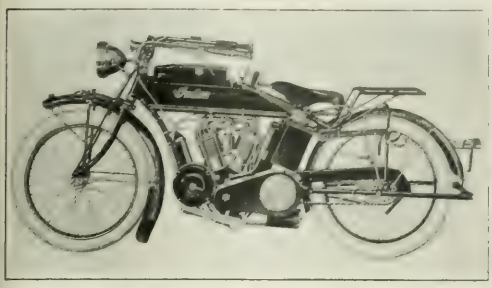


FIG. 1—MOTORCYCLE EQUIPPED WITH ELECTRIC STARTER

at the second national motorcycle, bicycle and accessory show held at Chicago. A view of the Indian machine is given herewith, showing how the casing containing the batteries is suspended beneath the saddle. The electric-starter motor is attached below the batteries and is completely inclosed. The drive is direct to the gasoline-engine shaft through an inclosed roller chain and a cone clutch.

As a starting device the motor works under a compound field, using both series and shunt winding. As a charging dynamo it operates with the shunt winding only. Thus through the medium of the controller-switch arrangement the combination of a compound motor and shunt dynamo is obtained. A magnetic regulator governs the armature

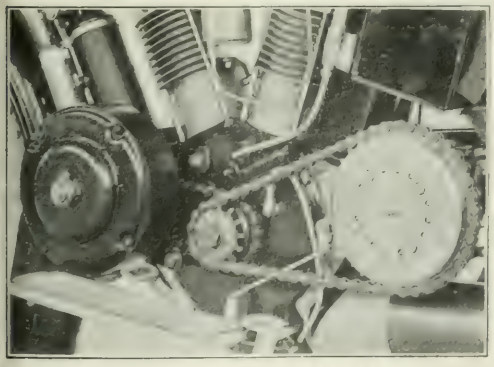


FIG. 2—ELECTRIC STARTER AND ENGINE DRIVE

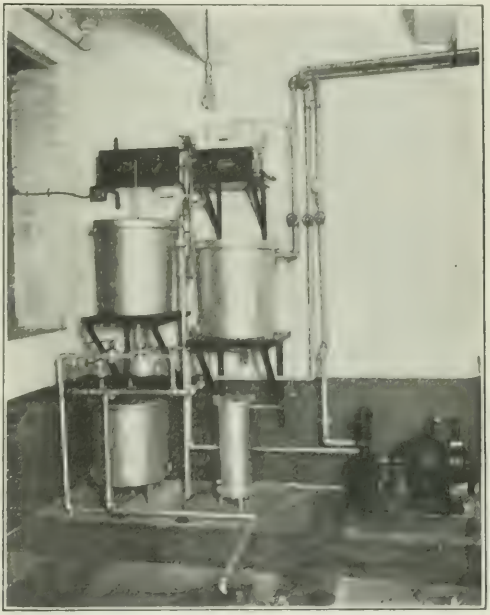
output, giving the correct charging rate, which is usually taken as 9 amp per hour.

The complete electrical system weighs 62.75 lb. The individual weights are: Motor-generator, 25.25 lb.; batteries, 14.5 lb. each; head-lamp, 2.25 lb.; tail-lamp, 0.5 lb.; signaling apparatus, 2 lb.; regulator, 1.5 lb.; switch block, 1 lb.; connecting block, 0.25 lb.; wiring, 1.25 lb.

## Ozone Water-Purifying Apparatus

The American Ozone Company, Niagara Falls, N. Y., is manufacturing two types of ozone water purifiers based on the discoveries of the French electro-chemist, M. Marius Otto. One type is designed for intermittent use in residences and offices, and the other for hotels, apartment houses, office buildings, factories, etc.

The small-size "Ozosure" water purifier consists of an ozone generator inclosed in an aluminum box fitted with an air drier for removing the moisture from the air used in the generation of the ozone. A tin pipe connects the ozone generator with the faucet. The ozone is drawn into the purifier faucet by the suction of an emulsifier or mixer, which at the



OZONE WATER PURIFYING APPARATUS

same time forces the ozone into the water as it passes through the faucet. The box occupies a space measuring about 13 in. by 12 in. and protrudes about 9 in. from the wall.

The purifier faucet operates automatically, the ozone generator being started up and the water turned on with one movement by pressing down the handle. A single upward touch similarly closes the faucet and switches off the supply of energy. The lighting of an indicator lamp on the generator box shows whether the ozonizer is in full operation or not. This small purifier has a capacity of from 1.25 gal. to 1.5 gal. per minute. It is portable and can be taken with tourists when traveling and attached wherever suitable electric service is available.

The larger apparatus, although different in design, is

identical in principle with the type just described. It forms a [illegible] plant which can be installed in any convenient part of the building where connection with the main water-supply service pipe can be had. Its purifier consists of an ozone generator made of enameled cast aluminum, an air drier, an emulsifier and mixing valve, an automatic float switch, a solenoid and a porcelain-lined, enameled tank of sufficient capacity to insure a constant supply of treated water. The capacity of this purifier ranges from 500 gal. per day up. The apparatus shown in the illustration is installed in a seventeen-story building at Buffalo, N. Y. The equipment is not complicated and does not require very much space. Sufficient water is treated to supply all the offices of the building in addition to a circulating system which has a drinking fountain on each floor.

In places where the water is liable to be turbid a filter is a necessary adjunct of the ozonizing apparatus, as the purpose of the latter is to purify the water and not to clarify it.

## High-Tension Pole-Top Switch

In the accompanying illustration is shown a high-tension pole-top switch for outdoor substations. The 10-ft. cross-arms are used to support the channel-iron bases on which the switching elements are mounted, the three single-pole



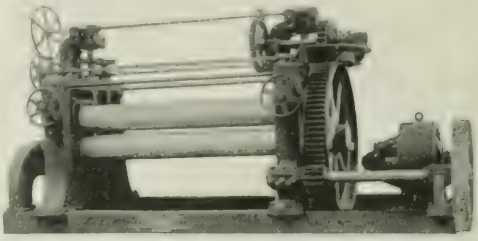
POLE-TOP SWITCH

units being mechanically interlocked so that they operate simultaneously. The operating rod extending down the pole is provided with a handle which can be locked in either open or closed position as desired. Circuits can be opened under full-load conditions with this equipment, the arc being ruptured on magnetic blow-out discharging horns. The contacts and operating mechanism are designed so as not to freeze in cold weather. This switch is manufactured by the Delta-Star Electric Company, Chicago, Ill.

## Plate-Straightening Machine

What is declared to be the largest plate-straightening machine ever built is shown in the illustration herewith. The distance between housings or uprights is 10 ft. 5 in. The machine has six forged-steel rolls, each of which is finished to a diameter of 16 in. Three of these rolls are in the upper tier and three in the lower. Two of the upper rolls are placed alternately with the lower rolls to provide corrugating action on the plate passing through the machine. The third upper roll, which has independent adjustment both vertically and laterally, pinches or stretches the plate at any desired point. The straightener is designed to attain its maximum capacity when handling 3.5 per cent nickel-steel plates 1.375 in. thick at a roll speed of 40 ft. per minute.

The machine is operated by a Westinghouse 100-hp variable-speed reversing motor, the machine and motor be-



LARGEST PLATE-STRAIGHTENING MACHINE

ing supported on the same base. The motor is directly connected to the main driving shaft through cast-steel gears. The pinching roll is counterbalanced at each end to prevent sudden drop after the operation of straightening a plate is completed. The raising and lowering of the other two upper rolls is accomplished by means of a friction clutch. The machine weighs 120,000 lb.

The machine was built by the Hilles & Jones Company, Wilmington, Del., for the St. Lawrence Bridge Company, which will use it in connection with the work on the new Quebec bridge.

## Portable Substation for Coal Mine

The Berwind-White Coal Mining Company, Windber, Pa., has recently added a 400-kw Westinghouse portable substation to its equipment and is using this substation in the development of its outlying properties where permanent substations have not yet been erected. The portable substation's equipment, which is similar to that in a permanent installation, comprises transformers, a switchboard and a rotary converter. The apparatus is mounted in a car resembling an ordinary freight car.

When the work at a new development reaches the point



PORTABLE SUBSTATION FOR COAL MINE

where direct current is necessary, the portable substation is hauled out to the workings, connected to the alternating-current transmission system, and is started to work generating direct current. When the permanent substation is built the portable one becomes unnecessary and is taken to the next development.

The portable substation is also used as an auxiliary in

case of break-down. If accidents occur at any of the permanent substations, the portable outfit is sent to carry the load until repairs can be completed. One portable substation is thus practically the equivalent of a duplicate set of apparatus at each permanent substation.

## Automatic Electric Cellar Drainer

The automatic electric cellar drainer illustrated herewith consists of a centrifugal pump directly connected to a vertical motor. The pump is installed in a 3-ft. well into which the seepage drains, while the motor and control apparatus are mounted on the floor level where they are accessible for inspection and out of the way of moisture.



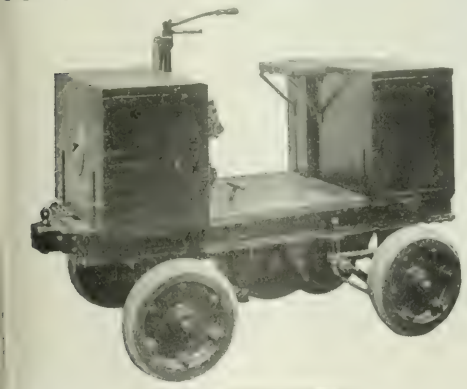
CELLAR-DRAIN PUMP

A float plays between two stops on a vertical rod which is connected to the motor-control switch. When the water in the well rises sufficiently to cause the float to press against the upper stop, the motor is started, and it continues in operation until the water level is so lowered that the float presses against the lower stop, thus cutting off the supply of energy. The pump shown is rated to deliver 500 gal. per hour against a head of 5 ft. and 150 gal. per hour against a head of 20 ft.

This apparatus is manufactured by the Vaile-Kimes Company, Dayton, Ohio, with the exception of the motor, which is the product of the Westinghouse Electric & Manufacturing Company.

## Storage-Battery Trucks and Tractors

The Atlas Car & Manufacturing Company, Cleveland, Ohio, is placing on the market rubber-tired storage-battery trucks and tractors for hauling and handling freight in and around manufacturing plants, warehouses, railway and baggage depots, etc. The tractor illustrated herewith can exert

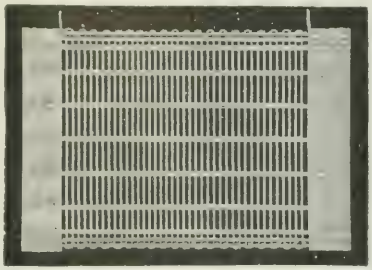


STORAGE-BATTERY TRACTOR

drawbar pull of 300 lb. and will haul trailer loads up to 10 ons over level floors. The truck has a capacity of 3000 lb. nd will carry this load up grades. One charge of the batteries is sufficient to operate either the tractor or the truck roughout a working day of ten hours. The wheels are ade of steel and are equipped with roller bearings and olid-rubber tires. The power is transmitted from the otor to the wheels by differential gears, thus permitting e wheels to turn independently in rounding curves.

## Heating Apparatus

The Dubilier Electric Company, 63 Fifth Avenue, New York, is placing on the market a heating unit which contains no metal except that of the resistor wiring itself. This heater, as illustrated herewith, is made of high-resistance material which is interwoven with pure asbestos cord. The whole is treated and made rigid so that it can-

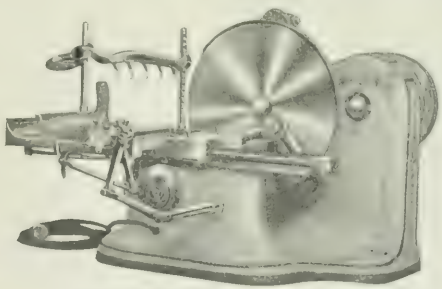


HEATING UNIT

not be easily deformed. Connections can be made every few inches, and when used in motor-starting rheostats the strips can be arranged with such intervals of resistance that the motor will accelerate without jerks. The unit is light and durable and as a resistor is well adapted to use for cranes and railway controllers on account of its ability to withstand the effects of violent vibrations.

## Electric Meat Slicer

The motor-driven meat slicer illustrated herewith is the product of the A. J. Deer Company, Hornell, N. Y. It is provided with ball bearings throughout and the carriage of the device is controlled by an automatic release clutch. An electric sharpener keeps the cutting edge of the knife always keen. The adjustment giving thick or thin slices of meat can be changed when the machine is in operation. The slicer is designed so that the carriage works inde-



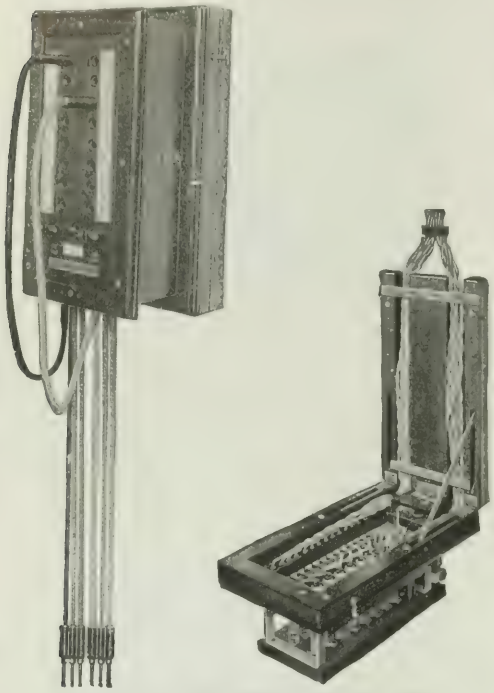
BACK VIEW OF ELECTRIC MEAT SLICER

pendently of the knife. The machine is 30 in. long, 28 in. wide, 21 in. high and weighs 248 lb.

## Railway Way-Station Test Boards

The Western Electric Company, New York, has developed and placed on the market a test board for testing and "patching" telephone train-dispatching circuits so that interruptions to service may be minimized. Two kinds of boards are used, one being equipped for two metallic circuits and the other for four metallic circuits. The board, together with the accompanying cabinet, is made of oak. The jacks through which the lines are carried are mounted

on the face of the board, each with its designation strip. Below these jacks are mounted keys for switching the selector and telephone equipment from its regular circuit to the patching cords. The patching cords, which are moisture-proof, hang from the bottom of the cabinet and are connected to terminals inside the test board. The wiring



FIGS. 1 AND 2—TEST BOARD, CLOSED AND OPEN

is run in twisted pairs and is held in place by removable straps.

A removable cover, which is fastened in place by hooks, gives ready access to all line terminals, while the jack terminals are easily found when the apparatus board hinged at the lower edge is opened. All wires, as can be seen from Fig. 2, are visible for inspection when the apparatus board is opened.

The train wire and the message wire are carried through the test board, provided two such circuits are used. If no message wire is installed two telegraph circuits are usually made up of iron wire and brought through the test board for possible use in patching. The telegraph wires are also frequently brought into the test board even if a message wire is used. The train wire, being most important, must always be kept working, thus making it necessary to carry the message and telegraph wires through the boards in order that they may be used for patching in emergencies.

## Cable-Reel Jack

The cable-reel jack illustrated herewith has a reversible frame top or head by means of which the screw can be placed in three different positions to accommodate different sizes of reels, thus making one jack take the place of three. In Fig. 1 the frame top is shown resting on the lower cross-pieces and so placed that the screw barrel attached to the frame top is above the head plate. This is for the lowest position with a minimum height of 18 in. In Fig. 2 the frame top is turned around so that the screw barrel is below the head plate and is placed on the top part of the frame. This is the intermediate position, giving a minimum height of 24 in. By turning the top so that the barrel is again above, the highest position with a minimum height of 32 in. is attained. This is shown in Fig. 3. The



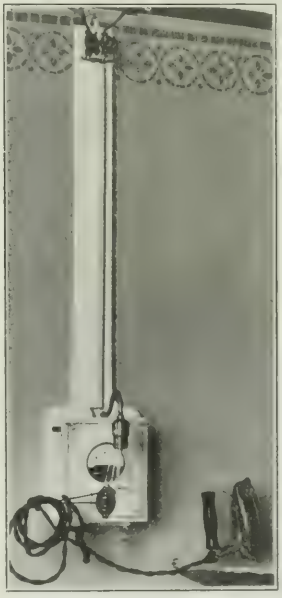
FIGS. 1, 2 AND 3—CABLE-REEL JACK WITH REVERSIBLE FRAME

jack is made to accommodate reels varying from 36 in. to 80 in. in diameter. The frame legs rest on floor plates.

The device was designed and patented by Mr. Colman J. Mullin and is manufactured by the Norris Electric Specialties Company, 38 Park Row, New York.

## Electric Wall Cabinet

The electric wall cabinet shown in the accompanying illustration is a portable device for introducing electric service quickly and at low cost into unwired houses where the owner does not care to install the usual wiring. The meter is incased in an iron box which is fastened to a wooden base, the whole being hung from a nail in the wall in any part of the building where the line wires may be reached easily. A swinging arm is attached to the box for supporting the flexible cord feeding the iron, and a pilot lamp indicates when the iron is in circuit. This lamp is shown beneath the box, but in later types it is placed inside. A bracket and an incandescent lamp for lighting purposes are also provided.



ELECTRIC WALL CABINET FOR UNWIRED HOUSES

In order to cut down the cost of the installation, the meters can be mounted inside the box at the meter shop, the entire apparatus being thus readily portable. One man can install the outfit. He first drives a nail or screw into the wall 9 ft. or 10 ft. above the floor, hangs the board as shown, plumbs it, puts in the bottom screw, bores two holes just above the fuse blocks the regulation distance apart, puts in two porcelain tubes, and then shoves through the two wires already provided, making connection with the line drop outside.

The cabinet was devised by Mr. W. E. Clement, contracting agent of the New Orleans Railway & Light Company, and is being manufactured by the Electrical Development Company, New Orleans, La.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Large Cable Order Placed with the Western Electric Company.**—A recent order placed with the Western Electric Company by the Cumberland Telephone & Telegraph Company called for 79,000 ft. of 600 pair conductor, or about 18,000 miles of single conductor. This order is considered of unusually large size.

**Large Stationary Diesel Engine Sold.**—Through their United States representative, W. R. Haynie, 30 Church Street, New York, Carels Frères, of Ghent, Belgium, have just closed a contract with the Coronet Phosphate Company, 99 John Street, New York, for a 750-hp Carels two-stroke-cycle stationary Diesel engine, for direct connection to a 500-kw alternator, to be installed in its power plant at Pembroke, Fla.

**Storage Battery Sales Conference.**—During the week of Dec. 1 the Electric Storage Battery Company, of Philadelphia, Pa., held a sales conference at the Bellevue-Stratford Hotel in that city, attended by the managers of its several sales offices. In celebration of its twenty-fifth anniversary, the company held on the same date a reception for the representatives of various electric-vehicle manufacturers. Following an informal luncheon at the factory, an inspection was made of the company's shops. In the evening a banquet was given to the guests of the company at the Ritz-Carlton Hotel.

**Terry Turbines Make Unusual Record.**—In the plant of the Toledo (Ohio) Railway & Light Company two 40-hp Terry turbines have been operating almost continuously since 1909 at 1800 r.p.m., driving Sirocco blowers for forced draft. During the four-year period it is reported that not a cent has been spent for repairs on either turbine. Placed on a steel framework about 50 ft. above the floor line of the engine room, they are visited only once a month to make sure that oiling and adjustments are correct. While one or the other, and frequently both, of these turbines have been continually in operation throughout this period, they are reported never to have given the slightest trouble.

**New Colliery Breaker to Be Electrically Operated Throughout.**—The new Loomis colliery of the Delaware, Lackawanna & Western Railroad Company is rapidly nearing completion, and the breaker, on which work is now progressing, is to be electrically operated throughout. Energy will be supplied for this purpose by the Nanticoke (Pa.) power plant of the company, which is at present furnishing electricity for the operation of the Truesdale colliery breaker. Similar to the latter breaker, the one at the Loomis colliery will be equipped in general with individual motor drive for the various machines, such as shakers, grids, spiral separators, sorting tables, rolls and jigs, used there for breaking and grading the coal.

**Storage Batteries Used to Operate Raft Lamps.**—A great deal of the timber cut in the territory drained by the Columbia River and its tributaries is floated down that stream annually in immense rafts. To prevent interference with navigation in the daytime these rafts have to be towed down the river at night, and to guard against accidents it is necessary to place lights at each end of every raft. For some time past electric lights have proved very popular for this service, and a raft-light outfit assembled by the Astoria Hardware Company, of Astoria, Ore., has enjoyed a good sale. Two 4-cp lamps wired in parallel furnish the light and are run from a battery of two 6-volt storage cells, with a capacity of 100 amp-hr. These batteries are supplied by the Electric Storage Battery Company, of Philadelphia, Pa.

**Decline in Orders Noticed by the Western Electric Company.**—For the ten months ended Oct. 31 the sales of the Western Electric Company were at the rate of $76,000,000 per annum. During the month of October the volume of business billed out by that company was large but the volume of new orders received was not equally satisfactory. Early in 1913 there was an unusually large business handled, but in the succeeding months the figures on new business have been approaching more nearly to normal until at the present time they appear destined to go somewhat below that level. It is stated by the company that the number of orders is larger than usual now, but that their average size is smaller than is ordinarily the case, so that, while the total volume of business is less, the cost of handling it is as great as or greater than usual.

**Electrical Equipment Planned for the Bureau of Mines Testing Plant at Pittsburgh, Pa.**—The estimate of appropriations for the United States Bureau of Mines for the fiscal year ending June 30, 1915, as approved by Secretary Lane of the Interior Department, has just been forwarded to Congress. The several items in this estimate total $752,000, representing an increase of $90,000 over the figures for the fiscal year ending June 30, 1914. Among the items on the first-mentioned estimate is one of $10,000 for the purchase of equipment for the testing plant at Pittsburgh, Pa. This is a new item, and it is stated that the money is needed for the purchase of both steam and electrical equipment. In support of this claim, the estimate states that the present power and electric service plant at the experiment station is entirely inadequate to the demands placed upon it and is in constant danger of break-down.

**Electric Pleasure-Car Company to Enter Truck Field.**—Announcement has just been made that the Chicago Electric Motor Car Company will soon begin the manufacture of commercial electric vehicles. It was stated that the increased facilities for production, which have recently allowed this company to make marked reductions in the prices of pleasure cars, will also permit its entry into the electric-truck industry. No changes are to be made in the Chicago organization, but with the expansion of the company Mr. C. A. Neuracher and Mr. A. L. Garford, well-known men in the automobile industry, have become allied with the company, Mr. Neuracher now being president and chief engineer. Mr. Gail Reed, of Chicago, has been made secretary of the expanded organization. Definite announcement as to whether the commercial vehicles will be made in Chicago or in Toledo factories of the company, has not been made, but rumor has it that most of this work will be carried on in the Ohio city.

**Efforts to Boom Trade with Russia.**—In an effort to open up to American products the vast Russian Empire, which has a population of about 150,000,000, a market which has hardly been touched by American manufactures, the National Association of Manufacturers has planned a new department of its organization, which will be known as the Russian and Far Eastern division and will have for its object the fostering of trade relations between the two countries. A. J. Wolfe, formerly connected with the Department of Commerce, is to have charge of this new division. It was stated by a representative of the association that official recognition has been taken in Russia of the efforts to provide, in this new division, the necessary auxiliary services for promoting an increased trade between that country and the United States, and at the conference to be held in the offices of the association, at 30 Church Street, New York, on Dec. 16, on the occasion of the inauguration of the new service, the principal address will be delivered by C. J. Medzikhovsky, commercial attaché to the Russian Embassy at Washington. Other speakers conversant with Russian trade conditions will also address this meeting.

**Specially Designed Electric Truck for Hauling Ice.**—The [illegible] Motor Vehicle Company, of Cleveland, Ohio, has recently sold to the Porto Rico Ice Company a 3½-ton electric truck some of the features of which are unusual. On account of the torrid heat in Porto Rico and the long haul of 6 miles over which ice must be carried from the central plant of the company to a substation, it was necessary to have a truck body as near heat-proof as possible. To meet these conditions the following special construction was followed: The sides, front and roof of the body are of double-panel construction, 4 in. thick, and all packed between the panels with cork. To withstand the intense heat from the ground, the floor is made 4½ in. thick and is built in layers. From top to bottom these layers are 1 in. solid oak plank, 1¾ in. asphalt composition, 1 in. cork board and ¼ in. Georgia pine board. The rear doors of this truck are regular refrigerator doors, and when they are closed the truck is a veritable refrigerator, practically air-tight, and will carry ice in hot Porto Rico many miles. Inside the body are adjustable cross-bars which can be put in against the ice to hold it from shifting while in transit, whether the truck is loaded full or not. The storage batteries used in this car are of the "Ironclad Exide" type, manufactured by the Electric Storage Battery Company, of Philadelphia, Pa.

**Foreign Markets for Electrical Wiring Devices and Supplies.**—In Austria electrical specialties are in general use Sockets, switches, conduits, plugs and small apparatus such as hair driers, fans, heaters and electric irons can be bought at ordinary prices within 5 or 10 per cent of the retail prices in the United States. These are mostly made in Austria or Germany, and are as convenient as the American product, although perhaps not as durable. The American Edison standard socket is not known there, the Bergmann Isolier socket being largely used. In Belgium there is a spirited German competition in electric-light supplies, and the merchants of that country sell these supplies at prices almost defying competition. At the same time the field for electrical development in Antwerp is unlimited. There are no jobbers or wholesalers in this district, and goods cannot be sold by correspondence. All trade literature must be in French, and prices and measurements must be in francs and the metric system respectively. Dealers in Salonica, Greece, import directly from the manufacturers in Austria-Hungary or Germany, but many of them would be glad to import from America if prices and terms that compare favorably with those they now obtain can be offered. These dealers state that there is no special apparatus suited to the needs of their market, but they express a desire to handle a line of electrical novelties, such as curling irons, coffee pots, toasters, hot plates and electric irons, all of which are unknown there. The energy supplied in that locality for lighting is 220 volts direct current. There is a great deal of competition in the incandescent electric-light business in Milan, Italy, although American electric-light apparatus is not found in this market to any appreciable extent. There are no manufacturers of electrical materials in Palermo, Italy, practically the entire demand being supplied by German concerns or by manufacturers in northern Italy. There are a few electrically heated devices to be found in Norway, the majority of which are made in Germany or England. For the most part these are cheaply made, and if American manufacturers are to obtain a good share of the business it will be necessary for them to offer low-priced utensils of good quality. Electrical supplies are extensively manufactured in Sweden, but the import from foreign countries is also considerable, especially from Germany. Sockets are always of the American Edison base standard. There are no imports from the United States.

**Large Electric Mine Hoist Contract Awarded.**—To the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa., was awarded in November the contract for building the largest electric hoist in the Western Hemisphere and one of the largest of its kind in the world. The purchaser is the North Butte Mining Company, and the hoist will be put in service at the Granite Mountain copper mine of that company. The technical details of this equipment, as it is planned, are of considerable interest. The hoisting drums, which will be 12 ft. in diameter, will be driven by a directly connected electric motor, running at a speed of about 71 r.p.m. Power will be supplied to this motor from a motor generator set equipped with a 50-ton flywheel to secure elimination of the peaks that would be drawn from the power line during periods of starting and acceleration. Hoisting with this equipment will be done in balance, but the equipment is large enough to take care of unbalanced hoisting. The capacity of the hoist will permit 300 tons per hour being hoisted from the 2000-ft. level, or 200 tons per hour from the 4000-ft. level. The system of control and power equalization used will be that commonly known as the Ilgner system, in which a flywheel driven by the motor-generator set is permitted to give up some of its stored energy to supply the peak load drawn by the hoisting motor. In order to reduce the flywheel losses to a minimum, the flywheel will be incased in a smoothly finished steel housing and provided with special type of self-lubricating bearings. The hoisting motor will be of the type used in steel mills and will be of a very heavy construction. In fact, all of the equipment has been designed with absolute reliability as the paramount consideration. This motor will have a maximum intermittent rating of 4500 hp, and the motor-generator set will be driven by an induction motor having a continuous normal rating of 1400 hp. The difference between these ratings represents approximately the amount of energy that will be supplied by the flywheel momentarily during starting. The installation is so designed that the draft of power from the power line will be practically constant throughout any cycle of hoisting. A number of special safety devices are comprised in the equipment, including electrically released brakes, automatic slow-down devices to prevent skip or cage ever going through head-sheaves, and a special controller to limit the speed when hoisting men.

## Statement of the Copper Producers' Association for November

A further increase in the stocks of copper on hand is shown by the figures in the following monthly statement for November. This seems to be the result not so much of an increase in production as of a big falling off in domestic consumption.

| | —November, pounds— | | —October, pounds— | |
|---|---|---|---|---|
| Stocks on hand in the United States on first of month | | 32,[illegible] | | 29,743,094 |
| Production | | 134,087,778 | | 139,070,481 |
| | | 166,654,090 | | 168,863,575 |
| Domestic deliveries | 48,656,858 | | 68,173,720 | |
| Foreign deliveries | 70,067,803 | | 68,123,473 | |
| | | 118,724,661 | | 136,297,193 |
| Stocks on hand at end of month | | 47,929,429 | | 32,566,382 |

### NEW YORK METAL MARKET PRICES

| | —Dec. 2— | | —Dec. 8— | |
|---|---|---|---|---|
| Copper | Bid | Asked. | Bid | Asked. |
| Standard, spot* | | | | |
| | Selling Prices | | Selling Prices | |
| | £ s d | | £ s d | |
| London, standard, spot* | 65 15 0 | | [illegible] | |
| Prime Lake | 15.00 | | 14.50 | to 14.75 |
| Electrolytic | 14.50 | to 14.75 | 14.25 | to 14.50 |
| Casting | 14.37½ | | 14.12½ | to 14.25 |
| Copper wire base | 14.00 | | 15.50 | to 15.75 |
| Lead | 4.10 | | 4.10 | |
| Nickel | 40.00 | to 45.00 | 40.00 | to 45.00 |
| Sheet zinc, f.o.b. smelter | 7.50 | | 7.25 | |
| Spelter, spot | 5.15 | to 5.20 | 5.12½ | to 5.25 |
| Tin, spot | 38.50 | to 39.00 | 37.50 | to 37.75 |
| Aluminum | | | | |
| Prompt delivery | 19.00 | | 19.00 | |
| Future | 18.75 | to 19.25 | 18.50 | to 19.00 |

### *OLD METALS

| | | |
|---|---|---|
| Heavy copper and wire | 13.50 | 13.50 |
| Brass, heavy | 8.75 | 8.75 |
| Brass, light | 7.75 | 7.75 |
| Lead, heavy | 4.20 | 4.05 |
| Zinc, scrap | 4.37½ | 4.37½ |

### *COPPER EXPORTS

Total tons to Dec. 8.....6,682

*From daily transactions on the New York Metal Exchange.

# Corporate and Financial

**Canadian General Electric Declares Extra Dividend.**—An extra dividend of 1 per cent on the common stock, in addition to the regular quarterly dividend of 1¾ per cent, has been declared by the Canadian General Electric Company and will be payable Jan. 2. An extra dividend of like amount was declared on this stock a year ago.

**Central Illinois Public Service Company Increases Its Capital Stock.**—The Central Illinois Public Service Company, of Mattoon, Ill., which is one of the subsidiary companies of the Middle West Utilities Company of Chicago, has certified to the Secretary of the State of Illinois that it has increased its capital stock from $6,000,000 to $10,000,000.

**Annual Report of the Northern California Power Company, Consolidated.**—In its annual report for the year ended Oct. 31 the Northern California Power Company, Consolidated, showed gross earnings of $814,238 and a net operating surplus of $213,237. During the year ended on the above date the company added 1069 customers to its business, with a load of 3475 hp. During the coming year the company expects to add 5325 hp more to its connected load, part of which is already under contract. The copper companies in its territory are large users of electricity for electrolytic refining of ores.

**Boston Edison Stock Issue Voted.**—At an adjourned meeting held on Dec. 3 stockholders of the Edison Electric Illuminating Company of Boston, Mass., voted to increase the capital stock from $18,204,400 to $20,480,000 by the issue of 22,756 new shares. The present capital stock consists of 182,044 shares. There were over 100,000 shares represented at the meeting. The directors have set the price of the new issue at $215 per share, offering the rights for subscription by the stockholders on a one-eighth basis. The company will neither buy nor sell rights. Rights to subscribe for the new issue will expire on Dec. 30.

**Assessments on Stock of the Columbus Railway & Light Company.**—Two assessments of $10 each have been called on the $5,000,000 capital stock of the Columbus Railway & Light Company by its board of directors. The first payment is to be made on or before Dec. 30, 1913, and the second on or before June 30, 1914, and these assessments will make the stock $40 a share paid up. After payments have been made, the stock will be exchanged for stock of the Columbus Railway, Light & Power Company, under which the properties now operated by the Columbus Railway & Light Company will be consolidated.

**Proposed Stock Increase of Tampa Electric Company.**—A special meeting of the stockholders of the Tampa (Fla.) Electric Company has been called for Jan. 5 to vote on the proposition for an increase of $374,000 in the capital stock of the company. It is proposed to offer the new stock to the stockholders for subscription at par, on a basis of one share of new stock for each six shares of old stock held. The reason given for this issue is that funds are needed for the payment of a floating debt of $125,000, incurred by the company during the past year for extensions and improvements, and that money will be needed to finance further improvements planned for the coming year.

**Canadian Utility Purchased.**—The Sherbrooke Railway & Power Company, of Sherbrooke, Que., has recently purchased the Burrows Falls Power Company, which supplies the electric lighting and power service in Ayers Cliff, Que. The first-named concern now owns numerous electric generating properties in this neighborhood, all of which are connected by the main transmission line from the company's central station at Sherbrooke. This company has been pushing its power sales recently and has secured contracts for industrial power, three of which are for 700 hp, 500 hp and 150 hp respectively, with enough small contracts to make a total of about 1500 hp of new business, most of which will become connected load within the next quarter.

**Puget Sound Traction to Make Note Issue.**—A meeting of the stockholders of the Puget Sound Traction, Light & Power Company has been called for Dec. 23 to authorize the issue by the company of short-term bonds, the proceeds of which are to be used for refunding notes for $7,500,000, which mature on Feb. 1, 1914. Note was made in the *Electrical World* of Nov. 1 of a recent increase in the capital stock of the company which was made for the purpose of meeting this obligation. The new bond issue is planned in order to supplement the first move toward retiring the above-mentioned notes. No statement has been made as to the amount, interest rate or length of maturity of the proposed issue, but nothing longer than five years is expected. The notes, if authorized, will be secured by a mortgage on the property of the company.

**Stockton Gas & Electric Corporation's Bonds to Be Redeemed.**—The outstanding first mortgage twenty-five-year 6 per cent gold bonds of the Stockton Gas & Electric Corporation, dated Jan. 1, 1909, have been called for payment and redemption on Jan. 1, 1914, under the terms of the issue. These bonds will be redeemed on the above date at the office of the Mercantile Trust Company, 464 California Street, San Francisco, Cal., at their face value and interest at 6 per cent, together with all accrued interest at the same rate which shall not have been paid at that time. Interest will not be paid on the bonds after Jan. 1, 1914. This company was consolidated several years back with six other electrical properties in California and is at present controlled by the Western States Gas & Electric Company, one of the holding companies in which H. M. Byllesby & Company have a controlling interest.

**Capital Stock of National Gas, Electric Light & Power Company Increased.**—A certificate was filed at Trenton, N. J., recently, increasing the capital stock of the National Gas, Electric Light & Power Company from $4,000,000 to $10,000,000. The stock now consists of $5,000,000 common and an equal amount of 6 per cent preferred shares. The company controls the following public utility properties: The Cape May (N. J.) Illuminating Company, the Carbondale (Pa.) Gas Company, the Goshen (Ind.) Gas Company, the Joplin (Mo.) Gas Company, the Niles (Mich.) Gas Company, the Port Huron (Mich.) Light & Power Company, the Port Huron Gas Company, the Portsmouth (Ohio) Gas Company, the Quincy (Ill.) Gas, Electric & Heating Company, the Rome (N. Y.) Gas, Electric Light & Power Company, and the Warsaw (Ind.) Gas Company. Its president is J. T. Lynn, of Detroit, Mich.

**Present Status of the Utah Securities Corporation.**—Under date of Dec. 1, a statement was issued by S. Z. Mitchell, president of the Utah Securities Corporation, covering the status of that concern, as follows: "The Utah Power & Light Company and its subsidiary, the Western Colorado Power Company, now have in operation twenty-three hydroelectric generating stations, of an aggregate rated capacity of 76,900 hp, with three steam-reserve generating stations, of an aggregate rated capacity of 13,200 hp. There is under construction a 29,250-hp addition to the hydroelectric plant at Grace, Idaho, which is to be completed early in 1914 and which will increase the capacity of this plant from 14,750 hp to about 44,000 hp. When this addition is placed in operation the aggregate rated capacity of the hydroelectric plants of the subsidiary companies will be increased to 106,150 hp. There is also being constructed a new development at Oneida, Idaho, which will have an initial capacity of 27,000 hp. Your subsidiary companies now have in operation a total of 1660 miles of high-tension transmission and distributing lines. There are under construction and approaching completion 133 miles of 130,000-volt and 14 miles of 44,000-volt double-circuit steel-tower transmission line and 42 miles of 44,000-volt pole line, making a total of 189 miles of high-tension transmission lines now under construction. The number of customers of the operating companies has been increased from 11,622 as of June 1, 1913, to 13,315 as of Oct. 31, 1913, while the capacity of motors, lights and other electrical machinery of the customers as of Oct. 31, 1913, aggregated 70,204 hp, as compared with 66,212 hp as of June 1, 1913. It is expected that when the addition to the Grace plant is placed in operation, early in 1914, both the gross and net earnings will be materially increased, as it will be possible to supply additional power under contract but which cannot now be delivered because of insufficient plant capacity." The gross earnings of these companies for the twelve months ended Oct. 31 amounted to $1,664,216, and net earnings of $977,015 were realized. The total output of the generating stations operated by them during the month of October was 21,936,101 kw-hr.

## Business Notes

**Harvey Deschere & Company** is the new name of the interchangeable sign business carried on at 50 Church Street, New York, by Harvey Deschere.

**The Electric Construction & Machinery Company,** 1622 Second Avenue, Rock Island, Ill., has just made the announcement that after Jan. 1, 1914, its office address will be 1828 Third Avenue, Rock Island.

**The Waco Electrical Supply Company** announces that R. S. Wakefield, until recently manager of the Fort Worth (Tex.) branch of the Wesco Supply Company, has resigned from that company to become connected with the Waco Electrical Supply Company, of Waco, Tex.

**The Clark Electric & Manufacturing Company,** Singer Building, New York, specializing in transmission-line supplies and protective devices, has recently enlarged its line and is now supplying finely finished ornaments of cast brass or bronze for use in lamp fixtures and pedestals.

**The Watauga Power Company** has recently announced the removal of its general offices to 615 State Street, Bristol, Tenn. All matters relating to the company will be handled from this office in the future. The general manager of the company is S. M. Vance, and M. P. Steelman is its secretary and treasurer.

**The Ideal Electric & Manufacturing Company,** of Mansfield, Ohio, has lately reopened its Chicago office, which is now in the Fisher Building, 343 South Dearborn Street. Its district manager in charge, J. A. Adamson, has been engaged in the sale of electrical machinery in this territory for a number of years.

**The Century Electric Car Company,** of Detroit, Mich., has established a New England agency, with headquarters at 410 Newbury Street, Boston, in charge of Edward Atkins. The company manufactures two sizes of electric broughams, a four-passenger car having the only underslung chassis on the market and a five-passenger car with duplex control. It is the company's intention to establish other agencies in the principal cities of New England.

## New Industrial Companies

**The F. E. Davis Engineering Company,** of Detroit, Mich., has been organized by F. E. Davis, of Detroit, to manufacture the Kemco, an attachment for charging the lighting batteries of an automobile.

**The Shawmut Electric Signal Company,** of Boston, Mass., has been incorporated with a capital stock of $300,000 by James B. Clogher, Edward L. Parsons and James M. West. The company proposes to manufacture electric and magnetic signals.

**The H. L. F. Trebert Rotary Motor Company,** of Rochester, N. Y., has been chartered with a capital stock of $150,000 to manufacture and deal in machinery. The incorporators are H. L. F. Trebert, M. J. Schrag, of Rochester, and L. G. Ogden, of Penn Yan, N. Y.

**The Electric Contracting Company,** of Trenton, N. J., has been incorporated with a capital stock of $50,000 to manufacture electrical appliances, machinery, etc. The incorporators are W. Eldridge, of Lawrenceville, N. J.; S. E. Aller, and F. J. Carr, of Trenton.

**The Nachod Signal Company,** of New York, N. Y., has been chartered with a capital stock of $100,000 to manufacture railway appliances, etc. The incorporators are G. B. Delafield, of New Brighton; J. W. Stone, of Pelham, and W. H. Adams, of New York, N. Y.

**The United Gas & Electric Engineering Corporation,** of New York, N. Y., has been incorporated with a capital stock of $100,000 to do a general consulting engineering and contracting business. The incorporators are H. Morgan, G. H. Onley and W. M. Clark, of New York, N. Y.

**The Swedish Rhythmic Vibrator Company,** of Chicago, Ill., has been incorporated with a capital stock of $10,000 to manufacture and deal in electric vibrators and other electrical and mechanical appliances. The incorporators are Blake O. Smith, C. E. Barry and William A. McGuire.

## Trade Publications

**Railway Motors.**—Bulletin A4173 of the General Electric Company describes its ventilated commutating-pole railway motor and supersedes the company's previous bulletin on this same subject.

**Wiring Devices.**—Bulletin No. 829 of Pass & Seymour, Inc., Solvay, N. Y., contains forty pages illustrating and briefly describing a comprehensive line of wiring devices and giving the price of each.

**Ornamental Lighting Posts.**—A small four-page "throwaway," with insert folder, has recently been printed by the George Cutter Company, of South Bend, Ind., to describe its new five-lamp boulevard post.

**Water Sterilizers.**—Catalog 12-E, issued by the Forbes Company, 1234 Callowhill Street, Philadelphia, relates to the household type of Forbes water sterilizer. This apparatus sterilizes the water by heat developed electrically.

**Small Electric Tractors.**—Bulletin 1160, issued by the Atlas Car & Manufacturing Company, of Cleveland, Ohio, describes its line of small storage-battery tractors and freight trucks, which are adapted for use in manufacturing plants and repair shops.

**Motor-Driven Exhaust-Fan Outfits.**—Motor-driven exhaust-fan outfits for direct current and alternating current form the subject of Bulletin No. A4174, published by the General Electric Company. The bulletin is devoted to the subject of fans for ventilating purposes and contains, in addition to other data, illustrations and dimension diagrams of the various motors built by the company for this purpose.

**Electric Breakfast Set.**—Folder No. 4266 issued by the Westinghouse Electric & Manufacturing Company, entitled "The Electric Breakfast Set," describes and illustrates the toaster-stove and coffee-pot type percolator and shows how easily a breakfast can be prepared with these convenient devices. The total time required for the preparation of the breakfast is fifteen minutes, and its cost of operation is 2 cents, based on 10 cents per kw-hr. for energy.

**Circuit-Breakers.**—"Who's Who and What's What" is the title of a thirty-two-page folder, size 4¼ in. by 10 in., which the Cutter Company, Philadelphia, has recently issued. The introduction, by the company's president, Mr. A. Edward Newton, is a brief survey of the company's work in the development of the I-T-E circuit-breaker during the last twenty-five years. Biographical sketches, with portraits, of various employees of the company form the "Who's Who" part of this pamphlet.

**The Wallace & Tiernan Company,** of 136 Liberty Street, New York, is engaged in the manufacture of special apparatus of various kinds for scientific research work along electrical lines, and it expects by the first of the year to be turning out its complete line of such apparatus, including conductivity cells, Wheatstone bridges, ozone apparatus, air-flow meters and other like products. The president of the company is M. F. Tiernan and C. F. Wallace and C. A. Simpson are vice-president and secretary respectively.

**Sliding-Contact Rheostats.**—Catalog 780, recently issued by James G. Biddle, 1211 Arch Street, Philadelphia, describes more than 400 sliding-contact laboratory rheostats, with different styles of mounting. The current ratings range from 0.3 amp to 40 amp., and the range of total resistance varies from 0.15 ohm to 5000 ohms. Use is made of special alloy wire wound on thin enameled metal tubes or slate blocks unless a new non-inductive crossed winding is specified. It is said that these rheostats have an almost infinite variety of applications.

**Storage Batteries.**—The Electric Storage Battery Company, of Philadelphia, Pa., has recently issued a four-page folder containing the paper presented by Bruce Ford at the fourth annual convention of the Electrical Vehicle Association of America, in Chicago. The title of the paper, "Lead Battery Developments During 1913 for Electric Vehicles," explains its scope. The company's latest publication gives extensive information on its type X "Exide" battery for automobile starting and lighting service, together with prices on these batteries and their several parts.

# Personal Mention

**Mr. E. H. Jaekel** has been appointed superintendent of the municipal electric lighting plant at Barron, Wis.

**Mr. P. Whitfield** has been appointed electrical superintendent for the town of Battleford, Saskatchewan, Canada.

**Mr. T. M. Early,** of Marietta, Ga., has been made superintendent of the new municipal light and water plant of Gainesville, Fla.

**Mr. Alfred Wallace** has been promoted from the position of superintendent of the Columbia (S. C.) Gas & Electric Company to the place of general manager.

**Mr. Henry J. Appert, Jr.,** has been appointed assistant manager of the Claremont Power Company and the Colonial Power & Light Company, Claremont, N. H.

**Mr. H. P. Davis,** of the Ontario Power Company, Niagara Falls, Ont., has resigned to accept the position of superintendent of the Salmon River Power Company at Altmar, N. Y.

**Mr. George Baxter,** formerly with the Haverhill (Mass.) Electric Company, has been made superintendent of the Exeter (N. H.) plant of the Rockingham County Light & Power Company.

**Mr. Clarence P. Westlake** has been appointed superintendent of the Columbia (S. C.) Gas & Electric Company as successor to Mr. Alfred Wallace, who has been made general manager of the company.

**Mr. Alten S. Miller,** formerly president and general manager of the Union Electric Light & Power Company, St. Louis, Mo., has been in Europe, where he has spent several months examining the gas fields of Hungary.

**Mr. C. S. Johann** has tendered his resignation as manager of operations of all of the plants of the Eastern Pennsylvania Power Company, of Easton, Pa., to join the staff of the Macan, Jr., Company, consulting engineer, in the same city.

**Mr. H. Godet,** of New York City, has been elected president of the Rico (Col.) Mining Company in place of Mr. Carl Owen, who has resigned. The company operates a hydroelectric plant at Rico, Col., of which Mr. G. E. Hicks is superintendent.

**Mr. Hugo Reisinger,** New York, the well-known importer of electrodes, who is widely known outside of electrical circles as a patron of art, has been elected president of the Germanic Museum of Harvard University, succeeding his father-in-law, the late Adolphus Busch.

**Mr. R. W. Bruce,** of London, Eng., has been appointed general superintendent and chief engineer of the Canada Electric Company, Amherst, N. S., and also will have charge of the electrical equipment of the Maritime Coal, Railway & Power Company, at Joggins Mines.

**Mr. F. K. Martin,** for the past five years electrical superintendent for the town of Battleford, Saskatchewan, Canada, has accepted the position of electrical superintendent for the town of Humboldt, Saskatchewan. Mr. Martin was previously electrical superintendent for the Canadian Ship Building Company.

**Mr. Frank F. Fowle,** consulting electrical engineer, New York, has been retained as expert for the State in the investigation of telephone rates now under way before the Public Service Commission of Vermont. The investigation will cover all of the companies doing a telephone business within the State.

**Mr. R. P. Leavitt,** formerly electrical superintendent of the Albany Southern Railroad, of Hudson, N. Y., who resigned from that company on Nov. 15, has assumed his new duties with the New York & Queens Electric Light & Power Company, of Long Island City, N. Y., as superintendent of the Newton district.

**Mr. J. H. McClure,** formerly of Philadelphia, has been appointed general superintendent of the Citizens' Light & Power Company, Oil City, Pa., as successor to Mr. W. W. Cole, who has been acting general manager of the local railway and lighting company. Mr. Cole, who is a member of the firm of Day & Zimmerman, of Philadelphia, has just completed the work of reorganizing the properties and will return to his many and varied duties in New York, Philadelphia and elsewhere.

**Mr. William R. Aldrich** has been appointed acting professor of electrical and mechanical engineering at the University of Arizona during the sabbatical leave of absence of Prof. W. W. Henley. During the past two years Mr. Aldrich was connected with the staff of the United States Reclamation Service, Shoshone Project, Powell, Wyo.

**Mr. Guy G. Crane** has resigned as superintendent of the city water department of Rockford, Ill., to become superintendent of the municipal electric-light and water plant of Lansing, Mich. Mr. Crane was formerly connected with the Allis-Chalmers Company at Milwaukee and took a position with the Rockford & Interurban Company in charge of the electrical and engineering work on Dec. 1, 1906. He remained with that company until April, 1913, when he was appointed superintendent of the water department.

**Mr. James G. White,** president of J. G. White & Company, Inc., returned Wednesday, Dec. 10, from a six months' absence in England and the Continent. A large part of his time was spent in London at the home office of J. G. White & Company, Ltd., in connection with the recent activities of that concern in the formation of the International Light & Power Company, Ltd., a holding company owning securities in several electric light and tramway properties in various parts of South America. The last two months were spent by Mr. White in motoring through France and Austria.

**Mr. Howard G. Wilson** has accepted the position of editor with the Underwriters' Laboratories, Chicago. Mr. Wilson was a student at Armour Institute of Technology, entering practical work in 1900. In 1909 he became connected with the Chicago Board of Fire Underwriters as electrical inspector, and after three years in this work entered the employment of Fred S. James & Company, an insurance firm, as traveling electrical engineer. This position he leaves to join forces with the Underwriters' Laboratories. Mr. Wilson has from time to time contributed to the periodical press articles on various subjects allied to electricity and insurance engineering.

# Obituary

**Andrew Sangster** for many years superintendent of the municipal electric light department of the city of Sherbrooke, Quebec, died suddenly at his home on Nov. 9.

**R. E. Bunning,** an electrical expert, died at his home in Plainfield, N. J., Dec. 6, following an illness which began ten months ago in Lima, Peru, where he was engaged in constructing an electric light and power plant.

**Dr. Henri Simon,** chief of the radio-telegraphic service of Switzerland and a pioneer in the use of X-rays, died at Geneva, Switzerland, Dec. 9, a victim of these rays. He had endured many surgical operations, having lost one arm and part of the other.

**William M. Finley,** formerly news editor of the *Electrical World* and more lately an editorial writer on the *Wall Street Journal,* died at his home in New York on Dec. 7. Mr. Finley was born fifty-six years ago in Shelbyville, Ky., and was graduated from Monmouth College. He was at one time editor-in-chief of the Louisville *Dispatch* and managing editor of the Louisville *Post.* In 1895 he was assistant postmaster of Louisville.

**George Henry Stout,** a motor-service salesman in the contract department of the Commonwealth Edison Company, who died recently, was employed by Mr. Thomas A. Edison in the early days of electrical development. He obtained a position in the Edison laboratory in Menlo Park and was sent abroad when the first companies were organized in Europe. It is said that Mr. Stout did the original wiring in the Grand Opera House of Paris and in the residence of Baron Rothschild in that city. He remained abroad five years and afterward was engaged in electrical work in Louisville and Cincinnati, becoming connected with the Commonwealth Edison Company in 1905. Mr. Stout was fifty-six years of age.

# Construction

## New England

MORRISVILLE, VT.—Within the next six months the managers of [illegible] electric-light plant expect to install one 1000-hp Leffel [illegible] governor, and one 750-kva Westinghouse generator and switchboard. Equipment has already been purchased. C. A. [illegible] superintendent.

STERLING, MASS.—Within the next six months the managers of the municipal electric-light plant expect to erect 3 miles of distribution lines to furnish electricity for commercial purposes; also to purchase an electrically operated pump (automatic control) for the municipal water system; also poles, transformers, wire, meters, etc., for above extension. H. W. Rugg is superintendent.

STOCKBRIDGE, MASS.—The Stockbridge Ltg. Co. expects to purchase within the next month complete equipment for a 100-kva substation and synchronous motor (three-phase, 60 cycles, 11,000/220 volts). Joseph Franz is engineer.

TURNERS FALLS, MASS.—The Franklin El. Lt. Co., of Turners Falls, has recently installed a new street-lighting system, consisting of 26 250-watt lamps on the main street and 116 75-watt lamps in the residential districts. The new contract is for a period of ten years from Nov. 1, 1913. Within the next six months the company expects to purchase general wiring supplies and line material for repairs (not a great amount). M. H. Mahoney is superintendent.

## Middle Atlantic

CORNING, N. Y.—The Town Board has granted the Elmira Transmission Co. a franchise to erect transmission lines through the town for a period of 50 years. Under the terms of the franchise the company cannot distribute electricity in the town.

DUNKIRK, N. Y.—The Dunkirk El. Mfg. Co. expects to purchase within the next six months boilers having a rating of from 200 hp to 400 hp. H. T. Litchfield is secretary.

ELLENVILLE, N. Y.—The Ulster Lake Co., of Ellenville, expects to purchase within the next two months 900 ft. of 46-in. by 3/16-in. steel-riveted pipe and waterwheel governor. C. D. Divine is treasurer.

MARCELLUS, N. Y.—The owners of the Marcellus lighting plant expect to purchase some lightning arresters and transformers. F. W. Knapp is manager.

NEW YORK, N. Y.—Bids will be received by the superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, N. Y., until Dec. 15 for installing electric equipment in new Public School 94 on Old House Landing Road, Cutter Avenue and Lafayette Place, Little Neck, borough of Queens.

OAKFIELD, N. Y.—The Public Service Commission has granted the Genesee Lt. & Pwr. Co., of Batavia, permission to purchase from the United States Gypsum Co., of Oakfield, the electrical distribution system in this village. The Public Service Commission has also approved the franchise given by the village of Oakfield to the Genesee company, permitting it to operate an electrical distribution system here. The company has also been awarded a five-year contract for lighting the streets of the village. The system will consist of forty 40-cp tungsten series lamps. Orders have been placed with the Westinghouse company and the General Electric Company for the necessary meters and transformers for changing the system from 133 cycles to 25 cycles. The system will be operated in connection with the transmission lines of the Genesee company which now run near this village. H. K. Stein is superintendent.

PORT HENRY, N. Y.—Within the next 30 days the Port Henry Lt., Ht. & Pwr. Co. expects to erect about 2 miles of distribution lines to maintain about 50 street lamps between Port Henry and Mineville. George H. Barwise is secretary.

SHERBURNE, N. Y.—Within the next 30 days the electric-light commissioners expect to erect about one-half mile of transmission line and to purchase some incandescent lamps. During 1913 a 200-hp Corliss engine and one 125-kva, 23,300-volt, two-phase, 60-cycle Crocker-Wheeler generator were installed in the municipal electric-light plant. William Champ is superintendent.

SOUTHAMPTON, N. Y.—The Suffolk Lt., Ht. & Pwr. Co., of Southampton, expects to erect transmission lines from Southampton to Bridgehampton. William B. Hambright is superintendent.

CENTERPORT, PA.—The Council has granted the Hamburg Gas & El. Co., of Hamburg, a franchise to erect a distribution system to furnish electrical service in this borough.

EXETER, PA.—The Borough Council has granted the Consumers' El. Co. a 60-year franchise in Exeter a contract for lighting the streets of the borough for a period of 10 years. The contract provides for Westinghouse arc lamps at $54 each per year. The Citizens' Ilg. Co., of Pittston, holds the present contract. Exeter has not a post office.

FAIRVIEW, PA.—The contract for the electrical work in all the buildings for the State Hospital for the Criminal Insane, at Fairview, has been awarded to the Baird Ostherhout Co., 1112 Chestnut Street, Philadelphia, Pa.

HAMBURG, PA.—The Hamburg Gas & El. Co. expects to extend its system to the borough of Centerport to furnish electricity there and to purchase material for a distribution system for same. The company was recently granted a franchise in Centerport. A. J. Althouse is superintendent.

NEWCASTLE, PA.—The Standard Steel Car Co., of Newcastle, is reported to have abandoned its power plant and will secure electricity to operate its works from the Shenango & Mahoning Pwr. Co. The company is changing from direct to alternating current and is installing new equipment and machinery at a cost of about $50,000.

POTTSVILLE, PA.—Plans, it is reported, have been completed by the Eastern Pennsylvania Rys. Co., of Pottsville, for the erection of a new power plant at Palo Alto (a suburb of Pottsville), to cost about $350,000. This is to be an addition to its present power plant, located at the same place. A site has been acquired for the new plant.

READING, PA.—The Reading Merchants' Ice Co. has entered into a contract with the Metropolitan El. Co. for electricity to the amount of 300 hp to operate the machinery in its plant. Work will soon begin on the installation of electrical equipment at an early date.

RINGTOWN, PA.—Within the next three months the Ringtown El. Lt., Ht. & Pwr. Co. expects to erect a new steam power plant. J. A. Yost is secretary.

SCRANTON, PA.—The Scranton Ry. Co. has entered into a contract with the Scranton El. Co. whereby the latter will furnish electricity to operate the street-railway system of the former. It is estimated that from 4000 kw to 5000 kw will be required to operate the street-railway system.

TOMS RIVER, N. J.—Within the next four months the Toms River & Island Heights El. Lt. & Pwr. Co. expects to purchase a complete ice-manufacturing plant (from 10 to 20 tons capacity). C. A. Brant is general manager.

TRENTON, N. J.—The contract for the erection of a substation on Olden Avenue for the Public Service El. Co. has been awarded to Newton K. Bugbee and W. & J. H. Morris, of Trenton, at $12,000.

BUCKHANNON, W. VA.—The Buckhannon Lt. & Wtr. Co. expects to purchase within the next 30 days one 200-kw, three-phase generator and a 300-hp Bessemer gas engine (directly connected) and switchboard; also two 50-arc lamp transformers, 25 arc lamps and 100 incandescent-lamp fixtures. J. G. Mayfield is general manager.

FAIRMONT, W. VA.—The Fairmont & Clarksburg Pwr. Co., it is reported, contemplates the construction of two hydroelectric power plants, No. 1 to be situated at Valley Falls, 14 miles east of Fairmont, and No. 2 6 miles south of Grafton, to develop 10,000 hp and 50,000 hp respectively. The proposed work will include two power houses (40 ft. by 60 ft.), two concrete power dams and two (hollow-type reinforced concrete) storage dams, having a capacity of 1,500,000,000 cu. ft. The fall of No. 1 plant is 72 ft. and of No. 2 plant 290 ft., to be connected by a 14,000-ft. tunnel driven through coal seam. The equipment will consist of nine turbines directly connected to generators. Two substations will also be erected. J. S. Rex, of Monongah, W. Va., is secretary.

WARWOOD, W. VA.—The Brooke El. Co. has applied to the Commissioner of Ohio County for a 50-year franchise to erect transmission lines, cables and conduits for the transmission of electricity on several roads in the county. F. P. McNell is attorney for the company.

WILLIAMSON, W. VA.—Within the next two weeks the Williamson Lt. & Ice Co. expects to purchase one 100-hp, 2300-volt, 60-cycle, two-phase, 600-r.p.m. motor. The company has recently purchased a 30-ton ice machine to be driven by motor. O. B. Welch is vice-president and manager.

CULPEPER, VA.—The Culpeper Lt. & Ice Co. expects to purchase within the next four months a 150-hp water-tube boiler, a 10-in. by 30-in. Corliss engine, a 50-kw or 60-kw, 250-volt direct-current generator and a rheostat, switches, etc. G. F. Major is superintendent.

ROYCE, VA.—Bids will be received by the Town Council until Jan. 5 for a franchise to install and operate an electric system in Royce for a period of 30 years. J. F. Stinson is acting Mayor.

STAUNTON, VA.—Within the next 30 days the Staunton Ltg. Co. expects to erect an outdoor substation at Fisherville to supply electricity to the rock quarries and crushers. Equipment has already been purchased. W. F. Ficklen, Jr., is superintendent.

WASHINGTON, D. C.—Bids will be received at the Engineer Depot, United States Army, Washington Barracks, D. C., until Dec. 15 for furnishing 14 ventilating blowers connected to 110-volt alternating-current, single-phase motors (right-hand); two ventilating blowers connected to 110-volt direct-current motors (left-hand); two 18-in. disk or propeller fans directly connected to 110-volt alternating-current, single-phase motors, complete, with starter; four 18-in. disk or propeller fans directly connected to 110-volt direct-current motors, complete, with inclosed starting rheostat and main switch (ready to run sets). Further information may be obtained upon application to Lt. Col. Joseph E. Kuhn.

WASHINGTON, D. C.—Bids will be received at Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Dec. 16 for furnishing at the various navy yards and naval stations the following supplies: Charleston, S. C., Schedule 6108—For one silent-chain drive with pulleys, eight electric diamond nose tailors' irons, two electric cutting knives, three miscellaneous motors, one electric stove, one three-pole knife switch and one switchbox for above. Bids will also be received

until Dec. 23 as follows: Brooklyn, N. Y., Schedule 6089—20,000 ft. double, flexible silk conductor; Schedule 6091—Miscellaneous electric dental engines, etc., seven electric dental sterilizers; Schedule 6089—11,000 ft. 10-conductor plain interior-communication cable, 10,000 ft. galvanized soft-steel leaded and armored twin-conductor wire, 6000 ft. plain twin-conductor wire; Schedule 6088—18,000 ft. stranded, portable shiplighting cable, 40,000 ft. incandescent lamp cord, 7000 ft. stranded rubber-covered wire. Newport, R. I., Schedule 6093—Miscellaneous seamless copper tubing. Bids will also be received until Dec. 30 for the following: Brooklyn, N. Y., Schedule 6120—One 72-cell storage battery, 30 headgears for radio receiving sets, one 7½-hp, 125-volt motor, complete. Philadelphia, Pa., Schedule 6116—Compressed cork for insulating purposes. Philadelphia, Pa., and Portsmouth, N. H., Schedule 6085—Miscellaneous seamless drawn tubing for condenser tube ferrules. Mare Island, Cal., Schedule 6085—22,000 lb. drawn brass seamless condenser tubes (admiralty mixture); Schedule 6084—Miscellaneous copper rod and bar, soft-rolled copper sheet; Schedule 6087—Miscellaneous brass and copper wire. Key West, Fla., Schedule 6112—One seven-panel switchboard. Boston, Mass., Schedule 6117—9000 lb. galvanized and annealed crucible cast-steel wire; Schedule 6083—8000 lb. brass voice tubing. Puget Sound, Wash., Schedule 6084—25,000 lb. ingot copper, grade No. 1. Bids will also be received until Jan. 6, 1914, as follows: Puget Sound, Wash., Schedule 6106—Electrically operated dishwashing machine. Tiburon, Cal., Schedule 6103—Two 75-hp induction motors and one switchboard panel. Mare Island, Cal., Schedule 6102—One motor-driven pump. Bids will also be received until Jan. 27, 1914, for furnishing at the navy yard, Brooklyn, N. Y., Schedule 6107—12 marine water-tube boilers, with tools complete. T. J. Cowie is paymaster general, U. S. N.

## North Central

BARAGA, MICH.—Final surveys are being made for the proposed hydroelectric plant of the Sturgeon River Pwr. Co. on the Sturgeon River in Baraga. The present plans provide for the construction of three dams on the Sturgeon River, two power houses, 8 miles of pipe line and 35 miles of electric transmission lines. When completed, the plant will furnish energy to more than a dozen towns and cities in Michigan. J. K. Gronholdt, of New York, N. Y., is chief engineer of the company.

DETROIT, MICH.—Arrangements are being made by the Eastern Edison El. Co., of Detroit, to extend its transmission line from its power house in Detroit to the towns of Warren and Centerline to furnish electrical service in those towns. The town of Warren has contracted for the installation of 50 tungsten lamps of 100 cp. The cost of the work is estimated at $35,000.

DOWAGIAC, MICH.—The Electric Light Commission expects to purchase within the next six months a condensing engine and possibly a 100-kw alternating-current generator and some poles. William E. Reynolds is contract agent and superintendent.

LAKEVIEW, MICH.—The Lakeview El. Lt. Co. expects to change its plant to three-phase system, which will necessitate the purchase of a new or second-hand generator.

MARSHALL, MICH.—Plans are being prepared, it is reported, by the Commonwealth Pwr. Co., of Jackson, for the erection of a substation in Marshall. This staton will furnish electricity to operate the cars of the Michigan United Trac. Co., of Jackson.

RICHMOND, MICH.—The Marquette County Gas & El. Co., of Ishpeming, Mich., has been awarded a contract to install a street-lighting system in Richmond, consisting of fifty 100-watt lamps.

SAGINAW, MICH.—The Saginaw Ammonia & Blueing Co., it is reported, contemplates the construction of an addition (50 ft. by 20 ft., one story) to its plant to provide space for the installation of an electric and steam plant, to be used for distilling purposes.

BARBERTON, OHIO.—The City Council has adopted a resolution authorizing the director of public safety to purchase a site for a proposed substation for the municipal electric-light plant. Bids for equipment for the substation will soon be called for. William S. Mitchell is Mayor.

CLEVELAND, OHIO.—The F. Zimmerman Co., 1723 Leonard Avenue, Cleveland, molding manufacturer, it is reported, expects to purchase equipment for its power plant now being built at 2198 West 110th Street, Cleveland.

CLEVELAND, OHIO.—The City Council has authorized the expenditure of $18,504 for the purchase and installation of 18 transformers (500 kva) and $37,000 for cable to be used in connection with the municipal electric-light plant. W. J. Springborn is director of public service.

CLEVELAND, OHIO.—Approximately 15 miles of overhead wires will be placed underground by the public utility corporations next year, according to the schedules submitted to the director of public service and the special investigating committee of the City Council. W. J. Springborn is director of public service.

CLEVELAND, OHIO.—Plans are being prepared by the National Telephone Sup. Co., of Cleveland, for the construction of a manufacturing plant in Cleveland, to cost about $60,000, for which bids for construction will be received Feb. 14. Machinery, with the exception of lighting and power plant, motors and transmission equipment, has been selected. Light and power will be supplied from the same unit, which will be driven by a natural gas engine of approximately 100 hp. Richardson & Yost, 354 Rockefeller Building, Cleveland, are architects and engineers.

CLEVES, OHIO.—Bids will be received at the office of R. R. Robinson, village clerk, until Dec. 15 for lighting the streets, alleys and public places with electricity for a period of ten years.

NEW BREMEN, OHIO.—Bids will be received by the City Council until Jan. 10 for one motor-driven water pump, working against a head of 46 lb. and a maximum pressure of 100 lb. E. R. Haines is city clerk.

SWANTON, OHIO.—The County Commissioners have granted the Swanton Lt. & Pwr. Co. permission to erect transmission lines through a corner of Lucas County. The company proposes to extend its service to Neapolis.

FLEMINGSBURG, KY.—The Flemingsburg Lt. & Ice Co. expects to purchase within the next six months a 150-hp engine and 100-kw direct-current generator (directly connected) and one 72-in. by 18-ft. return tubular boiler. C. E. Cooper is secretary and manager.

PIKEVILLE, KY.—Within the next six months the Sandy Valley Lt. & Pwr. Co., of Pikeville, expects to change its entire plant from 220 volts, direct current, to 2200-110 volts, 60 cycle, alternating current, including 40,000-to-2200 volt switching apparatus and transformers. The company also expects to purchase within the next six months about 250 meters, a complete lightning-arrester equipment for 2200 volts, a complete series tungsten street-lighting outfit, and electrical appliances and supplies necessary for this change. L. L. Stone is general manager.

EDINBURG, IND.—A special election will be held on Dec. 30 to vote on the proposal to issue bonds for improvements and extensions to the municipal electric-light and water plants.

GARRETT, IND.—The city of Garrett is contemplating the construction of a concrete and steel chute at the water and light plant and the installation of additional equipment, including a 200-hp boiler, an engine and generator (directly connected). W. W. Mountz is city clerk.

TIPTON, IND.—The city of Tipton may possibly purchase a turbine for the municipal electric-light plant and overhaul the distribution system. Arthur C. Herren is superintendent.

WILLIAMS, IND.—The Southern Indiana Pwr. Co., of Bedford, has applied to the Public Service Commission for permission to issue $500,000 in capital stock, the proceeds to be used to pay off floating indebtedness, purchase more land, and for extensions to its plant. The company's plant is located in Williams, which furnishes electrical service in a number of towns in this vicinity, including Bedford and Oolitic. Horace C. Stillwell, of Anderson, is president.

EARLVILLE, ILL.—The Village Board has decided to install a new street-lighting system in Earlville.

ERIE, ILL.—The Village Board has granted the Illinois Northern Utilities Co., of Chicago, a 25-year franchise to operate in Erie and also a 10-year contract for lighting the streets of the village.

GILLESPIE, ILL.—The City Council has instructed the light committee to prepare plans for improving the street-lighting system in the business section of the city.

KEWANEE, ILL.—City Commissioner Dunbar has announced that new equipment will be required for the municipal water-works station. The commissioner, it is understood, favors equipping the pumping station for electrical operation.

LODA, ILL.—The local electric-light plant, owned by Matthew Coffey, has been purchased by the Central Illinois Utilities Co., of Paxton, Ill.

MONMOUTH, ILL.—The Monmouth Pub. Serv. Co., it is reported, contemplates improvements to its plant, including the installation of a 750-kw turbo-generator. The company also proposes to rebuild its ice plant.

OREGON, ILL.—An issue of $7,000 in bonds is contemplated by the city of Oregon for the purpose of making repairs to the dam across the Rock River here, where it is proposed to establish a power plant.

PANA, ILL.—W. H. Suffern, of Decatur, has submitted a proposal to the City Council asking for a 20-year franchise to construct and operate an electric-lighting system in Pana. If granted a franchise he will install a new plant. Mr. Suffern agrees to furnish 2000-cp arc lamps for street lighting at $50 each per year.

PEORIA, ILL.—Plans have been submitted by the Association of Commerce to the city of Peoria for remodeling the Coliseum, which includes the installation of a new lighting system.

SPRINGFIELD, ILL.—Mayor John S. Schnepp has introduced an ordinance in the City Council providing for the purchase of a generator and a 400-hp boiler for the municipal electric-light plant. This is a separate plan from the ordinance for the purchase of a generator to be installed at the municipal water-works station to provide electricity for lighting the streets and for power purposes.

WASHBURN, ILL.—The Washburn Ht., Lt. & Pwr. Co. is contemplating the installation of a 5-ton to 10-ton ice plant in connection with its central station before the next season for ice opens. W. E. Lycan is president and manager.

BARRON, WIS.—Within the next three months the managers of the municipal electric-light plant expect to purchase one 125-hp to 150-hp oil or steam engine and one 120-hp waterwheel and governor. Series tungsten street lamp fixtures will be purchased next spring to replace the arc lamps now in use. E. H. Jackel is superintendent.

[illegible] WIS. [illegible] of Fall Creek is contemplating the construction of a municipal electric-light plant. The proposed plant will [illegible]

LAKE MILLS, WIS.—Within the next 30 days the managers of the municipal electric-light plant expect to erect 3 miles of 6600-volt transmission line, material for which has already been purchased. B. C. Engsberg is superintendent.

NEW LONDON, WIS.—The Electric Light and Water Commission expects to build within the next five months a concrete reservoir and pumping station for pure water supply. Within the next three months the commission expects to purchase two 125-kw to 200-kw, three-phase, 2300-volt generators (directly connected) and one six-circuit switchboard for above. O. H. Pribnow is superintendent.

RANDOLPH, WIS.—Bids will be received by J. O. Jones, village clerk, for the installation of an engine and dynamo, including labor and material, until Dec. 15, in accordance with plans and specifications prepared by the Langstadt-Meyer Construction & Supply Co., of Appleton, Wis., which may be seen at the office of the village clerk.

CARLTON, MINN.—Bids will be received by the Board of County Commissioners of Carlton County, Carlton, until Jan. 6 for the construction of jail and sheriff's residence in Carlton, according to plans and specifications prepared by Vernon J. Price & Co., architects, Palladio Building, Duluth. Separate bids are to be submitted as follows: On general contract work, plumbing, heating, wiring and cell work. Plans are on file in the office of August R. Norman, county auditor, Carlton, and at the offices of the architects in Duluth or Rexall Block, Crosby, Minn.

CHASKA, MINN.—Within the next six months the Electric Light Commission expects to purchase a coal-handling system to unload cars. E. F. Strang is manager.

ROCHESTER, MINN.—Bids will be received by the State Board of Control, State Capitol Building, St. Paul, until Dec. 17 for electrical construction for power plant at the Rochester State Hospital, Rochester, in accordance with plans and specifications, prepared by Charles L. Pillsbury Co., engineer, Metropolitan Life Building, Minneapolis, Minn. Copies of plans and specifications may be seen at office of the superintendent, State Hospital, Rochester, at the Builders' Exchange in Minneapolis and St. Paul, at the office of the State Board of Control and at the office of the engineer. Bids will also be received at the same time and place for the installation of a telephone system and watchman's clock system for the Rochester State Hospital. Bids must be submitted on forms supplied by the engineers.

ST. PETER, MINN.—Within the next six months the Electric Light and Water Department expects to erect additional distribution lines, to cost about $3,000, and to purchase a 150-kw or 200-kw generator and turbine or engine. F. N. Wilson is superintendent.

BAGLEY, IA.—The contract for equipment for the municipal electric-light plant has been awarded to the Globe Electrical Co. of Milwaukee, Wis., for $5,325. The proposed plant will be driven by a 30-hp crude-oil engine.

DENISON, IA.—The installation of a municipal electric-light plant in Denison is under consideration.

GARNER, IA.—The Enterprise El. Lt., Ht. & Pwr. Co., of Garner, expects to purchase within the next six months a generator and engine.

PILOT MOUND, IA.—At an election held recently the proposal to establish a municipal electric-light plant was carried.

KANSAS CITY, MO.—Bids will be received by Henrici, Kent & Lowry Engineering Co., 715 Reserve Bank Building, Kansas City, Mo., consulting engineers, until Dec. 18 for equipment for the new power plant of Montgomery, Ward & Co., of Kansas City. Bids will also be received until Jan. 15 for excavations, for furnishing and installing one trash-burning furnace, piping, breeching, coal and ash-handling apparatus, power-plant wiring and pipe covering. For details see proposal columns.

KIRKWOOD, MO.—Within the next six months the managers of the municipal electric-light plant expect to purchase new equipment, including engines, boilers and generators for a 300-kva plant, and they would like to receive estimates of cost on same. They also purpose to install a 10-ton ice plant in connection with the electric plant. W. A. Trussell is superintendent.

MONROE CITY, MO.—Within the next six months the managers of the municipal electric-light plant expect to establish a day service. O. R. Emerson is superintendent.

ST. LOUIS, MO.—The advertisement requesting bids to be opened Dec. 20 for plumbing and wiring for the extension to the United States public building in St. Louis, Mo., has been withdrawn by O. Wenderoth, supervising architect.

COGSWELL, N. D.—The Cogswell El. Lt. & Pwr. Co. expects to purchase within the next six to eight months a 15-hp gasoline engine and a direct-current generator. H. L. Saylor is secretary.

GREGORY, S. D.—The plant of the Gregory Lt. & Pwr. Co. was recently destroyed by fire, causing a loss of from $12,000 to $15,000.

VALLEY, NEB.—Within the next few months the managers of the municipal electric-light plant expect to purchase a few meters and two coils of weatherproof wire. Albert C. Hedberg is village clerk.

CAWKER CITY, KAN.—The city of Cawker does not propose to construct a municipal electric-light plant as reported in the issue of Nov. 22. The proposed bond issue is for the purpose of purchasing the local electric-light plant. C. R. McKinley is city clerk.

SABETHA, KAN.—The managers of the municipal electric-light plant are planning to rebuild the distribution system, material for which has already been purchased; the installation of an ornamental street-lighting system is also under consideration. A 187-kva, three-phase, 60-cycle, 2300-volt Westinghouse turbine has recently been installed. F. W. Hunter is general superintendent.

WATHENA, KAN.—Within the next three months the managers of the municipal electric-light plant expect to purchase one car load of 30-ft. white cedar poles. F. A. Whitney is superintendent.

## Southern States

DANBURY, N. C.—The installation of an electric-light plant is under consideration by the Town commissioners.

GREENVILLE, N. C.—A committee, consisting of Aldermen Rountree, A. B. Ellington and Fire Chief D. D. Overton, has been appointed by the Board of Aldermen to make investigations in regard to the cost of proposed improvements to the water and light plants and the installation of a fire-alarm system for the town. The cost of the work is estimated at $25,000.

NEWBERN, N. C.—The Municipal Water and Light Department expects to complete within the next two months the power station for the light and water plants; also to purchase within the next six months one 500-kw, 2300-volt, three-phase steam generating unit (directly connected). Two 50-lamp, 6.6-amp rectifiers outfits and luminous-arc lamps manufactured by the General Electric Co. have recently been installed. H. H. Hodges is superintendent.

PICKENS, S. C.—Within the next two months the Ivy Wtr., Lt. & Pwr. Co., of Pickens, expects to purchase a set of meters. A. M. Morris is president.

WOODRUFF, S. C.—The City Council is contemplating the installation of an electric-lighting system.

PUNTA GORDA, FLA.—At an election held Dec. 2 the proposal to issue $60,000 in bonds for extensions to electric-light, water and sewer systems was carried. George S. Stone is president of Council.

CARROLLTON, ALA.—The City Council has granted the Delma Lumber Co. a franchise to construct and operate an electric-light plant in Carrollton for a period of 20 years. George M. Collins and Dr. H. H. Mobley, of Gordo, are interested in the project.

CARROLLTON, MISS.—The managers of the municipal electric-light plant expect to extend the municipal electric-light system through North Carrollton within the next six months and will purchase poles and line material for same. W. E. Stilson is manager.

NATCHEZ, MISS.—Bids will be received until Dec. 17 by the city of Natchez for lighting the streets of the city for a period of five years. Specifications are on file in the office of the city clerk.

BATESVILLE, ARK.—The city of Batesville has just completed a new reinforced concrete power house (100 ft. by 50 ft.) and a concrete coal bin of 600 tons capacity and the installation of a 150-kw Fort Wayne alternating-current generator. Within the next week the electric light and water commission expects to purchase electrical heating and cooking apparatus for the holiday trade. W. H. Walkup is superintendent.

BEEBE, ARK.—The A. C. Ward El. Co., of Beebe, is contemplating extending its service to Cabot, Ward, McRae and possibly to other nearby towns.

TEXARKANA, ARK.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 5 for a conduit system and lighting fixtures in the United States post office and court house at Texarkana. For details see proposal columns. O. Wenderoth is supervising architect.

MANSFIELD, LA.—Within the next four months the Mansfield Ice Co., Ltd., expects to purchase 75 110-volt, 60-cycle meters.

NEW ORLEANS, LA.—Bids will be received by the Sewerage and Water Board, Room 508, City Hall, City Hall Annex, New Orleans, until Jan. 30, for furnishing electrical machinery under Contract 59-D; also for drainage canal work under Contract 60-D. Specifications for both contracts furnished upon application, upon the deposit of $50 and $10 respectively. Bids will also be received by the Sewerage and Water Board, fifth floor, City Hall Annex, New Orleans, until Jan. 6 for pumps and flood gates, under Contract 58-D, plans for which will be furnished on deposit of $500. George G. Earl is general superintendent and F. S. Shields is secretary.

CUSHING, OKLA.—The Cushing El. Lt. & Pwr. Co. has recently purchased a 16-in. by 36-in. Harris Corliss engine, one 150-kva, three-phase, 60-cycle Allis-Chalmers generator, and a three-panel switchboard. The company is now installing 25 100-watt tungsten street lamps. H. Askin is secretary.

HUGO, OKLA.—The property of the Hugo Ice & Lt. Co. has been purchased by the American Pub. Ser. Co., of New York, N. Y. Extensive improvements are contemplated to the system. H. E. Mole, 55 Liberty Street, New York, N. Y., is chief engineer of the American Pub. Ser. Co.

McALESTER, OKLA.—Plans are being made by the Pioneer Tel. & Tel. Co. to rebuild its local system at a cost of $38,000. Elmer Speaker is local manager.

ARANSAS PASS, TEX.—At an election held recently the citizens voted to issue $8,000 in bonds for the construction of an electric-light plant.

COOPER, TEX.—The Delta El. & Mfg. Co., of Cooper, expects to purchase within the next four months one 125-hp boiler; also to purchase at once a rectifier to charge batteries for automobiles. The company would like to purchase an appliance for control of street lamps (lamps are in multiple and on main wires) and if possible would like equipment to control them without extra wires. R. J. Thomas is president.

HAMILTON, TEX.—H. M. Weiser, who recently purchased the property of the Hamilton Lt. & Pwr. Co., is enlarging and improving the power plant. New machinery is now being installed.

HICO, TEX.—Within the next two months the Hico El. Lt. & Pwr. Co. expects to erect 22 miles of transmission from Hico to Walnut Springs. H. Gleason is manager.

HOUSTON, TEX.—The Houston El. Co. is contemplating extending its street-railway system to Sunset Heights, a distance of 4 miles.

## Pacific States

CATHLAMET, WASH.—Ingalls Brothers, of Cathlamet, who were recently granted a 25-year franchise by the City Council to construct and operate an electric-light system in Cathlamet, have agreed to install the system within six months.

GRANITE FALLS, WASH.—The Granite Falls El. Co. expects to purchase 1½ miles of No. 6 bare copper wire within the next two months. C. H. Cleaver is secretary and treasurer.

SEATTLE, WASH.—Under an executive order of President Wilson, 1120 acres of unsurveyed land belonging to the government on Illabot Creek, Skagit County, were recently withdrawn from entry and will be reserved for a water-power site.

SPOKANE, WASH.—The stockholders of the Washington Wtr. Pwr. Co. have approved the proposed increase of capital stock from $15,000,000 to $20,000,000. The proceeds will be used to take care of outstanding indebtedness and for future construction work.

BEND, ORE.—The Bend Wtr. Wks., Lt. & Pwr. Co. is contemplating the installation of an ornamental street-lighting system in Bend. Property owners on Bond, Oregon and Wall Streets are agitating the installation of an ornamental lighting system in those districts.

PORTLAND, ORE.—The contract for the construction of the power plant in the Pittock Block has been awarded to the Charles C. Moore Co., 99 First Street, San Francisco, Cal., at about $80,000.

PORTLAND, ORE.—The Portland Ry., Lt. & Pwr. Co. expects to install within the next few months several arc lighting sets and a considerable number of magnetite-arc lamps for city lighting. O. B. Coldwell is general superintendent of Light and Power Department.

ANAHEIM, CAL.—The Anaheim Board of Trade is considering the question of lighting the state highway from Fullerton to Santa Ana, a distance of 11 miles. The associated chambers of commerce of Orange County has been asked to appoint a committee to promote the project.

LOS ANGELES, CAL.—The board of experts, consisting of George L. Hoxie, of New York, N. Y.; Prof. C. L. Cory, of Berkeley, and C. W. Koiner, of Pasadena, employed by the City Council to investigate and report on the cost of the electrical distribution system for aqueduct, has submitted its report to the Council. The cost of a system to furnish electrical service to the entire city, exclusive of the electric railways, is estimated at $5,697,635; the cost of operating such a system would be $1,283,716 per year; the annual income the city would receive from the operation of such a system is estimated at $2,029,000. The report provides for reaching every customer in the city and distributing a peak load of approximately 36,000 hp.

SAN BERNARDINO, CAL.—The Southern Sierras Pwr. Co., of San Bernardino, it is reported, is contemplating the construction of a transmission line from San Bernardino to Benning, to cost about $400,000.

SAN DIEGO, CAL.—The City Council has awarded the contract for the installation of ornamental lamp standards on Third Street to the Howell El. Co., at $4,330; the company was also awarded the contract for a lighting system on F Street, to cost $4,950. The city will construct a lighting system on Seventh Street, to cost about $6,100.

MIDVALE, IDAHO.—The Adams County Lt. & Pwr. Co. has applied to the City Council for a franchise to construct and operate an electric-light and power plant in this city.

HARDIN, MONT.—At an election held recently the citizens voted to grant a franchise to E. A. Crowell and B. Blum to construct and operate an electric-light plant.

SHERIDAN, WYO.—An agreement has been reached between the city and the Sheridan County El. Co. for the installation of an ornamental street-lighting system in Sheridan. The present plans provide for the erection of 66 standards carrying five-lamp clusters.

EAGLEWOOD, COL.—The City Council is considering the installation or purchase of an electric-lighting system.

LAS VEGAS, NEV.—An order has been issued by Secretary Lane of the Department of the Interior creating a power site reserve in Boulder Canyon, on the Colorado River, 20 miles east of Las Vegas. It is estimated that 40,000 hp can be developed.

## Canada

MEDICINE HAT, ALTA.—Two of the by-laws recently passed by the burgesses of Medicine Hat provide for the necessary expenditure for extensions and improvements to the municipal electric-light and gas systems.

KERRISDALE, B. C.—The establishment of a municipal electric-light plant is being agitated by the Kerrisdale Ratepayers' Association.

LILLOOET, B. C.—The Lillooet Lt. & Pwr. Co., it is reported, will soon begin work on the construction of a hydroelectric power plant near Lillooet.

NELSON, B. C.—The City Council is contemplating the installation of a tungsten street-lighting system, to cost about $16,000.

CARBERRY, MAN.—The town of Carberry expects to change the street-lighting system from series arc lamps to series tungsten lamps and to install additional lamps. M. J. Melville is town electrician.

NIAGARA FALLS, ONT.—Plans are being considered for building a tunnel from the Whirlpool to the Lewis escarpment, a distance of 3 miles. If the plan is carried out, about 30,000 hp will be developed at the foot of Lewiston Heights. E. B. Reed, of Lockport, N. Y., is interested.

ST. CATHARINES, ONT.—The City Council on Dec. 1 ratified the by-law to expend $116,000 for the installation of a distributing system for electricity to be supplied by the Hydro-Electric Power Commission and also indorsed the agreement with the commission.

SAULT STE. MARIE, ONT.—The Tagona Wtr. & Lt. Co. has notified the City Council that it will not ask for a renewal of its franchise.

AYER'S CLIFF, QUE.—The Sherbrooke Ry. & Pwr. Co., of Sherbrooke, has acquired the property of the Burrows Falls Pwr. Co., thus securing a franchise to furnish electricity for municipal and commercial purposes in the town.

PRINCE ALBERT, SASK.—The Council has decided to engage an engineer to make investigations and report on the possibilities of obtaining power from Lacolle Falls.

WOLSELEY, SASK.—The managers of the municipal electric-light plant expect to erect a second primary line in town within the next 30 days; also to purchase within the next two months washing machines, electric irons, heating and cooking apparatus. The town has recently purchased the property of the Central Lt. & Pwr. Co. Charles Stengell is manager.

YORKTON, SASK.—The managers of the municipal electric-light plant expect to purchase within the next two months one 500-hp generating unit (Diesel engine), tenders for which will be received until Dec. 22; also within the next six months to purchase 65 ornamental lamp standards for five-lamp clusters. Contract has been awarded for the erection of a new power house to Messrs. Walker & Ritchie, of Portage la Prairie, Man. M. M. Inglis is electrical engineer.

DAWSON, YUKON TERRITORY.—A movement has been started to establish municipal ownership of water service, electric lighting, telephones and other public utilities, through the Dawson Civic League, which was recently organized. Committees have been appointed to secure data in regard to the cost of municipal installation and operation of same.

## Miscellaneous

VALDEZ, ALASKA.—The City Council has granted Alfred B. Iles, of Valdez, a franchise to erect transmission lines for the distribution of electricity over the principal streets of the city.

# New Incorporations

RUPERT, IDAHO.—The Star El. Lt. & Pwr. Co. has been incorporated with a capital stock of $10,000 by J. P. Puckett, Harry H. Shillington and Jay N. Shaver.

PORTLAND, MAINE.—The Central Iowa Lt. & Pwr. Co. has filed articles of incorporation under the laws of the State of Maine. The company is capitalized at $300,000 and proposes to construct, maintain and operate power plants for the supply and distribution of electricity for all purposes. A. F. Jones is president and T. L. Croteau treasurer, both of Portland.

BETHANY, MO.—The Bethany Tel. Co. has been incorporated with a capital stock of $50,000 by W. M. Foster, John A. Lilly and O. H. Nally.

PHOENIX, N. Y.—The Phoenix Gas & El. Co. has been incorporated with a capital stock of $40,000 by Herbert Dunn, J. A. Haws and L. M. Hutchinson, all of Phoenix. The company proposes to furnish electricity and gas for lamps and motors in Phoenix.

CLEVELAND, OHIO.—The Utilities Service Co. has been incorporated with a capital stock of $10,000 by John Anderson, Joseph E. Kewley and Charles W. Louder.

CONDE, S. D.—The Conde Lt. & Pwr. Co. has been incorporated with a capital stock of $15,000 by M. Ehler, Caroline Raylor and George I. Ehrier, all of Conde.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED DEC. 2, 1913.

Compiled by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.

1,079,931. MICROPHONE; J. J. Comer, Chicago, Ill. App. filed Nov. 28, 1910. Differential type with carbon diaphragm; voice vibrations transmitted to unequal portion of the diaphragm.

1,079,946. TROLLEY FINDER; P. J. Minck, Brooklyn, N. Y. App. filed May 31, 1909. Eccentrically mounted hollow finder drums at opposite sides of trolley wheel.

1,079,948. FUSE PLUG; T. E. Murray, New York, N. Y. App. filed July 24, 1913. Fuse strip doubled over a supporting partition, engaging the screw shell at one end and the other end passed out through center of plug.

1,079,991. ELECTRICALLY CONTROLLED RAILWAY SWITCH; E. S. Olmsted, Beechmont, Ky. App. filed March 22, 1913. Trolley wheel first opens and then closes the circuit of the electrically operated switch-throwing device.

1,079,994. COMMUTATOR MOTOR; H. K. Schrage, Vesteras, Sweden. App. filed Sept. 9, 1911. Induction-motor type; speed regulated by brush displacement.

1,080,005. ELECTRIC WATER PURIFIER; L. A. Fitzer, Los Angeles, Cal. App. filed March 15, 1913. Plates held spaced by being seated in grooves in the bottom board of the tank.

1,080,018. ELECTRICAL COMMUNICATING SYSTEM; L. N. Miller, Rochester, N. Y. App. filed March 17, 1909. System over which fire-alarm reports or calls may be sent or telephonic communications may be maintained.

1,080,026. MOTOR-REVERSING MEANS; H. B. Taylor, Wilkinsburg, Pa. App. filed Feb. 23, 1912. One side of armature is connected to an intermediate point in the field winding, and switch serves to connect other side of armature to either of the two terminals of the field winding.

1,080,028. TYPEWRITING MACHINE; C. H. Vogel, Vancouver, B. C., Canada. App. filed Aug. 22, 1910. Electromagnet completes the stroke of the type bar started by the finger key.

1,080,029. ELECTRIC GENERATING TRANSMITTING AND DISTRIBUTING SYSTEM; F. W. Walker Port Washington, Wis. App. filed Nov. 27, 1911. An auxiliary engine has a driving connection with the rotary element of the transformer, which is connected with the transmission line.

1,080,044. ELECTRICALLY OPERATED REVERSING GEAR; K. Brüll, Budapest, Austria-Hungary. App. filed Feb. 27, 1912. An auxiliary motor switches the gear into the three main positions of rotation to the left, stoppage and rotation to the right.

1,080,051. ELECTRIC LOCOMOTIVE; G. M. Eaton, Wilkinsburg, Pa. App. filed June 9, 1910. Has trussed side frames.

1,080,058. SWITCH; G. W. Hart, West Hartford, Conn. App. filed April 1, 1913. Foot-operated starting switch for automobiles.

1,080,061. INDUCTION MOTOR; R. E. Hellmund, Pittsburgh, Pa. App. filed Jan. 7, 1911. Particularly for locomotives; circuit changes accomplished through three slip-rings and an externally actuated switching device located within the revolving part.

1,080,088. AUTOMATIC SIGNALING AND TRAIN-STOPPING COMBINATION CIRCUIT DEVICE; C. C. Turner, Portland, Ore. App. filed May 27, 1912. Electromechanical contrivances on the moving vehicle engage with the third rail.

1,080,113. HEATING MOLTEN ELECTROLYTES; F. Von Kugelgen, Holcombs Rock, Va., and G. O. Seward, East Orange, N. J. App. filed March 28, 1911. Gaseous combustible is burned within a hollow electrode.

1,080,126. CONTROLLER FOR ELECTRIC MOTORS; H. F. Stratton, Cleveland, Ohio. App. filed June 20, 1912. Alternating-current controller with magnet whose winding always takes a small amount of current regardless of the position of the controlling device.

1,080,140. MOTOR-CONTROL SYSTEM; C. S. Dauler, Cleveland, Ohio. App. filed July 24, 1913. Partial manual and automatic control.

1,080,146. MOTOR-CONTROL SYSTEM; J. H. Hall, Cleveland, Ohio. App. filed March 18, 1913. Safety limit switch stops motor when mechanism driven thereby reaches certain limit of movement.

1,080,161. INDICATOR MECHANISM; E. J. Pace and O. E. Kellum, Los Angeles, Cal. App. filed Dec. 13, 1911. Station indicator.

1,080,167. MEANS FOR ELECTRICALLY TRANSMITTING ORDERS OR SIGNALS AND FOR INDICATING THEIR NATURE, AND THE POINTS OF TRANSMISSION; H. Quertier, Wellington, New Zealand. App. filed Sept. 2, 1910. For transmitting orders from the tables in a restaurant to the kitchen or servery.

1,080,200. ALTERNATING - CURRENT - MOTOR CONTROLLER; C. A. Dresser and H. Fankboner, Chicago, Ill. App. filed July 2, 1909. Remote control alternating-current motors by means of alternating-current apparatus.

1,080,214. REGULATOR FOR ELECTRIC FLUID HEATERS; W. S. Hadaway, Jr., New York, N. Y. App. filed Sept. 5, 1911. Fluid-in-circuit heater which is adjustable with respect to the supply vessel so as to vary the level of the liquid therein.

1,080,230. ELECTRICAL SLIDING CONTACT; J. V. Purssell, Friendship Heights, Md. App. filed Dec. 12, 1912. Re-bent spring body with insulator finger holds which may be gripped to lift the contact from engagement with the tuning coil or other device.

1,080,234. DRY-CELL BATTERY; A. Rordame, Salt Lake City, Utah. App. filed May 14, 1913. Insulated screen packing with obliquely disposed interstices is interposed between the metal container and the bibulous lining.

1,080,236. WEIGHING SCALE; J. L. Saylor, Minneapolis, Minn. App. filed July 25, 1910. Scale movable on track beneath the discharge openings in a commodity cabinet, and the scale beam controls the electromagnetic discharge valves.

1,080,237. WEIGHING SCALE; J. L. Saylor, Minneapolis, Minn. App. filed July 24, 1911. Electromagnetically controlled discharge valve under control of a scale beam.

1,080,246. CONTROLLING SYSTEM FOR SIGNALING CIRCUITS; C. E. Beach, Binghamton, and H. W. Doughty, New York, N. Y. App. filed Oct. 31, 1910. Fire-alarm and police-telegraph system.

1,080,247. BATH CABINET; M. Beadle, Battle Creek, Mich. App. filed June 29, 1912. Foldable and practically air-tight.

1,080,257. INSULATOR; K. Bruchsaler, San Francisco, Cal. App. filed May 5, 1913. Porcelain tube with retaining strip insertable with the tube and bendable to hold tube in place.

1,080,260. INTERCOMMUNICATING TELEPHONE SYSTEM; P. G. Burgess, Jamaica, N. Y. App. filed Sept. 29, 1910. Includes dictagraph installation.

1,080,271. ART OF SIGNALING BY ELECTROMAGNETIC WAVES; R. A. Fessenden, Brant Rock, Mass. App. filed May 4, 1906. Tunes by varying both the coupling and the amount of wire in each coil of the transformer by infinitesimal increments.

1,080,287. SIGNALING DEVICE; M. Levison, Chicago, Ill. App. filed May 19, 1911. Annunciator is actuated only upon maintenance of the changed conditions in the main circuit for a predetermined lapse of time.

1,080,321. PRINTING MACHINE; G. M. Breckenbridge, Chicago, Ill. App. filed Nov. 4, 1912. Motor drives through interposed clutch; automatic means to break circuit and disconnect clutch.

1,080,323. AUTOMATIC FIRE ALARM; L. J. Bryant and J. Case, Bradford, Pa. App. filed March 19, 1913. Fusible link holds one arm of a spring yoke out of engagement with a contact post.

1,080,325. ATTACHMENT PLUG FOR ELECTRIC CIRCUITS; F. H. Chapman and O. E. Kenney, Toledo, Ohio. App. filed Feb. 24, 1913. Plug member of the coupling has a spring-pressed center-contact plunger.

1,080,326. ATTACHMENT PLUG FOR ELECTRIC CIRCUITS; F. H. Chapman and O. E. Kenney, Toledo, Ohio. App. filed Feb. 24, 1913. Plug with spring-pressed plunger; brush on plunger makes sliding engagement with a contact on the plug and serves also to limit movement of the plunger.

1,080,327. ATTACHMENT PLUG FOR ELECTRIC CIRCUITS; F. H. Chapman and O. E. Kenney, Toledo, Ohio. App. filed March 21, 1913. A pivoted dog on the plug is thrown out into engagement with the screw of the socket when plug is inserted all the way in the socket.

1,080,339. THERMOSTATIC CIRCUIT CLOSER; J. Hartley, Philadelphia, Pa. App. filed Sept. 21, 1908. Fusible element holds spring-pressed contact disk out of engagement with a relatively fixed contact disk.

1,080,344. PROCESS OF SMELTING METALS; J. D. Hillard, Albany, N. Y. App. filed Nov. 26, 1907. Continuously feeding and operating preheating kiln in combination with one or more electric furnaces.

1,080,354. FIRE-ALARM SIGNAL BOX; W. J. Leveridge, Plainfield, N. J. App. filed March 12, 1913. Applies "break-glass" principle to an ordinary pull-lever type of fire-alarm box.

1,080,355. SYSTEM OF ELECTRICAL DISTRIBUTION; J. O. Luthy, San Antonio, Tex. App. filed Feb. 26, 1913. Supplies current at voltage in excess of that normally required by the translating devices, and successively varies the voltage between predetermined limits and rapidly reverses the order of voltage variation.

1,080,387. BRAKE FOR ELECTRIC-MOTOR-OPERATED MACHINES; M. Taigman, New York, N. Y. App. filed March 24, 1913. Combines brake with the starting box.

1,080,388. ELECTRIC-MOTOR DRIVING UNIT; M. Taigman, New York, N. Y. App. filed March 24, 1913. Motor unit supplied as an individual portable member ready for immediate installation.

1,080,403. MEANS FOR COMPENSATING POLYPHASE ALTERNATING-CURRENT COMMUTATOR MOTORS; E. F. W. Alexanderson, Schenectady, N. Y. Assignor to General Electric Company, a corporation of New York. App. filed Aug. 25, 1913. Drum winding connected to one side of the source of supply and the commutator brushes connected to the other side of the source.

1,080,405. BALL JOINT; L. W. Andersen, Waterbury, Conn. App. filed Sept. 6, 1913. Relatively movable hemispherical shells containing guard plates protecting the wiring.

1,080,410. SHOE OR SKATE FOR ELECTRIC RAILWAYS; A. W. Barnhart, Cairo, W. Va. App. filed Jan. 31, 1913. Collector yieldingly supported between pole pieces of an electromagnet.

1,080,412. SIPHON RECORDER; S. G. Brown, London, Eng. App. filed Feb. 6, 1912. Employs short siphon tube and controls its movements in a way to reduce its inertia.

1,080,414. ELECTRIC CLOCK; F. Brunko, Zurich, Switzerland. App. filed March 25, 1913. Contact is scraped clean by means of a vibratory device during the time that the second contact member does not bear against the contact.

1,080,475. INDUCTION MOTOR; W. H. Powell, Milwaukee, Wis. App. filed March 4, 1911. Forces the conducting bars and short-circuiting rings of the squirrel-cage winding in intimate contact with each other by means exterior to the bars.

1,080,480. ELECTRIC FIRE ALARMS; F. Ricords and M. Lewry, New York, N. Y. App. filed Dec. 27, 1912. Combined fire-alarm box and push-button switches for sending in an alarm.

1,080,483. PRIMARY BATTERY; C. B. Schoenmehl, Waterbury, Conn. App. filed Dec. 9, 1910. Two compressed oxide of copper negative electrodes so arranged with respect to the positive electrodes as to insure four working faces.

1,080,484. GALVANIC BATTERY; C. B. Schoenmehl, Waterbury, Conn. App. filed April 23, 1912. Copper oxide plate and the coacting zinc electrodes are properly supported on a frame suspended from the cover of the jar by a single supporting rod.

1,080,493. THERMO REGULATOR; W. J. Smith, Urbana, Ill. App. filed June 30, 1911. Combination of thermostat and relay control to maintain constant temperature.

1,080,496. FUSE FOR ELECTRIC CUT-OUTS; L. E. Steward, Muncie, Ind. App. filed Dec. 10, 1912. Fuse strip detachably secured to laterally extending terminals carried by the end caps of the cartridge.

# Electrical World

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**Developing the Latent Market**

Even a superficial examination of electrical conditions in any community will reveal the fact that a considerable portion of the population do not enjoy any of the advantages of electric service, and of those who do only a very small percentage enjoy them to the full. This indicates that there is an immense load still to be had and that, ignoring entirely future developments in the art, the electrification of railroads and of industries not yet won over to electrical operation, the saturation point is so very remote that no account need be taken of it. The stability of electrical investments and the vast amount of new capital that is being poured into the industry, used as rapidly as it can be raised, and limited only by the cost of money, reflect this favorable condition. With a view to stimulating the demand for electricity on the part of the general public and of educating those engaged in electrical work to the great opportunities incident to a harmonious and co-operative movement, the Society for Electrical Development was organized more than a year ago. Its plans have been outlined in our columns from time to time and are again set forth in the present issue together with indorsements from men prominent in the industry. In order to commence its work, the society asks from an industry representing an invested capital of at least $2,500,000,000 the modest sum of $200,000. Thus far it has been able to raise about $170,000, and, be it said to the detriment of that branch of the industry which is destined to reap the greatest ultimate reward from the movement, the central stations have not supported it as liberally as their relative financial strength warrants. There has been a tendency in central-station circles to regard the movement as utopian; but judgment should not be rendered without a fair trial, and the amount of money involved is not so large that the experiment, if it be so regarded, cannot be tried for a year at least. A similar movement has met with marked success in less progressive Germany. The publicity campaign of the Electric Vehicle Association of America, affecting only a small branch of the industry, has shown results sufficient to justify a continuance of the work, and now the National Commercial Gas Association, with prospects less promising, is raising a fund of $300,000 for general educational purposes, half of which sum has already been subscribed. It would be a reflection on the entire electrical industry to permit this great co-operative movement to die without giving it a chance to justify its existence. What appears more visionary to the prospective user of electricity than the claims of exponents of central-station service, and yet are not all the claims substantiated when the actual installation has been made? "Do it electrically" is what the central stations of the country preach, and "Do it electrically" is the motto of the Society for Electrical Development. If the work of that society is to be done at all, it should be done at once, and it can be done at once if the central stations of the country join the movement. It is certainly worthy of their support, and that support should not be withheld with the goal so near at hand.

**The Tallulah Falls Plant**

This important hydroelectric station, described in this issue, is noteworthy as being the only large development at really high head east of the Mississippi, if one excepts Niagara, which can hardly be placed in the high-head class. Six hundred feet of head is rather unusual anywhere, and to find a large installation working at this head in the southern Appalachian country is somewhat impressive even in these days of big plants. The present installation consists of five 17,000-hp turbines, each connected to a 10,000-kw generator. The general construction of the system is that typical of the development of high heads, except that advantage was taken of the topographical conditions to build a 110-ft. dam above the natural falls of the stream. Below the dam is a tunnel cut-off nearly a mile and a quarter long, terminating in an artificial forebay of concrete and steel, from which drop five 60-in. penstocks, a little over 1000 ft. long, to the wheels below. The hydraulic conditions therefore are quite unusual, owing to the desirability of adding to the head by an exceptionally high dam, and to the contour which brought about the tunnel construction and the artificial forebay. At the power house, too, are to be found some unusual features. The use of Francis type turbines for this head is rather exceptional, but it is advantageous on account of the great size of the units and the gain possible by giving them exceptionally high rotative speed. Probably impulse wheels would not have proved so suitable on a 10,000-kw scale. Another interesting feature of the plant is the storage pond and its appurtenances. The location where the reservoir could be most conveniently formed was about 6 miles above the head-works, where a 90-ft. dam was thrown across the stream capable of impounding more than 1,000,000,000 cu. ft. of water. This pond renders available, when it is drawn upon, a considerable power, and the plans include an auxiliary plant at this point containing two 3000-kw units to utilize the water drawn from storage and transmit the energy to the main line below. At the main dam provision has been made for keeping the head constant during floods by the installation of ingenious automatic swinging flashboards controlled by counterweights so as to hold the elevation of the pond back of the dam practically constant. During the period of construction

a temporary hydraulic plant with a 40-ft. head constructed below the site of the main dam was utilized for working the air compressors. Taken altogether, the hydraulic arrangements of the plant are of exceptional interest and the electric system will make an addition to the list of really high-voltage plants, since the transformers are designed to deliver energy to the line at 110,000 volts. The generators are on vertical shafts with the weight carried in suspension from oil pressure bearings at the upper end of the shaft, an arrangement which is particularly good from the standpoint of easy inspection of the bearings.

## Regulation by Counter-Emf Cells

A brief article in our columns this week describes a very interesting application of counter-emf cells on a large scale for storage-battery regulation. Ordinarily central-station storage batteries are regulated by the use of end cells in such number as may be necessary. This method is altogether effective, but it is open to some practical objections chiefly by reason of the considerable complication in the switching apparatus and the extra care needed on account of the fact that the end cells are ordinarily at different stages of charge from the main battery, and hence may require special attention. The present arrangement works on the principle of holding the electromotive force steady at any necessary point below its maximum value by inserting the requisite number of counter-emf cells. These are built up out of unformed lead plates in the usual battery tanks with the ordinary electrolyte. When such a cell is put in circuit with the main battery it begins to form, thereby setting up a counter-emf which lowers the battery terminal voltage by the amount of its charging voltage.

In the installation described twenty-four counter-emf cells furnish the necessary amount of regulation for a 150-cell battery of large storage capacity. Regulation is secured by short-circuiting the necessary number of these cells, the result being a momentary heavy rush of discharging current in the local circuit which dies away almost instantly from lack of energy storage behind it. It is found in practice that the counter-cells never form fully enough to discharge an embarrassingly large amount of energy. Most of the energy lost seems to be spent on the electrolyte, and its total amount is small since the battery is used only for relief in emergencies and the counter-cells are out of circuit both when the battery is charging and when the heaviest demands fall upon it. The main battery is thrown upon the system automatically when the voltage falls too low, and the counter-cells at this time form a useful cushion to prevent too sudden a rush of current if the voltages of the system and the battery are undesirably far apart. For this particular sort of use the counter-emf cells seem excellently adapted, and the simplification of the switching arrangements over those necessary when end cells are employed in the ordinary way is very noticeable. Not the least of the advantages of the scheme is that every cell of the working battery is kept at the same stage of charge, since the whole battery charges and discharges together. The counter-emf cells, too, are practically fool-proof and almost indestructible.

## Appliances as a Source of Revenue

We have published from time to time reports of the progress which has been made in the exploitation of heating and cooking apparatus and the like, and scarcely an issue passes in which some new application of electricity to the service of the average man, or some new device for accomplishing a useful end, is not described. In spite of all such evidence of activity, the fact remains that these miscellaneous uses of electricity, really of direct importance to the householder as well as to the central station, have not advanced with the rapidity which might reasonably be expected. Just what the obstacles are is not altogether easy to ascertain, but in looking over the field it seems most probable that the main trouble is lack of realization on the part of the central station that a great field for the sale of energy is ready to be opened. Appliances by many makers are available. Most of them are good and some of them are both cheap and good. Campaigns of education have been liberally carried on, frequently with somewhat disappointing results, occasionally with fair returns.

Some light may be thrown on the situation here by turning a little attention to the work recently done in and about London, of which many reports have been published in the English papers within the last year. Many thousand kilowatts in appliances have been placed in service within that time, and some definite information is accumulating as to the nature of the load and the possible revenue. Experience seems to have shown that once a customer uses such appliances the income received from him for such work, even at British prices, rises to a considerable fraction of that of the lighting revenue from the same customer, and it has been found that the only added expenditure in most cases is a possible increase in the size of meter. Now and then, of course, when an exceptionally large number of appliances must be installed the service equipment must be increased, although the British experience, like most of that here, indicates that appliance load is mostly, sometimes entirely, off the peak. The exact distribution of such load varies with the character of the community served, but there seems to be a tendency toward a large improvement in the diversity factor, so far as the evening load is concerned, so that while appliances may and do produce a very noticeable effect at certain times of the day, there is very little tendency to raise the main afternoon peak. The British experimenters openly say that there is a first-class lucrative field in appliance work even at very low prices, owing to the fact that it thus utilizes the whole generating and distributing system more efficiently.

The main feature of the British campaign for business has been the establishment of a very low secondary rate for appliance load, a rate varying in different stations from 4 cents down to as low as 1 cent per kw-hr., generally being from 2 cents to 3 cents. The primary charge is a demand charge of one sort or another, generally estimated with a somewhat liberal concession to the consumer, although in many cases nominally rather high. The chief point is that the secondary rate is so adjusted that the small consumer gets the benefit of it for this particular kind of load. Many of the secondary rates charged in America are nominally low enough to encourage electrical heating

and cooking, but with rare exceptions they are so adjusted that only the very large consumer gets the slightest benefit from them. The theory upon which the British manager keeps down his secondary rate is substantially that the business is profitable even at this low rate by reason of the nature of the load on the generating and distributing system. In more than one of the stations about London gas ranges and gas heaters have been driven out in considerable numbers and the appliance load as a revenue winner is firmly established. With proper cultivation of the field equally good results should follow here, because, while the small area of distribution covered by most of the British plants and the advantages of cheap coal and labor tend to keep rates down as compared with those current here, yet, on the other hand, the British price for gas is generally astonishingly low compared with the price charged in this country, so that the chance for competition here is at least equally good and probably better.

## Wanted: Legislation to Promote Business

The Secretary of Commerce has added his recommendations to the already large mass of suggestions for legislation on business. The Attorney-General complains that violations of the anti-trust law are being reported constantly. The Postmaster-General announces that he and President Wilson have discussed with open minds the question of ultimate federal control of telegraph and telephone lines. A few days later his annual report urges it. A member of the Interstate Commerce Commission expresses his opinion to the effect that if increases in railroad rates are allowed there ought to be concurrent legislation giving the commission control over security issues in order to insure proper financing. Where will these proposals lead? Consider what a few of them mean. Take only one or two of the points advanced by the Secretary of Commerce. He would have a law providing that there shall be a presumption that all restraints of trade are unreasonable and that the reasonableness of a restraint must be established by the party exercising it. That is to say, every restraint would have to be justified. This raises the question of what would constitute a restraint under such a law. Suppose a manufacturer finds that there is serious overproduction in his industry. Temporarily production has passed far beyond consumption. He either reduces the output of his factory or closes down entirely until the consuming demand again justifies greater production.

Would the Secretary classify reduction in production as restraint of trade? To what expense would his law automatically put the manufacturer who wanted to obey it? Necessarily the government would be required to provide an agency before which the plea of the manufacturer would be made. Thousands of cases would clog the machinery of this agency, whether it was a court, a commission or a member of the President's Cabinet. Instead of the expedition that ought to promote trade there would be delay to hinder it. This is a very cumbersome method and unreasonably restrictive. Instead of the presumption that all acts of a restrictive nature are unreasonable there should be a sharp definition of many acts that are not unreasonable and that any fair-minded governmental agency would so hold. This would be consistent with the desire expressed by President Wilson to "reduce the area of debatable ground" created by the Sherman law. Since the suggestion of the Secretary of Commerce would fail to clarify the outlook and appears to be inconsistent with the wish of the President to "relieve business of uncertainties" and provide "a clear path" which business men "can travel without anxiety," we are led to the conclusion that the real ideas of the administration are not yet ready for announcement.

Another suggestion of the Secretary of Commerce is that $431,000 be appropriated for an investigation to determine whether or not large combinations make for efficiency; in other words, whether many small units render better service than a few large units. The humiliating experiences of the government in undoing some large industrial combinations ought to prove that uneconomic steps are either futile or dangerous. There are weak and inefficient forms of large business as well as of small business. Size alone is not the test. If this large appropriation could be granted and then used to promote business instead of to investigate it, the results would be practically useful instead of academically or doubtfully useful. The outspoken views of the Postmaster-General in regard to government ownership of telegraph and telephone lines are met by a calm expression of confidence by Mr. Vail. The unfortunate feature about the matter is that stockholders cannot feel happy over declines in securities. They become frightened and sacrifice securities on a declining market.

Consideration for unfortunate stockholders ought not to be outside of the fair duty of government officials. But with them free speech is free speech on matters vitally affecting others. The cost is nothing to them, it is the concern of others. The utterances of both the Postmaster-General and a member of the Interstate Commerce Commission have accentuated the present distressed investment situation in New England. Investors there have been hard hit. This is not the time for government officials to wave their personal flags. It is the time for them to labor for confidence. The mistakes that were made in New Haven policies have imposed heavy penalties upon those who were least able to bear them. The time is here now for healing, corrective steps. What we need most is legislation to promote business. What we do not need is legislation to hamper honest industry in its aim of production at a fair profit. Every act that hinders business is a double handicap in these times. Every act that promotes business has a contagious influence on the hopes of others. It would be a wholesome relief to read more in governmental bureau reports and utterances about ways to develop business and less about ways to prevent business. Instead of tearing down what it does not like, let the government say what it does like and alert and enterprising men will seize the chance to build up from that. We do not want hampering legislation and policies that close the door to development and stifle industry. We do want constructive legislation and policies that open the door to progress and prosperity.

# The News of the Week

**Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.**

## Interlocking Directorates Not Illegal

Judge Windes, of the Circuit Court of Cook County, Ill., refused Tuesday to grant a temporary injunction sought to restrain the so-called interlocking of directors in the Commonwealth Edison Company and the People's Gas Light & Coke Company, of Chicago. The petitioner, Mr. James J. McCarthy, president of the Chicago & Cleveland Car-Roofing Company, and comparatively a small stockholder in the gas company, complained of interlocking as shown by the service on the gas board of Messrs. Samuel Insull, James A. Patten and John J. Mitchell, directors of the Commonwealth company. Judge Windes found that there was no allegation that showed fraud or injury to the complainant. The judge said that it is certainly the duty of the directors to do what is best for all the stockholders of a corporation, but if there is absence of fraud and the directors are doing what they think is best for the majority of stockholders, the mere fact that one small stockholder may be injured does not justify the court in restraining the directors as asked by the petitioner.

## Problems in Electrolytic Deposition

The regular monthly New York meeting of the American Institute of Electrical Engineers for Jan. 9 will take the form of a joint session with the American Society of Mechanical Engineers and the American Electrochemical Society, at which the topic of discussion will be "The Power Problem in the Electrolytic Deposition of Metals." President C. O. Mailloux of the Institute will preside, and the following papers will be presented: "Limitations of the Problem of Electrolytic Deposition," by Mr. Lawrence Addicks, superintendent United States Metals Refining Company, presenting a brief statement of the conditions imposed by practice in the electrolytic refining of copper as a typical process; "The Mechanical Side of the Problem," by Mr. H. E. Longwell, mechanical engineer Westinghouse Machine Company, dealing with the application of gas and steam prime movers for driving generators of the type required, and "Sources of Direct Current for Electrochemical Processes," by Mr. F. D. Newbury, Westinghouse Electric & Manufacturing Company, covering the design of electrical machinery for high-speed generation of the large currents required in electrochemical work. The papers will be illustrated. Following the joint session those in attendance will be the guests of the Institute at a smoker to be held in its rooms on the eleventh floor of the Engineering Societies Building.

## Large Connecticut River Development Foreshadowed

The Northern Connecticut Securities Company, controlling electric-lighting properties in Windham and Tolland Counties and the United Light & Water Company, of Waterbury, New Britain, Greenwich, Norwalk and vicinity, has purchased the water rights of the Connecticut River Company at Windsor Locks, Conn., and plans to develop 30,000 hp if the approval of the federal government can be obtained. A large dam is to be built across the river with a lock installation which will permit navigation of the stream to Springfield and possibly Holyoke. The Connecticut River Company, organized in 1828, has developed 3500 hp at Windsor Locks. The estimated cost of the proposed hydroelectric development is about $5,000,000. A bill has been introduced into Congress by Representative Gillett authorizing the building of the dam. About twenty similar bills are awaiting attention at Washington, the Connecticut River measure being first on the list. The policy of the government in relation to the Windsor Locks development will in large degree forecast the future of hydroelectric undertakings on navigable streams of interstate character.

## Salaries for Ontario Hydro-Electric Power Commissioners

At the annual general meeting of the Ontario Municipal Electric Association, held in Toronto Dec. 9, a resolution to the effect that the Hydro-Electric Power Commission be authorized to set aside from the funds of the municipalities a sum not exceeding $25,000, to be paid for management and operating expenses, was passed. The matter has been laid before the Premier, the suggestion being that, in addition to the amount paid from public moneys to the chairman of the commission as an honorarium, a sum not exceeding $25,000 be authorized by the municipalities to be paid from the funds of the undertaking to remunerate members of the commission. It was stated that the enterprise, having passed the organization and construction stages and being now established as an operating and going concern cannot expect to get the particular and skilled attention and management to which it is entitled without paying for it something approaching the salaries which are offered by the large private corporations.

## New York Safety Exposition

The first International Safety and Sanitation Exposition was held from Dec. 11 to Dec. 20 at the Grand Central Palace, New York, under the auspices of the American Museum of Safety. A number of the exhibits were of electrical interest, and all of them showed how some employers are continually devising means for safeguarding their employees. Notable among the displays was that of the Pennsylvania Railroad. Numerous small and simple devices, such as wooden pliers for pulling fuses, hangers for lamps, safety locks for automatic elevators, etc., that have proved their value in preventing accidents were shown. A section of single track with third-rail and overhead signal bridge was also exhibited. Models of a prostrate man and an attendant, showing how a pulmotor is operated, were a feature of the New York Edison Company's safety exhibit. The Westinghouse Electric & Manufacturing Company, the General Electric Company and the Benjamin Electric Manufacturing Company had machines fitted with safety devices operated intermittently during the display. The exhibit of the Illuminating Engineering Society attracted much attention. It consisted of a number of miniature rooms and lighting installations, showing correct and incorrect methods of illumination. The New York Telephone Company's exhibit was made up of several switchboards and a model

of New York City and vicinity. The object of the display was to show how a message would be sent from Arlington, N. J., to the Schuyler exchange in New York.

## To Prevent Conflicts in Dates of Societies' Meetings

The secretaries of seventeen American engineering organizations held a meeting in the Engineering Societies Building, New York, on Saturday, Dec. 13, to discuss plans for the prevention, so far as possible, of the setting of the same dates for important meetings of different associations. Engineers do not need to be reminded of the necessity for some good get-together work along this line. Some overlapping is unavoidable, but in the future a concerted effort will be made to avoid simultaneous sessions wherever possible, and it is certain that the engineering body generally will be keenly appreciative of whatever measure of success is achieved. The seventeen executives at Saturday's meeting represented a collective national membership of more than 100,000 engineers, engaged in various branches of the engineering profession, all more or less correlated—gas, electric, mechanical, civil, illuminating, mining, marine, etc. Preliminary measures were discussed, and it is probable that by an early date the scheme will take more definite shape in the formation of a society of the executive secretaries of the national engineering associations.

## Mr. Tripp on Business Conditions

A statement on business conditions written by Mr. Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, was published in the New York *Sun* on Dec. 15. Mr. Tripp said:

"The operations of the tariff for the last two months do not indicate that any serious inroad upon profits is to be expected to result directly from the reduced duties. The product of our company is generally of a highly specialized character and particularly adapted to the demands of the service in this country, with which we are far more familiar than German and other foreign competitors. Further, we are on this side constantly expending a great amount of money in developing improved and more efficient types of apparatus, and in general it is safe to say that the United States leads the world in the electrical manufacturing industry. I doubt, therefore, if foreign competition will be able and can afford to keep pace with our development work.

"While in my opinion the electrical manufacturing business will not be adversely affected directly to any serious extent by the reductions in the protective tariff on articles of its manufacture, it should be borne in mind that other lines of business may be seriously affected thereby, and that a diminution of business in any substantial industry will of necessity react on all other enterprises.".

## 1914 Meetings, Pittsburgh Section, I. E. S.

The advance program prepared by the Pittsburgh Section of the Illuminating Engineering Society for its 1914 meetings includes the following:

On Jan. 16 Messrs. E. B. Rowe and H. H. Magdsick, of Cleveland, Ohio, will present a paper entitled "A Photometric Analysis of Diffusing Units with Varying Indirect Components," and Messrs. A. B. Wilson and F. J. Blaschke, of Cleveland, Ohio, will discuss "The Relation of the Engineer to the Problem of Fixture Designs."

On Feb. 13 Messrs. A. C. Cotton and Harold Kirschberg will present a paper on "Railroad Yard Illumination, Including Truck Scale and Classification Yard Lighting."

On March 13 Mr. S. B. Stewart will speak on "Modern Gas Lighting."

On April 17 the subject to be presented by Mr. C. E. Stephens, Pittsburgh, Pa., will be "The Development of Flame-Type Carbon Arc Lamps."

On May 15, the last meeting of the season, Mr. Ward Harrison will discuss "The Illumination of Building Exteriors."

## Oldfield Patent Infringement Bill

Mr. William A. Oldfield has introduced in the House of Representatives a bill relating to patents, with special reference to infringement procedure. According to the bill, which has been ordered printed, the plaintiff charging infringement shall make a prima facie statement showing title and infringement, whereupon the court shall enter an interlocutory order directing that the defendant shall (a) file with the plaintiff each month a statement of the number and selling price of the devices made, sold or used by the defendant until the final decree in the suit, and (b) shall at the same time pay to the plaintiff a royalty of 5 per cent of the total selling price so reported. If the selling price be not established, or at its own discretion, the court may fix an arbitrary price as a reasonable selling price.

When such application has been made by the plaintiff and the statements are filed and royalty paid by the defendant, the defendant shall not thereafter be required to account for or pay any other profits or damages for any infringement so reported and paid for, nor shall any injunction be issued against the continued use of the specific infringement so reported and paid for. No defendant shall be required to pay more than 5 per cent royalty on any device under one or more patents controlled by the same interest at any time subsequent to the commencement of the infringement complained of.

## Quarterly Rejuvenation in Chicago

The quarterly rejuvenation of the Jovian Order in Chicago, held at the Hotel Sherman on the evening of Dec. 15, was a dignified and impressive affair. Those in attendance comprised ninety-one Jovians and thirty-seven candidates. Thirteen applicants for membership were unable to attend. The class of neophytes included many men of considerable prominence in the electrical and allied industries in Chicago. Before the initiation there was a dinner at which Mr. H. E. Niesz, statesman for Chicago, presided. Speeches were made by Messrs. E. H. Waddington, alternate statesman for Illinois; Perry R. Boole, Stentor; Sam A. Hobson, past-Jupiter and great chief Stentor; F. W. Harvey, Jr., chairman of the membership committee in Chicago, and W. N. Matthews, of St. Louis, reigning Jupiter.

Mr. Matthews outlined the objects of Jovianism and gave a brief review of the history of the organization, speaking of Mr. Sam A. Hobson as the most enthusiastic Jovian in the order. The order has nearly 13,000 members, 750 of whom are in St. Louis and about 700 in Chicago. Mr. Matthews explained how the work of the new commercial division might be expected to give exercise to the dormant possibilities of the "sleeping giant"—the Jovian Order. In a number of ways the new commercial division can make itself useful. One is the possible establishment of co-operative display rooms by electrical industries, and Mr. Matthews cited the example of Columbus, Ohio, where this has been done. The initiation, which was carried out in a careful and impressive manner, with elaborate accessories, was followed by a vaudeville entertainment. The well-trained degree team was made up as follows: Jupiter, Mr. George C. Richards; Neptune, Mr. W. E. Finley; Pluto, Mr. L. M.

Willey; Vulcan, Mr. T. C. Hawkins; Hercules, Mr. O. L. Johnson; Mars, Mr. J. W. Foster; Apollo, Mr. A. E. Lubeck; Avrenim, Mr. Charles Dubsky; Mercury, Mr. W. E. Bischoff; imps, Messrs. F. L. Lewis, captain; Robert Hayes, A. R. Johnson and J. Donohue. Mr. Morgan P. Ellis was stage director.

## Electrical Illumination at Springfield (Mass.) Dedication

At the dedication last week of the new group of municipal buildings at Springfield, Mass., a brilliant display of outline lighting was a prominent feature. Over 1400 25-watt lamps were installed temporarily on the tower and adjacent buildings of the group. On the tower twenty 500-watt lamps were also used to mark the corners and top of the Campanile. The work was handled by the M. W. Foster Electric Company, of Boston, Mass., energy being supplied for the display by the United Electric Light Company of Springfield.

## Tendencies of Commission Regulation

In an address before the Los Angeles City Club in which he discussed the subject of regulation Dr. George L. Hoxie, New York, said in part:

"The commissions were organized in response to a demand that abuses be corrected. The abuses were intolerable, and they have been corrected to a very large degree. The work of the commissions has always been to render justice only in one direction—that is, in the direction of issuing orders to the corporations which they did not particularly welcome—reducing the rates, orders for operations and so forth, all in the direction of improving the service to the public and decreasing its cost.

"It may be readily seen that every such order issued brings us nearer to the time when to go further in that direction, instead of relieving the public justly, will put a burden on the corporation unjustly. Whether that time has been reached or not, necessarily it will be reached eventually. Then the question is, will public opinion stand back of the commissions in such a way that it will permit them to hold the scales of justice evenly between corporations and the public?"

In a letter issued by E. W. Clark & Company, of Philadelphia, it is said that state commissions are usually fair and reasonable and do not impose unnecessary hardships on the companies. It calls attention, however, to the fact that very few of the commissioners have any knowledge of the operation and management of public utilities at the time of their appointment. The letter adds:

"This, however, is a situation with which the utilities corporation must cope until such time as there shall come to the commissioners, through long service, knowledge of the business in which they are engaged. And during the 'period of learning' the training the commissioners will be getting must be, in a large measure, at the expense of the utilities. The majority of commissioners so far appointed have represented the highest type of citizenship in their respective states. These commissioners are well paid, as far as salaries are concerned, and for this reason there have been drafted into the service men who are of high personal qualifications. No local prejudices are permitted to interfere with the decisions of such men, and there is very little possibility of such tactics as are sometimes employed by councilmen and other city officials in 'holding up' corporations for graft for the 'killing' of obnoxious legislation.

"While the commissions have been in operation for only a few years, enough has been gleaned from their decisions to warrant the assertion that they will eventually work out to the benefit of both the corporations and the public. True, there have been some radical decisions which have not met favor with the companies affected, but there have also been others which have shown a tendency on the part of the commissioners to deal fairly with the corporations and to consider their interests in just as important a light as they do the welfare of the general public.

"It is to the interest of the utility corporations and the public that most of the commissions have supervision over the issuance of new securities. To the scrupulous operator this provision is not restrictive. Securities having the indorsement of a state commission are naturally much easier to sell and they represent an added protection to the investor."

## Report of Secretary of Commerce

Secretary of Commerce Redfield in his annual report, made public on Dec. 15, outlines his ideas in regard to trust legislation. He says in part:

"That there are immediate and well-known conditions that should and can be remedied by law is apparent. Some of these remedies are, for instance, a law providing that there shall be a presumption that all restraints of trade are unreasonable and placing the burden of establishing the reasonableness of such restraint upon the party alleging it; legislation looking to fundamental charter provisions for every corporation doing interstate business; that stocks and bonds shall not be issued except for money or property at its true money value, preventing the watering of stocks; that corporations shall not hold stock in other competing companies, and that neither a person nor a corporation shall at the same time own a controlling interest in two or more competing corporations, and that the officers of corporations shall not be affiliated directly or indirectly by holding office in other corporations.

"Regardless of such legislation, however, there still remains a fundamental economic fact to be determined, to wit, whether the trust or monopolistic form is socially and economically efficient in production, as is alleged, and upon the solution of this problem must depend the ultimate attitude of the government toward combinations and consolidations in business.

"It is contended by some that with the increase in the size of industrial enterprises there goes a reduction in the cost of extraction, manufacture and distribution, and that such reduction in cost is accompanied by lower prices to the consumer and does not involve a reduction in wages or an impairment of the conditions of labor.

"According to this view there is a point beyond which increase in size does not result in increase in efficiency, but rather in loss and waste, so that the maximum efficiency is not attained by large combinations but by concerns of moderate size.

"It is important that we should know the truth about the fixing of retail prices and as to whether giving the privilege of so fixing the prices to a manufacturer tends toward monopoly or does not so tend. Nations abroad are said to favor by law that which we forbid. The law with us is for the time established by the decision of the Supreme Court that the fixing of retail prices on the part of manufacturers is unlawful. If, however, new legislation should in the future be required, it is important that the truth be known lest injustice be done not so much to the manufacturer as to the consumer.

"Some men, well informed, argue that the fixing of retail prices under conditions where competition in manufacture exists tends to promote competition. Others say that the refusal to permit the fixing of retail prices tends to monopoly because, in the cut-throat competition certain to follow, obviously the stronger competitor will survive and may

eventually have the business in his own hands, for the law forbids the making of agreements to maintain prices, and under these circumstances the weakest must go to the wall.

"An investigation of trade agreements is also in progress, with a view to establishing some facts as to what agreements, if any, apparently in restraint of trade are really in aid of competition and should be exempted from the operation of the Sherman act. There is also an investigation pending with reference to the merits and demerits of a condition which prohibits a uniform price from being fixed by manufacturers and jobbers, binding upon retailers as to articles of their manufacture."

The Secretary asks for an appropriation of $431,700 for an inquiry into the efficiency of large corporations.

## Street-Lighting Tables for 1914

To insure the greatest possible accuracy, the *Electrical World's* street-lighting tables for 1914 have been prepared as three separate schedules correct respectively for the northern, middle and southern sections of the United States. This year (the twenty-fifth that these street-lighting schedules have been issued) an appropriate set of the tables will be distributed gratis to every central station and lighting plant in this country and Canada. On request the schedules will also be sent gratis to any subscriber desiring a copy.

The departure in issuing the tables for 1914 as three different schedules based on geographical latitude was adopted to attain greater accuracy than was hitherto possible with a single set of tables. As a result the figures now cover the entire area of the United States and southern Canada with a maximum error of less than ten minutes.

The northern tables are correct within five minutes for the States of Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, Michigan, Wisconsin, Minnesota, the Dakotas, Montana, Wyoming, Idaho, Oregon and Washington, and for southern Canada.

The middle schedules (which are virtually a continuation of the tables of former years based on the latitude of Philadelphia) apply with an error of less than ten minutes to all the North and Middle United States lying north of the southern boundaries of Virginia, Kentucky, Missouri, Kansas, Colorado, Utah and Nevada, including the entire area of the States mentioned as well as all of California north of Monterey. The southern schedules apply to the States of North Carolina, South Carolina, Georgia, Florida, Alabama, Tennessee, Mississippi, Louisiana, Arkansas, Oklahoma, Texas, New Mexico, Arizona and that section of California south of Monterey.

As in previous years, the schedules give the times for lighting and extinguishing lamps on the "all-night system," the "Philadelphia moonlight system" and the "Frund system."

The data in Table No. 1 have been compiled in such a manner that by following this schedule the lamps are lighted one-half hour after sunset and are extinguished one hour before sunrise, giving a yearly operation of about 3830 hours. An "all-night" lighting schedule, giving a yearly total of about 4000 hours, could be obtained by lighting fifteen minutes earlier and extinguishing fifteen minutes later than shown in this table.

In the so-called "Philadelphia moonlight schedule" (Table No. 2), beginning the fourth night after new moon, advantage is taken of the moonlight, and on nights when the moon is full or nearly so the lamps are not lighted. On other moonlight nights the lamps are extinguished one hour after moonrise and lighted one hour before moonset. With this schedule the lamps are in operation about 2000 hours per year.

Table 3 is calculated according to the system of Mr. Frund and ignores the moon until after midnight throughout the year. The lighting hours after midnight are the same as those in Table No. 2. This schedule entails the use of lamps for about 3000 hours per year.

All of the tables are based on mean local time. Where standard time is used and it varies considerably from local sun time the proper deduction or addition must be made. For the convenience of users, hours after midnight are set down in the tables as being a continuation of the night of the date indicated.

As above noted, a copy of these street-lighting tables may be obtained gratis by addressing the *Electrical World*, 239 West Thirty-ninth Street, New York City, and specifying the set of schedules desired.

## Consolidation of Doherty Holding Companies

Plans have been perfected whereby three of the Henry L. Doherty & Company holding companies will be consolidated. The Cities Service Company will acquire the properties and assets of the Utilities Improvement Company and the Consolidated Cities Light, Power & Traction Company. The transaction will be carried out through an exchange of stock. Utilities Improvement Company preferred stock will be exchanged share for share for Cities Service Company preferred stock. For each two shares of Utilities Improvement Company common stock one share of Cities Service Company common will be given. For each two shares of Consolidated Cities company common stock one share of Cities Service Company common will be given. The 5 per cent bonds of the Consolidated Cities company will remain outstanding. With these changes the Cities Service Company will have outstanding $27,368,426 preferred stock and $15,718,380 common. It will have about seventy operating companies serving a total population of about 2,000,000 and with gross revenues of over $17,000,000.

In his letter to stockholders of the companies Mr. Henry L. Doherty, the president, says in part:

"This decision was reached after careful study and much discussion, especially with our English associates, and it is the judgment of your directors that the consummation of this arrangement, whereby the assets of the three companies are combined in one organization, will advance the interests of all stockholders of the three companies.

"The above action has put the Cities Service Company in a position to provide for the future requirements of its financing on a broad and sound basis. Arrangements to this end have been made with European bankers. A London office will be opened and several London directors will be admitted to the board.

"The Cities Service Company thus becomes one of the largest American public utility holding companies. The net earnings from operation of its subsidiary properties for the past year were more than two and five-eighths times the total interest charges on underlying bonds and other indebtedness.

"The larger volume of its assets will give it a stronger recognition than it has heretofore had. Its factor of safety, because of the diversified location of its properties in widely separated localities throughout the United States and Canada, the broader market for its securities because of the very much larger number of stockholders and consequent wider distribution of its securities, the greatly enlarged equity and earning power behind its fixed obligations—all of these tend to establish for the company an improved financial position.

"Beginning from Oct. 1, 1910, dividends of the Cities Service Company have been continuous, the first being a quarterly dividend paid Jan. 1, 1911, 1½ per cent on the preferred stock and three-quarters of 1 per cent on the

common stock. Since Jan. 1, 1911, its dividends have been paid monthly, on the first of each month, one-half of 1 per cent monthly on the preferred stock, and on the common stock in 1911 at the rate of 3 per cent per annum, in 1912 at the rate of 4 per cent per annum, and in 1913 at the rate of 5 per cent per annum. Beginning with the January dividend of 1914 (payable Feb. 1), the dividend rate on the common stock will be 6 per cent per annum.

"The properties which the Cities Service Company will now control and operate are in prime operating condition, large amounts having been expended on them this year for extensions, improvements and betterments, in addition to all other necessary expenditures for maintenance or upkeep, thereby providing for the increasing demand for service in the communities supplied. This consolidation will enable the company to effect many important economies in operation and is made on such a basis that there will not be a reduction from the present rate of earnings on the preferred and common stocks of the Cities Service Company. These earnings for the year ended Oct. 31, 1913, were more than twice the preferred dividend requirements, and were sufficient, after paying 6 per cent preferred dividends, to show more than 10 per cent earned on the average amount of common stock outstanding for the year.

"It is estimated that net earnings for 1914 will, after payment of interest on the company's 7 per cent notes and dividends on its preferred stock, be equivalent to fully 14 per cent on the total amount of common stock now to become outstanding. Your officers are enabled to make this prediction because of their confidence that the reports and estimates furnished by the various operating managers and engineers and tabulated and verified by our auditors are conservative and reasonable."

## National Civic Federation Utility Bill

The public utility commission bill, drafted by the department on regulation of interstate and municipal utilities of the National Civic Federation and submitted at the annual meeting in New York on Dec. 11, was not adopted. The thanks of the federation were given to the department which considered the matter and the bill was then referred to the executive council with power to act.

At the session on Dec. 12 Mr. John Hays Hammond made an address on the Sherman law. He favors maintaining the basic principle of the Sherman law—at least until a new, substantive law shall be enacted to protect the interests of the public against possible aggression on the part of trusts. He does not believe there is any need of a new law to supersede the Sherman act, but, while this act may be regarded as the keystone of the law governing modern industrial development, it does need further definition and amplification by supplemental legislation. Further definition is required because of existing uncertainty as to the legality of corporate procedure; amplification is necessary to prevent objectionable practices which may not be inhibited by the present law—but more particularly for the purpose of increasing the elasticity of the law to permit corporate practices when of undoubted value to industry and yet not detrimental to the general public.

Mr. Hammond also favors a federal incorporation act. The regulation of corporations involves problems so comprehensive and complicated that he believes the administration of the laws governing their conduct should be left to an interstate industrial commission. This commission should consist chiefly of business men, with whom should be associated experts on economic subjects and lawyers who have had extensive corporation practice. The dignity of this commission should be on a parity with that of the Supreme Court of the United States—in which case it would appeal to the ambition of men of the highest ability who have the requisite qualifications.

With the Sherman law amended and yet left flexible enough to admit of the application of the light of reason in decisions of the commission, Mr. Hammond believes there would be an instrument which would meet all the requirements of the present industrial development.

## Milwaukee Merchants' Co-operative Christmas Festoons

Wide-awake and enterprising merchants in the outlying districts of Milwaukee do not intend to sit idly by and allow all of the profitable Christmas trade to be drawn to the brighter down-town districts. To make their own streets attractive they have gone in together, each contributing as his means will permit, and have suspended incandescent-lamp festoons on the trolley span wires of the Milwaukee Electric Railway & Light Company. Energy for the lamps is taken from the direct-current feeders on the poles.

The construction has been made as inexpensive as possible. By clamping an iron upright to the top of the poles,



FESTOON OF INCANDESCENT LAMPS ON STREET IN MILWAUKEE

an iron wire, about No. 9 in size, is supported well above the trolley wires. The lamps, wired in multiple series, are strung along this support and curve downward at the ends near the poles to form an arch. In the Third Street district arches are placed across the street at each pair of trolley poles.

## Effect of Utah Power & Light Decision

The decision of the United States Circuit Court of Appeals in the Utah Power & Light Company case was mentioned in a previous issue of the *Electrical World*.

The decision holds that the act of May 14, 1896, empowering the Secretary of the Interior to permit, under general regulations to be fixed by him, the use of, or rights-of-way upon, the public lands and national forest reservations for the purpose of generating, manufacturing and distributing electric energy, repeals the act of July 26, 1866, in so far as it related to the subject of generating and distributing electric power and that the company must acquire its rights-of-way in accordance with the provisions of the later act.

The court denies the company's contention that it was protected in its tenure because that tenure was authorized by the laws of the State of Utah, exercising sovereign and exclusive jurisdiction with respect thereto. The court says:

"The proposition that absolute and perpetual rights in the public lands may be acquired for private gain by mere appropriation, without purchase or compensation, and in

the exercise of a state sovereignty which transcends the constitutional power of the Congress, is a somewhat startling one. The constitution of the United States provides that 'Congress shall have power to dispose of and make all needful rules and regulations respecting the territory or the property belonging to the United States.' This is the supreme law of the land and embodies an express grant of power to the national government."

The court holds further that in the express stipulation of the act enabling the people of Utah to form a constitution and state government they disclaimed all title to the unappropriated public lands within the boundaries of the State, and until the title to these lands has been disposed of by the United States it shall remain subject to the disposition of the federal government. This provision was later incorporated in the constitution of Utah, thereby becoming a part of the law of the State, and it secured to the United States full control of the public lands within the limits of the State. On this point the court says: "The exercise by Congress of a power which is granted in express terms must supersede all legislation over the same subject by the states."

The decision reverses the decree of the lower court and remands the case for further proceedings. The result of this would be the filing of an answer by the Utah Power & Light Company, the retrial of the case in the United States District Court and an appeal by the company through the United States Circuit Court of Appeals to the United States Supreme Court. However, a stipulation might be entered into for a hearing of the case on the present record in the United States Supreme Court. Just which course will be pursued has not yet been determined. It is, however, the intention of the company to have the case heard by the United States Supreme Court by one of these methods.

## Mr. Vail on Government Ownership

A decline in American Telephone & Telegraph Company stock, following the reports from Washington about government ownership of telegraph and telephone lines, led Mr. Theodore N. Vail, president of the company, to issue a statement in connection with the announcement of a declaration of the regular quarterly dividend of 2 per cent. Mr. Vail said on Dec. 16:

"If it were not for this feeling of uncertainty on the part of a number of our stockholders I should not be at all concerned over the discussion of the possibility of government ownership of telephone lines. If the government takes over the telephone property there will have to be an appraisement, and any appraisement that can be made which will be upheld by the courts will give our property a greater value than that at which we carry it on our books.

"I am no more afraid of government competition, obviously, than I am of government ownership."

Mr. Vail commented as follows on the plan suggested by Congressman Lewis for purchase of the telephone lines and their use for telegraph purposes: "If they are able to use the telephone wires to take care of the telegraph business, they will be able to do something that we have not been able to do."

The annual report of Postmaster-General Burleson, suggesting government ownership of telegraph and telephone lines, was submitted to Congress on Dec. 17. It said in part:

"A study of the constitutional purposes of the postal establishment leads to the conviction that the Post Office Department should have control over all means of communication of intelligence. The first telegraph line in this country was maintained and operated as a part of the postal service, and it is to be regretted that Congress saw fit to relinquish this facility to private enterprise. The monopolistic nature of the telegraph business makes it of vital importance to the people that it be conducted by unselfish interests, and this can be accomplished only through government ownership.

"Every argument in favor of the government ownership of telegraph lines may be advanced with equal logic and force in favor of the government ownership of telephone lines.

"Since June last the department has been conducting an investigation to determine the desirability and practicability of extending the government ownership and control of means of communication, with a view to the acquisition by the government of the telegraph and telephone facilities, to be operated as an adjunct to the postal service. The Postmaster-General is now engaged in reviewing the data collected, and later, if desired, will submit same to the appropriate committees of Congress for their consideration."

## New York Meeting of Electric Vehicle Association

At the meeting of the Electric Vehicle Association held in New York Dec. 16 abstracts were read of the papers delivered before the recent convention at Chicago. These papers were abstracted briefly in the Nov. 1 and Nov. 8 issues of the *Electrical World*.

The president's address was first reviewed by Mr. Harvey Robinson in the absence of its author, former President Arthur Williams. This was followed by an abstract of a paper entitled "Electrical Vehicle Salesmanship," by Messrs. George H. Kelly and E. J. Bartlett, which was read by Mr. William P. Kennedy. At its conclusion Chairman F. W. Smith remarked that the intention of the association is to follow out a number of the suggestions made therein, adding that a committee has been formed, with Mr. W. H. Blood, Jr., as chairman, to promote better co-operation between manufacturers and central stations.

Mr. H. F. Thompson called attention to a statement made in the paper on vehicle salesmanship that 1400 central stations had been solicited by the Baker Motor Vehicle Company for information regarding a plan of co-operation and that only twenty replies had been received. He declared this to indicate that the electrical industry as a whole is not interested in the electric vehicle. Mr. F. N. Carle suggested that an analysis be made of conditions in a number of cities in different sections of the country. In approaching a prospective user of electric vehicles care should be taken to give him statistics of a locality similar to his own.

Mr. D. F. Tobias, of the United Electric Light & Power Company, New York, recited how his company is endeavoring to co-operate with manufacturers and garage owners. At present, he stated, there is a lack of proper garage facilities in New York City, and he added that more vehicles could be sold if the garages were better fitted for electric-vehicle service. The electric company has opened part of its 147th Street garage to the public. New garages are being built and the company is exerting itself to the utmost to increase the accommodations throughout that part of the city in which it gives service. Mr. C. L. Littlefield, of the New York Edison Company, also told of the activity of his company in promoting co-operation.

Mr. Day Baker outlined briefly the reports of the local sections given at the Chicago convention. Mr. Bruce Ford commented on the paper entitled "Recent Developments in Lead Batteries" delivered by himself at the convention. Mr. F. N. Carle then read abstracts of his own paper, "The Merchant, the Central Station and the Electric Truck," and a paper by Mr. E. L. Callahan on "Co-operation of Manufacturers and Central Stations." Mr. E. W. Curtis followed with a few words on Dr. E. E. Pratt's address before the convention. Mr. D. F. Tobias closed with an abstract of a paper prepared jointly by himself and Mr. C. A. Duerr on "The Electric Vehicle in Department-Store Service."

## The Dielectric Strength of Thin Insulating Materials

At the 30th meeting of the American Institute of Electrical Engineers, held at New York, Dec. 12, Mr. F. M. Farmer, of the Electrical Testing Laboratories, New York City, presented a paper on "The Dielectric Strength of Thin Insulating Materials," reporting the results of tests made to determine the effect of electrode area on the apparent dielectric strengths shown by various insulations in the form of thin sheets.

Using two similar flat, circular electrodes ranging from 0.0156 in. to 6 in., 10 in. and 15 in. in diameter, placed directly opposite each other, tests were made (1) on insulating cloth and thin-sheet hard rubber in air; (2) on insulating cloth in air and in transformer oil; (3) on transformer oil with various spacings, and (4) on air with various spacings. These experiments showed conclusively that the apparent dielectric strength of insulating materials in the form of thin sheets is materially higher with small electrodes than with disks of large diameter. Although the amount of variation differs widely with different materials the general rule thus discovered is believed to apply to all dielectrics, whether gaseous, liquid or solid. Curves were presented showing the numerical data obtained for the conditions of the experiments. With ordinary sheet insulating materials such as paper and cloth, variations of 50 per cent were found between the values obtained using the 0.0156-in. electrodes and those 8 in. or 10 in. in diameter. With oil, under the same conditions, the variation was even 1000 per cent. While, in accordance with the general opinion, it is true that with very sharp needle points failure will occur at a relatively low voltage, the results of the tests show that if the size of the electrodes be increased to any appreciable area, the corresponding puncture value is much higher than with large electrodes.

In conclusion, Mr. Farmer recommended the formulation of standard specifications for testing insulating materials, especially when in the form of thin sheets.

*Discussion*

Among those called on by President C. O. Mailloux during the discussion were Messrs. F. W. Peek, Jr., Schenectady, N. Y.; C. E. Skinner, Pittsburgh, Pa.; H. W. Fisher, Pittsburgh, Pa.; M. E. Tressler, Pittsfield, Mass.; Dr. E. B. Rosa, Washington, D. C.; Clayton H. Sharp, New York; John B. Taylor, Schenectady, N. Y.; A. E. Kennelly, Boston, Mass.; D. B. Rushmore, Schenectady, N. Y.; H. M. Hobart, Schenectady, N. Y.; W. I. Middleton, Cambridge, Mass., and C. F. Scott, New Haven, Conn.

Mr. Peek said that with films of oil 0.001 in. thick it has been possible to obtain spacings at the rate of 1,000,000 volts per cm. While with air loss does not begin to take place until after break-down has occurred, losses in the case of solid insulation start as soon as the voltage is applied, heating and weakening the insulation and finally causing it to rupture. Mr. Peek recommended that a standard size and shape of electrode for testing be specified.

Mr. Skinner, before presenting his own discussion, read brief communications from Messrs. Phillips, Thomas and R. P. Jackson. Mr. Thomas pointed out the possibility of errors due to distortion caused by electrostatic capacity in the test equipment. As such distortion and regulation will differ for each area and thickness tested, misleading results are apt to be obtained unless these effects are eliminated. Mr. Jackson observed that thin air pockets between the electrodes and the insulating material might become sources of corona, causing heating, unless the insulating material and electrodes were perfect plane surfaces held in contact by sufficient pressure.

Mr. Skinner recounted some early experiences in insulation testing, emphasizing the increasing importance of the subject of insulation. He admitted that the instantaneous-test value may be of little use in design work.

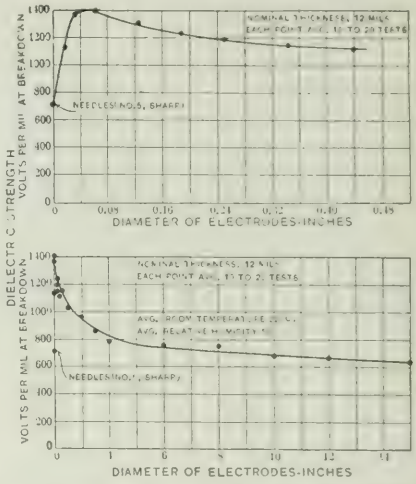
Mr. Fisher described an apparatus for testing varnished cloth. He also described the method of averaging the results of forty tests carried out in five groups.

Mr. Tressler confirmed Mr. Farmer's results in general, by experiments of his own, although he said he had not obtained such large variations in dielectric strength with electrodes of different diameters. Mr. Tressler recommended the use of one-hour tests where possible, the one-minute puncture voltage being used to indicate the starting voltage for the one-hour test. For solid insulations he recommended employing flat disk electrodes 19 cm in diameter, with square edges and insulated on the sides to prevent corona and arcing. For liquid insulations, he proposed using flat disk electrodes 25 mm in diameter.

Dr. Rosa commented on the effect of heating and the expenditure of energy losses in affecting the apparent dielectric strength of the insulating material.

Mr. Taylor recommended using direct-current for making voltage tests, in this manner eliminating the heating factor.

Dr. Kennelly said that the problem is often one of three dielectrics in series—the insulating material itself and the two thin strata of air held between the dielectric proper and the electrode plates. Tests using large electrode areas




EFFECT OF ELECTRODE AREA ON DIELECTRIC STRENGTH OF VARNISHED CAMBRIC WHEN TESTED IN AIR

will be expensive and tedious, and the speaker therefore recommended standardizing tests employing small electrodes and little samples.

Mr. Hobart commented on the need of establishing a relation between the aging of insulating material and the temperature to which it is subjected. With progress in electrical design, he said, it will be important to know how far builders may go with conservatism in the direction of higher temperature.

Mr. Middleton confirmed some of Mr. Farmer's results with figures obtained from his own earlier tests, and discussed the effect of corona in causing breakdown.

Mr. Scott spoke of the complexity of the phenomena often observed in insulating materials, emphasizing the need of correlating these data under general scientific laws. Insulation, he pointed out, still remains the single indefinite factor in the design and operation of electrical machinery, transmission lines and other electrical apparatus.

At the close of the discussion a smoker was held in the Institute rooms, where refreshments were served and social intercourse was enjoyed.

# Developing the Latent Electrical Market

**The co-operative movement and what it means to the manufacturer, central station, jobber and electrical contractor—Opinions of the leading men in the industry**

THE history of commercial development offers nothing comparable to the almost magical growth of the electrical industry. In ten years the cost of construction and equipment has leaped from $500,000,000 to about $2,000,000,000 and the output of electrical energy has increased tenfold. Financiers have estimated that in order to meet pressing demands the industry will require new capital at the rate of $400,000,000 a year for the next five years. What the output of electrical energy will be at the end of that time or what the diversity of its use will be no one can approximate.

In spite of this predicted marvelous growth, there is a well-grounded impression that out of the total number of buildings in the United States only a small percentage are wired for electricity. Thus the possibilities for new business are very great, and when intensive cultivation of existing services is taken into consideration the outlook is exceedingly bright. Certainly the bankers have implicit faith in the stability of electrical investments and in the great future of the electrical industry, otherwise the money which is poured into electrical enterprises by the hundred millions would be diverted to some other fields.

On the assumption that only a small fraction of the possible electrical business of the country has been obtained, and as a means for the correlation and acceleration of all forces now working for electrical progress, the Society for Electrical Development was organized. Its primary object is the expansion of the electrical business. The movement, while it is one of the most encouraging that have taken place in the electrical industry for some time, is by no means unique. An organization similar to the Society for Electrical Development has been in existence in Germany since 1911, and the movement has met with greater success there than was anticipated. The Electric Vehicle Association of America last year raised $42,000 for general advertising purposes and this year $34,000. A fund of $300,000 is being raised by the National Commercial Gas Association to be devoted to a widespread campaign of publicity in the United States and Canada. Approximately $150,000 has already been raised for that fund. Outside of the utility field, the Gum Lumber Manufacturers' Association plans to continue work which has been done for several years by a number of individual manufacturers to further the interest of the gum lumber trade. It expects to spend $45,000 a year, the greater part of which will be devoted to advertising. Numerous other co-operative movements are working throughout the country to enlighten the public on the merits and uses of certain products.

The minimum sum which the Society for Electrical Development has set out to obtain before commencing its work is $200,000, and of this approximately $170,000 has now been subscribed. While the membership is growing the subscriptions based on that membership are not increasing in the same ratio. The central-station industry particularly is not responding to the movement as liberally as was anticipated, otherwise the society would now be in full swing. By concentrated work on that branch of the industry the society hopes to complete the necessary fund shortly. What the society proposes to do with that fund is best set forth by its general manager, Mr. J. M. Wakeman. When interviewed this week, Mr. Wakeman said:

### Aims of the Society

"According to statistics, only 20 per cent of the houses in the United States within serviceable reach of the central stations are wired for electric lighting, and not 1 per cent are wired for full electric service. Less than 20 per cent of the energy used in factories, foundries, shops, mills, etc., is electrical. This means that 80 per cent of the houses situated within serviceable distance of central stations constitute an enormous latent market, and that the factories, foundries, mills and shops using belt-driven machinery constitute another enormous latent market, and even the houses which are wired for electric lighting are only consuming a part of the energy which they could and would consume if they were wired for full electric service.

"The Society for Electrical Development plans to demonstrate to the owners of houses not already wired the advisability and practicability of adopting electric service and educating the people who are already using electric lighting to the advantages of the various electrical devices which can be introduced into the household as labor-saving devices, or to add to the comfort or convenience of the home. This will develop the latent market, as will also the campaign which we purpose to carry on in the trade papers of the country, advocating the use of electric motors in industrial plants and pointing out the many possible applications and advantages of electricity.

"All this additional business means to the manufacturer of motors and other devices larger opportunities for business, which means more trade for the supply jobber and dealer. It means more work for the contractor, and it means more revenue for the central station.

"The central station is in a position to benefit by every sale made by the work of this society. Every time the society succeeds in inducing a householder or a manufacturer to put in an energy-consuming device which otherwise would not have been sold it brings added revenue to the central station. In fact, the central station is the residuary legatee of the work of this society and should be its chief support. Some central stations feel that their field is entirely local and they cannot see any advantage in subscribing to a national effort. As a matter of fact, the educational campaign which this society purposes to carry on is of a character that no central station can afford to undertake alone. It is not intended to take the place of the local advertising and local effort for business, but is intended to enhance the value of the latter.

"National magazines coming into the central station's territory, bearing the message "Do it electrically" put in plain English and presented to the people in an attractive manner, thus setting them thinking about the advantages of the use of electricity, will go a long way toward making it easy for the local central station by its advertising and its direct business-getting campaign to secure results.

"Some jobbers also feel that their business is local and hardly realize that our campaign is going to create a demand for supplies which the dealers will have to fill, which means a greater business for the jobbing houses,

which in their turn supply the dealers. The fact that 60 per cent of the important jobbers of the United States are already members of the society demonstrates the fact that the majority of the jobbers realize the value and importance of the work of the society.

"Our campaign among architects, showing them the necessity for providing full electric service instead of merely electric lighting, and our campaign educating the people to the ease with which old houses can be wired for electric service, will mean more work for the contractors. It is self-evident that the creation of a greater demand for motors and other electric devices must mean more business not only for the manufacturers of such apparatus but also for the manufacturers of wire, fuses, motors, transformers, insulators and every other device used in the production and transmission of electric current.

"The amount of the subscription of any one individual company is comparatively small, but its accumulation into one fund to be expended under the direction of the officers of this society will enable the electrical industry to develop the latent market very quickly and more economically than could be done by any other possible method.

"There are, of course, in the electrical industry a number of individuals who feel that the other man may do the work of developing the industry, and that they themselves will reap the benefit of the other man's work. While, of course, this will be true to a certain extent of the work done by the Society for Electrical Development, there are a number of ways in which the members will receive direct benefits that will not accrue to those who are not subscribing to the movement.

"It has already been demonstrated that the educational advertising carrying the name of the society only will result in a tremendous number of inquiries from all over the country as to where certain devices can be purchased, what such devices would cost, the cost of installation, etc. All such inquiries will be addressed to the society and will be forwarded to the local members who are in a position to answer them. This means that in a city where a number of jobbers are members and other jobbers are not supporting the movement the members will get all the inquiries brought in by the advertising circulated in that city. Thus, if a man is not broad-minded enough to be imbued with a spirit of co-operation and looks at this matter from a purely selfish standpoint, he can, even from this point of view, count upon getting returns far greater than his subscription.

"To recapitulate, the work of the society is not intended to take the place of individual effort in the local market, but its work will be broad enough to bring direct results to its members and to give each interest represented in the society a great and lasting benefit. The development of the latent market is the great commercial problem of the electrical industry, and the solution of this problem is the work of the Society for Electrical Development."

### How the Industry Regards the Movement

In order to ascertain how the industry as a whole regarded the movement, the *Electrical World* interviewed representatives of the four electrical branches embraced in the Society for Electrical Development. What these men think of the movement is set forth in their own words as follows:

Mr. Henry M. Byllesby, president H. M. Byllesby & Company, Chicago: "You can quote me as favoring the aims of the Society for Electrical Development. Co-operation for such a worthy object as the increase of the use of electrical energy and electrical appliances is certainly most commendable, not only from the viewpoint of all interested in the industry, but from the broader view that the work should further public convenience and industrial efficiency. I am particularly pleased with the [illegible] methods tending to promote the welfare of individuals identified with all branches of the industry, and I am in hearty accord also with the effort to encourage harmonious relations which shall assist in maintaining the industry high in the confidence of the public."

Mr. Neil C. Hurley, vice-president Hurley Machine Company, Chicago: "We have no hesitation in saying that we are in entire and cordial sympathy with the Society for Electrical Development and its aims and methods. We want to help and be helped in our relations with the electrical industry, and we are confident that the society affords a means to that end. We try to do all in our power to further the industry, and our experience with the society is such that we are confident that its purpose likewise is to advance the interests of the industry as a whole in a broad-minded and fair-minded way."

Mr. W. W. Low, president Electric Appliance Company, Chicago: "In my judgment, the Society for Electrical Development deserves hearty encouragement. One reason for this belief is that general business conditions are somewhat depressed at the present time, owing, perhaps, to the tariff readjustment and the currency agitation. Now, if we can get this big movement for electrical co-operation under way, say by the first of the year, the effect ought to be to create new business or give an impetus to business in new channels. Thus, it seems to me, there is a great opportunity, by doing the work for which this society is organized, to stimulate the electrical industry during the months ahead of us when it, with other industries, may be otherwise retrogressive. In short, the aims of the society are not only correct at any time but particularly apropos at present to tide over what promises to be a rather lean period."

Mr. W. E. Robertson, Robertson-Cataract Electric Company, Buffalo, N. Y.: "The Society for Electrical Development offers the jobber an opportunity to participate in and help shape a campaign the purpose of which is to create an increased demand for electrical apparatus, supplies and devices of all kinds. The jobber's stock is so diversified that no matter where the public's interest is quickened the effect is immediately felt in some department of his business. Increased demand means an opportunity for net profit, because operating expenses spread over a small or moderate demand in a given line of material consume the entire possible gross profit. A net profit is only possible where there is a brisk or healthy demand. By co-operating with the other branches of the industry the jobber makes possible the existence of the Society for Electrical Development. Its existence will practically insure a satisfactory volume of business. In good times the activity of the society will augment the peak of his business, and this augmented peak furnishes the opportunity for an exceptionally high net profit. In dull times the activities of the society will increase his volume to a point where the possible profit on it will meet, or very nearly meet, his operating expense. Knowledge of the tremendous diversity in the stock carried by the jobber, in addition to the low cost of membership in the Society for Electrical Development, is all that is necessary to convince a logical business man of experience that the Society for Electrical Development offers an opportunity to participate in an enterprise in which he, the jobber, cannot lose."

Mr. Ernest Freeman, Freeman-Sweet Company, Chicago, president National Electrical Contractors' Association: "I am 'plugging' for the Society for Electrical Development all the time. I believe earnestly that this organization will promote the interests of the electrical contractor, electrical manufacturer, electrical dealer and the central-station operator. Naturally, I am particularly [illegible] and

I am urging members of the National Electrical Contractors' Association to join the Society for Electrical Development and help it all they can. Co-operation is a good thing for all concerned. It is the order of the day, and you can put me down as favoring unreservedly the aims of the Society for Electrical Development."

Indorsements of the movement have also been received from Messrs. J. B. McCall, president of the Philadelphia Electric Company; E. W. Rice, Jr., president of the General Electric Company; E. M. Herr, president of the Westinghouse Electric & Manufacturing Company; T. N. Vail, president of the American Telephone & Telegraph Company; H. B. Thayer, president of the Western Electric Company; F. A. Vanderlip, president of the National City Bank of New York; Thomas A. Edison, C. P. Steinmetz and Elihu Thomson. Their estimates of the movement and its possibilities are as follows:

MR. J. B. MCCALL, president of the Philadelphia Electric Company: "The object, underlying principles and plans of the Society for Electrical Development appeal strongly to me as representing essential progress and refinement in more efficiently extending electrical service. The fact that selling costs of different branches of our industry, particularly the competitive branches, are either stationary or tend to increase from year to year is a matter that warants serious consideration for improved efficiency in distribution. This situation contrasts strongly with the tremendous strides made in research, engineering and manufacturing. I believe that this trade movement will not only greatly facilitate the extension of our business but will, in doing this, develop a spirit of harmony and co-operation within the trade and toward the public of the greatest possible value. Our membership in the society is our strongest indorsement."

MR. E. W. RICE, JR., president of the General Electric Company: "I am in hearty sympathy with every practical effort to extend the electrical business, and it would seem obvious that valuable work may be done along the lines proposed for the new society. The electrical industry as the latest comer in the industrial field should lead in new business methods. All electrical workers, including competitors, have manifold interests in common; all are vitally interested in finding new fields to cultivate, in the reduction of waste, the promotion of honest business methods and the formation of correct public opinion. While many have come to the conclusion that under modern conditions there is a necessary limit to the old competition, all will probably agree that there is no limit to the new competition, the competition in co-operation."

MR. E. M. HERR, president of the Westinghouse Electric & Manufacturing Company: "The aims and purposes of the Society for Electrical Development have greatly interested me from their inception, and I have watched the progress in this work with a great deal of interest. The purposes and aims of the society cannot help but be of great advantage and value in the development of the electrical business. I have recently returned from a short trip in the East and have been very much interested and pleased to see the slogan 'Do it electrically' prominently displayed in many places."

MR. THEODORE N. VAIL, president of the American Telephone & Telegraph Company: "Co-operation is the most effective factor of prosperity. Rational competition with co-operation is constructive and progressive and is the only cure for our present evils and the only hope of the future. If the Society for Electrical Development can help in bringing this about in electrical development it will have accomplished much, for in that field lies a great future."

MR. H. B. THAYER, president of the Western Electric Company: "Co-operation between the various elements of the electrical industry, such as the Society for Electrical Development proposes, is a broad and comprehensive undertaking, and if it is in any measure successful, should be of much value to the central stations, manufacturers, distributers and contractors in the electrical business."

MR. F. A. VANDERLIP, president of the National City Bank: "I believe thoroughly in the purposes of the Society for Electrical Development. It is founded on right principles and it is constructive in every way. It is based upon the theory of broadening the scope of its members' activities and not of being in any way detrimental to one for the benefit of another. At the same time, its own success is so involved with good service to the public that mutual advantage must be derived from its activities. From the extension and the enlargement of central stations and the broader dissemination of electrical service, much economy directly beneficial to the public can be effected. In the education of the public along the line of increasing electrical facilities, diverse load-factors can be obtained and service thus greatly cheapened. I believe the society, while based upon the natural desire for more business for its members, is at the same time doing real public service, and it should receive hearty support."

MR. THOMAS A. EDISON, Orange, N. J.: "I have been greatly interested in perusing the pamphlet dealing with the principles, plans and methods of membership of your society, and am much impressed with the wisdom displayed in its conception. It is indeed remarkable that, in a business of such phenomenal growth and having such keenly competitive interests, there could be evolved a plan sufficiently comprehensive to bring about at once an incalculable increase of business to the good of all concerned while not in the least disturbing the benefits of proper competition. If the objects of the society are carried out as proposed, I think the next few years will show an enormous advance in the use of electrical devices."

DR. CHARLES P. STEINMETZ, Schenectady, N. Y.: "Co-operation is now the basis of prosperity. Competition, which has started our industrial progress, has become destructive and harmful to progress, if not limited and restrained by co-operation as the great economic force of modern industrial progress."

DR. ELIHU THOMSON, West Lynn, Mass.: "I believe that the Society for Electrical Development has a great field before it in harmonizing interests and preventing ruinous competition by the methods which imply co-operation and mutual understanding. To do this effectively will, of course, require wise administration and a sympathetic attitude on the part of those connected with our industry. I have no doubt that if these are secured the benefits which may accrue will go far to counteract many of the difficulties under which business is at present conducted, and tend to its future development in the most healthful and hopeful way."

Regarding the trade impressions of the Society for Electrical Development, Mr. H. H. Cudmore, who has visited various parts of the country as a lecturer for the society, said: "For several weeks it has been my privilege and pleasure to assist the officers of the Society for Electrical Development in performing field work, exploiting the many advantages to all engaged in the electrical industry in all its branches that will come from joining the Society for Electrical Development. The general impression of all the trade seems to be covered in one statement: They do not clearly understand the plans of the society. In proof of this I found in the cities of Pittsburgh, Pa., Columbus and Cincinnati, Ohio, and in Louisville, Ky., that all of the representative concerns engaged in the electrical business were glad to make application for membership in the society when they clearly understood what the definite plans and purposes of the society actually are. No indi-

vidual, firm or corporation that derives all or any part of its income from the electrical business can afford to remain unfamilar with the plans that are actually worked out, ready to be put in motion as soon as the minimum fund of $200,000 has been subscribed. More than three-quarters has been pledged, and membership in the society to-day is more valuable than any other plan individual members can possibly have to develop their own business, so my plea is that everyone engaged in the electrical business should at least post himself on the plans of the society immediately. If all will do this, they will join at once."

## Public Service Commission News

### Maryland Commission

The Maryland Public Service Commission has received a letter from Mayor Higgins of Easton, Md., asking that the complaint of the town burgesses against the Easton Light & Fuel Company be dismissed. The request was granted in an order issued by the commission. On account of differences between the public and the company the Mayor and Council had negotiated with a promoter for the establishment of a competing plant. However, the promoter announced that he could not secure the capital he had expected and a settlement has been made with the old company.

### Ohio Commission

A joint petition has been filed with the Ohio Public Service Commission by the Dayton Power & Light Company and the Xenia Gas & Electric Company of Xenia asking that they be allowed to consolidate through the purchase of the entire stock of the Xenia company by the Dayton company. The Dayton company now owns all of the $100,000 bonds of the Xenia company and $95,000 of the $100,000 stock.

The Mahoning County Light Company has asked permission to sell $10,000 bonds which have already been authorized. The proceeds are to be used as a beginning in the equipment of an electric plant.

The Northern Ohio Traction & Light Company, of Akron, has reported to the commission that it is unable to sell at par $300,000 preferred stock, which was authorized some time ago. It requests that it be permitted to sell at 95.

### Massachusetts Commission

A bill to reduce the membership of the Public Service Commission from five to three and to cut down the salaries of the commissioners from $8,000 to $5,000 will be introduced in the next Legislature. Under the former law salaries of the commissioners were paid by the railroads, and the new law not only increased the membership of the board but also raised salaries, so that the cost of regulation by this commission is likely to exceed $190,000 in the present year, as compared with $70,000 the year before. The supervision of telephone and telegraph companies has been added to the duties of the board this year. During the coming year the membership of the board will be materially changed, even if no additional legislation goes through. A plan is being discussed to appoint Commissioner Bishop, who retires in the summer of 1914, head of the inspection department. During the first half year of its existence the commission has been handicapped by considerable friction which it has not been able to conceal from observation at its public hearings, and the reorganization of its office force has been subjected to some criticism, although steps are being taken to improve the business activities of the board.

The Municipal Lighting Board of Rowley has petitioned the Gas and Electric Light Commission for authority to sell electricity for motor service at less than cost, setting prices varying from 15 cents net per kw-hr., for consumption up to and including 50 kw-hr. per month, to 8 cents for 800 kw-hr. and over.

### New Jersey Commission

The Board of Public Utility Commissioners of New Jersey has disapproved of a sale involving $620,000 of 5 per cent consolidated mortgage bonds of the North Hudson County Railway by the Public Service Railway. The board renders its decision upon the ground that the sale of such entire issue to the Fidelity Trust Company of Newark at 97 without seeking competitive bids evidences favoritism and constitutes a departure from a sound and safe rule of action whereby the company would obtain less than the utmost possible amount from the sale of the securities. The board further states that while it has no interest in what purchaser may secure the bonds, it becomes its duty to see that the price brought by an issue involves no infringement of the rights of the shareholders of the company or its patrons. Inasmuch as any amount received for the refunding bonds less than par must be amortized during the life of the bonds, an additional burden by just this amount is imposed upon the patrons of the company and an additional barrier by just this amount is interposed between the company's shareholders and their dividends.

### Nevada Commission

A supplemental opinion has been issued by the Public Service Commission of Nevada in the case involving rates of the Ely (Nev.) Light & Power Company. The commission issued an order some time ago prescribing rates for the company. The city of Ely was complainant in the case. The maximum rate ordered was 15 cents per kw-hr. The company did not obey the order and started proceedings in court to enjoin its enforcement. The commission filed an answer to the bill. Subsequent to these proceedings, a further hearing was held at which the company furnished additional data bearing upon the reasonableness of the rates prescribed by the commission. With further investigations and close analysis of the data and full consideration, the commission was forced to the conclusion that the order originally made would, if put into effect, reduce the earnings of the company to such an extent as not to leave a fair compensation for the service rendered or a reasonable return upon the value of the property used in performing the service. It therefore issued a supplemental order providing for a maximum rate of 17 cents per kw-hr. for the first 50 kw-hr. consumed per month; 16½ cents per kw-hr. for the next 100 kw-hr.; 15 cents per kw-hr. for the next 100 kw-hr., and 12½ cents per kw-hr. for all in excess of 250 kw-hr. per month. The minimum charge of $2 per month was reduced to $1.50. Motor and street-lighting rates were not affected by the order.

Mr. J. S. Shaughnessy, first associate commissioner, filed a dissenting opinion. He declared that the commission reached its conclusion on the basis of the reproduction value new of the property when the depreciated value should have been taken, that the operating expenses were seemingly excessive and that the order did not recognize the principles that a reduction in rates may result in a substantial increase in the volume of business. Mr. Shaughnessy added that in the valuation by the engineer for the commission the totals allowed for the different items were generous, the land used in operation being valued by comparison with the selling value of contiguous property. The plant and distribution system were put in at the going unit cost prices thereof. Buildings were valued on the basis of prices furnished for their duplication by two contractors at Ely. In addition, 20 per cent was allowed for engineering, superintendence, contingencies and interest during construction. The company submitted evidence to show that its aggregate investment for plant and improvements was $80,000, but the plant has been in operation six years, and during that time land values have depreciated. The investment was made at a boom time, when the population was 50 to 100 per cent greater than now. Mr. Shaughnessy favored a schedule of 12, 10 and 8 cents per kw-hr.

# Current News Notes

Swiss Bankers Inspecting Public-Utility Properties.—Messrs. E. Odier and F. Dominice, of Geneva, connected with prominent financial interests of Switzerland and France, have recently completed a survey of some of the public-utility properties of H. M. Byllesby & Company, of Chicago, in which the interests they represent have considerable investments. At a recent luncheon given by Mr. Byllesby in their honor at the Union League Club, Chicago, they expressed themselves as pleased with the results of their inquiry.

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New York's Urban Traffic Growing 90,000,000 a Year. During the year which closed June 30, 1913, the number of passengers carried by New York's electrically operated transit system—subway, surface and elevated—was 1,769,889,284. This total exceeds by 90,000,000 that for the previous twelve-month period—an increase equivalent to the entire population of the United States. The increase in the subway traffic alone was 25,000,000 for the year, and was practically equaled by the growth in the number of surface-line passengers. The nickels collected during the year by all the New York transit companies totaled $87,718,359.

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Postal Telegraph-Cable Company Again Suffers Loss from Wire Cutters.—The Postal Telegraph-Cable Company offered a reward of $1,000 on Nov. 14 for information leading to the arrest and conviction of persons who have cut a number of its cables. The company has suffered in this way before, and there seems to be no doubt that the work is done maliciously. On the night of Nov. 12 a large cable on the top of a building at 179 North Wabash Avenue, Chicago, was cut. It is also stated that a cable on the South Side Elevated Railroad structure in Chicago was cut on the night of Nov. 13 in three places, and that single wires on South Halsted Street were also cut.

* * *

Examination for Accountant, Public Service Commission.—An examination will shortly take place for the position of junior accountant for the Public Service Commission of the Second District, Albany, N. Y. It is open to men between the ages of twenty and thirty who have a knowledge of the theory and principles of economics, including accounting, finance and statistics. The examination will include a discussion of one of several topics, such as valuation, depreciation, capitalization and return on investment, especially related to public service problems. The position carries a salary of from $1,080 to $1,500 per annum. Application blanks may be secured from the State Civil Service Commission, Albany, N. Y.

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To Reclaim 8,000,000 Acres in California.—At a recent meeting of the California Realty Federation held at Del Monte, Cal., Mr. A. L. Shinn, of San Francisco, presented his plans for irrigating 8,000,000 acres in the Sacramento and San Joaquin Valleys, involving the development and transmission of large quantities of hydroelectric energy. Mr. Shinn proposes to conserve the water which now goes to waste through the floods of the Sacramento River, constructing reservoirs in the mountains at elevations of 2000 ft. to 3000 ft. The head available would be used for developing electrical energy, which would in turn be applied to pumping water up to lesser elevations—1000 ft. or less—for irrigation distribution at the head of the valley.

* * *

Water-Supply Amendment to Constitution in New York.—A constitutional amendment adopted at the election in New York State on Nov. 4 provides that the forest reservation as now fixed by law shall be kept forever as wild forest lands. The Legislature may provide by general laws for the use of such lands for the construction and maintenance of reservoirs for municipal water supply, for the canals of the State and to regulate the flow of streams. Such reservoirs shall be constructed, owned and controlled by the State, but such work shall not be undertaken until after the boundaries and high-flow lines shall have been accurately surveyed and fixed. The Legislature shall provide for a charge upon the property and municipalities benefited for a reasonable return to the State upon the value of rights and property used and services rendered, which shall be fixed for terms of not exceeding ten years and be readjustable at the end of any term.

* * *

State to Construct Its Own Light and Power Conduits.—Basing their action on the claim that it is their intention to escape possible monopolistic control in the distribution of electric light and power within the limits of the city of San Francisco, members of the California State Board of Harbor Commissioners made an announcement on Nov. 14 of plans for the State to lay its own conduits along the piers and bulkheads within their control. By thus owning its own electrical distribution system the State can buy energy from the lowest bidder. This action followed within a few weeks the published announcement of the intention of the Universal Light & Power Company to begin service on the zone system throughout the city of San Francisco. The latter company, according to a statement of one of its officers, will begin laying main-line conduits throughout the business section soon and claims that it will sell electricity at rates much lower than any now available.

* * *

Government Ownership of Railroads.—Mr. W. C. Brown, president of the New York Central Lines, made an address before the directors of the Chamber of Commerce of the United States at Rochester, N. Y., on Dec. 8, in which he said that government ownership of railroads would be a dangerous mistake. He believes that the decision of the rate case now under consideration before the Interstate Commerce Commission will either substantially check the movement for government ownership or prove to be a long step in this dangerous direction. In his opinion, if the moderate advance asked by the railways is denied, it will be impossible for them to secure funds with which to make improvements. Without these improvements expansion of the commerce of the nation must gradually come to a halt. In this event, if it should come, the demand that the government provide the funds necessary to supply adequate transportation facilities will be irresistible, and government ownership and operation, with whatever it involves for weal or woe to the nation, will be the inevitable result.

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## SOCIETY MEETINGS

New York Companies' Section, N. E. L. A.—"Personal Initiative Within Corporate Enterprise," by Mr. J. W. Eaton, and "Instrument Maintenance," by Mr. S. E. Boyland, were the titles of two papers presented by their authors at a meeting of the New York Companies Section of the National Electric Light Association on Dec. 15.

* * *

Safety Committee of the Empire State Association.—The executive committee of the Empire State Gas and Electric Association has appointed as members of the new safety committee for work in behalf of the association throughout the State Messrs. W. P. Strickland, New York & Queens Electric Light & Power Company; Henry Flood, Central Hudson Gas & Electric Company; W. L. Bruce, Westchester Lighting Company; A. T. O'Neill, Syracuse Lighting Company, and Victor T. Noonan, Rochester Railway & Light Company.

Boston Section, I. E. S.—Mr. L. A. Hawkins, of the research laboratory of the General Electric Company, Schenectady, N. Y., addressed the Boston Section of the Illuminating Engineering Society, Dec. 9, on the topic "The Nitrogen-Filled Lamp and Its Possibilities." The meeting was held in the Boston Edison company's auditorium, and the attendance numbered over 150.

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Meeting of Illinois Northern Utilities Branch, N. E. L. A.—At the regular meeting of the Illinois Northern Utilities Branch of the National Electric Light Association held at Dixon, Ill., Nov. 21, Mr. H. W. Young, of Chicago, spoke on "Selling Power from High-Tension Lines." The lecture was illustrated by some forty lantern slides showing many outdoor high-tension installations.

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Southern California Jovians' Dinner.—The Jovian Electrical League of Southern California met at Christopher's, Los Angeles, on Wednesday, Dec. 10, at noon, for lunch, with Mr. R. H. Manahan as chairman. Mr. F. T. Woodman, president of the Los Angeles Harbor Commission, spoke on "The Harbor and the Kilowatt," and the guests were also entertained by a few vaudeville numbers.

* * *

Architecture and Illumination.—At a meeting of the New York Section of the Illuminating Engineering Society, Dec. 11, Mr. Frank E. Wallis gave an interesting illustrated talk on classic styles of architecture and the design of architectural features with respect to the illumination they receive. Mr. Wallis' address was followed by a paper by Mr. Howard E. Watkins entitled "Periods of Architecture as Applied to Fixture Design."

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Public Service Section, N. E. L. A.—A meeting of the Public Service Section, N. E. L. A., was held in Newark, N. J., on Dec. 15, with approximately 325 members and guests in attendance. Mr. Dudley Farrand outlined in an interesting way some of his experiences as president of the N. E. L. A. in its earlier days and called attention to the benefits resulting from the establishment of the various company sections, the idea of which originated during his administration. A paper on "New Business from Old Customers," describing the advantages and importance of obtaining this class of business in residence, commercial and industrial applications, was read by Mr. W. A. Cox. A paper on "The Extension of the Generation and Transmission System in Southern Jersey" was read by Mr. E. B. Meyer. The author described the generating station in course of construction at Burlington, N. J., the substations at Riverside, Bordentown and East Trenton, and the 51 miles of transmission line construction. The new-business possibilities of this district and the reason for various engineering details of the problem were outlined by the author and those who discussed his paper.

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Railroad Men Studying Electrical Working.—At a meeting of the American Railway Association held in Chicago Nov. 19 the committee on electrical working presented a very brief report. It is giving attention to the questions of overhead working-conductor clearances and clearances for automatic train stops. Both of these subjects are also under discussion by the railway technical associations. The committee simply reported progress, desiring to await the conclusions of the technical associations before recommending action to the American Railway Association. Mr. George Gibbs, chief engineer of electric traction for the Long Island Railroad, is the chairman of the committee, the other members being Messrs. J. D. Isaacs, consulting engineer Southern Pacific Company; L. C. Fritch, chief engineer Chicago Great Western Railroad; J. H. Davis, electrical engineer Baltimore & Ohio Railroad; E. B. Katté, chief engineer electric traction New York Central & Hudson River Railroad; A. S. Baldwin, chief engineer Illinois Central Railroad, and A. R. Whaley, vice-president New York, New Haven & Hartford Railroad. The American Railway Association's membership represents 269,317 miles of track.

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American Economic Association.—The twenty-sixth annual meeting of the American Economic Association will be held in Minneapolis, Minn., from Dec. 27 to 30. The American Sociological Society will hold its annual meeting at the same time and place. The tentative program of the American Economic Association meeting shows that among the papers to be presented are the following: "The Control of Public Service Corporations," by Prof. John H. Gray, University of Minnesota; "The Renewed Extension of Government Control of Economic Life," by Mr. David Kinley, president of the American Economic Association; "Theory of the Making of Railway Rates," by Dr. D. H. Meyer, Interstate Commerce Commission; "Syndicalism," by Mr. John Graham Brooks, Cambridge, Mass.; "The Economic Effects of the Supreme Court Trust Dissolutions," by Prof. Willard E. Hotchkiss, Northwestern University.

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American Association for Labor Legislation.—The American Association for Labor Legislation will hold its seventh annual meeting in Washington, D. C., on Dec. 30 and 31. The meeting will be a joint session with the American Political Science Association. Among the papers to be presented are the following: "The Federal Industrial Relations Commission," by Mr. Frank P. Walsh, chairman Federal Industrial Relations Commission; "Labor Law Enforcement Through Administrative Orders," by Mr. Charles H. Crownhart, chairman Wisconsin Industrial Commission; "The Philosophy of Labor Legislation," by Mr. W. F. Willoughby, Princeton University, president of the American Association for Labor Legislation; "The Practicability of Compulsory Sickness Insurance in America," by Mr. Joseph P. Chamberlain, Legislative Drafting Association, New York. The afternoon session on Dec. 31 will be devoted to discussion of the subject of "Working Hours in Continuous Industries." Several papers will be presented on subjects of interest in this connection. Among those specially invited to lead the informal discussion on this subject, under the five-minute rule, are Mr. Robert S. Hale, Edison Electric Illuminating Company of Boston.

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Detroit-Ann Arbor Section, A. I. E. E.—The second regular meeting of the Detroit-Ann Arbor Section of the A. I. E. E., which was held at the University of Michigan, Ann Arbor, Mich., was attended by many men prominent in Michigan engineering circles. Dean Mortimer E. Cooley of the university engineering department spoke on "Factors Determining a Reasonable Charge for Public Utility Service," and Prof. George W. Patterson talked on "Financial Versus Engineering Estimate of the Value of a Public Utility." Tables showing the distribution of capital invested in gas and hydroelectric plants were presented and discussed by Prof. H. C. Anderson. Mr. Lawton T. Hemans, chairman of the Michigan State Board of Railroad Commissioners, spoke at length on the work which the board has accomplished as well as that which it has before it. "Depreciation" was the topic discussed by Mr. Gardner S. Williams, consulting engineer, Ann Arbor. Prof. David Friday discussed the subject of bond discounts and suggested how such discounts should be entered on the books. About 150 were present. As the papers and discussions presented at this meeting were considered of general interest, effort is being made to have them printed. Mr. Ray K. Holland, electrical engineer, Ann Arbor, is secretary of the local A. I. E. E. section.

# Hydroelectric Development at Tallulah Falls, Ga.—I

**Station of Georgia Railway & Power Company the largest in operation in the South—Plant has high-head reaction wheels and very large outdoor substations**

THE Georgia Railway & Power Company, of Atlanta, Ga., has recently placed in operation its hydroelectric station at Tallulah Falls, which is one of the largest water-power plants in the world. The station, which was designed and erected under the supervision of Mr. C. O. Lenz, consulting engineer of New York, has the distinction of being the largest now operating in the South and possesses the highest-head reaction turbines in the country. These wheels have carried over 18,600 hp in actual operation, so that they are also among the highest-powered turbines of the world. The exciters are mounted on the main units, thus obviating the use of separate water-wheels and penstocks and making for higher overall efficiency of the plant. Energy is transmitted over steel tower lines at 110,000 volts to substations at Atlanta, Newnan, Lindale, Gainesville and Cartersville, which are all of the outdoor type, that at Atlanta being the largest outdoor substation thus far built.



FIG. 1—ONE OF THE MAIN GENERATING UNITS AT TALLULAH FALLS, GA.

The Tallulah Falls development includes the construction of a solid masonry dam, 110 ft. high, situated above the Ladore Falls of the Tallulah River; a concrete-lined tunnel through rock for a distance of 6670 ft., having a net sectional area of 151 sq. ft., a structural steel reinforced forebay and surge tank; five steel penstocks, each 60 in. in diameter and 1200 ft. long, with provision for the future installation of a sixth penstock, and a power plant containing five 17,000-hp vertical-shaft, spiral-case-turbines, each directly connected to a 10,000-kw generator, space being provided for the future installation of the sixth unit. The power plant is situated in the gorge about 600 ft. below the top of the bluff, and to facilitate the delivery of apparatus to the plant an inclined railroad with complete hoisting equipment was constructed leading from the terminal of the railroad above to landing platforms at the entrance to the power house.

At the rear of the power plant and connecting with it is a transformer and high-tension switch house from which the delivery of electrical energy is controlled.

A storage dam is under construction about 6 miles above the Tallulah Falls development which will create a reservoir having a storage capacity of 1,250,000,000 cu. ft. This dam is of the reinforced concrete deck type with concrete buttresses and reinforced concrete apron on the downstream side over the spillway section. Provision is made within this dam to install a small power plant which will utilize the energy of the water which is released from storage.

The construction of the various parts of the development, especially the rock excavation at the dam site and in the tunnel, demanded the use of a great amount of compressed air. A temporary compressor plant was built 600 ft. downstream from the entrance to the tunnel, where a timber dam 8 ft. high and 60 ft. long was erected. This plan enabled the construction of a development having a 48-ft. head.

This dam created a pond about 600 ft. long with an average width of 125 ft. The intake for the penstocks was located at one end of the dam and was provided with suitable headgates and racks. A penstock 7½ ft. in diameter and 80 ft. long brought the water from the dam to a 1000-hp turbine which drove two air compressors, each rated at 2500 cu. ft. of free air per minute. There was also a 3-ft. pipe feeding the turbine which operated two 50-kw generators used for lighting the tunnnel. Air was compressed to 110 lb. pressure and distributed to the several workings in

the tunnel through a pipe 8 in. in diameter at the compressor plant. The pipe line was laid above the tunnel on the surface of the ground and was provided with branches leading through the adits and shaft to the drills, the size of the pipe reducing as branches were taken off.

The amount of air from these two compressors was not always enough for construction purposes, and an auxiliary



FIG. 2—MAIN DAM, SHOWING SWINGING FLASHBOARD COUNTERWEIGHTS

steam-driven compressor with a rating of 1500 cu. ft. of free air per minute was installed near the lower end of the tunnel to assist the water-driven compressors. When not required for this service the steam plant furnished air for the drills at work on the power-plant site.

### Main Dam and Automatic Swinging Flashboards at Tunnel Intake

The intake dam is a rubble concrete structure of the gravity type arched to a radius of 900 ft. The maximum height of the dam is 110 ft. above the original ground surface, with footings on solid rock from 10 ft. to 20 ft. below; the crest length is 444 ft., and the total length of spillway is 280 ft. divided into ten sections, 28 ft. between piers.

The spillway is fitted with automatic swinging flashboards hinged on the lower edge and controlled by rolling counterweights so arranged and designed that the elevation of the water back of the dam will be maintained within 3 in. of the normal elevation of 1500 when passing a flood discharge of 12,000 cu. ft. of water a second. The counterweights are concrete cylinders 26 ft. long by 3.25 ft. in diameter and are fitted at each end with heavily geared rolling contacts which roll on specially curved racks attached to the side of the piers above the crest. As the flashboards are lowered, owing to the pressure of the water, the counterweights are forced to roll up the incline by the pull of galvanized-steel cables wound on a drum at either end of the counterweight and connected to the top of the flashboards.

The piers on the crest of the dam between which the flashboards are placed carry a highway bridge made up of plate girders embedded in concrete, having a 12-ft. roadway and platforms for hand-operated hoists for manipulating the flashboards should this be desirable when the water is drawn down or to enable the station operators to control the water at some other elevation than that which the flashboards are designed to maintain. The hoists serve also to manipulate two sand gates in the dam.

The footings of the dam were excavated below the riverbed and at each end of the dam until solid and homogeneous rock was exposed. The earth and rock excavations necessary to secure suitable foundations amounted to 10,000 cu. yd.

The rubble masonry in the dam is made up of concrete mixed in the proportions of one part of Royal Portland cement, three parts of sand and six parts of crushed rock in which rocks or "plumbs" which could be easily handled by derricks were embedded. The Royal Portland cement was manufactured by the Dixie Portland Cement Company at Richard City, Tenn., each car being thoroughly inspected, and samples from each car were tested in accordance with the standard tests of the American Society for Testing Materials. The total amount of concrete in the dam is 38,000 cu. yd., and the work was placed at the rate of about 800 cu. yd. to 1000 cu. yd. a week.

### Storage Dam

The storage reservoir, situated near Mathis, about 6 miles above the dam at the intake works, will be formed by the construction of a reinforced-concrete dam of the Ambursen type, 90 ft. high and about 700 ft. long, across the riverbed, and a dike dam of the same type of construction across a depression about 50 ft. below the crest of the concrete dam and the elevation of the water in the reservoir. These dams will raise the water in the reservoir to elevation 1689, and the storage thus created will impound 1,250,000,000 cu. ft. of water.

The main reservoir dam will have thirty-three buttresses, spaced 18 ft. center to center, and the footings of the buttresses are approximately 6 ft. to 10 ft. below the original ground level. The horizontal joints of each buttress where thinner sections rest on thicker sections below are made up with raised keys so that there can be no possibility of horizontal sliding.

The reinforced-concrete deck which is carried on the upstream faces of the buttresses is of the arched beam type



FIG. 3 DOWNSTREAM SIDE OF INTAKE DAM

of construction, the face of the deck being flush with the upstream faces of the buttresses. The thickness of the deck at the crown of the arch is 39 in. at the bottom and 18 in. at the top. The deck is sealed with the river bottom by means of a cut-off wall, 4 ft. thick, which extends 10 ft. or 15 ft. below the original ground surface.

The spillway deck and apron are constructed of rein-

forced concrete and are designed to offer the least resistance to the passage of floods and at the same time protect the footings of the buttresses from undermining. The spillway apron is 18 in. thick. The crest of the dam will be divided into sixteen sections, each section being 16 ft. clear between piers, which are 2 ft. in thickness and which will carry a footbridge about 12 ft. above the crest of the dam.

The concrete in the structure is mixed in the proportions of one part cement, two parts sand and four parts crushed stone for the upstream deck, crest and spillway apron, and 1:3:6 for the concrete in the buttresses.

Three 48-in. hydraulic gate valves of special design are provided to drain the reservoir when necessary. These valves are equipped with gates having a straight lower edge and are fitted with machine-surfaced brass guides for the steel gate with hoisting apparatus and racks having a screening area of about 375 sq. ft. per section or 1875 sq. ft. for the entire intake. The division walls are 3 ft. in thickness and are extended forward to form the intake piers. The piers are provided with stop-log grooves and are arranged so that it is possible to gain access to any gate for repairs when necessary. At the rear of each division wall there is an opening, 22 ft. high by 11.5 ft. wide, which allows the water to pass to the tunnel entrance at the center of the rear wall at the bottom. The bottom of the tunnel is 26.5 ft. below the elevation of low water and 46.5 ft. below the elevation of high water in the reservoir, so that

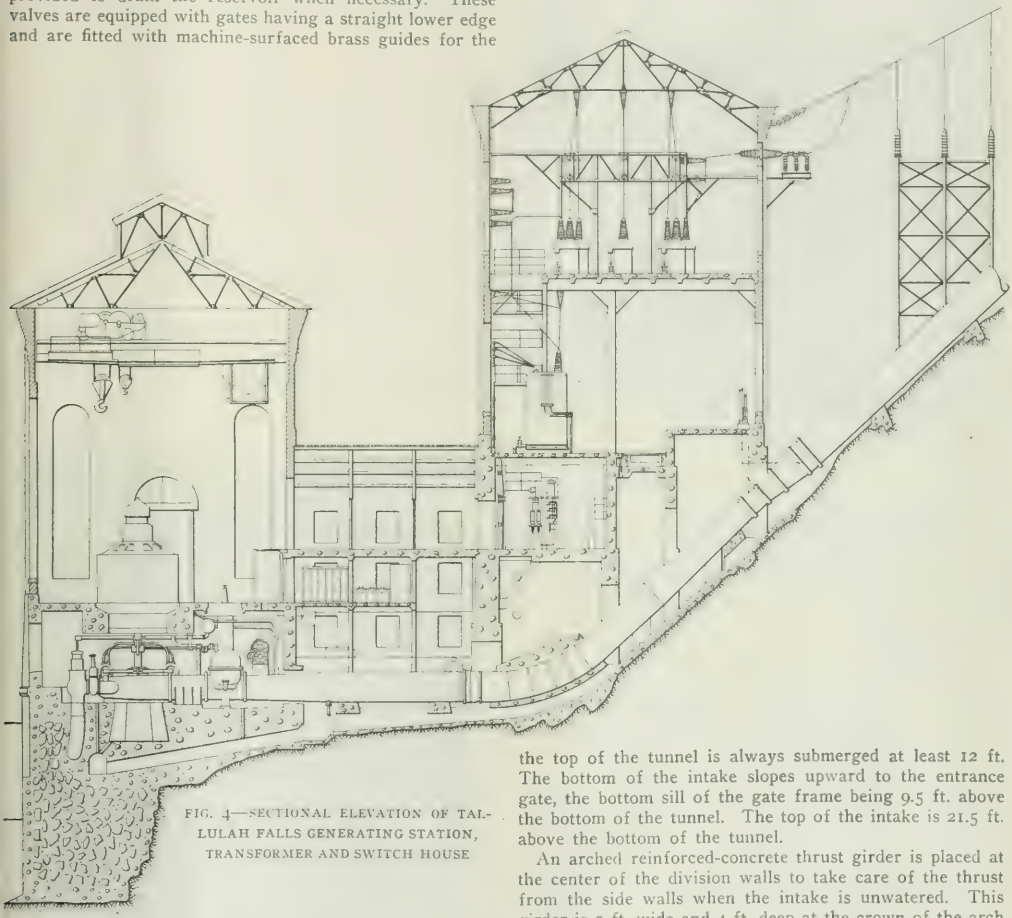


FIG. 4—SECTIONAL ELEVATION OF TALLULAH FALLS GENERATING STATION, TRANSFORMER AND SWITCH HOUSE

gate. This design was adopted as being the most suitable for throttling purposes.

Provision is being made for the future construction of a power plant containing two 3000-kw units which will utilize the energy of the water drawn from storage and which will deliver the energy over a transmission line to the main line at the power plant below.

## INTAKE

The intake forming the entrance to the tunnel is a reinforced-concrete structure 62 ft. wide by 38 ft. from front of intake piers to face of rear wall. The chamber is divided into five sections by concrete division walls, each section being provided with an 8-ft. by 10-ft. structural-

the top of the tunnel is always submerged at least 12 ft. The bottom of the intake slopes upward to the entrance gate, the bottom sill of the gate frame being 9.5 ft. above the bottom of the tunnel. The top of the intake is 21.5 ft. above the bottom of the tunnel.

An arched reinforced-concrete thrust girder is placed at the center of the division walls to take care of the thrust from the side walls when the intake is unwatered. This girder is 5 ft. wide and 4 ft. deep at the crown of the arch and is placed so that the top is about 3 ft. above the low-water elevation in the reservoir, thus forming a platform from which the lower set of racks can be raked by hand in the two sections which are not provided with mechanical raking devices.

The gate hoists are hand-operated. One of the hoists is fitted with steel gears, the other four with cast-iron gears. The force is transmitted to the gate through structural-steel gate stems which pass through roller guide bearings.

The racks are made up of ⅜-in. x 4-in. flat bars, spaced 1⅝ in. center to center, and rest on 12-in. I-beams. The slope of the rack is 5 in. to the foot from the vertical. Two sections of the intake are fitted with two sets of racks each about 20 ft. long. The other three sections are fitted with

continuous racks and motor-operated, mechanical raking devices to remove débris, particularly during the season of the year when leaves are floating on the water.

### Tunnel

A concrete-lined tunnel, 6670 ft. long, connects the intake with a forebay excavated in the rock. The tunnel section resembles a horseshoe in shape, the height being 14



FIG. 5—INTAKE AND TUNNEL

ft. and the width 12 ft., with the top arch at a radius of 6 ft. The net sectional area is 151 sq. ft. It is lined with concrete for an average thickness of 18 in.

The tunnel has a maximum rating of 1555 cu. ft. of water per second, with a velocity of water of 10.3 ft. per second. The normal flow through the tunnel with rated load on all the units in the plant is 1160, with a corresponding velocity of 7.7 ft. per second.

To facilitate the construction of the tunnel one shaft and three adits were constructed. The distance from the entrance portal to the shaft is 1283 ft., from the shaft to the first adit 1443 ft., from the first to the second adit 1473 ft., from the second to the third adit 1011 ft., and from the third adit to the discharge portal 1460 ft. Thus the working of the tunnel was conducted through six openings, making ten headings. The shaft is about 100 ft. deep and about 10 ft. by 12 ft. in section. The adits are 7 ft. high by 13 ft. wide.

The excavation of the tunnel was accomplished by first excavating a heading 8 ft. high the entire length between adits and then excavating the bench. The rock encountered in places required special timbering and was of such a nature that the progress of the work was greatly delayed.

The concrete lining was placed around steel forms by means of a specially designed air concreting machine. The concrete was mixed in the proportions of one part Portland cement, three parts sand made from rolled crushed rock and five parts crushed rock. The total amount of concrete for the tunnel is estimated to be 18,000 cu. yd., the total yardage of excavation being about 60,000 cu. yd.

### Forebay

The forebay at the lower end of the tunnel is designed to take care of the maximum surge due to the sudden closing of the gates of all the wheels when running at 25 per cent overload. It is estimated that during 25 per cent overload operation the elevation of the water in the forebay will be about 12 ft. below the elevation at the intake, owing to friction losses in the tunnel, and that if all the turbine gates are suddenly closed the resulting surge in the tunnel will raise the water in the forebay to about 29 ft. above the elevation at the intake.

The bottom of this forebay is about 63 ft. below the ground level and is 30 ft. by 71 ft. inside in plan and 93 ft. high. The walls of the forebay are of concrete reinforced with heavy structural-steel framework with cross-tie beams. An emergency gate, 7.5 ft. square, made of structural steel is placed at the entrance of each penstock at the bottom of the forebay. Each gate is swung on pin hinges on the top side and is held open by a chain passing over a hand-operated hoisting mechanism at top of the forebay.

### Penstocks

From the forebay the water is conducted to the turbines through 60-in. penstocks. Five of these penstocks have been constructed, with provision for a sixth to be constructed at a later date. The penstocks are of riveted steel varying in thickness from 3/8 in. to 9/16 in. and are from 1200 ft. to 1258 ft. in total length from the forebay to the power plant. The greater portion of the penstocks are on grades exceeding 70 per cent, the maximum grade being 150 per cent.

At the upper end of the penstocks remote-controlled, motor-operated gate valves, 60 in. in diameter, are provided. These valves are furnished with limit switches and are operated from the power plant.

At the lower end of the penstocks a heavy anchorage casting of cast steel is solidly embedded in the concrete of the power house and connects with the turbine casing on one side and with a hydraulically operated gate

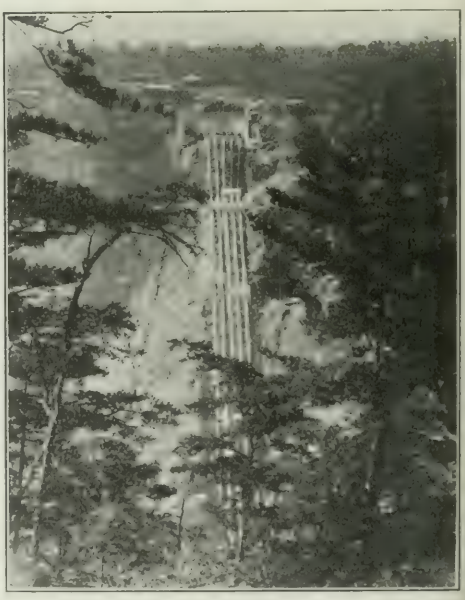


FIG. 6—FOREBAY AND PENSTOCK

valve on the other side. These anchorages are designed to take the thrust from the penstocks and thus relieve the wheel cases from stresses tending to impair their alignment.

The hydraulically operated gate valves are 45 in. in diameter and are fitted with leather-cup ring-packed pistons. These valves are furnished with a pilot or operating valve so designed that the gate can be held in any position desired

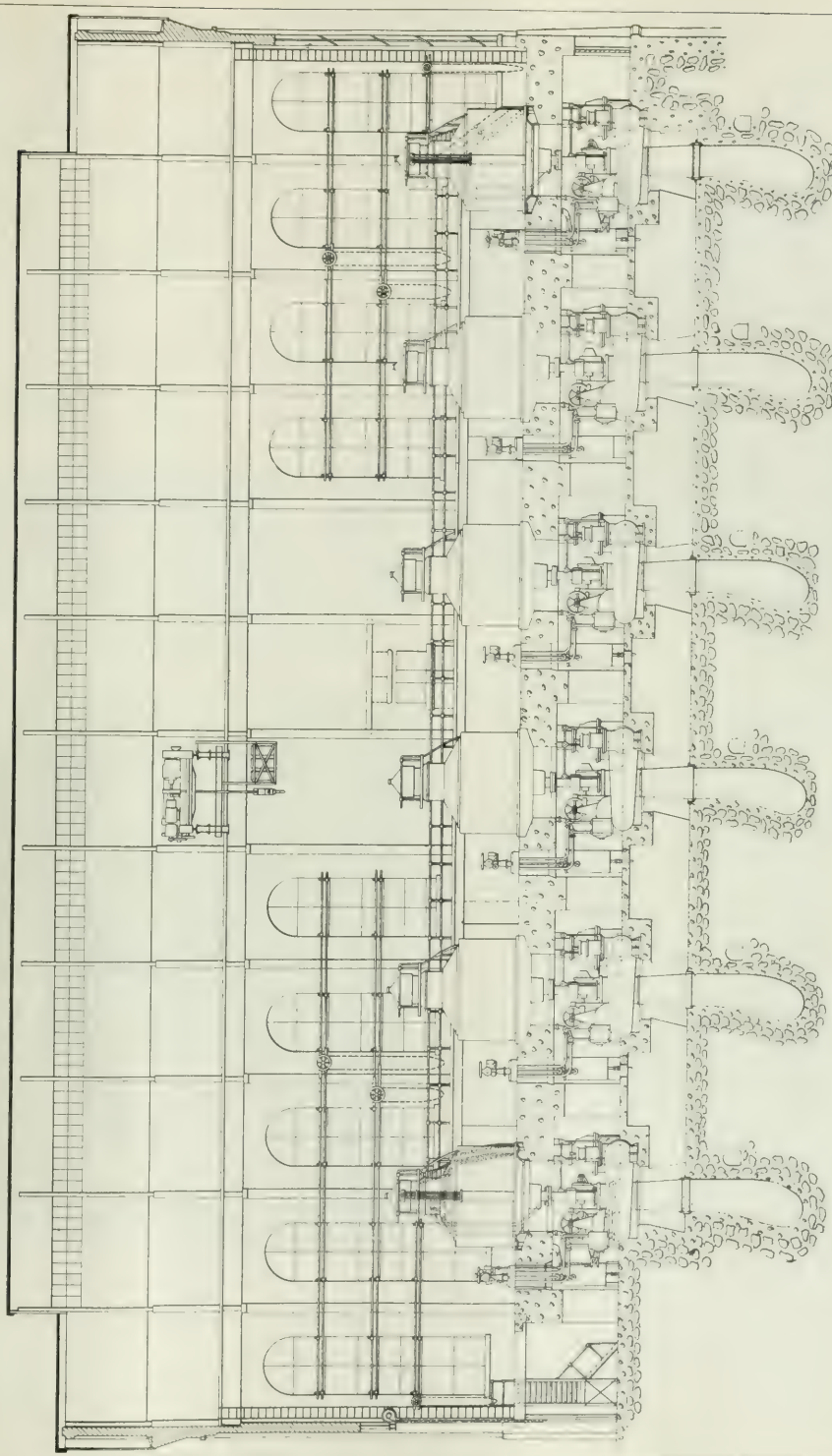


FIG. 7—LONGITUDINAL ELEVATION OF GENERATING STATION OF THE GEORGIA RAILWAY & POWER COMPANY AT TALLULAH FALLS, GA.

the operator. The hydraulic pressure in the cylinder for operating the valve is that due to the head of the water in the penstock.

Above the hydraulic gate valve and just outside the power plant a Venturi meter with 35-in. throat is installed in each penstock. The indicating and recording instruments are located in the switch house.

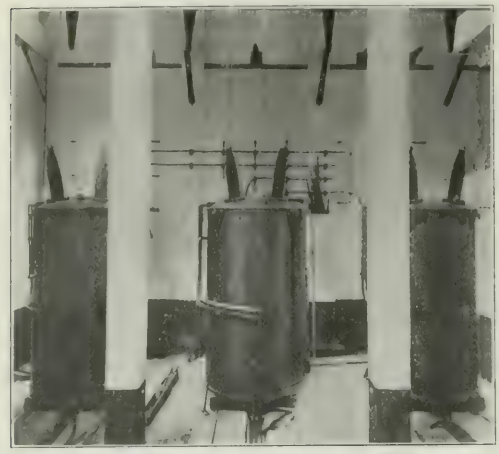


FIG. 8—HIGH-TENSION TRANSFORMER ARRANGEMENT

The penstocks are carried on concrete piers spaced about 32 ft. center to center. At or near each change of grade a heavy concrete anchorage block is provided for each straight section over 100 ft. in length.

### Power Plant Buildings

The general arrangement of the buildings, which include the main power house and a transformer and high-tension switch house, resembles a letter H. The power house faces the tailrace excavated in the riverbed. At the rear of the power house, and separated from it by a clear distance of 28 ft., the switch house is situated, these two buildings being interconnected by a small building containing the switch-control apparatus. By this arrangement ample light is admitted on all sides of the principal buildings.

The main power house is 192 ft. long by 48 ft. wide and contains space for six main units spaced 28 ft. center to center. The lower chords of the roof trusses are 49 ft. above the generator-room floor. Massive concrete construction was used for the foundation, the walls being of concrete to an elevation 1½ ft. above the main generator floor. The generator-room floor is constructed with heavy steel girder beams to distribute the load from the generator frames, and the concrete is monolithic with the side walls.

The structural-steel framework of the building rests on the concrete foundation walls. A plate girder runway is provided for a 60-ton crane. The roof trusses are of the Fink type and support purlins having 15.5 ft. span, on which the roofing tiles are laid directly.

The side walls of the power house are constructed of red brick with marble pilaster caps and windowsills. The roofing is of reinforced-concrete tile construction colored red to harmonize with the coloring of the side walls. The roofing tile is designed to rest directly on purlins spaced 4 ft. center to center and is arranged to seal weather-tight on all edges. A monitor extends nearly the entire length of the ridge of the roof and contains about 1200 sq. ft. of window area.

The windows are of the "Fenestra" steel-type sash, glazed with selected double-thick American sheet glass. The monitor sashes and about half of the other sashes are operated by the Drouvé system of window operators. Rolling steel doors are provided at the principal entrances. Steel stairways and railings are located at convenient places extending from floor to floor.

A gallery 155 ft. long, with a stairway at each end, is provided along the back of the generator room, which forms the roof of the rheostat rooms and from which the operator commands a good view of the operating floor.

The basement of the turbine room contains the complete turbine unit together with the pressure pumps and gate-controlling mechanism. The generator-room floor above supports the frames of the main generators and the superimposed thrust bearings which carry the entire revolving parts of the machines.

The transformer and high-tension switch house is 250 ft. long by 50 ft. wide and is situated on the side hill of the gorge back of the power house so that the front wall is 25 ft. to the rear of the back wall of the power house.

The transformer room is above the low-tension room, the elevation of the low-tension switch-room floor being the same as that of the gallery in the power house. This room provides space for eighteen transformers.

The high-tension switch room is located over the transformer room and contains all the high-tension switching gear of the station, as well as the high-tension buses from which the electrical energy is taken out to the transmission lines.

The general construction of the building is similar to that of the main power house, except that there is no monitor and the roof trusses are of a special design with a raised cord to provide space for the necessary buses without unnecessarily raising the walls of the building.

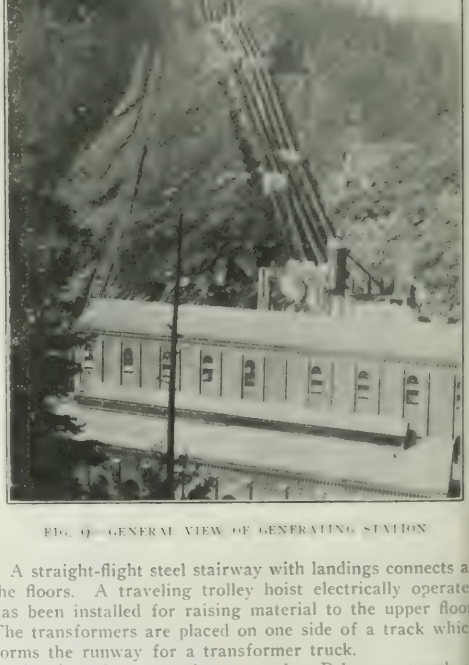


FIG. 9—GENERAL VIEW OF GENERATING STATION

A straight-flight steel stairway with landings connects all the floors. A traveling trolley hoist electrically operated has been installed for raising material to the upper floor. The transformers are placed on one side of a track which forms the runway for a transformer truck.

The first floor contains a 250-kw Pelton waterwheel, tapped off from the penstocks, which is used to run an

auxiliary exciting generator, and also a small compressor plant for the supply of air for cleaning and other purposes. The second floor, which is at the same elevation as the generator room of the power house, contains lavatory fixtures and lockers. The upper floor, which is at the same elevation as the gallery in the power house, into which it opens, and as the low-tension switch room in the switch house, contains the switching gear for controlling all the main switches throughout the station.

### HYDRAULIC MACHINERY

The prime movers of the power plant consist of five S. Morgan Smith Company 17,000-hp vertical-shaft turbines of the Francis type with scroll cases. Space is provided for a sixth unit, making the ultimate generating capacity 102,000 hp.

The turbines are designed for an average head of 600 ft. and operate at 514 r.p.m. Each turbine is provided with an oil-pressure governor, twin-gate operating cylinders and a heavy walking beam to operate the gates. A relief valve of special design to discharge about 70 per cent of the water in case of a sudden closing of the gate is connected



FIG. 10—HIGH-TENSION SWITCH ROOM

to the scroll case of each turbine on the same center line as that of the penstock connection.

The runners are of special design and are of bronze, while the gates are of forged steel with bronze-bushed pivot bearings and bronze-lined packing glands. Selected cast iron was used for the scroll cases, which were cast in one piece and each case tested under 400 lb. hydraulic pressure per square inch. Each case is about 14 ft. outside diameter and contains about 28 tons of metal. Each turbine discharges through concrete draft tubes lined with steel plate of such design that the water is delivered to the tailrace with minimum disturbance of the water. The normal draft head on the runner is 22 ft.

The general arrangement of each prime mover consists of the turbine runner, the rotating field of the main generator and the armature of the exciting generator, each superimposed above the other on the vertical shaft and the whole carried by an oil-pressure thrust bearing at the upper end of the shaft, with the exception of the exciter, which is above the thrust bearing. There are two guide bearings, one above the turbine runner and one below the generator armature. The shaft is made in two sections of nickel steel and with forged steel flanges and tapered flange bolts fitting into concentrically reamed holes. The governor pump and the pump for supplying oil to the thrust bearings are driven by worm-gear-driven counter shafting in the generator-room basement. Each unit is fully equipped with its own governor and thrust-bearing pumps, the thrust-bearing pumps being interconnected so that the pumps can be operated interchangeably.

The six main generators are of the General Electric Company's vertical types rated at 10,000 kva, 514 r.p.m., 6600 volts, 60 cycles, three-phase, with 100 kw, 250-volt exciters on the dome of the main generators. Each exciter is capable of exciting two generators at its full load. These machines have a flywheel $(WR^2)$ effect of 1,250,000 ft.-lb. The revolving field is made up of solid sheet steel disks bolted together.

The switchboards are placed on the top floor, overlooking the main operating room of the switch-control house which joins the generator building to the switch house. A benchboard contains all the control switches, mimic buses, signal lamps, etc., and directly in the rear are vertical instrument panels containing indicating and integrating instruments.

The exciter switchboard is on the main floor of the generating room, directly under the control panels. Directly opposite each generator is a panel containing the field resistor dial, remote-control field-switch operators, signals, etc.

From the generators the main cables are carried to the adjoining switch house and connected through their respective oil switches, buses, etc., to the step-up transformers. Three 3333-kva single-phase transformers per generator group transform the voltage from 6600 volts to 63,500 volts, giving 110,000 volts to the line potential when Y-connected. From the high-voltage terminals of the transformers the energy is carried through high-tension oil switches, buses, etc., to the outgoing lines. The neutral of these transformers is connected through a neutral resistor at the end of the switch house.

The entire station control is centered about this point, and it is possible by the use of remote-control apparatus to control the operation of all the main apparatus in the station. The generator rheostats are placed under a gallery entirely isolated from the main operating room and ventilated with suitable louvers, so that the heat can be readily carried away.

In the main generating station the entire excitation is taken from the direct-connected exciters, there being no motor-generators or water-driven exciters, thereby eliminating the need of complicated hydraulic connections in order to select any particular penstock.

The scheme of isolating each generator has been carried out, and the low-tension transfer bus is the only connecting link between the generators in the low-tension switching room. These oil switches are mounted in groups and separated about 20 ft. from each other. The high-tension 110,000-volt bus is carried from the roof trusses of the high-tension switching gallery, the trusses being of a special design in order to give sufficient clearance for the wiring. By this type of truss it is possible to cut down considerably the height of the building and use the usual waste space for wiring. The high-tension wiring is carried from the switch house through a new type of line entrance bushing specially developed for this plant, and it requires no exterior protection from the weather other than the bushing itself. On the exterior of the building there is an extension of the interior bus, making it possible to supplement the interior bus in case of trouble to bushings, insulators, etc. All the high-tension electrolytic arresters, horn-gaps, etc., are mounted on a structure built on the side of the hill adjoining the switch house.

In a subsequent article the transmission line and semi-outdoor substations, that at Atlanta being the largest in the world, will be described.

# Ornamental Lighting in Residential Districts

**Series tungsten system covering all streets of Champaign, Ill.—Underground and overhead distribution. By J. R. Cravath**

THE artificial lighting of down-town streets by means of ornamental lamp standards has become extremely popular among progressive American cities and towns. Little has been done, however, toward the extension of such ornamental lighting over the streets of entire communities particularly in residential sections. For this reason the features of the complete system which



FIG. 1—CHAMPAIGN STREET LIGHTING, OVERHEAD SUPPLY

lights Champaign, Ill., a city of 15,000 people, should be of special interest to residents of similar small cities since it shows what can be done with a very limited amount of money.

Before the installation of the present system Champaign was lighted by the method typical of cities of its class in the Mississippi Valley, namely, inclosed alternating-current 6.6-amp series carbon arc lamps, spaced two blocks apart at every other street intersection. In the downtown district, however, some of the more enterprising merchants had joined together and erected thirty-six five-lamp standards of a familiar type. In 1911 the city voted bonds for $35,000 to install an ornamental street-lighting system, although, unfortunately, its City Council and citizens were insufficiently informed as to the extent and kind of a system which could be put in for $35,000. Accordingly several months later, in 1912, when the writer was retained to draw up plans, he was faced with the rather difficult problem of designing an ornamental system which would come within the appropriation and yet be creditable to the city. Instructions received from the Council were to place wires underground within the fire limits in the central part of the city and overhead in the residential sections.

### Selection of Types of Construction

Extensive preliminary studies were first made of street-lighting systems in other cities. Special consideration was given to the excellent scheme in use at Toronto, Canada, using 24-ft. concrete poles about 110 ft. apart with a special design of lantern on each pole. In spite of the low cost at which these concrete poles were made in Toronto, it was found that they would be too expensive for the Champaign installation, and it was finally decided to use very light tubular steel poles.

Another problem was that of securing reliable underground construction for a series system operating at a maximum pressure of 2200 volts. Single-conductor lead-covered and steel-taped cable naturally suggested itself, but at the time these plans were being prepared only one installation of such cable on high-voltage series work could to the writer's knowledge be found in the United States, that at Charles City, Ia. Considerable doubt existed in the minds of many engineers whether the effect of the steel-tape magnetic circuit inclosing such a single conductor carrying alternating current would not set up so much reactance as to make the use of such cable out of the question. A special test made on the Charles City circuit, carrying 6.6 amp, showed, however, the total drop in pressure per 1000 ft. of No. 6 steel-taped 3500-volt cable to be 6.07 volts, of which about 2.7 volts was accounted for by the ohmic resistance, so that the use of this cable was found to be quite feasible.

The next problem was that of securing an ornamental design of lantern which should also be as efficient as possible. After considerable study a design was evolved which offered the advantages of a good-sized reflector together with an artistic antique appearance, a combination apparently not heretofore available.

In the down-town district the plans called for sixty-four single-lamp standards, each equipped with a ball globe, a series socket and a 200-cp series tungsten lamp. All are within the fire limits and are supplied from single-conductor lead-covered and steel-taped underground cable. These sixty-four post lamps were installed simply to supplement the existing ornamental lighting and are placed on the less important streets not already lighted by the five-lamp clusters. The single-lamp standards present nothing new in design, since they consist simply of fluted pressed-

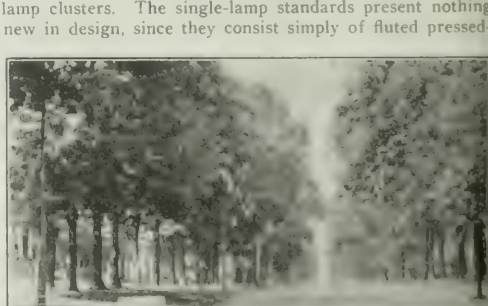


FIG. 2—CHAMPAIGN STREET LIGHTING, UNDERGROUND SUPPLY

steel columns with cast bases and tops equipped with 14-in. Alba ball globes having 8-in. necks.

### Overhead Distribution in Residential Section

In the residential districts, where the wires are overhead, light tubular steel poles are installed. The commonest size of pole is 25 ft. long with a bottom section 3 in.

n internal diameter and a top section 2.5 in. in internal iameter. Although the same type of pole is employed or both lamps and lines, such light steel-pole construction vould not be at all suited to a general distribution sys-em as the poles are not heavy enough to permit natural ncreases in line capacity and there would be difficulty in vorking on live lines in the daytime. For a street-lighting ystem, however, where the number of lines will always be imited to a few No. 6 wires, and where the energy is off uring the daytime, this objection does not hold. These ght poles are unobtrusive and render the street-lighting ircuits as inconspicuous as it is possible to have them with verhead construction.

All sections of the overhead system are designed to be asily converted into an underground system wherever the roperty owners along any given street desire to pay the ost of making the change. In such an event cast-iron ases can be slipped around the bottoms of the poles, these ases being used to cover the entrance of the underground able.

In the overhead districts the general plan has been to ocate 100-cp series tungsten lamps at the street intersec-ions and 60-cp series tungsten lamps midway between treet intersections on the longest and the most important locks. As it was not feasible to locate lamps midway of ll blocks, some uniform rule had to be adopted for locat-ng these mid-block lamps. This rule was as follows: On locks over 400 ft. between street centers one lamp was laced in the middle of the block provided that there were ight houses fronting on the street or that the street was mportant enough to be paved. In case the system is later hanged to underground each of the present overhead-line oles can be made to carry a lantern with a 32-cp lamp, r such additional lamps can be added with the present verhead distribution. The system selected therefore ffers great flexibility.

The design of lantern and bracket used comprises a cast-



GS. 3 AND 4—STANDARD FOR SIDE-STREET LIGHTING AND STANDARD FOR TYPICAL RESIDENCE STREET

on lantern top into which is screwed a 1.25-in. standard ipe, bent as shown in the illustrations, to form a bracket ith the aid of a curved brace. The lantern top contains porcelain series receptacle and film cut-out of the Gen-al Electric type used on exposed work. The size of the st-iron top is such as to cover and render inconspicuous 18-in. flat white enameled-steel reflector. A cylindrical Alba lantern globe, 8 in. in diameter and 8 in. high, is held up against this reflector by four long bolts passing through a cast-iron ring into which the bottom of the globe fits. The flat reflector is placed low over the lamp so as to intercept as much of the upward light flux as possible.

The distribution of light about this type of lantern equipped with a 60-cp series tungsten lamp, as compared to

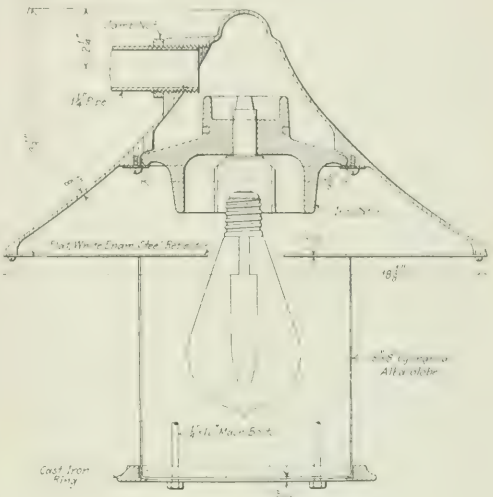



FIG. 5—DETAILS OF LAMP

a 14-in. upright Alba ball globe with the same lamp, is shown by the accompanying photometric curve, based on tests made by the Electrical Testing Laboratories of New York. This curve shows about 18.5 per cent greater candle-power at an angle of 75 deg. from the vertical with the lantern than with the plain ball, and an increasing percentage at angles nearer the vertical.

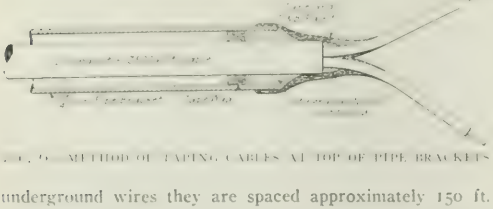
In most series incandescent-lamp fixtures which have the wires concealed in the pipe of the bracket a weak point of insulation results where the wires enter the bracket. Special attention was given in the present design to securing good insulation at the point of entrance, while at the same time having the bracket present a neat appearance. Duplex 3500-volt cable is used inside the bracket, and where the cable leaves the bracket a special joint of compound and tape is made up as shown in the sketch. Where this design of lantern bracket is used with underground work the duplex high-tension cable is provided with similar joints at the top of both the pipe bracket and the pole, while a porcelain disconnecting series pot-head is used in the base of the pole.

### Underground Construction at Private Expense

The system as originally designed (and upon which the successful bidder submitted a proposal bringing the total cost within the $35,000 appropriation) called for sixty-four 200-cp lamps on single standards, with underground supply, 331 lanterns with 100-cp lamps, and 252 lanterns with 60-cp lamps, making a total of 583 lanterns with overhead supply in the residence districts.

After the contract had been let to the successful bidder, the property owners on some of the best residential streets asked permission to put in an underground system and pay the extra cost involved. This permission was granted in all cases, but with the provision that the plans for the underground system should be approved by the city's engineer. In order to secure uniformity, a rule was adopted requiring all lanterns in the residence district to follow the standard pattern already designed. For those residence

streets in which underground lines were installed at the [illegible] new post was designed resembling in general the overhead posts but provided with a cast-iron base resting on a concrete block, instead of the usual tubular steel embedded in concrete. This underground-type post is 16 ft. high, or 4 ft. shorter than the regular overhead poles. Where these posts are installed on residence streets with

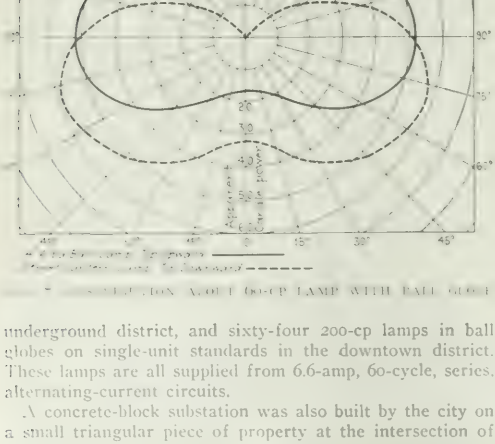


METHOD OF TAPING CABLES AT TOP OF PIPE BRACKETS

underground wires they are spaced approximately 150 ft. apart along each curb line, making one lamp for each 75 linear feet of street. Necessarily some slight variation has occurred from this spacing on account of the length of the city blocks and also because of various obstructions. The rule was made, however, not to permit lamps to be placed on both sides of the street unless property owners were willing to stand the expense of a lamp-post for every 75 linear feet of street, as it had already been demonstrated by certain tests in Chicago that unless such a spacing as this could be maintained it would be better to have all the lamps on one side of the street. In the residential underground districts, as just described, the lamps are all of 32-cp rating. The energy required per mile of street is therefore between 25 per cent and 30 per cent more than with the typical arrangement in the overhead districts, but by reason of the more frequent spacing of the lamps the minimum illumination on the street is about four times that in the overhead district. The city operates these additional underground lamps without extra expense to the property owners in consideration of the increased installation expense already borne by them.

### Summary of System Installed

The street-lighting installation as finally completed consists of 309 100-cp lanterns and 218 60-cp lanterns supplied by overhead wires; 156 32-cp lanterns in the residential




[illegible] CANDLE-POWER DISTRIBUTION CURVE OF 60-CP LAMP WITH FULL GLOBE

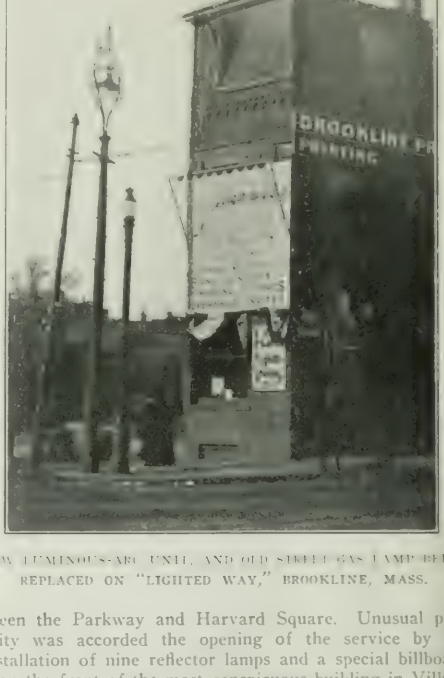
underground district, and sixty-four 200-cp lamps in ball globes on single-unit standards in the downtown district. These lamps are all supplied from 6.6-amp, 60-cycle, series, alternating-current circuits.

A concrete-block substation was also built by the city on a small triangular piece of property at the intersection of two streets near a railroad yard. Energy is obtained over a three-phase feeder from the power house of the Urbana & Champaign Railway, Gas & Electric Company, [illegible] distant. The substation contains eight "A-W" series regulators, one for each street-lighting circuit. Allowance was made for growth on all the circuits. It is not intended to operate any circuit at a pressure over 2200 volts. The regulators are without moving parts, and the substation is operated without any regular attendant. The city purchases its energy at the company's bus, paying 2 cents per kw-hr.

All of the construction work was done under a general contract by a company now known as the Caldwell Electric Company of Champaign, Ill., under the supervision of the engineer for the city.

## "Lighted Way" for the World's Wealthiest Town

The Boston suburb of Brookline, famed as the wealthiest town in the world, inaugurated a "White Way" system of street lighting on Nov. 3, when forty-five 6.6-amp luminous-arc lamps of General Electric design were placed in service by the Boston Edison company in the district be-




NEW LUMINOUS-ARC UNIT AND OLD STREET GAS LAMP BEING REPLACED ON "LIGHTED WAY," BROOKLINE, MASS.

tween the Parkway and Harvard Square. Unusual publicity was accorded the opening of the service by the installation of nine reflector lamps and a special billboard upon the front of the most conspicuous building in Village Square, by the local newspaper "write-ups," and by a band concert, moving-picture show and parade on the night when the current was turned on. Each of these new street-lighting units consumes 510 watts and is mounted on a wooden pole 17 ft. high. The accompanying photograph shows a "gas arc" lamp displaced by the new installation and also the "Lighted Way" celebration notice. As the opening occurred at the height of the gubernatorial campaign, the occasion was utilized by one enterprising candidate as an opportunity to win proselytes to his standard, and the aristocratic old town had a lively evening. The system is to be greatly extended in the near future.

# Storage-Battery Control by Counter-Emf Cells

**The 150-cell, 5750-amp-hr. stand-by installation of the Union Electric Light & Power Company, St. Louis, Mo., employing remotely controlled short-circuiting switches**

COUNTER-EMF cells provide voltage regulation for a 150-cell, 5750-amp-hr. standby storage battery in use by the Union Electric Light & Power Company, St. Louis, Mo., remotely controlled magnet switches being used to short-circuit in succession the subtractive counter cells, thus raising the effective terminal voltage of the battery.

The battery does not float on the line but is automatically thrown onto the system when needed by low-potential relays. Meanwhile the battery receives no preliminary voltage adjustment except the cushioning action automatically interposed by the counter cells.

Compared with end-cell systems of control, this counter-cell method avoids excessive copper construction in the battery room, eliminates expensive end-cell switches and works all of the active cells of the battery uniformly on both charge and discharge. In addition, a valuable cushioning effect is introduced by the counter cells, as illustrated by the fact that the battery can be thrown onto the system while its own terminal pressure is even 60 to 70 volts above the bus potential, without perceptible voltage variation of current flow.

### Cushioning Action of Counter Cells

The counter-cell electrodes, although inert, unformed sheets of lead, acquire their counter-emf in a twinkling after being put in circuit, and build up to the difference in pressure, thus confirming the original expectation that it would be unnecessary to keep the counter cells "formed" or "charged" in order to secure the counter-emf action



FIG. 1—INTERIOR OF STORAGE-BATTERY ROOM, COUNTER CELLS AT REAR

instantly when needed. The actual amount of active material built up on these counter-cell plates is, however, apparently very slight, even after extended use in the main circuit. As each cell is short-circuited it sets up an initial momentary rush of several thousand amperes, but this flow dies away almost instantly, leaving the cell inert. The total energy loss entailed in the counter cells is, of course, quite negligible, since the battery is discharged only in emergencies for standby service and the counter cells are all cut out when the battery is on charge.

The greater part of the energy dissipation in the two volts drop per counter cell appears in heating and dissociating the electrolyte, rather than in building up any amount of active material. The operation of the battery

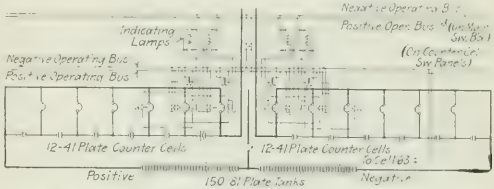



FIG. 2—CIRCUIT DIAGRAM OF COUNTER-EMF-CELL STORAGE-BATTERY CONTROL

under the most severe test conditions has also been altogether without incident, despite the many novel problems involved in its arrangement.

The accompanying diagram shows the arrangement of battery, counter cells and switches. The main battery comprises 150 Gould type T-61 lead cells, each containing sixty-one plates, with room for future increase to eighty-one if necessary. Wood spacers are used between plates and the tops of the cells are covered with heavy glass plates which largely collect and return electrolyte splashings and evaporation. Each 10-in. by 18-in. side plate has, however, a 4-in. semi-circular opening which admits inserting a hydrometer without raising the glass. The tanks, of 2⅛-in. wood lined with 8-lb. lead, measure 49 in. long, 23 in. wide and 49 in. high, giving ample "mud" clearance for even the whole positive plates to sludge away without causing short-circuit.

### Details of Cell Construction

The tanks are supported on standard Gould oil-filled glass pedestals with porcelain bases, which in turn rest on cast-sulphur blocks coated with an acid-resisting paint to prevent disintegration of the sulphur. These blocks, poured in position on the floor, measure 7 in. by 15 in. and are 2 in. thick, and each supports two pedestals of adjoining tanks. Porcelain tiles are embedded in the sulphur. On these rest the 4½-in. porcelain cylinders, which carry the annular glass oil cups. Any electrical leakage which could occur must therefore cross these oil surfaces. Each tank is supported on six such pedestals, at a height of 15 in. above the floor, easily admitting the body of a man for inspection of the tank bottom. Tanks at the ends of the rows have five instead of three outer pedestal supports, to guard against settling and tipping.

Two 8-in. by 0.5-in. copper bars make up the main battery conductor, which is supported from the ceiling by rod hangers with double strain insulators. The copper bars are put together with steel bolts and nuts, over which, on the protruding threads, are screwed lead caps, the interior space being filled with vaseline. A 5-hp motor-driven fan exhausts air from the battery room through two 4 ft. by

3-ft. ceiling outlets, and a number of inlet registers on the far side of the room insure circulation when doors and windows are closed.

The 150 cells of the main battery are arranged in eight rows, and along the south wall are located the twenty-four counter-emf cells. Opposite each counter cell, but just outside in the substation room, are the corresponding short-circuiting switches. The counter cells are made up of unformed Gould spun-type plates, both sets alike, contained in forty-one-plate tanks, 34 in. by 22 in. Most of the counter cells contain fifteen plates, arranged in groups of eight and seven, but the last cells to be short-circuited have twenty-three plates and the next to the last twenty-one plates, thus affording greater carrying capacity for the cells in circuit longest. In mounting and construction the counter cells are similar to the main battery. The counter cells are short-circuited in groups of two, each pair being connected to its switch by two 4-in. by 0.5-in. copper bars. Slotted 10-in. by 14-in. slate slabs form the entries where the buses penetrate the wall, slate spacer-blocks making the joints air-tight. The short-circuiting switches are thus mounted outside and free of any battery fumes which might corrode their contacts or parts.

### Remotely Controlled Switching Operation

As the sketch shows, these short-circuiting switches close across from the counter cell to the main bus conductor, thus gaining the advantage of multiple carrying capacity when more than one switch is closed. The switches are operated from groups of standard remote-control buttons on the substation switchboard. These actuate 220-volt relay coils on the switches, which in turn complete the operating-solenoid circuits. The switch mechanism, also locally designed, is of toggle construction and takes 30 amp while closing, but is held closed mechanically. Each switch is opened from the corresponding switchboard control button by a tripping coil reconstructed from a relay. Back contacts report the position of the switch to pilot lamps on the board. The switches are so interconnected that No. 1 must be closed before the actuating circuit of No. 2 is completed, and so on, insuring operation of the switches in their proper order. Each switch closes laminated-spring contact surfaces, 3.25 in. by 4 in., against the busbars. In emergency the switches can be hand-operated from the switch gallery.

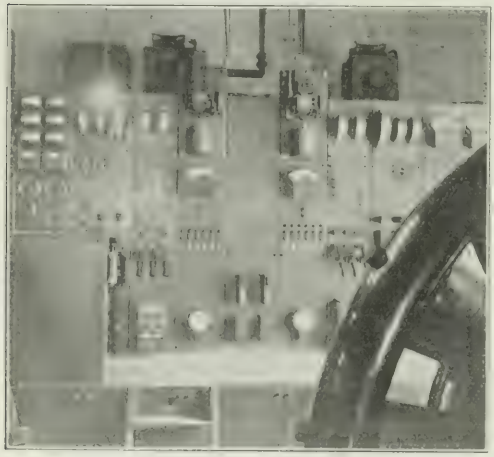


FIG. 3—SWITCHBOARD, SHOWING MAIN OPERATING SWITCHES

The main battery leads are connected to the system through 12,000-amp Westinghouse solenoid-operated switches, arranged with low-voltage relays and hand control. When the 110/220-volt system pressure falls below the predetermined figure, these relays cause the main switches to close, at once connecting the battery to the line. This connection can take place with impunity, regardless of the voltage difference between line and battery, since the counter cells serve as a cushion, building up a reverse emf to prevent a sudden current rush. Even with the system at 240 volts between outers and the battery pressure 300 volts or more, connection has repeatedly been closed through the counter cells without appreciable voltage variation or current flow.

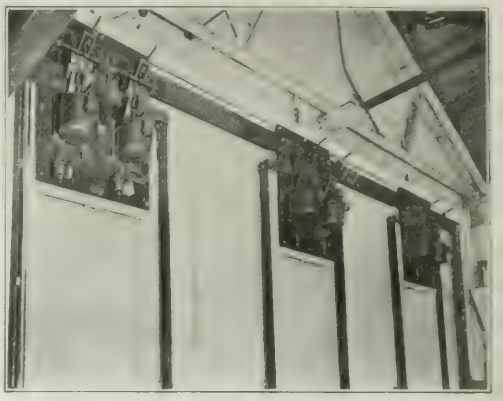


FIG. 4—REMOTE-CONTROLLED ELECTROMAGNETIC SHORT-CIRCUIT SWITCHES

In succession, the attendant then short-circuits counter-cells until the battery is carrying its apportioned load. This rating is as follows: 5750 amp for sixty minutes; 11,500 amp for twenty minutes; 17,250 amp for ten minutes; 23,000 amp for six minutes. The capacity in kilowatts is: At the 5750-amp rate, 1500 kw; at the 11,500-amp rate, 1470 kw; at the 23,000-amp rate, 5865 kw.

This interesting counter-cell installation was designed and constructed under the direction of Mr. S. B. Way, now vice-president and assistant general manager of the Milwaukee Electric Railway & Light Company and formerly electrical engineer for the St. Louis Union Electric Light & Power Company.

## Illumination Revision Produces Satisfied Customers

The Commonwealth Power Company, Jackson, Mich., is giving trial demonstrations of the best methods of lighting industrial establishments. Where a factory is insufficiently illuminated or the distribution is not suited to the work carried on, the electric company will, with the consent of the consumer, revise a portion of the lighting system and point out how the efficiency of human labor is improved thereby. These changes are made without charge, but the increased satisfaction of the customer resulting from the correspondingly improved operating conditions is a big asset to the company when capitalized as good-will. The fact that the utility company shows an interest in the illumination of his premises makes the consumer look toward it as an adviser. In many cases where a saving to the consumer has been effected by the revision enough extra lamps have been ordered installed for display purposes to bring the total energy consumption above the original demand. Besides securing satisfied customers through the improved lighting, the central-station company can make use of the revised installations as examples of model illumination in talking to prospective consumers.

# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Setting the Meter-Installation Pace

To stimulate its sales staff in their efforts to add new business at the rate estimated at the beginning of the year, a Southern central station has mounted a large pointer and dial in its salesmen's room, the periphery of the dial being marked off into a thousand divisions, each of which represents a meter the head of the department hopes to put into service during the present year. Each day as the records of the preceding day's business are received the pointer is advanced the corresponding amount, showing at a glance how nearly the staff is keeping up with the pace set for it. The scheme provokes the interest and enthusiasm of the men and, simple as it is, has been found well worth while by this company.

## Flatiron Campaign at Defiance, Ohio

In the smaller towns of the Middle West the prevailing method of conducting flatiron campaigns seems to be to inaugurate a house-to-house canvass and offer the housewives electric irons on trial to be paid for at reduced rates. A modification of this style of campaign recently started by the Defiance (Ohio) Gas & Electric Company has met with more than a fair degree of success.

An agent who had had some experience in selling was engaged with the understanding that he was to receive a commission of 50 cents for each iron sold. He was then provided with a book containing blank forms such as the one shown in the illustration herewith. The order book was provided with alternate white and yellow forms, the white blanks being filed in the office and the carbon duplicates being retained by the solicitor to show the neighbors of the woman who had bought an iron.

As will be seen from the form, the iron is placed on trial

Defiance, Ohio, Aug 15 1913

DEFIANCE GAS & ELECTRIC CO.
SALES DEPARTMENT
410 CLINTON STREET
DEFIANCE, O.

Please deliver to my address one Type K Electric Flat Iron, with the understanding that I am to have a free trial for a period of two weeks. The price of this iron is $3.50 If I do not return the iron to 410 Clinton St., on or before 2 weeks you may charge $ 3.50 to my account, or I will pay $ 0.50 per month until the above sum is paid.

Sign here Mrs James Smith

Agent John Doe Address 12 Second St

NOTICE—Pay no money to Selling Agent

FORM USED IN IRON CAMPAIGN AT DEFIANCE, OHIO

and if it is not returned to the office within two weeks the price, $3.50, is charged to the customer and made payable at the rate of 50 cents per month. At the end of two weeks 125 irons had been sold, and Mr. J. F. Deatrick, Jr., who is contract agent for the company, is confident that there is still room for more irons among the 8000 inhabitants of which Defiance boasts.

## A Convenient Lamp-Testing Box

For testing incandescent lamps without injury to the eyes of the exchange clerk at the delivery counter, the Manchester (N. H.) Traction, Light & Power Company uses the home-made device shown in the accompanying illustration. It consists of a wooden box 7.5 in. long and 6 in. square, with a 4-in. projection at one side carrying a



LAMP-TESTING BOX

small indicating wattmeter. One end of the box is open while the other end is fitted with a contact cup into which the lamp is pressed for testing the continuity of its filament. The top of the box is fitted with a glass window composed of an ordinary exposed and developed blank photographic negative. This serves to screen the observer's eyes from the glare of the filament but nevertheless transmits enough light from the latter to show the filament distinctly illuminated. On the side of the box toward the wattmeter a plain glass window is used so that the customer can see the lamp at its full brilliancy while he notes the reading of the instrument. As the customer sees such a test only occasionally, there is no likelihood of eye strain on his part, but for the clerk the large number of lamps tested daily at the delivery counter makes the translucent upper window a valuable feature.

## Electric-Vehicle Development at Worcester, Mass.

An energetic electric-vehicle campaign is being conducted by the Worcester (Mass.) Electric Light Company, and within eighteen months the sale of forty-seven machines has been accomplished in the city, which was formerly known as one of the most conservative places of the East. The company has added an electric-vehicle sales engineer to its organization, has greatly enlarged its garaging facilities at the Faraday Street substation, and has eliminated nearly all of its horses, with an early prospect of performing all its transportation service by electric trucks. Every part of Worcester, which has numerous hills in its topographical make-up, is covered by the company's service, inspection and installation wagons, which also regularly "make" a 10 per cent grade 0.75 mile long outside the town of Leicester, a suburb now on the company's system.

Ten commercial electric vehicles are in the company's

own service, ranging in size from a 750-lb. wagon to a 3.5-ton truck, the latter being provided with a novelty in the shape of a gin-pole receptacle for use in erecting poles. Meter setting, motor and transformer deliveries and the handling of freight between the railroads and the company's storehouses are all cared for by electric vehicles. Among the recent large concerns adopting electric vehicles in Worcester are the Coes Wrench Company, the Barnard Sumner & Putnam Company, the Morgan Construction Company, the Bay State Coal Company and the Graton & Knight tannery. A recent newspaper advertisement of the Worcester company featured the possibilities of the electric vehicle in holiday-trade deliveries, and special efforts are being made to secure business along this line.

## Large Lighting Units Attract Crowds

Formerly in auction salesrooms on crowded city thoroughfares the auctioneer was obliged to use his voice to attract the attention of the passing throng. In Pittsburgh, however, the electric-service company's solicitors have altered this condition by inducing the proprietors of one down-town auction room to install high-wattage tungsten lighting units near the entrance and over the head of the crier, where the lamps will attract the attention of the public and lead persons to enter. When doubt concerning the feasibility of the scheme was expressed by the owner the solicitor had only to call the prospective customer to his door and point out the difference between the number of persons waiting for cars and loitering in front of the well-lighted shops and those before the stores which were dark. A few minutes' observation in this way furnished convincing evidence of the value of electric lighting in attracting and holding crowds.

## Electrical Equipment of a Modern Hotel

In the accompanying tabulation there is listed the electrical equipment of a modern hotel structure in the South, whose connected central-station load aggregates nearly 185 kw. The lighting installation comprises 2500 25-watt tungsten equivalents. Individual drive has been employed throughout, a total of 160 hp in motors being in use. Both electrical energy and steam-heating service are purchased from the central station, although the hotel management operates its own boilers for cooking and hot-water heating purposes. The annual energy consumption for lighting

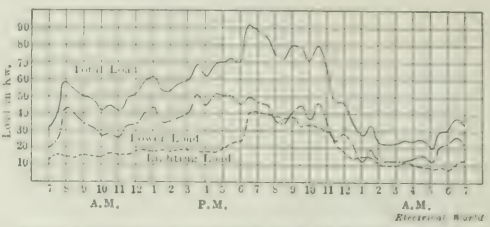
MOTOR EQUIPMENT IN MODERN HOTEL (20 MOTORS, 163.5 HP)

| Number | Size, hp | Speed | Machinery Driven |
|---|---|---|---|
| 1 | 6 | 898 | Belted to exhaust fan. |
| 1 | 0.25 | | Elevator signal system. |
| 3 | 30 | 425–850 | Direct-connected to three elevators. |
| 1 | 2 | 1200 | Direct-connected to air-washer. |
| 2 | 5 | 1800 | Direct-connected to house pumps. |
| 2 | 2.5 | 550 | Direct-connected to sump pumps. |
| 1 | 7.5 | 825 | Belted to vacuum pump. |
| 1 | 3 | 1050 | Direct-belted to ice crusher. |
| 2 | 1.5 | 700 | Silent chain, to ice machines. |
| 1 | 0.5 | 2400 | Direct-connected to circulating pump. |
| 1 | 5 | 216 | Belted to exhaust fan. |
| 1 | 0.5 | 1800 | Geared to potato peeler. |
| 1 | 0.5 | 1500 | Silver polisher. |
| 1 | 3 | 1050 | Belted to dish washer. |
| 1 | 0.25 | 1700 | Direct-connected to beer pump. |

amounts to 118,500 kw-hr., and that for motor service to 183,000 kw-hr., with load-factors respectively 21 and 17 per cent.

For furnishing steam for cooking and hot-water heating, there are installed two 40-hp internally fired Scotch marine boilers. These operate at approximately 40 lb. pressure, supplying steam for soup kettles, boilers, hot plates, chafing dishes, coffee and tea urns and other similar cooking devices, and to the heaters used for supplying hot water to the various parts of the hotel.

Exhaust steam from the cooking apparatus and boiler-feed pump supplies such distilled water as is necessary for ice making. It is therefore rarely necessary to furnish live steam for this purpose.




HOURLY LIGHTING AND MOTOR LOAD OF HOTEL FOR JULY

Individual-motor drive is employed throughout, all motors being of the 220-volt direct-current type, with the exception of the 110-volt, 0.25-hp motors which operate the elevator signals and the beer pump. The table herewith shows the size of motor employed for each purpose, and the accompanying curve-sheet reveals the hourly demand of the lighting and motor circuits.

## The Value of a Cooking Load

By R. B. Mateer

Many plausible reasons are cited in support of the apathetic attitude generally maintained toward electric cooking and the electric range. To quote a few of the statements heard: "Electric cooking occasions a high demand and our system will not stand it." "The public is not prepared for electric cooking." "Look at the cost of rebuilding our system to accommodate such service." And from the combination gas-electric plant manager, "Why boost electricity when we also sell gas?" Such a list might be continued indefinitely, although each expression shows either a lack of initiative on the part of the management of the utility or a woeful want of knowledge of the practical operation of the modern electric range.

With the view of stimulating interest in electric cooking the accompanying table is presented, giving consumption and cost data gained from a year's practical experience in a household using electricity for lighting and cooking purposes and gas for water heating. Electricity for lighting was sold at 7 cents per kw-hr. and for cooking purposes at 3 cents per kw-hr., while the price of gas was 90 cents per 1000 cu. ft.

The characteristic results presented in the table afford some idea of the value of such combination service as supplied to the average home. They suggest also the possibilities obtainable were the electric range more generally pushed—not as an auxiliary but as an all-year-round appliance. The twelvemonth period covered is sufficient to demonstrate the value of a cooking and heating load as compared with the consumption of the average residence consumer for illuminating service only.

It will be noted that while only 287 kw-hr. were required for lighting, 2441 kw-hr. were consumed for cooking purposes. This cooking consumption occurred, furthermore, at an annual load-factor twice that of a purely lighting load. Again, the annual gross receipts were only $20.95 for the customer's lighting service, while for his cooking even at the 3-cent net rate $73.23 was assured. The amount actually collected was, however, $92.87, since the absence of an authorized heating rate necessitated the use of the "power" schedule with its high minimum of $6 per month based on

the connected heating load. The connected load for lighting was 1000 watts. That for heating was 750 and that for cooking 4400, a total of 5150 watts, but the maximum demand never exceeded 2225 watts.

Day circuits suggested the development of industrial load. Aggressive sales engineering secured revenues far in excess of the early expectations of the office managers

COST OF ONE YEAR'S DOMESTIC ELECTRIC COOKING AND LIGHTING, WITH WATER HEATED BY GAS

| Lighting | | Cooking | | Water Heating | |
|---|---|---|---|---|---|
| Kw-hr. | Amount | Kw-hr. | Bill Rendered | Cu. Ft. | Amount |
| 9 | $0 63 | | | 1,100 | $0.99 |
| 37 | 2 59 | 149 | $6.40 | 4,800 | 4.32 |
| 37 | 2 59 | 289 | 8.67 | 6,200 | 5.58 |
| 45 | 3.15 | 390 | 11.70 | 10,400 | 9 34 |
| 35 | 2.45 | 114 | 12.42 | 6,300 | 5 67 |
| 27 | 1.89 | 331 | 9.93 | 5,000 | 4.50 |
| 26 | 1.75 | 325 | 9.75 | 6,400 | 5.76 |
| 33 | 1 47 | 195 | 7.00 | 4,000 | 3.60 |
| 48 | 1 25 | 88 | 7 00 | 4,100 | 3 69 |
| 15 | 1.05 | 118 | 7 00 | 3,500 | 3.15 |
| 15 | 1.12 | 86 | 7 00 | 3,600 | 3 24 |
| 11 | 1 00 | 58 | 6 00 | 2,100 | 1.89 |

of utilities. Judging the future by the past, will it be the insistent demands of aggressive citizens for service that is efficient and convenient, or will it be the awakening of public utilities to the investment already tied up in their residential circuits which, idle in daytime, may be made good revenue producers—that will bring about the wider development of cooking and heating service?

## Central-Station Unit-Cost Accounting

The attention given to accounting methods by the N. E. L. A. and other central-station organizations, followed by the advent of the public commission with its compulsory rules, has awakened many central-station managers to the possibilities presented by good bookkeeping systems for the detection of "leaks" which drain the company's treasury. Many of the systems in use have merit and are producing good results. Among these the unit-cost system which has been instituted at the Muncie (Ind.) property of the American Gas & Electric Company gives promise of showing the relative operating characteristics of the plant equipment in a manner that will leave little doubt as to the value of each piece of apparatus as compared with its neighbor.

In the illustrations presented herewith each blank used in connection with this system is reproduced. Fig. 1 shows the daily time slip made out by each workman. At the end of each day one of these slips is filled out, the man stating in the blank space left for the purpose on which station unit

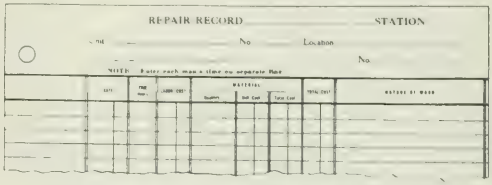



FIG. 2—STATION REPAIR RECORD

or auxiliary he has been employed. The workman also fills in the time for each job and indicates the nature of his work. Any material used on the job is also included in his report. All time slips are then O. K.'d by the plant clerk, who has instructions to see that all blanks are properly filled.

At Muncie it has been found advantageous to keep the costs for the engine and generator as one unit, for it is sometimes hard for the men to tell whether their work has been done on the steam or the electrical end of the machine. To facilitate further the work of the men who make out the slips, each unit in the station has been stenciled with the number which corresponds to the one placed opposite its name in the monthly record (Figs. 4 and 6). The cooperation of the workmen has been sought in order that the column of the blank in Fig. 1 which is headed "Kind of Work Done" shall not be meaningless, and after they have had a few instructions from the plant clerk, who signs the completed blanks, little trouble is experienced in securing reliable information as to the nature of the work performed on any particular machine.

The so-called "daily oil record" shown in Fig. 3 is in

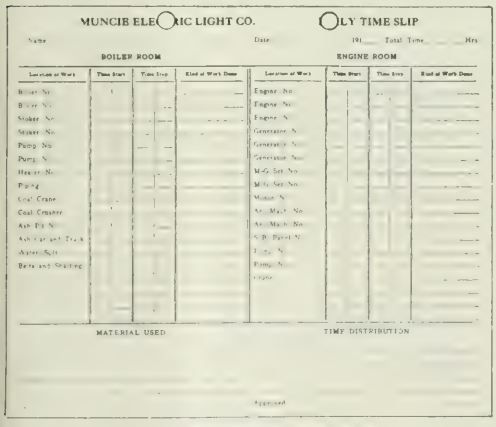



FIG. 1—WORKMAN'S TIME SLIP




FIG. 3—RECORD FOR OIL USED PER UNIT

reality a semi-monthly record. The blank form is tacked upon a board near the unit to which it applies, and as the oil is used for the machine a record of each measure is marked on the slip. These blanks are collected at the end of each fortnight and used in connection with the portion of the daily time slip marked "material used" to make up the record of the machines.

Since the time slips are generally soiled and not in condition to be kept as records, the data they contain are transferred each day to the station-repair and station-operating records, the headings of which are reproduced in Figs. 2 and 5. Upon these forms the first step in the cost analysis is taken. The item of time and labor spent in plant operation is separated from that taken by repairs, and entered in the columns provided for that purpose. An operating and a repair sheet are kept for each unit in the plant. The time in operation and the time banked are noted on the sheet for each boiler.

At the end of the month a complete and compact record of the time spent in operation, material used for repairs, and time consumed in making repairs is afforded by these two sheets. These data are then once more transferred to sheets known as unit-cost records, shown in Figs. 4 and 6. Upon the boiler-room unit-cost record two lines are provided for each boiler and auxiliary in the station. On

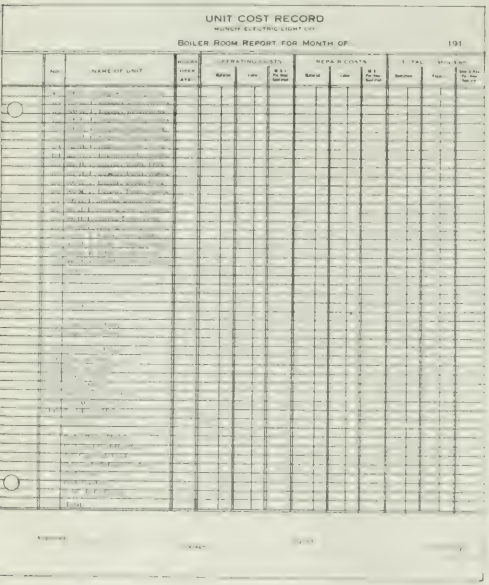



FIG. 4—UNIT COST RECORD FOR BOILER ROOM

the first line are entered the time in hours which the boiler was in actual operation, together with the operating costs of material and labor and the repair costs for material and labor. A like entry is made in the second line for the time during which the boiler was banked. With this information on the blanks a simple division reduces all of the data to a common basis, that of material and labor cost per hour operated, from which any unit can be compared with any other on points of repair costs and operating costs.

Similar treatment of all the engine-room equipment brings out the cost of operating and repairing the individual units in that part of the station with a vividness which will certainly be conducive to good judgment in the future purchase of machines. On this record the various makes of machines stand out against each other on a common basis which reveals their faults and tells of their shortcomings. Not only does the record show the faults but it constructively points the way to the avoidance of similar future troubles. Monthly reports are totaled and preserved, forming a yearly record for the station units.

The maintenance of these records requires the time of one man for about one and a half hours each day throughout the month, excepting the time required for totaling. The collection and calculation require longer, and the time allowed for this work varies with the amount of repairs that has been made in the month. A separate set of books kept by the accounting department of the company carries the interest and depreciation charges on the equipment so

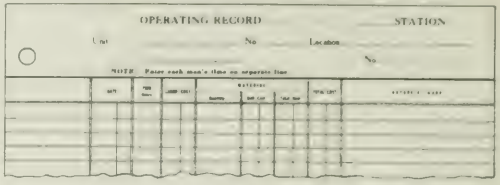



FIG. 5—STATION OPERATING RECORD

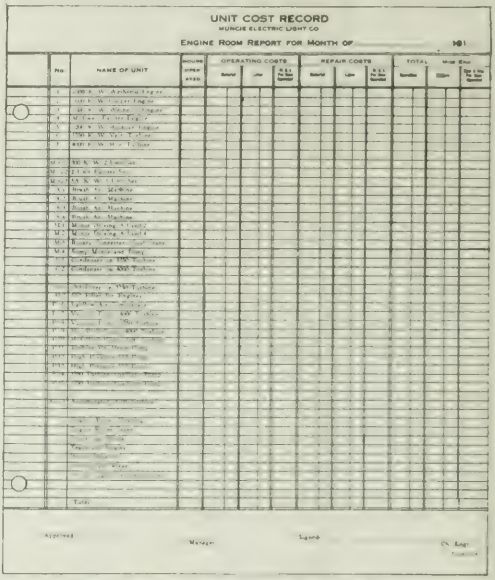



FIG. 6—ENGINE-ROOM UNIT COST RECORD

that they are not included in these reports. As yet no attempt has been made to apply this scheme to the outdoor work of the company, although the system seems to be admirably adapted to that service.

## Electric Ranges in Winnipeg

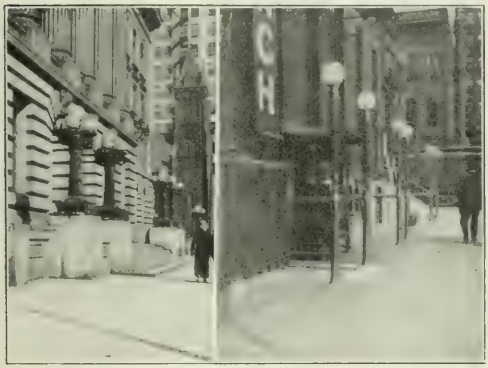
Owing to a typographical error, the number of electric ranges now in use in the city of Winnipeg, Man., was stated to be "more than 100" in a news item on "Electric Cooking Facts" printed in the *Electrical World* of Dec. 6 relating to an address by Mr. G. A. Hughes, of the Hughes Electric Heating Company. As a matter of fact there are approximately 1000 Hughes electric ranges installed in the city of Winnipeg.

# Illumination and Wiring

## Signs of Readiness for "White Way Lighting"

In a community of 100,000 inhabitants without an adequate uniform system of street lighting the individual ideas of the more progressive mechants and business men usually manifest themselves in privately owned installations of curb and building exterior illumination. The accompanying illustrations show how in one city of the class mentioned the lack of an efficient street-lighting system has led to the installation of widely varying types of fixtures ranging from very elaborate to extremely inexpensive patterns. The five-lamp ornamental standards shown in Fig. 1 are used about a public building. Fig. 2 shows a case in which the lamps are mounted on extensions of the brass handrail of a basement entrance. Each 10-in. globe contains a 60-watt lamp. Throughout the entire business section and even in front of churches and beautiful residences are to be found privately owned curb-lighting systems including every type of illuminant from single-lamp ornamental standards to elaborate arc-lamp posts.

With an active central-station company standing ready to furnish electrical energy for the lighting, with the entire



FIGS. 1 AND 2—LIGHTED FRONT OF PUBLIC BUILDING, AND INEXPENSIVE LIGHTING UNITS AT CITY SQUARE

population of the city seemingly favoring the movement, and with much smaller towns in the immediate vicinity successfully maintaining well-lighted streets, it looks as though here the time was ripe for the installation of some sort of modern street lighting. In places like the one described the City Council would do well to lend a more attentive ear to the advice offered by its friend the electric service company.

## Toledo's Electric Slogan Signs

The Toledo (Ohio) Railways & Light Company has presented to the city of Toledo one of the largest and most elaborate municipal slogan signs ever constructed or erected. The display, which was built by the Valentine Electric Sign Company, Atlantic City, N. J., measures 58 ft. high and 78 ft. long.

The first picture to appear shows an engine, tender and train of cars. Presently the train is seen to start, smoke comes from the stack in short puffs, and sparks shoot from under the wheels as they revolve. As the cars gain speed the track recedes and the smoke stretches out over the entire length of the train. Meanwhile the moving parts of the engine are working true to life, and the whole picture gives an accurate representation of a train going at full speed. The train picture then disappears and a huge freight steamer, like those used on the Great Lakes, is seen plowing through the water, throwing up spray at its bow, as shown in Fig. 1. Its flags are waving, smoke comes from its huge stack, and waves strike against its sides. The idea in showing the boat and train, it is explained, was to emphasize Toledo's importance as a center

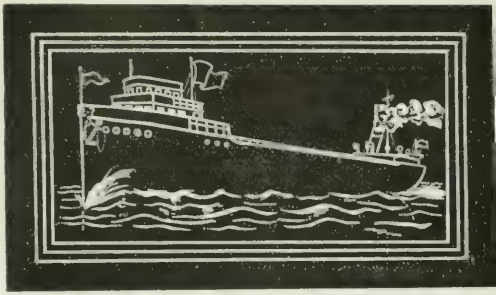


FIG. 1—LAKE STEAMER DEPICTED ON TOLEDO'S NEW SLOGAN SIGN

of transportation by both land and water, for the city's position at the head of Lake Erie and at the point of debouchure of the Maumee River with its system of cross-state canals has given Toledo a location of great strategic value in the country's inland commerce.

Finally, as the boat fades away the city's slogan, "You Will Do Better in Toledo," is flashed on in 18-ft. letters, while around the legend, revolving in different directions, appears a border of varicolored light. Three rows of lamps make up the letters—two rows being white and one red, so that the resultant is a pink color.

More than 7000 10-watt tungsten lamps were utilized to light this big sign, which complete weighs about 24 tons. It was erected on the roof of the Valentine Building, in which the Toledo city offices are located. The first exhibition of the sign was made a civic event. The Toledo Railways & Light Company will maintain the sign, the city providing only the locaton.

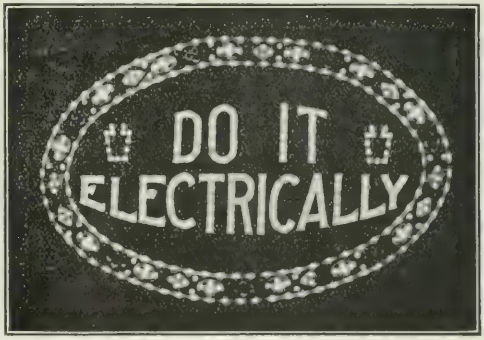
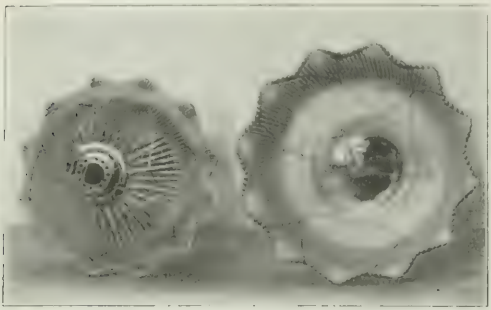



FIG. 2—SIGN ERECTED BY ELECTRICAL DEVELOPMENT SOCIETY

Another striking and artistic electric slogan display already in operation in Toledo is the "Do It Electrically" sign (Fig. 2), which the Society for Electrical Development recently erected in a prominent roof-top position. There are over 500 tungsten lamps in this sign, and the words of the motto are surrounded with a Persian jewel border in eight colors.

## Protection from Falling Lamps and Reflectors

The use of wire netting to prevent injury from falling lamp shades and reflectors is not a new idea, but such protection is being carried out and expanded in the Westinghouse factories at East Pittsburgh, Pa., in an interesting and instructive manner. The accompanying illustrations



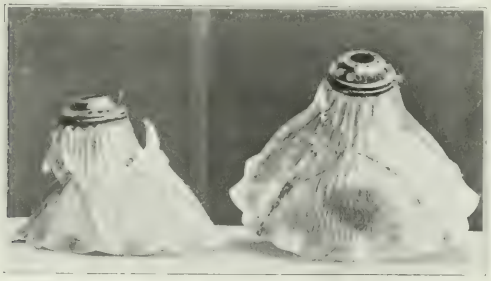
FIGS. 1 AND 2—METHOD OF FASTENING PROTECTIVE NETTING, SHOWING COILED WIRE CRADLE FOR LAMP TIP

show the application of the idea to glass reflectors for incandescent electric lamps.

As the glass shades come from the reflector manufacturer they are taken to the lamp and reflector supply room and there fitted with protective wire screens. Two girls are regularly employed to put the 2-in.-mesh netting over the shades and wire it to the brass cap at the top of the reflector. The netting fits the shades snugly both inside and out and is scarcely noticeable at a distance.

High-wattage lamps such as are used in these 12-in. and 16-in. reflectors also present a hazard by sometimes falling from their sockets when the plaster compound holding the glass bulb to the brass socket softens, transferring all mechanical strain to the leading-in wires. To anticipate accidents from this source a small double-coil spring like that shown in Fig. 2 is hooked to the netting and forms a cradle for the tip of the lamp bulb.

Figs. 3 and 4 show two reflectors which were broken into several pieces and yet were held aloft by the wire mesh. One of these reflectors, that shown in Fig. 3, hung just above a steam boiler which exploded, shattering the shade as seen, although the netting prevented in-



FIGS. 3 AND 4—WIRE NETTING HOLDING THE BROKEN SHADES IN PLACE

juries from flying glass. The reflector in Fig. 4 was found broken by an inspector while making lamp renewals. It is estimated that the large piece of glass at the front weighs about 2 lb. Such a weight falling from the height of the usual ceiling might have inflicted an ugly wound.

## Effective Method of Emphasizing Window Lettering

To increase the effectiveness of the sign painted on the window of a Boston office, providing a transparency effect when viewed from the street, two adjustable lamps are arranged nightly as shown in the illustration. The window, 4 ft. 6 in. square, carries an advertisement and trade-mark which are easily seen during the day, although at a height one story above the street. After dark when the office is lighted this lettering becomes somewhat obscured unless a contrast is provided behind it. The problem was solved, however, by pulling down a white roller curtain and turning on two 60-watt lamps in the reflectors shown. These reflectors are mounted on the ends of ¾-in. tubing, forming in each case an adjustable arm 32 in. long. The use of a combined ball-and-socket and pin joint at the arm support provides maximum flexibility. When the lamps are thrown into service the transparency effect from the street below is almost as sharp as if the window lettering were



USE OF PORTABLE LAMPS TO LIGHT WINDOW SIGN

projected on the screen in a darkened auditorium, and the contrast of this window with others in the same block is so striking as to compel attention from the street level and make the words it bears as legible as in the daytime.

## Recent Telephone Patents

### Telephone Lock

When a telephone is left in an exposed condition, especially when on the message rate system, it sometimes becomes advisable to lock it against use by non-authorized persons. A lock for this purpose is the subject of a patent granted jointly to Messrs C. D. Rhinhardt and L. P. Saponoff, of New York City. The lock consists of a hinged hasp arranged to fit the upright of the usual desk stand and provided with dependent lugs, which will embrace the hook-switch lever in a manner to hold it depressed. The hasp carries a lock with key.

### Subscribers' Station Apparatus

In an endeavor to increase the efficiency of transmitters, Mr. G. A. Nussbaum, of London, England, has invented a transmitter in which the rear face of the diaphragm carries one of the electrodes. The microphone button is held near this electrode, the wall of the latter being formed by means of a tubular ring of resilient material. This effects a close but flexible contact.

An antiseptic device that is patented by Mr. K. Tichy, of Chicago, utilizes a protective sheet of paper. It consists of a sheet metal holder adapted to the clamp beneath the shoulder of the ordinary mouthpiece. A roll of paper is carried at one end of the holder with a winding spool at the

other. Fresh paper is drawn across the mouthpiece as desired.

A railway dispatch selective system has been patented by Mr. A. C. Reid, of Genoa, Ill., in which signaling of the desired line is accomplished by prolonging the current impulse at one particular angular displacement of the apparatus. This prolonged impulse is obtained by attaching a long tooth on the selector wheel which prevents breaking of the circuit for this particular station at the desired angle. This patent is assigned to the Hall Switching & Signal Company.

In the illustration is shown an automatic switch, patented by Mr. G. E. Mueller, of La Grange, Ill. The contact banks are arranged inside of a surface curved as indicated by the dotted lines. It will be seen that through the combined use of a vertical and horizontal axis the contact wipers may be swung to any desired contacts. The motion of the wipers

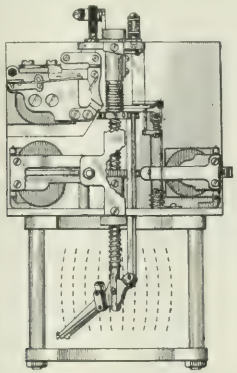


FIG. 9—GENERAL VIEW OF GENERATING STATION

about the horizontal axis is effected through a sliding sleeve mounted upon the vertical shaft. This patent has been assigned to the Kellogg Switchboard & Supply Company.

# Letters to the Editors

## Combined Synchronous and Induction Motor Loads

*To the Editors of the Electrical World:*

SIRS:—Referring to the editorial comment in the *Electrical World* of Nov. 22 on Mr. H. L. Wallau's article entitled "Combined Synchronous and Induction Motor Loads," permit me to suggest that the "express-company-delivery" example used will cause many of your readers to question their present understanding of the subject.

It is well known that there is required less prime-mover energy to carry a given kva load at low power-factor than at high power-factor; but in the example chosen, as much energy in the shape of oats, wages, maintenance, etc., would be necessary with fifty of the wagons delivering packages to the villages and the other fifty transferring in the town as when the entire 100 wagons were delivering in the villages. In other words, seemingly the same energy would be required for a 100-kva load at 50 per cent power-factor as at 100 per cent power-factor. The facts are, as well known, that with a given kva electrical load the energy costs will fall off as the power-factor decreases, although not directly in proportion.

*Cincinnati, Ohio.* W. S. CULVER.

[It is impossible to find any mechanical or economic simile for electrical phenomena that will accurately represent all of the factors involved. We fully agree with Mr. Culver that our simile for an express system does not correctly indicate the magnitude of the disadvantages incident to operating an electrical system at low power-factor. However, it serves the desired purpose of showing that the term "wattless power" is not only inaccurate but actually misleading.—EDS.]

## Apportionment of Off-Peak Load Costs

*To the Editors of the Electrical World:*

SIRS:—It seems that the problem of just and equitable rates for electrical energy is about as far from a satisfactory solution as ever. This fact is disclosed by the letter in your issue of Nov. 22 in which Mr. S. M. Kennedy states that "the most unprofitable class of service is that supplied to the small consumers at the maximum rates." This argument has been stated and re-stated many times. The main reason for this contention undoubtedly lies in the common assumption that nearly all costs should be charged to the peak-load customers; that is, mainly to the users of electrical energy for lighting. The further ground for this contention is the assumption that the off-peak loads belong to the company, or, as stated by Mr. Ralph D. Mershon in his discussion of a paper on "Hydroelectric Plants" by Mr. H. L. Doherty, "it is fair that the supplying company should have the full advantage of non-coincidence of peaks, that it should not share this advantage with the consumer."

If that assumption be tenable, then the first statement by Mr. Kennedy may in some cases be conceded. The just and equitable distribution of costs between different classes of consumers is the crux of the whole matter. If the user of electrical energy for lighting pays all the costs, evidently the income from motor service is all profit. When, however, the costs are apportioned even approximately as they should be, then the whole matter assumes a different aspect, as disclosed by the following, taken from the records in the case of the Madison Gas & Electric Company (7 Wisconsin R. R. Com., R. 162): "If revenues and costs of production, as computed in Table VII, are compared, the greatest discrepancy is noted in *incandescent lighting*. Total costs here aggregate $130,783.90 as against revenue of $169,657.64, . . . and in *power business*, both railway and commercial, a cost of $49,199.73 as against a revenue of $49,283.25." The italics are mine. This shows a net profit of $38,873.74 on incandescent lighting and $83.50 on energy sold for motor service. The profit from incandescent lighting is approximately 30 per cent of the costs, while the profit derived from motor service is less than 0.2 per cent. Undoubtedly this is not an unusual case. The fact that the daily peak of the street-railway company coincides with the lighting peak in the winter seems to indicate that if costs were equitably apportioned it would be shown that the net profit of $83.52 would be changed to a net loss.

The fallacy in the usual method of apportioning costs is found in the assumption that the off-peak load belongs to the public utility company. Underlying this there is another assumption, namely, that the *public service* company is a *private* concern. Sooner or later it will be recognized that, as stated by Mr. Max Thelen, a member of the California Railroad Commission, "the fundamental relationship existing between the public and its public utilities is that of principal and agent. Out of this relationship logically should grow the proper basis for determining the rates which a public utility is entitled to charge." Under this principle the off-peak load, or the advantage due to a non-coincidence of peaks, does not belong wholly to the public utility.

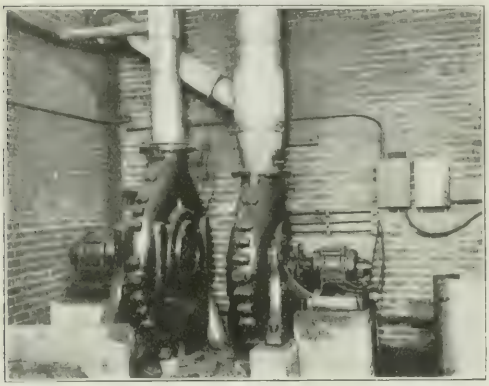
*Madison, Wis.* C. M. JANSKY.

# Field of the Operating Engineer

**A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers**

## Motor-Driven Compressor for Special Cupola Furnace

To separate brass and copper from slag skimmed from ladles the Michigan Smelting & Refining Company, Detroit,

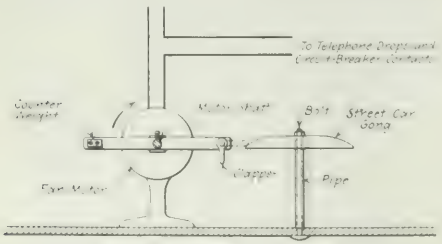


MOTOR-DRIVEN COMPRESSORS IN SMELTING AND REFINING WORKS

Mich., is using a special cupola furnace, air for which is furnished by a motor-driven centrifugal compressor. A pressure of 1.5 lb. is required to prevent the slag from packing when molten, and as only 0.75 lb. pressure is needed in the reverberatory and crucible furnaces two separate compressors are installed to furnish the respective pressures. The two sets are shown in the accompanying illustration. The high-pressure unit is rated at 3300 cu. ft. per minute, while the low-pressure compressor is designed to deliver 2100 cu. ft. per minute.

## Motor-Driven Alarm Bell

The accompanying sketch shows a simple motor-driven power-house alarm gong which is connected with not only




POWER-STATION ALARM GONG

the telephone but also with all of the important feeder circuits of the Paducah Light & Power Company, Paducah, Ky. The accompanying sketch is quite self-explanatory. Fixed to the fan-motor shaft is a balanced cross-bar, one end of which is fitted with a loose-swinging clapper. When the motor and arm are in rapid rotation, the clapper swings out under centrifugal force and strikes the street-car gong in the dotted position shown. Before securing the motor base to the stand, Mr. Joseph Jacobs, of the Paducah Light & Power Company, suggests that the motor be first started and brought closer and closer to the gong until an adjustment is reached where the greatest possible volume of sound is produced. The gong in the Paducah station can be heard three blocks away. The gong motor is energized through back contacts on the drops for the telephone and through the relays for the circuit-breakers

## A Single-Phase Two-Phase Confusion

The accompanying diagram indicates conventionally a system of incidental connections that caused operators and inspectors a lot of trouble before the source of irregularity was found. The two-phase induction motor was located some distance away from the two-phase alternator which was installed in a power station that included a complicated system of switches for reinforcing either single-phase or two-phase feeders, leading to motor and lamp mains of outlying buildings. No attempt has been made to reproduce the actual connections that caused the trouble, because no one knows what they were. The connections of switch *A* do, however, indicate the net results of the unusual combination that obtained occasionally to keep everybody guessing. Here it may be seen that when switch *A* is up the motor gets two-phase currents from the alternator. When the switch is down, however, both of the motor coils are subjected to currents from the same phase of the alternator. The result of this condition, which was in evidence only occasionally, was that sometimes the motor would start and sometimes it would not, and on several occasions when the inspector was summoned by the time he had got there the motor was all right again, because manipulations of the switches in the power station had restored the two-phase conditions necessary for starting. As numerous tests had proved the motor itself to be perfectly regular in the matters of resistance, impedance, speed and torque, and as the inspector had about exhausted the field of investigation of conditions likely to prevail, he started in to investigate some of the conditions not likely to prevail. Thus it happened that he tested the phase re-

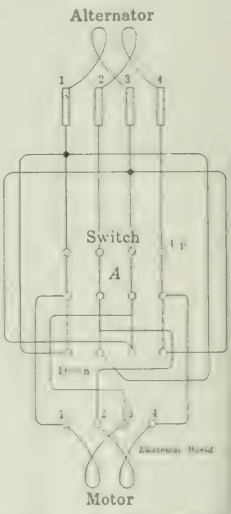



DIAGRAM OF CONNECTIONS CAUSING SINGLE-PHASE TWO-PHASE CONFUSION

lations of the currents supplied to the motor at one of the times that it refused to do anything but hum and blow fuses. This test revealed that at such times as the motor failed to start the two currents supplied to it were from the same phase of the two-phase alternator. An independent line run to the motor from the station busbars fixed things, and they have stayed fixed.

## Pay-Envelope Safety Suggestions

For inculcating safety ideas the pay envelope offers a medium not easily overlooked by the recipient. Repeated suggestions to "be careful" insisted on from week to week in different words cannot fail in their mission of education. Realizing this, the United Gas Improvement Company, of Philadelphia, Pa., in line with its other endeavors toward accident prevention, prints rubber-stamp safety suggestions on its pay envelopes, thus emphasizing the safety idea at a most opportune time. Among the admonitions given in this way are "Safety always," "Every effort toward safety helps." "Are you guarding the danger points?" "Carelessness is dangerous," "Safety preserves life and happiness," and "Safety first, last and all the time."

## Rotor Resistance and Torque

The maximum torque of an induction motor is independent of the resistance of its rotor, but by changing the resistance of the rotor the maximum torque can be obtained with any desired percentage of synchronous speed. On rotors of the squirrel-cage type the resistance is governed by the dimensions and material of the rotor bars, and these properties cannot be varied during operation. On rotors of the internal rotating resistance type and of the slip-ring type the effective resistance of the rotor is variable by means of the variable resistor in series with it. On this type of motor the maximum torque can be disposed best to suit existing conditions. Some motors are on duty that require great torque for starting a heavy connected load, but once the load is started not so much torque may be required. Other motors need but little torque at starting because they are started comparatively free and the load worked on after they are up to speed. In the first case a rotor of high resistance would be required; in the second case a rotor of comparatively low resistance; in both cases, assuming the same machine to be involved, the total maximum torque obtainable would be the same.

To illustrate the practical application of these facts: (1) In one case in mind a little three-phase squirrel-cage induction motor operating from a single-phase line was started by means of a resistor-inductor, phase-splitting starting box. When the motor was cold it could not start its load, a shoe-buffing machine, except when assisted by pulling on the belt. After several starts at close intervals or after half an hour of normal operation the motor would start its load promptly and without assistance, because heating of the rotor would increase its resistance, thereby transferring the rotor's maximum torque back toward the point of zero speed. (2) In another case exception was taken to the slow speed of a slip-ring induction motor that operated a traction conveyor used to haul hot car wheels from the molding floors to the pit in a wheel foundry. Inspection showed the motor and the external resistor and controller for operating to be regular in every respect. The line voltage was above normal, the track on which the conveyor trucks traveled was clean, and the trucks were well lubricated and free from interferences. All gears and bearings on the pulling machine were in good shape, and with the traction cable removed the speed of the motor was practically synchronous. By a process of elimination the more common sources of irregularity were dismissed and the cause of slow speed proved to be the long distance between the motor and the controller and rheostat to which it was connected. The leads used to short-circuit the rheostat on the last controller position were so long that what should have been a short-circuit had sufficient resistance to impair the running torque and appreciably affect the maximum speed. On moving the rheostat and controller about 250 ft. nearer to the motor the desired maximum speed was obtained. Had this been impracticable it would have been necessary greatly to increase the cross-section of the wires that connected the motor, controller and rheostat together.

## Storage of Oil Fuel

BY R. T. STROHM

The method of storing the supply of oil for an oil-burning boiler plant is a matter to which careful consideration should be given. The objects that should be kept in mind while planning the storage system are safety and capacity.

For the average boiler plant of small or medium size the oil supply is usually stored in cylindrical steel tanks like that shown in Fig. 1. The tank is built up of steel plates, has dished ends and is usually buried in the ground at such a level that its top is below the level of the tips of the burners. The object of this arrangement is to prevent flooding of the furnaces or of the boiler room with oil in case a burner valve is accidentally left open; for with the tanks below the level of the burners the oil will flow back by

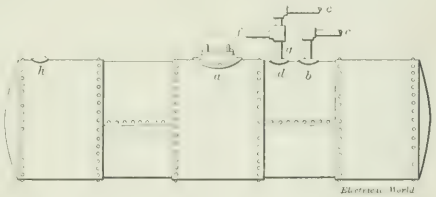



FIG. 1—OIL-STORAGE TANK WITH CONNECTIONS

gravity if a valve is left open at the burners. As the tank is usually covered with earth, it should have a good coat of tar or some protective paint to enable it to resist the effects of dampness.

The common sizes of oil tanks for boiler installations are 8 ft. in diameter by 28 ft. long and 9 ft. in diameter by 33 ft. long. The former has a capacity of about 10,500 U. S. gallons and the latter a capacity of approximately 15,500 U. S. gallons. In either case, a good quality of steel plate 5/16 in. thick should be used, and the heads should be made of 3/8-in. plate.

There should be no openings in the bottom, sides or ends of the storage tank. Such openings as are required should be at the top. The largest opening required is that for the manhole, as at *a*, Fig. 1, and this should be fitted with a screw-down cover. There must be a flange *b* for connecting the suction pipe *c* that leads to the pump, and another *d* for the overflow pipe *e*, leading back from the standpipe or from the pressure pumps. The filling pipe *f*, by which the oil is run into the tank from the tank car, may be attached by a T to the overflow pipe and both connected with the tank through the nipple *g* and the flange *d*. Again, there must be a flange *h* to which a ventilating pipe can be connected. If the oil around the end of the suction pipe must be heated, so that it will flow readily to the pumps, then it will be necessary to add two more flanges for the pipes that convey the live steam and carry off the condensation.

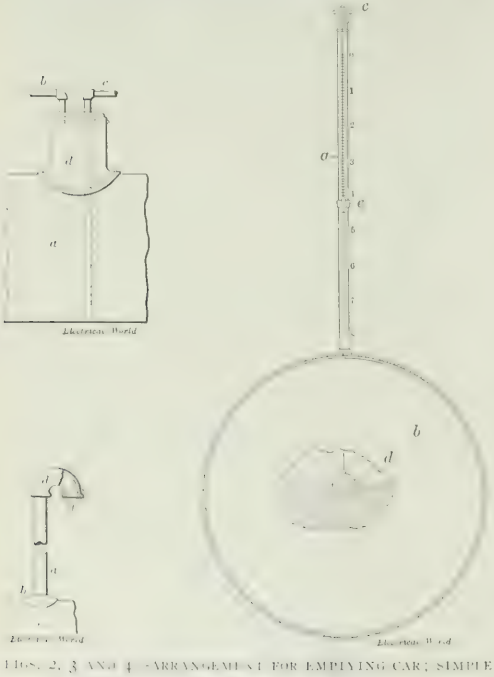
The work of designing and constructing the tank should

be put in the hands of a manufacturer familiar with the requirements of steam-boiler construction, because the tank must be absolutely oil-tight. All petroleum oils are very penetrative in their character, and if there is any suspicion of looseness at the seams or around the rivets, the oil will find its way through. For this reason the rivet holes should be drilled, or else punched and reamed, and the seams should be thoroughly calked.

The capacity of the tank or tanks installed depends on the size of the plant and the frequency with which shipments of fuel may be delivered. If the plant lies fairly close to the oil fields, so that there is little delay in obtaining fresh shipments, it is unnecessary to carry a large supply in storage, and the tank or tanks may be made of such size as to hold oil enough to run the plant for a week. A tank 9 ft. in diameter and 33 ft. in length will contain one week's supply of oil for a plant of 500 boiler-hp operating ten hours a day at an average efficiency of 75 per cent.

If the plant is so located that shipments of oil may be delayed and cannot be relied on to arrive with regularity, it may be necessary to provide storage capacity for a month or more of continuous working, so as to make reasonable provision against the possibility of a complete shut-down.

The location of the storage tanks must be carefully considered, in order to conform to the requirements of the underwriters. For example, if the tank is placed above the ground level, it must be situated at least 200 ft. from inflammable property, so as to minimize the danger to that property in case the oil should catch fire. In the case of a plant located in a town or a city, this requirement would



FIGS. 2, 3 AND 4.—ARRANGEMENT FOR EMPTYING CAR; SIMPLE FORM OF VENT PIPE; VENT PIPE AND TELLTALE

be hard to meet, owing either to the difficulty of finding available storage space or to the high cost of such space. On this account, storage tanks are usually placed underground. The requirements for an underground tank are that it must be at least 30 ft. from the nearest building and that it must be at least 2 ft. below the surface of the ground. In either form of installation the top of the tank must be below the level of the lowest pipe in the oil system, so that the plant cannot be flooded with oil.

For ease in filling, the storage tank should be near the railway siding on which the tank cars are run, and at a lower level, so that the oil may be run from the tank cars into the storage tank by gravity. This is the least expensive method of making the transfer. If the tank is not at a low

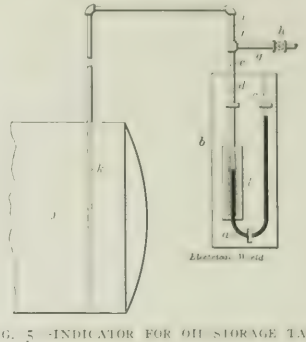


FIG. 5.—INDICATOR FOR OIL STORAGE TANK

enough level to allow this method of filling to be used, the oil may be pumped out of the tank car into the tank, the suction pipe extending into the tank car and the discharge pipe being connected to the filling pipe of the storage tank.

Air pressure has been used as a substitute for pumping in some instances. The method by which it is employed is shown in Fig. 2, in which *a* represents the central part of the tank car. Two pipes *b* and *c* are connected to the dome *d*. The former is short and extends only a little distance into the dome. The other is long enough to reach to the bottom of the tank car and is connected to the filling pipe of the storage tank. All other outlets from the tank car are kept closed, and compressed air is admitted through the pipe *b*. The pressure of the air on the surface of the oil forces the oil up the pipe *c* and over into the storage tank.

It is stated that tank cars are tested under a pressure of 40 lb. per sq. in., but it is wise to use a compressed-air pressure of not more than 10 lb. per sq. in. A pressure of 10 lb. per sq. in. will balance an oil column approximately 24 ft. high, and it is doubtful whether the storage tank will ever exceed this height above the bottom of the tank car. The use of air pressure in this way is strongly condemned by some of the tank-car lines, and placards are attached to their cars warning users not to employ this method of emptying the cars.

Of course, compressed air is not available in a great many plants, as most of them use steam to atomize the oil. Steam pressure would force the oil out of the tank car just as well as air pressure, but the steam would condense and the water would settle to the bottom of the car and be forced out with the oil into the storage tank. As a result, steam is not used in this way.

While the storage tank is being filled with oil, the air originally contained in it is being displaced and driven out. To afford a means of escape for this air, a vent pipe is attached to one of the flanges at the top of the tank. This pipe serves another purpose, also, in that it allows the escape of gases rising from the oil. At the ordinary temperatures at which the oil is kept in the storage tanks, there is a certain amount of evaporation, the lighter and more volatile constituents changing to the gaseous form. The vent pipe, open to the outer air, affords easy escape for these gases and prevents the rise of pressure that would result if there were no outlet.

One of the simplest forms of vent pipe is shown in Fig. 3. It consists of a straight piece of pipe *a* about 3 ft. long, screwed into the flange *b* on top of the tank *c*. On its

upper end a return bend *d* is screwed, and over the opening *e*, which faces downward, a piece of wire gauze *f* is firmly bound. The downward curve of the return bend prevents any sparks from dropping into the vent pipe and igniting the gases arising from the oil, and the gauze prevents the flame from traveling back into the tank even if the gases are ignited at the opening *e*, outside the gauze.

Another form of vent pipe is shown in Fig. 4. It is a straight pipe *a*, somewhat longer than the diameter of the storage tank *b*, and is screwed into a flange at the top of the tank. At the top of the pipe is a cap *c* that has a number of openings in its under side. These openings allow the escape of air or gases from the tank and are covered with wire gauze to prevent a flare-back.

This particular form of vent pipe serves also as a telltale, that is, as an indicator to show the amount of oil in the tank at any specified time. Inside the cap *c* is a small pulley over which a wire passes. To one end of the wire is attached a float *d*, which falls or rises as the level of the oil in the tank changes. To the other end of the wire is attached a pointer *e*, and as the float falls or rises the pointer rises or falls an equal distance. On the vent pipe, just behind the pointer, a scale is marked, divided into feet and inches, the total length of the scale being equal to the inside diameter of the tank. The position of the pointer then indicates the depth of oil in the tank, in feet and inches. A table may easily be compiled showing the amount of oil in the tank at each inch of depth. Then, when the depth of oil is noted on the telltale, the amount of oil corresponding to that depth can quickly be found.

If compressed air is used as the atomizing agent in the plant, or is otherwise available, the form of indicator illustrated in Fig. 5 may be used. A glass tube *a* of U-shape is fastened to a board *b* that in turn is fastened to the wall or to some other convenient support. The tube is partly filled with mercury and the leg *c* is left open to the air. The other leg *d* is connected by a rubber tube to a pipe *e* that is screwed into the T-fitting *f*. Two other pipes are connected to the T. That at *g* leads to the compressed-air system and is fitted with a valve *h*. The other pipe *i* leads to the bottom of the oil-storage tank *j*. All of this piping may be of ⅛-in. wrought-iron pipe.

The action of the indicator is simple. The valve *h* is opened very slightly, so that air leaks past it into the leg *d* of the U-tube and into the pipe *i*. As the air continues to flow into the pipe *i*, the pressure therein grows greater, and this pressure acts on the mercury and on the oil with equal intensity. The result is that the oil in the pipe *k* is forced down until finally it is all driven out at the lower end, and air escapes into the tank. At the same time the increasing pressure of the air forces the mercury down in the leg *d* of the tube and up in the leg *c*. Behind the leg *d* is a graduated scale *l*, and the position of the top of the mercury column in the leg *d* is read on the scale.

The deeper the oil in the storage tank, the greater is the pressure required to force the oil down out of the pipe *k*, and consequently the lower will the mercury be forced in the leg *d*. Every reading of the mercury level on the scale *l* therefore corresponds to a certain depth of oil in the storage tank, and hence to a certain definite quantity of oil. A table is compiled showing the amount of oil in the tank corresponding to each division on the scale. By comparing the reading at any time with the table the corresponding quantity of oil can be found. The accuracy of this device is based on the assumption that practically the same grade of oil is used continuously. If the oil varies in specific gravity from time to time, the scale will not correctly indicate the amount of oil in the tank.

With proper care there is little danger that the oil in the storage tank will catch fire; however, in some installations a steam pipe is connected to the top of the storage tank, so that live steam may be run direct from the boiler into the tank to smother any fire that may start.

## Operating Results with an American Locomobile

Tests of an American-built 175-hp locomobile unit which produced a kilowatt-hour on 16.35 lb. of steam and 1.94 lb. of coal were described by Mr. George S. Cooper before the recent meeting of the Ohio Society of Mechanical, Electric and Steam Engineers.

The set used in these tests was a "Buckeye-mobile" built by the Buckeye Engine Company of Salem, Ohio, as described in these columns Aug. 16 and Oct. 4. Since last January it has been employed to drive a 125-kw direct-current generator, and it is in daily operation, handling a shop load consisting of cranes, machine-tool motors and lamps. The load on the machine varies from 60 kw to 160 kw. Daily records of coal consumption and electrical output show an average economy, with this varying load, of 2.4 lb. of coal fired for each kilowatt-hour at the switchboard. The fuel used is Ohio bituminous coal containing 40 per cent volatile matter and about 14,000 lb.-Fahr. heat units per lb. Better results are obtained with lower volatile coal.

Carefully conducted tests have been run from time to time to determine the efficiency of the set with various grades of coal and with modifications of the furnace and grates. The accompanying figures, Table I, give the

TABLE I—RESULTS OF TESTS ON 175-HP BUCKEYE-MOBILE SET

| | A | B | C |
|---|---|---|---|
| Load, per cent | 95 | 114 | 136 |
| Indicated horse-power | 166 | 199 | 237 |
| Kilowatts | 99.4 | 121.5 | 146.8 |
| R.p.m. | 206 | 209 | 208 |
| Steam pressure, lb. | 209 | 208 | 207 |
| Saturation temperature, deg. Fahr. | 391 | 391 | 390 |
| Steam temperature at throttle, deg. Fahr. | 638 | 673 | 668 |
| Initial superheat, deg. Fahr. | 247 | 282 | 278 |
| High-pressure exhaust temperature, deg. Fahr. | 313 | 353 | 387 |
| Receiver pressure, lb. | 13 | 18 | 27 |
| Low-pressure inlet temperature, deg. Fahr. | 413 | 432 | 457 |
| Low-pressure superheat, deg. Fahr. | 169 | 178 | 188 |
| Low-pressure exhaust temperature, deg. Fahr | 146 | 150 | 162 |
| Feed-water temperature, deg. Fahr. | 131 | 132 | 138 |
| Vacuum (referred to 30 in. barometer), in. | 25.6 | 24.3 | 24.3 |
| Temperature gases base of stack, deg. Fahr. | 501 | 558 | 578 |
| Total steam per hour, lb. | 1626 | 1970 | 2420 |
| Steam per ihp-hr., lb. | 9.8 | 9.9 | 10.2 |
| Steam per kw-hr., lb. | 16.35 | 16.3 | 16.5 |
| Total coal fired per hour, lb. | 192 | 238 | 283 |
| Coal per ihp-hr., lb. | 1.16 | 1.195 | 1.195 |
| Coal per kw-hr., lb. | 1.94 | 1.95 | 1.93 |
| Boiler and superheater efficiency, per cent. | 76.9 | 76.6 | 77.0 |
| Thermal efficiency of engine, per cent. | 19.8 | 19.7 | 19.5 |
| Thermal efficiency of unit, per cent. | 15.6 | 15.1 | 15.0 |
| Heat value of coal, lb.-Fahr. thermal units | 14136 | 14099 | 14215 |

average results of seven tests using Pocahontas coal. Column A shows the average of three tests run at about 95 per cent of the rated load. Column B shows the average of two tests at 14 per cent overload, and Column C gives the mean of two tests at 36 per cent overload.

A feature of the economy curves obtained has been their "flatness," demonstrating the ability of the locomobile unit to handle large overloads with a scarcely perceptible loss of efficiency. While not shown in this series, other tests prove that the same valuable characteristic is possessed at underloads as well. The fuel consumption at three-quarter load is indeed within 5 per cent of the rated efficiency and even at half load the coal consumption is less than 20 per cent greater per horse-power than at rated load.

In comparing these results with data on other power plants it should be remembered, said Mr. Cooper, that the locomobile is essentially a small or moderate-sized plant. Small steam plants of ordinary types are usually quite wasteful of fuel for several reasons. In the first place small engines are almost always of the high-speed, non-condensing type, using 30 lb. to 40 lb. of steam per hp-hr. Radiation losses are also relatively greater in small plants, owing to the fact that small boilers, cylinders and pipes

surface per pound of steam carried than large ones.

The locomobile therefore presents means of reducing energy costs in a 50-hp or 75-hp plant to values as low as or even lower than those achieved by the large plant with its big units. This fact is further elucidated in Table II, which shows the distribution of the heat losses and the

TABLE II—COMPARATIVE PERFORMANCE OF STEAM PLANTS

| Type of Plant | Lb. Steam per Hp-hr. | Boiler Efficiency, per Cent | Lb. Coal per Ind. Hp-hr. |
|---|---|---|---|
| [illegible] | 9.2 | 76.3 | 1.08 |
| Non-condensing Buckeye-mobile | 12.9 | 74.0 | 1.48 |
| [illegible] economizers | ... | 73.7 | 1.71 |
| High-grade compound non-condensing plant | 20 | 70.0 | 2.07 |
| High-grade condensing, simple engine | 20 | 70.0 | 2.27 |
| Good non-condensing, simple engine | 24 | 70.0 | 2.5 |
| Good non-condensing, simple engine | 24 | 60.0 | 2.91 |
| High-speed non-condensing, simple engine | 30 | 60.0 | 3.66 |
| High-speed non-condensing, simple engine | 30 | 50.0 | 4.38 |
| Steam-engine [illegible], without feed-water heater | | 50.0 | 5.03 |

comparative fuel consumptions of a number of typical power plants. Mr. Cooper drew special attention to the fact that in the case of the simple-engine plant at the bottom of the table less than 4 per cent of the heat of the fuel is converted into work, while the condensing Buckeye-mobile shows an efficiency of 17 per cent, and the non-condensing Buckeye-mobile one of 12 per cent.

## Unbalanced Phases

By J. A. Horton

The engine-room operator of an industrial concern noticed that two of the three fuses in a three-phase line leading from the busbars to a three-phase motor operating a fan were heating, while the third fuse was comparatively cool. At the same time he noticed that the blower motor was running hotter than usual, although another motor on the same circuit showed no such tendency so far as could be ascertained by feeling it with the hand. A voltmeter indicated the voltages of the three phases to be balanced at the switchboard but to be unbalanced at the motor, which was about 600 ft. distant. Three ammeters cut into the three motor leads the next day indicated the phase currents to be balanced at a current value about 10 per cent above the full-load current rating of the motor. Reapplication of the voltmeter showed the voltages of the three phases to be balanced at 222 volts, normal voltage being 225 volts. A test of the other motor on the same circuit showed its voltages and currents to be perfectly balanced.

Apparently there was now nothing the matter with anything. As a matter of fact, this was the case. However, between the time of applying the voltmeter in the first place and of applying the voltmeter and the ammeters the day after the engineer had made a change without saying anything about it. The fuses in question had two three-phase circuits leading from them. With the intention of relieving the fuses, so that he would not have to replace them so often, the engineer took the three conductors of one circuit and transferred them to another set of fuses. In making the transfer to the new set of fuses one of two grounded legs was removed from the system, and in again connecting the three legs to the system the engineer happened to get the transferred grounded leg mated with the busbar that was already grounded through the untransferred grounded leg. In other words, before making the change the two grounds were on legs of different polarity and produced a partial short-circuit; after the change the two grounds were on the same leg in effect, so that the short-circuit was removed. The reason that one motor showed heating and the other did not was that the hot motor was already operating at overload, while the motor that was cool was operating comparatively light. Of course, a dead short-circuit would have blown the fuses as fast as they could be replaced; but it is conceivable that one of the grounds included part of the reactance of one of the compensators to limit the current to a certain extent. It would have been interesting to ferret out the actual cause of the trouble, but both of the motors were on work that could not be interrupted for ringing out.

## "Angular Parallel" Connection of Series Transformers

I frequently see wiring diagrams showing the secondaries of two series transformers in a three-phase system connected in so-called "angular parallel" arrangement. How is this connection possible if the emfs in the two secondaries are out of phase with one another? And, even if they were in phase, what would prevent the flow of current in the local circuit formed by the secondaries and the cross connections when the load is unbalanced? H. M.

The use of two series transformers in a three-phase system to show currents in all three leads represents an extremely interesting application of transformers, since it brings to the front several of the peculiar features of ordinary transformers usually neglected when considering these devices operated at constant potential and varying current. The secondary current of a series transformer can be safely assumed to bear a constant ratio to the primary current and to be directly in phase opposition to this current. The secondary circuit of two series transformers can be so interconnected that the separate currents are superposed in such a way as to produce a resultant third current, which may then be either the vector sum or the vector difference of the other two currents. The voltage assumes the value required to force the indicated amount of current through the impedance of the interconnected circuits. The secondary currents in two series transformers in a balanced three-phase system may be so superposed as to produce a resultant current exactly equal to each of the two secondary currents, or they may be so superposed as to produce a resultant current equal to 1.73 times the value of each of these currents. Obviously the correct method of superposition is that giving a value to the resultant current exactly equal to each of the other two currents. When the transformers are interconnected as just indicated the resultant current under every condition of balance or unbalance is exactly equal to—or proportional to—the current in the third lead of the three-phase system.

## Connections of Wattmeters and Power-Factor Meters

Please explain the method of connecting a wattmeter and a power-factor meter in circuit, both directly in series with the line and with the use of a current transformer. J. S. H.

In connecting with a wattmeter or a power-factor meter in a circuit, the so-called "current coil" is connected in series with the line, and the "voltage coil" is connected across between the two leads. The condition is not changed when use is made of a so-called "current transformer," which transforms voltage as well as current and can best be designated as a "series" transformer because of its connection in the circuits. The secondary coil of the series transformer is connected in series with the current coil of the wattmeter and also in series with the current coils of any watt-hour meter or power-factor meter that may be used in the same system. The series transformer serves merely to insulate the apparatus from the leads of the system and to reduce the current in the correct proportions for use in the wattmeter, power-factor meter or frequency meter.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*Phase Compensation.*—G. H. Eardley-Wilmot.—After referring to the importance of improving the power-factor in distribution systems the author describes two classes of rotary phase compensators, namely, those having no stators and those provided with stator windings. The features of the statorless type, as built by Brown, Boveri &

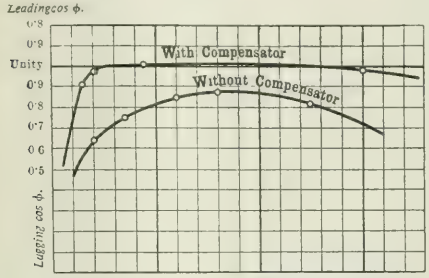



FIG. 1—CURVES SHOWING POWER-FACTOR OF A 100-HP INDUCTION MOTOR WITH AND WITHOUT COMPENSATOR

Company, are outlined, the performance of these machines being shown by curves. Examples are also given of its applications. With the statorless compensator there is no improvement of the power-factor at no load, but the degree of compensation possible reaches its maximum at about quarter load. The power-factor curve with the compen-

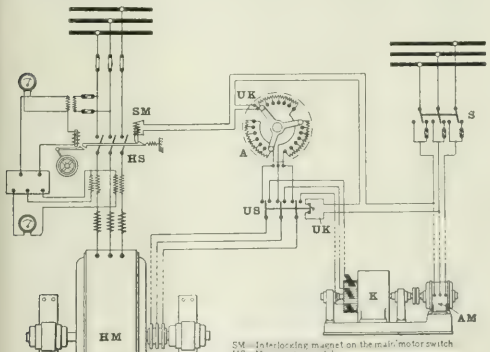



FIG. 2—DIAGRAM OF PHASE-COMPENSATING DEVICE

sator in operation then follows a straight line up to a point between 25 per cent and 50 per cent overload, after which it starts to drop off. This is borne out by Fig. 1, which shows actual test curves taken on a 100-hp induction motor fitted with a statorless compensator. In spite of the absence of a stator, commutation is very good, although these compensators cannot be built for such large currents as those designed for use with stator windings. A diagram of the general arrangement of a phase-compensating device is given in Fig. 2. It is important that the main switch shall not be closed unless both the starter and change-over switch *US* are in the starting position and unless the compensator set is running. If this were done—that is to say, if the main switch were closed when the change-over switch was so closed that the circuit between the rotor and the compensator was completed and the compensator itself were not running—the full rotor standstill pressure would be put across the brushes, probably resulting in the auxiliary machine being burned out. For this reason it is best to install some kind of interlocking device, and such a device is shown in the diagram in Fig. 2. Another point which should be noted is that the slip of the main motor is somewhat increased when a phase compensator is working in conjunction with it. In some cases the slip is as much as doubled, and this might make a very appreciable difference to the full-load speed of the motor, though such a large increase in the percentage slip would probably occur only in the case of large motors and when the normal slip is low.—London *Electrician*, Nov. 28, 1913.

*Amortisseurs.*—P. Boucherot.—The continuation and conclusion of his long mathematical article on the damping of alternators and the effect of amortisseurs (damping coils). The theory is given, first approximately, and later more rigidly.—*La Lumière Elec.*, Nov. 15 and 22, 1913.

### Lamps and Lighting

*Nitrogen-Filled Tungsten Lamp.*—K. Mey.—A translation in abstract of a German paper read before the German Association of Electrical Engineers on the Allgemeine Elektricitäts Gesellschaft "nitra" lamp, which is the German trade name for the new nitrogen-filled tungsten lamp operating at a specific consumption of 0.5 watt per cp.—London *Electrician*, Nov. 28, 1913.

### Generation, Transmission and Distribution

*Swedish Water-Power Plant.*—A long and profusely illustrated description of the power plant at the Porjus waterfalls which has been erected to supply energy to the state railway from Kiruna to Riksgränsen. This road has a length of 129 km (77 miles) and carries a great deal of freight and iron ore. When complete the power plant will contain ten generating sets, each rated at 8800 kw. For traction purposes single-phase current will be generated at 15 cycles and 4000 volts. For the energy requirements of the mines and metallurgical works three-phase, 25-cycle current will be generated at 10,000 volts.—*Elek. Kraftbet. u. Bahnen*, Nov. 14, 1913.

*Trollhättan.*—An illustrated article on the Trollhättan power plant of the Swedish government, which has a capacity of 80,000 hp. There are six three-phase generators, each rated at 9000 kw. Energy is generated at 10,000 volts to 11,000 volts. For transmission the pressure is raised to 50,000 volts by three groups of single-phase transformers. The largest substation is at Gothenburg, which is at present equipped with seven single-phase transformers, each rated at 3300 kva.—*Elek. Zeit.*, Nov. 27, 1913.

*German Power Plant.*—Mayer.—An illustrated article on the electricity supply of the city of Stettin, Germany. The power plant of the former Stettin electric company has been taken over by a new municipal corporation formed by the

municipality of Stettin, the province of Pommern, and three agricultural counties. The generating plant has been changed from direct-current to three-phase. The direct-current generators have been replaced by two three-phase, 5100-volt generators, each rated at 750 kw, and two new steam turbine generators, each rated at 3500 kw. The three-phase currents are transmitted to three substations. Distribution within the city is made by direct current and in the agricultural districts by three-phase alternating current.—*Elek. Kraftbet. u. Bahnen,* Oct. 24, 1913.

**Traction**

*Trolley-Wire Construction.*—W. VON MOELLONDORFF.—An illustrated article advocating the standardization of trolley wires and trolley poles. For trolley contactors in the form of sliding bows, aluminum-copper alloys have been extensively tested during the last few years. An alloy of commercial aluminum (98 to 99 per cent pure) with 6 per cent of copper has proved the best, since it is hardest and maintains a bright surface.—*Elek. Zeit.,* Nov. 27, 1913.

*German Railway Accidents.*—H. ALERTZ.—Statistical data of accidents on German electric railways during the year 1912. The report covers 173 railway systems. Thirty systems had no serious accidents; on the other 143 systems there were 239 persons killed (25 passengers and 214 people on the street), and 1128 persons were seriously injured.—*Elek. Kraftbet. u. Bahnen,* Nov. 24, 1913.

**Wires, Wiring and Conduits**

*Protective Relays.*—EMIL HAUSSER.—A long article, illustrated by diagrams, describing the use of relays for the protection of generators, rotary converters, motors and transformers and the use of protective relays in connection with busbar sets, feeders and lines connecting power plants with ring distribution systems. The fundamental principles of operation of different types of relays are also described.—*Elek. Kraftbet. u. Bahnen,* Nov. 4 and 14, 1913.

*Suspension Insulators.*—P. GESING.—An illustrated paper on methods of calculating the mechanical strength of overhead transmission lines with suspension insulators.—*Elek. Kraftbet. u. Bahnen,* Nov. 24, 1913.

**Electrochemistry and Batteries**

*Electric Conductivity Imparted to Liquid Air by Alpha-Rays.*—J. C. MCLENNAN AND D. A. KEYS.—In a number of experiments it has been shown, in agreement with a number of other experimenters, that liquid air when freshly filtered is an extremely good insulator, and that its conductivity, in the absence of any ionizing radiation other than that from the earth, is much the same as that of ordinary clean air at atmospheric pressure. The dielectric constant of liquid air was found to be 1.43. The saturation current obtained in air at ordinary pressure by the complete absorption of the alpha radiation emitted by a plate coated with polonium was found to be about sixteen times the maximum current obtained with the highest fields used when the radiation was absorbed in air at 101 atmospheres, and about 576 times the maximum current obtained in liquid air when the ionization was produced by the same radiation. The mobility of the positive ion produced in air at 116 atmospheres by alpha rays was found to be 0.0005294 cm second per volt cm, and that of the negative 0.0006217 cm second per volt cm, the latter being about 1.18 times the former. In the course of the investigation evidence was found of the existence of a penetrating radiation emitted by the layer of polonium which furnished the alpha rays.—*Philos. Mag.,* November, 1913.

*Radiology.*—C. RAMSAUER.—An illustrated description of the equipment of the new Physico-Radiological Institute of the University of Heidelberg.—*Elek. Zeit.,* Nov. 27, 1913.

**Units, Measurements and Instruments**

*Definition of the Ohm.*—The official committee of the French Parliament which is charged with drafting a law giving definitions of units of measurement has concurred on the metric system using the fundamental units of the meter, the kilogram and the second, and has also defined three other fundamental units—the centigrade degree of temperature, the ohm, and the bougie (decimal of candlepower). The ohm is defined as "the resistance offered to a constant current by a column of mercury of uniform cross-section at a temperature of zero deg. C. with a length of 106,300 cm and a mass of 14.4251 grams, according to the definition of the international ohm of the International Conference held in London in 1908."—*La Lumière Elec.,* Nov. 22, 1913. The definitions of the meter, the kilogram and the second are given in *La Lumière Elec.,* Nov. 29, 1913.

*Thermo-Electric Calorimeter Bomb.*—A description of a new calorimeter bomb of Ch. Fery. It is distinctive in that no water is used as the calorimetric mass, the metal of the bomb taking its place, and, second, the rise of temperature produced by the combustion of the sample is evaluated by a thermo-electric process. The apparatus, as shown in Fig. 3, consists of the calorimetric bomb proper, maintained in the center of a metallic envelope *A* by a disk *E*. The combustible under test is placed in the capsule *J* and is ignited by a magneto current sent through a fine wire running between the rods *K*. *D* is the outside coating. Previous tests having shown that thin steel does not insure perfect conductivity of heat, thus leading to lack of uniformity in results, red copper 3 mm to 4 mm (0.118 in. to 0.157 in.) thick is now used for the coating. *C* is the inside nickel coating which can be easily removed in order to weigh the moisture formed. The capsule *J* is always placed at the same height by means of an adjustment shown on the rod supporting it. The current to the wire located between the rods *K* is brought in from the outside contact screws *G*. Oxygen is admitted through the cock *F* and is thrown out in four horizontal jets, so as to avoid blowing away the combustible if the latter happens to be in the state of powder. The heat produced is read from the milli-voltmeter *L* either in millivolts or directly in calories, the latter being possible, of course, only when the amount of combustible is equal to the unit weight for the system of heat units used. Tests made with instruments at the Laboratory of Arts and Trades in Paris have shown the reliability of the instrument.—*La Génie Civil,* Vol. 63, No. 21, page 415, Sept. 20, 1913; abstracted in *Journal* of the Amer. Soc. Mech. Eng., November, 1913.

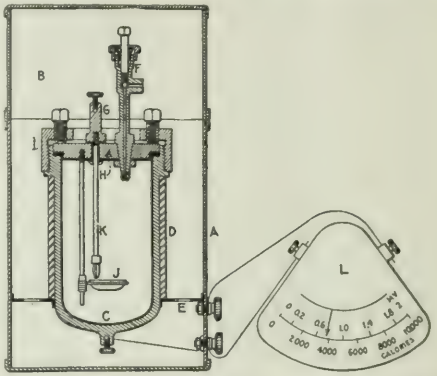



FIG. 3—THERMO-ELECTRIC DIRECT-READING CALORIMETER BOMB

*Insulation Resistance.*—S. EVERSHED.—The first part of a paper read before the (British) Institution of Electrical Engineers in which the author describes a number of experiments undertaken on various dielectrics, including cotton, paper and micanite cloth. The nature of insulation resistance is discussed and its dependence on certain factors, especially the pressure applied and moisture, is shown. The properties of a model insulator are dealt with. The

present instalment contains a description of the method of investigation, notes on typical examples of insulation, methods of measurement of dielectric resistances, and moisture curves for cotton, paper and micanite cloth.—London *Electrician*, Nov. 28, 1913.

**Telegraphy, Telephony and Signals**

*Telephone Relay.*—EUGEN REISS.—A long illustrated paper read before the Electrical Society of Berlin on a new telephone relay using a cathode-ray discharge tube

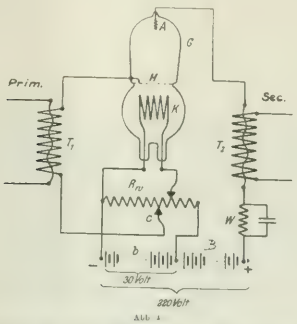



FIG. 4—APPARATUS FOR AMPLIFYING TELEPHONE CURRENTS

and based originally on the idea of Robert von Lieben. In the earlier construction the cathode rays were deflected magnetically by the currents the amplitude of which was to be enlarged. A different method is used, however, in the latest construction which is shown in Fig. 4. Here *G* is an evacuated glass container with three electrodes, namely, the cathode *K*, the auxiliary electrode *H* and the anode *A*. The auxiliary electrode fills the whole cross-section of the tube, but is perforated so as to permit passage of the current between the anode and cathode, which are connected to the battery *B*. The Wehnelt cathode *K* consists of a zigzag platinum ribbon wound on a glass tube, the platinum ribbon being covered with a thin film of barium oxide and calcium oxide. The cathode is brought to red heat at about 1000 deg. C. by means of a small 30-volt battery *b*. The primary currents, the amplitude of which is to be increased, act through the transformer *T* upon the circuit containing the cathode *K* and the auxiliary electrode *H*. The secondary currents—that is, the currents increased in amplitude by the relay—are taken from the secondary winding of the transformer *T*. The methods of adjusting the relay so as to get maximum sensitiveness are described. In order to have a mercury-vapor atmosphere, some amalgam is used in the discharge tube. As the device is now built by the Allgemeine Elektricitäts Gesellschaft (Fig. 5), *g* is the glass globe and *A* is the anode consisting of a spirally wound aluminum wire of 2 mm diameter. The auxiliary electrode *H* is also made of aluminum and has holes 3.5 mm in diameter uniformly distributed over its whole surface. The cathode consists of platinum ribbon 1 mm broad and 0.2 mm thick, covered with a thin film of calcium oxide and barium oxide. In order to obtain increased sensitiveness, it is possible to use several relays in cascade connection. If four relays are used in this way, the amplitude of the currents can be increased 20,000 times. The principal advantages of the relay are that it is non-sensitive with respect to mechanical vibrations and that it is practically free of inertia so that the wave-form is exactly reproduced. The same issue contains an account of the discussion which followed the paper. Ebeling agreed that this Lieben relay is more reliable than the mechanical relay of Brown, but the latter is somewhat simpler. Experiments are being continued by the German Telephone Department with both types of relays.—*Elek. Zeit.*, Nov. 27, 1913.

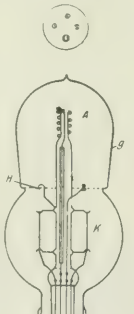



FIG. 5 — NEW CATHODE TUBE RELAY

**Miscellaneous**

*Balkan States.*—An article giving statistical data on the condition of the electrical industries in the Balkan States (especially imports from Germany) since the war.—*La Lumière Elec.*, Nov. 15, 1913.

*Ghent.*—J. REYVAL.—The first part of an article on generating sets and the Ghent exhibition. The present instalment gives details of a 1000-hp four-cylinder Carels-Diesel oil engine which drives a 600-kw alternator.—*La Lumière Elec.*, Nov. 8, 1913.

# Book Reviews

MASSE UND MESSEN. By Dr. Walter Block. Leipzig: B. G. Teubner. 112 pages, 34 illus. Price, 1.25 marks.

A brief treatise on physical metrology, in Teubner's "Natural and Intellectual World Series." It describes in a practical but scientific way the principal measures of length, mass, time, heat and electricity. The chapters relate to the following subjects: The metric system, principles of measurement, mechanical quantities and measures, thermal quantities and measures, optical quantities and measures, electric quantities and measures. The final chapter gives a brief idea of the theory of relativity. The treatment is simple and clear. The chapter on electric measures is not so modern in treatment as the rest.

HIRSCH WILKING ELEKTRO-INGENIEUR-KALENDAR, 1913. Edited by Arthur H. Hirsch and Max Barth. Thirteenth year. Berlin: Verlag von Oscar Coblentz. 373 pages, leather, illus. Price, 2.5 marks. Notebook supplement.

The thirteenth yearly appearance of this electrical-engineering calendar and pocketbook is signalized by this volume. The calendar contains a handy series of tables but does not contain many connection diagrams. Appended to the tabular matter is an excellent series of rules and regulations which are likely to be very useful. Curiously enough, the first page after the table of contents gives a graphical comparison between the centimeter and the Rhenish inch, which is about one-sixty-fourth longer than the English inch. A convenient loose-leaf diary accompanies the calendar.

GRUNDLAGEN DER ELEKTROTECHNIK. By A. Rotth. Leipzig: B. G. Teubner. 126 pages, 72 illus.

This elementary treatise discusses the principles of electricity and magnetism, leading to a discussion of direct-current and alternating-current dynamos and motors. Only the simplest of algebraic formulas are used in the quantitative elucidation of these principles. The book is divided into three chapters, dealing respectively with general principles of electric currents, direct currents and alternating currents. The entire treatment of the subject is extremely simple and is based on experimental demonstrations. The author's work would have been more compatible with international agreement had the symbols used for expressing Ohm's law been those adopted internationally, but except for such details the matter is very well presented. The book will commend itself to persons who, familiar with the German language but unacquainted with electrotechnics, desire an understanding of the fundamental principles of dynamos and motors.

# New Apparatus and Appliances

**An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers**

## Electric Water Heater

The 660-watt electric water heater illustrated herewith has been added to the line of heaters made by the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis. The new heater has a water capacity of 3 qt. and can be attached to any lighting circuit.

A small pilot lamp under a ruby-glass lens is arranged at the base of the heater and indicates when energy is being used. A two-button flush switch is mounted in the base. The heater is provided with a frosted-glass globe, decorated with cut-glass stars, and the base is heavily nickel-plated. The heating unit can be readily renewed.

This heater is particularly intended for use in buffets, restaurants and drug stores for providing hot drinks at the



WATER HEATER

bar or soda counter or for furnishing hot water for any purpose. It is also well adapted for home service.

## Electric Wheel Chair for San Francisco Exposition

A concession has been made to the Motor Chair Company, Chicago, to operate 200 of its motor-driven chairs at the Panama-Pacific Exposition in San Francisco in 1915. These chairs will seat two passengers and will be operated in a manner similar to the familiar "man-power" chairs now in service at Atlantic City, Palm Beach and other resorts.

A 0.5-hp compound-wound driving motor placed under the chair seat is connected to the two rear wheels of the chair through pinion-and-sprocket and chain reductions. Energy for operating the chair is drawn from a 12-volt, 150-amp-hr. Edison storage battery under the wicker dash. The motor runs at 1200 r.p.m. and the speed of the chair shown herewith is 3.5 miles an hour. It is said that chairs may be built with different reductions, giving speeds ranging from 1 mile to 10 miles an hour.

The feature of the chair, as described by Mr. Charles B. Chrysler, its inventor, lies in the control. A small foot pedal actuates the braking mechanism and the controller under the floor of the car. By various pressures on the

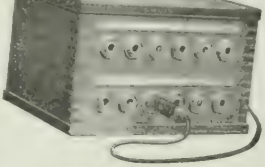


ELECTRIC WHEEL CHAIR

pedal the controller can be operated over four successive speeds ahead. Release of the pedal sets the brakes automatically. Twenty-four inches is given as the average distance which the chair will travel with brakes set.

## Cordless Jack Boxes for Way-Station Service

A cordless jack box for connecting the operator's set in a railroad way station to one or more lines passing through the station has been developed by the Western Electric Company, New York. This device does away with the knife-switch method of cutting in the operator's telephone or telegraph set on the train-dispatching lines. With the



CORDLESS JACK BOX

new box the connection is effected by means of a single-conductor plug, which is inserted in the line jack corresponding to the line over which it is desired to talk or telegraph.

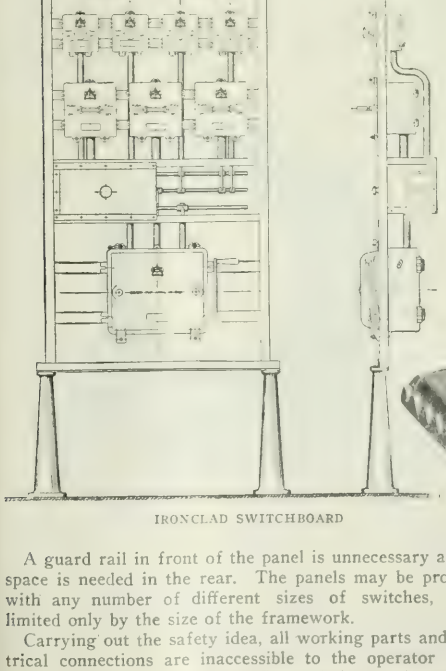
The jack used in the boxes for telegraph lines is different from that employed with the telephone circuit, a special jack being necessary for the telegraph apparatus. The tele-

phone jack boxes may be used to connect two or more lines together and at the same time have the operator's set bridged in on all of them by using one or more extra switching plugs. The jacks are thoroughly insulated to prevent trouble from sudden voltage surges or accidental crosses with transmission or lighting circuits, while all the jack springs are widely separated to prevent arcing and burning of the insulation. Screw terminals are used for connecting in outside lines, soldering thus being rendered unnecessary. A tie cord is furnished with the switching plug to keep the latter from being mislaid when not in use.

These boxes are manufactured in three sizes—one type for three lines, another for six lines and another for twelve lines, the latter consisting of two six-line units hinged together. Any of the jack boxes can be ordered partially equipped with dummy wooden plugs in the unequipped spaces, and jacks can be added at any time by knocking out the wooden plugs and screwing in the jacks.

## Ironclad Switchboard

The switchboard shown in the accompanying drawing is the product of the Detroit Fuse & Manufacturing Company, Detroit, Mich., and is of the "ironclad" type designed particularly with the idea of safety in mind. The framework is made of angle iron securely bolted together. The switches are entirely inclosed in cast-iron boxes and may be operated from the outside. The busbar chamber is constructed of sheet iron with a cover of the same material. The fuses are contained in the switch units specially employed with this type of board. No "live" metal parts are exposed. As the space is open between the switch units all connections may be made from the front.



IRONCLAD SWITCHBOARD

A guard rail in front of the panel is unnecessary and no space is needed in the rear. The panels may be provided with any number of different sizes of switches, being limited only by the size of the framework.

Carrying out the safety idea, all working parts and electrical connections are inaccessible to the operator under ordinary working conditions. The switches used are semi-automatic in action, the completion of the operation being beyond the control of the operator. Fuses can be readily changed without danger of accidents. By thoroughly grounding the outer case and the lever of the switch before the electrical connection can be completed, the liability to shock is eliminated.

## Electric Heating Pad

The Hotpoint Electric Heating Company, Ontario, Cal., has placed on the market an aluminum-cased heating pad. As illustrated herewith, the pad is made convex on one side



HEATING PAD

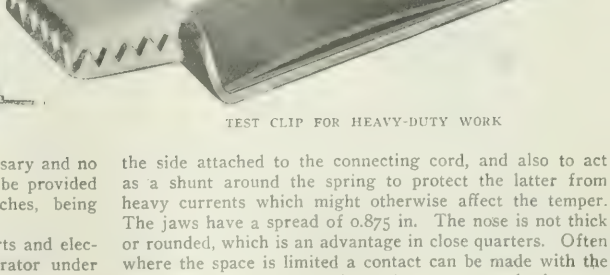
and concave on the other to fit the curve of the body. The heat control is designed to maintain any desired temperature between 100 deg. and 200 deg. Fahr., while the average energy consumption amounts to 40 watt-hr. per hour. The device is 8 in. in diameter and 0.625 in. thick and weighs 1.25 lb. The pad is effective in a wet pack and for bed-warming.

## Heavy-Duty Test Clip

R. S. Mueller & Company, Cleveland, Ohio, have brought out a new heavy-duty test clip, which is shown full-size in the accompanying illustration. This clip is called the "big brute" and is said to be able to carry 100 amp indefinitely without heating. When applied to flat surfaces where the jaws make good contacts it will carry 200 amp without excessive heating.

The outer members are made of an alloy containing 90 per cent copper. One of these is toothed around its edges, while the other is plain, the latter nesting firmly into the former. The inner member, acting as a spring, is made of blued steel with the points of application near the jaws. This gives a long leverage, which results in a strong "bite" and a firm contact.

Copper sheaves are placed under the spring to carry whatever current is picked up by the toothed member to

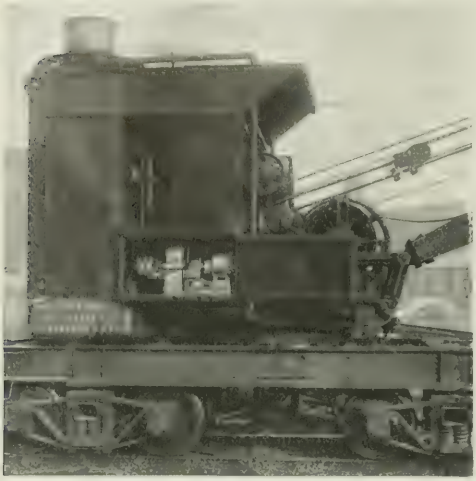


TEST CLIP FOR HEAVY-DUTY WORK

the side attached to the connecting cord, and also to act as a shunt around the spring to protect the latter from heavy currents which might otherwise affect the temper. The jaws have a spread of 0.875 in. The nose is not thick or rounded, which is an advantage in close quarters. Often where the space is limited a contact can be made with the side jaws where there would not be room to apply the nose.

## Turbine Generator for Crane Electromagnets

In order to avoid the necessity for dragging service wires along the track on which locomotive cranes using electromagnets work back and forth the 15-ton crane illustrated herewith has been fitted by the Brown Hoisting Machinery Company, Cleveland, Ohio, with a 5-kw turbo-generator set, built by the Terry Steam Turbine Company, Hartford,



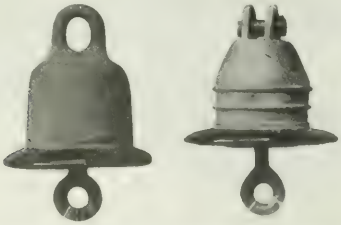
CRANE WITH ELECTROMAGNETS

Conn. The electromagnet energized by current from this unit is used for handling pig iron and scrap at any point within the reach of the 40-ft. boom.

The crane is operated by a reciprocating engine. The small generator set, which is entirely independent of the other operating parts of the mechanism, is mounted as shown in a compartment beneath the floor of the operator's cab, where it is entirely out of the way.

## Porcelain Strain Insulators

The Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., has recently developed two new types of porcelain strain insulators designed particularly for heavy overhead construction. These insulators combine a metal cap and a porcelain skirt to furnish the required dielectric strength. The metal parts consist of a malleable-iron



INSULATORS FOR HEAVY OVERHEAD CONSTRUCTION

cap, a drop-forged steel eye bolt and a malleable-iron sleeve by which the eye-bolt is securely fastened.

The metal and porcelain parts are cemented together with high-grade Portland cement, the cemented surfaces being corrugated to prevent failure except by actual shearing of the cement. The skirt of the porcelain also has corrugations on the under side to give additional creepage surface.

These insulators are made in two sizes. The metal parts of the smaller are sherardized and those of the larger are hot-galvanized. The smaller insulator is especially used for insulating cables when the working load does not exceed 1600 lb. Both insulators are tested at 5000 lb., being generally used for heavy service, such as dead-ending high-strength steel messenger cables with a working load of 4000 lb. for the smaller type and 8000 lb. for the larger.

## Compensated Polyphase Motor

The Bell Electric Motor Company, Garwood, N. J., is manufacturing a polyphase induction motor which can be brought up to full speed by throwing it directly on the line without any external resistance. The rotor has two sets of windings. A high-resistance winding similar to that used in direct-current motors is placed in the bottom of the rotor slots and is connected to the commutator. Another high-resistance winding similar to a squirrel-cage winding is placed in the top of the slots. No brushes are required.

At starting the squirrel-cage winding is used to bring the motor up to speed, and when full speed is nearly attained the commutator is short-circuited by means of a device, consisting of a plate of phosphor bronze, which is pressed against the commutator segments by two weights that are thrown out by centrifugal force. The rotor thereafter operates with a low internal resistance. The motor can thus be started automatically, since opening or closing the switch is all that is necessary to start or stop the machine. When the motor stops running, a large spring forces the plate of the short-circuiting device back to its original position, and the motor is then ready to start again.

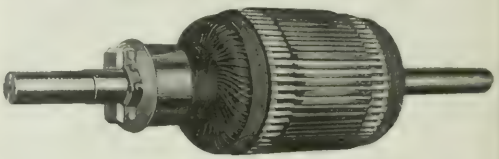


FIG. 1—COMPENSATED ROTOR

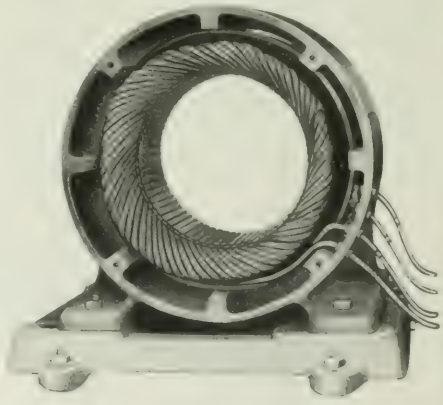


FIG. 2—STATOR OF COMPENSATED POLYPHASE MOTOR

The starting current varies from two to two and one-half times full-load running current. The motor will start under full load. By means of the two independent windings a double transformation results. This reacts on the stator winding, and raises the power-factor of the motor.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Electrical Manufacturer to Handle Automobile Accessory.**—The Electric Renovator Company, of Pittsburgh, Pa., maker of electrically driven vacuum cleaners, has frequently absorbed the Harroun Company, of Indianapolis, Ind., maker of the kerosene carburetors.

**Engineers Specializing in Utility-Regulation Work.**—William J. Norton and Paul P. Bird have severed their connection with the Commonwealth Edison Company and formed the firm of Norton & Bird, consulting engineers, making a specialty of public utility work. The new firm has its office at 72 West Adams Street, Chicago, and will specialize in rate reports and rate schedules, the preparation of reports required by federal and state authorities, the preparation of cases before public service commissions and the like. It will do much of the work of the Commonwealth Edison Company and other Insull companies before public utility commissions.

**General Electric Sales to Utility Companies.**—Three companies have recently placed orders with the above manufacturer for generating and auxiliary equipment. The Minneapolis & Ontario Power Company, Minneapolis, Minn., will place in operation in its station at International Falls, Minn., new apparatus consisting of a 2000-kw Curtis turbo-generator with 17.5-kw motor-generator exciter set, 5-hp and 25-hp motors, pumps and condenser equipment. The California-Oregon Power Company, Yreka, Cal., will add to the equipment of its station two 50-kva, one 100-kva and four 200-kva transformers, recently ordered. The United Electric Light & Water Company, Waterbury, Conn., will add to its station equipment three 600-kva transformers and accessories.

**Westinghouse Sales Activities.**—The Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa., has recently received from one large operating company an order for 10,000 electric irons. This is an unusually large single order for this class of apparatus. Among the orders recently placed with the Westinghouse Machine Company is one from the Pennsylvania Railroad for two 35,000-hp turbines, with surface condensers and other power-house apparatus, for the Long Island power house, which furnishes part of the power for the operation of the Pennsylvania tunnel system under New York City. The Norfolk & Western Railway Company has also placed an order with the machine company for three 10,000-hp turbines in connection with its electrification plans, and the Hamilton Electric Light & Power Company, Ltd., of Hamilton, Ont., has contracted for two 15,000-hp turbines.

**Motor-Driven Aerial Tramway Across the Andes Mountains.**—English interests in Colombia are planning to start work soon on the construction of an aerial tramway, about 37½ miles long, between Mariquita and Manizares. The ropeway, which will cross the Andes Mountains at an elevation of about 11,000 ft., will be built in twelve sections. At the junction point of each two sections an electric motor, of sufficient capacity to operate both sections, will be installed. The steel cable will be supported by structural steel towers, varying in height from 40 ft. to 125 ft. The energy for the motors will be generated hydroelectrically. A station will be built near Mariquita and two generators will be installed. The tower work is being done in the United States, and the cable, electrical equipment and power-house machinery will be supplied by English companies. It is expected that the work will be completed by Jan. 1, 1915.

**Electrical Dealers Find that Location Affects Class of Business.**—Sibley & Pitman, of 19 West Thirty-Sixth Street, New York City, are making extensive changes in their store arrangements in order to take care of the growth of their business. In the old down-town store a good business was done in a few standard lines of wiring specialties, but with their change of location they have experienced an unexpected growth along new lines. A large demand for domestic appliances has been noticed by them here, and they have recently put in a line of wireless apparatus to meet another new demand. The location of the new showroom, in close proximity to an active shopping center, results in larger sales of the heating and cooking and lighting appliances, although a good business is done in other lines. At present the store is reflecting the holiday spirit, and some electric toys are to be seen there, in addition to the regular lines.

**Litigation Relating to Telephone Competition in Illinois.**—Seventy-eight bondholders of the Interstate Independent Telephone & Telegraph Company have brought suit in the Circuit Court of Cook County, Illinois, charging that H. H. Evans, of Aurora, and B. E. Sunny, president of the Chicago Telephone Company, conspired to wreck the company and drive it out of competition with the Bell companies in central Illinois. The American Telephone & Telegraph Company, the Chicago Telephone Company, the Central Union Telephone Company and the First Trust & Savings Bank of Chicago are also named as defendants. Mr. Evans was president of the Interstate company until September, 1910. According to the bill of complaint, the defendants, or some of them, entered into a systematic effort to depreciate the market value of the stocks and bonds of the Interstate company. The court is asked to inquire into the transactions, contracts and agreements entered into during the year 1910 between Messrs. Evans and Sunny and the Bell companies. The Interstate company operated in Aurora, Joliet, Elgin, Peoria, Springfield, Sterling, Morrison and other cities of Illinois.

**Steel and Iron Industries Increasing Electrical Equipments.**—Elsewhere in this section note is made of the sale of boiler equipment to three of the large steel companies, and the expansion of that industry can be seen also in an increased demand for electrical apparatus. The Eastern Metal Corporation, New York City, will place in operation shortly in its power plant at Bayonne, N. J., a 370-kva, two-unit, three-bearing motor-generator set with blower equipment and switchboard. The United States Aluminum Company, Pittsburgh, Pa., will add to the electric drive equipment of its plant ten 20-hp induction motors with starting compensators recently purchased. The Standard Steel Car Company, New Castle, Pa., will install for electric drive fifty-four motors ranging in capacity from 5 hp to 50 hp. The Chase Rolling Mill Company, Waterbury, Conn., will add to the electrical equipment of its plant a 750-kva alternating-current generator recently purchased. The Union Iron Works, San Francisco, Cal., will install in their mills four additional 200-hp induction motors with starting compensators. In each of these cases the apparatus to be installed has either been obtained from the General Electric Company or an order has been placed with that concern for it.

**Good Boiler Sales Reported.**—The Babcock & Wilcox Company, of 85 Liberty Street, New York, has reported among some of the larger sales recently made an aggregate of 14,823 hp of boiler equipment. It is particularly significant at the present time to note that three of these large orders are from big steel companies, the American Iron & Steel Manufacturing Company, Lebanon, Pa., taking 1040 hp, the Minnesota Steel Company, of New Duluth, Minn., 1311 hp, and the Columbus (Ohio) Iron & Steel Company, 1776 hp in boilers. Another industrial company which has recently taken equipment of this kind is the Newport News (Va.) Shipbuilding & Dry Dock Company, to which 1480 hp

in boilers was supplied. Electrical generating companies on the list are the Miami (Fla.) Electric Light & Power Company, with 1040 hp, and the Western Gas & Electric Company, of Aurora, Ill., with 1004 hp. The largest order reported was for 2540 hp of boilers, with chain-grate stokers, sold to the Atchison, Topeka & Santa Fé Railway, Topeka, Kan.

**Proposed Investigation of Keokuk Hydroelectric Development.**—According to the newspapers, Representative Henry T. Rainey, of Carrollton, Ill., will introduce a resolution in the lower house of Congress calling for the appointment of a special committee to investigate the rights, duties and rates of the Mississippi River Power Company, which, as the successor of the Keokuk & Hamilton Water Power Company, built the great hydroelectric plant on the Mississippi River at Keokuk, Ia. "The Keokuk dam," Mr. Rainey is reported to have said, "is not proving the boon to Illinois that was predicted. The plan of procedure seems to involve buying up the lighting and power plants of the cities within range of the transmission lines, then to bring about the dismantling of these plants, and to end in conditions under which electrical energy for all purposes costs more than before. I do not care to name the Illinois cities that are being enthralled in this manner, but I feel sure an investigation would bring to light a dozen such cases. I am prepared to specify a few myself."

**Electrical Export Opportunities.**—In parts of Spain the rates for electric service seem very well fitted to an extension of trade in electrical appliances of various kinds. In Valencia there are four competing companies and, as a result of their fight for business, rates have gone as low as 1.8 cents per kw-hr., or even 0.54 cent in certain cases. Only one of these companies supplies direct current, the others furnishing alternating current of 50 cycles at voltages of 110, 150, 210, 260 and 500. Electricity is being increasingly used in the manufacturing industries in Valencia, and motors of from 2-hp to 5-hp rating are finding a large sale in the same vicinity for pumping purposes. While motors of American make have had some sale in the district, there seems so far to be little of the accessory and appliance business coming to this country. Turkey, while in the past and at present a poor field for electric sales, gives promise of a decided awakening in the near future. Three companies are now engaged in preparations for supplying electric light, telephone and street-railway service in Constantinople, and when these projects get a good footing there should be a rapid growth along electrical lines. An estimate of the number of electrical ranges sold in the United Kingdom annually places the figure at between 700 and 1000. Most of the electrical companies there are municipally operated and lack the authority to deal in appliances of this nature, which explains in part the small sale they enjoy. Such ranges as are sold are generally supplied directly to the user by the manufacturer, through branch stores or through retailers.

### NEW YORK METAL MARKET PRICES

| Copper: | Dec. 8 Bid | Dec. 8 Asked. | Dec. 16 Bid. | Dec. 16 Asked. |
|---|---|---|---|---|
| Standard, spot* | Selling Prices | | Selling Prices | |
| London, standard, spot* | £ s d 65 10 0 | | £ s d 65 0 0 | |
| Prime Lake | 14.50 | to 14.75 | 14.50 | to 14.75 |
| Electrolytic | 14.25 | to 14.50 | 14.25 | to 14.37½ |
| Casting | 14.12½ | to 14.25 | 14.00 | to 14.12½ |
| Copper wire base | 15.50 | to 15.75 | 15.50 | to 15.75 |
| Lead | 4 10 | | 4 00 | |
| Nickel | 40.00 | to 45.00 | 40.00 | to 45.00 |
| Sheet zinc, f.o.b. smelter | 7 25 | | 7 25 | |
| Spelter, spot | 5.12½ | to 5.25 | 5.15 | to 5.25 |
| Tin, spot | 37.50 | to 37.75 | 37.70 | to 37.95 |
| Aluminum: | | | | |
| Prompt delivery | 19.00 | | 18.75 | to 19.00 |
| Future | 18.50 | to 19.00 | 18.50 | to 19.00 |

### *OLD METALS

| | | |
|---|---|---|
| Heavy copper and wire | 13.50 | 13.50 |
| Brass, heavy | 8.75 | 8.75 |
| Brass, light | 7.75 | 7.75 |
| Lead, heavy | 4.05 | 3.95 |
| Zinc, scrap | 4.37½ | 4.37½ |

### *COPPER EXPORTS

Total tons to Dec. 16 . . . . . 15,740

*From daily transactions on the New York Metal Exchange.

## Corporate and Financial

**Electrical Properties to Be Sold by Receiver.**—The Consolidated Light & Power Company, with hydroelectric and steam generating properties at Mount Pleasant and Clair, Mich., and a transmission line in the same territory, will be sold at a receiver's sale in Detroit, Mich., on Jan. 13, 1914. At the same time, the Chippewa Construction Company, which has various holdings at Greenville, Mich., and elsewhere in the vicinity, will be sold.

**California Utility Seeks to Increase Capital Stock.**—A petition has been made to the California Railroad Commission by the Tulare County Power Company, of Lindsay, Cal., for permission to issue $80,000 additional capital stock. The proceeds of the sale of this stock, it is stated, will be applied to the building of an addition to the company's transmission system into the orange district of Tulare County. The present capital stock of the company has a par value of $530,000.

**Washington Distributing Company Changes Hands.**—The Big Bend Light & Power Company was incorporated in 1908 for the purpose of supplying electric energy for lighting and power service to the towns of Reardon, Davenport, Harrington, Ritzville, Sprague, Paha and Lind, Wash. A distributing business only was done, energy being purchased from the Washington Water Power Company. Word now comes that the former concern has been purchased by the latter, following a recent increase of $5,000,000 in its capital stock, note of which was made in the Nov. 29 issue of the *Electrical World*. The capital stock of the first-mentioned company is $271,000 outstanding, and it has $20,000 first mortgage 6 per cent bonds, also outstanding.

**Iowa Utility Plans to Extend Lines.**—Application for a franchise has been made by the Iowa Railway & Light Company for a high-tension transmission line between Cedar Rapids and Toledo, Ia., a distance of about 52 miles. This line will be another link in the system of transmission lines which the company purposes to build between Anamosa and Perry, Ia., several sections of which have already been completed. The company has outstanding $1,700,000 of common and $1,154,935 of 7 per cent cumulative preferred stock and $2,937,000 first and refunding mortgage 5 per cent gold bonds. First mortgage 5 per cent gold bonds of the Cedar Rapids & Iowa City Railway & Light Company to the value of $313,000 are also outstanding.

**Ohio Utility to Increase Common Stock.**—The Public Utilities Commission of Ohio has granted the petition of the Greenville (Ohio) Electric Light & Power Company for authority to issue $30,000 of new common stock, to be sold at not less than par. The proceeds of this sale are to be used for purchasing the material and for defraying construction expenses for a transmission line from Greenville to Union City, Ohio, and for extending the boiler capacity of the company's steam-power plant at the former city. The transmission line will be about 9½ miles in length, and the steam equipment to be installed will consist of two 300-hp Stirling boilers. A 125-ft. stack is also to be built, in connection with the installation of the new boilers.

**Capital Stock Increases of Illinois Utility Companies.**—Owing to the fact that the State Public Utilities Commission of Illinois will have general supervision of all public utilities in that State after Jan. 1, 1914, a number of utility corporations have been getting their financial houses in order under the law as now existing in anticipation of the change. A statement issued from the office of the Secretary of State at Springfield on Dec. 15 declares that within the last four months upward of $200,000 in fees has been paid into the office, representing a possible increase in the capitalization of public utilities of about $200,000,000. This increase in capitalization, however, is more apparent than real, as in the case of the merger of the Commonwealth Edison Company and the Cosmopolitan Electric Company of Chicago a fee was required on the joint capitalization of the two companies just as if the capitalization had been newly created, which was not the case. The smaller utility companies throughout the State are reported to be giving little attention, apparently, to the new law, but the larger companies have been studying the statute with care.

**Utah Power & Light Company Purchases Electrical Property.**—The Utah Power & Light Company is understood to have acquired the entire capital stock of the San Juan Water & Power Company, with a par value of $1,000,000, together with the outstanding $1,350,000 first mortgage 5 per cent gold bonds. While the San Juan Water & Power Company has been virtually under the same control since its incorporation in 1909, as a reorganization of the Animas Power & Water Company, this control was exercised through a majority interest in its stock and securities, rather than by outright ownership. The Utah Power & Light Company was organized in 1912 as the operating company in Utah and Idaho of the Utah Securities Corporation, which company controls it through stock ownership.

**Dean Electric Company Reorganization.**—The Dean Electric Company, of Elyria, Ohio, manufacturer of telephone apparatus and other electrical supplies, is in process of reorganization, and a committee representing the bondholders and other creditors of the concern has been formed to co-operate with the management in this work. E. F. Allen, J. M. Lenz and A. B. Garford will represent the bondholders, the merchandise creditors, and the banking creditors, respectively, on this committee. A statement by A. G. Bean, president of the company, assures co-operation between this committee and the management and contains the information that manufacturing will continue uninterrupted. The company has a capital stock of $1,655,000, with outstanding bonds of $50,000 par value, and a floating debt of over $300,000.

**Toledo Railways & Light Adds to Generating Capacity.**—On Dec. 14, eighteen days after its arrival at Toledo, the new 12,500-kw turbo-generating unit of the Toledo (Ohio) Railway & Light Company was placed in operation. This unit represents about 60 per cent increase in the generating capacity of the Toledo station and has been made necessary by a power demand largely in excess of the capacity of the station previous to its installation. In connection with this new unit the boiler capacity of the plant has been increased 15,000 hp. The company now has about 1200 motor-service customers, with over 3000 motors in operation, and both figures are rapidly increasing. The lack of adequate generating capacity has greatly retarded growth along these lines in the past year, but with the new unit in operation it is expected that many new power contracts will be obtained.

**Standing Committees of the Investment Bankers' Association.**—Announcement has been made by G. B. Caldwell, president of the Investment Bankers' Association, concerning the personnel of the standing committees of that organization for the coming year. The following appointments have been made of chairmen of the various committees: Constitution and by-laws, E. M. Stevens; finance and auditing, J. H. Smith; foreign relations, E. W. Bulkley; irrigation, reclamation and agricultural credits, A. C. Foster; legislation, A. G. Hoyt; membership, J. E. Blunt, Jr.; monetary legislation, John Perrin; municipal bonds, C. W. McNear; program for annual meeting, G. W. Kendrick, 3d; publicity, Lawrence Chamberlain; public service corporations, J. E. Oldham; railroad bonds and equipment notes, S. L. Fuller; taxation, F. W. Rollins, and timber bonds, Calvin Feutress.

**Pennsylvania Electrical Property Purchased.**—The National Properties Company, of Pittsburgh, Pa., has recently purchased the Chester County Light Company, which has a capital stock of $50,000, together with $25,000 first mortgage and $50,000 second mortgage bonds outstanding. The latter company has a perpetual franchise in Newcastle County, Del., and a transmission line from Newark, Del., to Avondale, Pa. It has also water-power rights at Rosemont and Tweedville, Del., where a hydroelectric generating station is in operation at the present time. The Chester County Electric Company is also controlled by the same concern. Electric light and power are supplied by the Chester County Light Company to numerous small towns in the southeastern part of Pennsylvania. Transmission lines now building will connect these communities with the large central station of the Wilmington & Philadelphia Traction Company at Wilmington, Del., which company came under the control of the National Properties Company early in 1913 through the purchase of a large block of common stock.

## Business Notes

**The Chicago Fuse Manufacturing Company** makes the announcement that after Dec. 15 its city trade in Chicago will be handled by W. O. Roach, who takes the place of W. E. Finlay, resigned.

**The Wagner Electric Manufacturing Company,** of St. Louis, Mo., has recently appointed T. T. Richards assistant manager. Mr. Richards has been associated with the company in its sales department for the past nine years, specializing in the marketing of new devices.

**The Alberger Pump & Condenser Company,** of 90 West Street, New York, has recently appointed T. S. Fuller as its secretary and treasurer, vice W. R. Billings, resigned. Mr. Fuller was formerly connected with the Scranton Bolt & Nut Company and was treasurer of Milliken Brothers.

**The Pittsburgh High-Voltage Insulator Company,** of Derry, Pa., has recently obtained the services of J. W. Blankenhorn for its electrical engineering department. Mr. Blankenhorn has been connected for some time with the engineering department of the Stone & Webster Engineering Corporation, of Boston, Mass.

**The Sterling Varnish Company,** of Pittsburgh, Pa., has secured the services of J. H. Shugg as insulation engineer. Mr. Shugg was until recently engaged in similar work at the Schenectady works of the General Electric Company, with which concern he has spent nearly a quarter of a century.

**Ray D. Lillibridge, Inc.,** of 111 Broadway, New York, states in a recent communication that rumors to the effect that the New York office and business are to be abandoned in favor of some California interests are without foundation. A branch office is, however, to be opened in San Francisco during 1914 to take care of the interests of clients who will exhibit at the Panama Pacific Exposition in 1915.

**Menominee Electric Manufacturing Company.**—Mr. L. M. Wood, purchasing agent for the Wesco Supply Company of St. Louis, has resigned his position with that company and after Jan. 1 he will be sales manager for the Menominee (Mich.) Electric Manufacturing Company. Mr. Wood worked himself up from the position of counter boy in the Wesco company, and he is one of the most popular of the younger electrical business men of St. Louis. He is a Jovian.

**The Collins-Wagner Company** has recently been organized with headquarters at 244 West Twenty-ninth Street, New York, for the purpose of manufacturing and selling electric and gas lighting fixtures and other bronze work. Both the manufacturing plant and the showroom of the company will be located at the above address. The president of the company, Charles Wagner, and the vice-president, A. V. Collins, have both been associated previously with companies in this line of work. H. M. Kahle is secretary of the new concern.

## New Industrial Companies

**Green, Ward & Weber, Inc.,** of Rochester, N. Y., has been incorporated with a capital stock of $10,000 to do an electrical contracting business. The incorporators are: Ralph D. Ward, Alfred L. Green and J. Fred Weber, all of Rochester.

**The Betschel Storage Battery Company,** of Chicago, Ill., has been incorporated with a capital stock of $31,000 by R. A. Risch, George M. Merke and H. L. Wuerfel. The company proposes to manufacture and sell electric batteries, electrical novelties, etc.

**The Ionex Electrical Development Company,** of Chicago, Ill., has been incorporated with a capital stock of $2,500 to manufacture and deal in electrical and mechanical machinery. The incorporators are Luther Johns, Irving S. Kemp and Edgar F. Beaubien.

**The Ingersoll Electric Vaporizer Company,** of Chicago, Ill., has been incorporated by Homer H. Ingersoll, Theobold Mueller and Daniel Mueller. The company is capitalized at $15,000 and proposes to manufacture and deal in machinery, tools, devices, etc.

# Trade Publications

**Switches.**—Catalog E, issued by the New York office of the Hart Manufacturing Company, has been supplemented by a discount sheet and a sheet treating of Diamond "H" wall cases.

**Watt-hour Meters.**—Alternating-current watt-hour meters are fully described and illustrated in a folder issued by the Westinghouse Electric & Manufacturing Company. Load curves of different types of meters are also shown.

**Securities.**—A booklet recently issued by W. P. Bonbright & Company, of 14 Wall Street, New York City, gives the latest available statements of some of the public utility properties in whose securities that company is dealing.

**Washing Machines.**—The Automatic Electric Washer Company, Newton, Ia., has recently issued a catalog illustrating and describing its motor-driven washer. There is a constantly increasing demand for electric washers that makes this catalog interesting and timely.

**Generators.**—In Bulletin A4151 of the General Electric Company engine-driven continuous-current generators of the commutating-pole type are described. These generators are manufactured in both two-wire and three-wire styles. They range in rating from 25 kw to 400 kw inclusive.

**Cable.**—The BX cable manufactured by the Sprague Electric Works of General Electric Company, 527 West Thirty-fourth Street, New York, is the subject of a leaflet recently issued, in which it is stated that this flexible-steel armored conductor has been in use fourteen years and is "still in the lead."

**Miner's Safety Lamp.**—The Edison Storage Battery Company, Orange, N. J., is distributing a ten-page pamphlet referring to its electric safety lamps for the conservation of life in mines. It tells in an interesting manner about the development of this lamp and describes the characteristics of the present lamp with the Edison cell.

**Pulmotor.**—A leaflet issued by the Draeger Oxygen Apparatus Company, 422 First Avenue, Pittsburgh, Pa., gives ten excellent and convincing reasons why the pulmotor should be installed wherever there is need for resuscitation apparatus. The company has also issued a folder referring to its helmets, which are being used successfully by mine workers.

**Diesel Engines.**—Carels Frères, of Ghent, Belgium, who are represented in the United States by W. R. Haynie, 30 Church Street, New York, have issued a pamphlet describing the Diesel engine supplied by them for driving the tank ship *Wotan*, belonging to the German-American Petroleum Company. This is the highest-powered engine of its type in existence.

**Wiring Material.**—The H. T. Paiste Company, Philadelphia, Pa., has recently published a 128-page illustrated catalog and price list of Paiste standardized wiring material. Since the publication of its last catalog the company lists in the present publication over 360 new articles added to the Paiste line. The catalog is well arranged and neatly printed. A code-word index, a catalog number index and a general index add to its usefulness.

**Line Material.**—The Line Material Company, South Milwaukee, Wis., is publishing the *Kyle Line Magazine*, an interesting little publication which in contents and make-up is somewhat different from the familiar house organ. The magazine, which is published monthly, is, as stated in an early issue, "devoted to common honesty, efficiency, humor and things in general," and is edited by Mr. David Gibson. The central double-page advertises the company's line material.

**Storage Batteries.**—"Twenty-five Years of Storage Battery Building" is the title of an interesting pamphlet lately issued by the Electric Storage Battery Company, of Philadelphia, Pa., on the occasion of its silver anniversary. The attractive cover, done in pearl gray with silver lettering, incloses a history of the company's growth, together with many pictures of its product and properties and photographs of its official staff. A smaller pamphlet just put out by the same concern tells about "boosting," or the auxiliary charging of vehicle batteries for short periods at rates higher than normal.

# Personal Mention

**Mr. J. H. Betts,** New York City, has been appointed statesman-at-large of the Jovian Order.

**Mr. M. Stephan,** operating manager of the Compagnie des Forges et Acieries Electriques, Ugine, Savoy, France, who was in this country for several weeks on business pertaining to the Girod electric furnace, sailed for Europe on Dec. 13.

**Mr. John F. Gilchrist,** assistant to the president of the Commonwealth Edison Company, addressed the Chicago Engineers' Club on Dec. 11, giving a history of central station development in Chicago and pointing out the advantages of concentrating the production of energy.

**Mr. John Howatt** has been appointed chief engineer of the Board of Education of Chicago. He has been an inspector for the United States Treasury Department in charge of the mechanical and electrical equipment of federal buildings in the Middle West. Of twenty-nine men who took the civil service examination for the position, which pays $6,000 a year, Mr. Howatt's name appeared first, with a percentage of 76.88. Mr. Howatt is thirty-two years old. He took the course in electrical engineering at the University of Minnesota, graduating in 1904 with the degree of E. E.

**Mr. E. B. Neiswanger,** superintendent of construction of the Texas Power & Light Company, has been appointed construction engineer of the company in charge of all construction, to succeed Mr. G. E. Moffat, chief engineer, who has resigned to accept a similar position with the Phoenix Construction Company. For ten years prior to entering the service of the Texas Power & Light Company in January, 1913, as superintendent of construction, Mr. Neiswanger was engaged in plant installation and efficiency work with mining and milling interests in Colorado, and with beet-sugar and irrigation projects in Kansas.

**Mr. Paul P. Bird** has resigned from the Commonwealth Edison Company to become a member of the new firm of Norton & Bird, consulting engineers, of Chicago. Mr. Bird was born in Kalamazoo, Mich., but during his boyhood his family removed to Rochester, N. Y., where he attended the Rochester Free Academy. He entered Cornell University in the class of 1900 and graduated with the degree of M.E. For several years thereafter he was employed by the Newport News Ship Building Company, of Newport News, Va., although in an interval of that employment he spent one year as instructor at Cornell. In 1904 Mr. Bird came to Chicago and for three years he was steam engineer for the Illinois Steel Company at the South Chicago works. In the fall of 1907 he was appointed by Mayor Busse chief smoke inspector for Chicago, and he held this position until May, 1911, when he accepted a position with the contract department of the Commonwealth Edison Company. Mr. Bird made an excellent record as head of the department of smoke inspection of the city of Chicago, and his work attracted wide attention. He read papers on the subject of smoke prevention before the Western Society of Engineers, the American Civic Association and other bodies. In 1910 and 1911 he was president of the International Association for the Prevention of Smoke. He is a member of the important committee on investigation of smoke abatement and electrification of railway terminals of the Chicago Association of Commerce. Mr. Bird is a member of the American Society of Mechanical Engineers and chairman of the flourishing Chicago section of that society. He is also a member of the Western Society of Engineers, the National Electric Light Association, the University Club of Chicago and of the Exmoor Country Club.



PAUL P. BIRD

**Mr. J. L. Longino** has succeeded Mr. M. A. Cohn as superintendent of the lighting department of the Merchants' Lighting Company, Little Rock, Ark.

**Mr. W. L. Davis** has recently been elected as assistant secretary and assistant treasurer of the Texas Power & Light Company and affiliated companies, including the Paris Transit Company, succeeding Mr. E. E. Reber, resigned. Mr. Davis entered railway service in 1906 with the Indiana, Columbus & Eastern Traction Company, later merged into Ohio Electric Railway Company. After holding various positions in the accounting department of this company, he was appointed statistician in 1909. In August, 1912, he accepted the position of traveling auditor of the Texas Power & Light Company, of which company, with its affiliated companies, he now becomes assistant secretary and assistant treasurer.

**Mr. M. C. Gilman** has been appointed sales manager of the Toronto Electric Light Company, Ltd., of Toronto, Ontario, Can., vice Mr. W. R. Sweany. Mr. Gilman was graduated from the electrical engineering course at Pratt Institute, Brooklyn, N. Y., in 1907, and since then has had experience in the central-station field as assistant power engineer of the Edison Electric Illuminating Company of Brooklyn, assistant power engineer of the Public Service Electric Company of Newark, power engineer of the Virginia Railway & Power Company of Richmond, Va., and power engineer of the Toronto Electric Light Company. For the past year Mr. Gilman has served as assistant to Mr. F. G. Clark, chief engineer of the Toronto Electric Light Company, Ltd., from which position he is now promoted to that of sales manager.

**Mr. William J. Norton** has severed his connection with the Commonwealth Edison Company to engage in private practice as a member of the new firm of Norton & Bird, consulting engineers, of Chicago. Mr. Norton is a native of Baltimore and obtained his academic education at Baltimore City College. After a business experience of three years with the Factories Mutual Fire Insurance Companies, he entered Cornell University, class of 1902, and was graduated with the degree of M.E. After leaving college Mr. Norton was connected for a short time with the engineering department of the Chicago Edison Company. Thereafter he was employed successively by the Chicago Ship Building Company and the New York Ship Building Company of Camden, N. J. Later he was vice-president and general manager of the Federal Sign System (Electric), with headquarters in New York. From 1907 to 1911 Mr. Norton was first assistant secretary of the Public Service Commission for the First District of the State of New York. In this position he gained a good insight into the subject of public utility regulation and was impressed with the importance of it. In 1911 he returned to Chicago to assist the Commonwealth Edison Company in the pending rate regulation by the City Council—a work which has just been carried to a successful conclusion. Two years ago Mr. Norton was made secretary of the rate research committee of the National Electric Light Association, a position which he still holds. He is also editor of *Rate Research*, the weekly paper published by the committee. He is a member of the American Institute of Electrical Engineers, the Illuminating Engineering Society, the Society of Naval Architects and Marine Engineers, the American Gas Institute, the Jovian Order and other societies. He also belongs to the Engineers' Club of New York, the University Club of Chicago and the Winnetka Country Club. He has published an annotated edition of the Illinois public utility law and has presented a number of papers before electrical societies on rate-regulation subjects. Perhaps the most interesting of these is "Two Epochs of Rate Regulation," read before the Michigan Section of the National Electric Light Association last summer.



WILLIAM J. NORTON

**Mr. E. W. Stevenson**, electrical engineer of the Hazard Manufacturing Company of Wilkes-Barre, Pa., has resigned from that company to become sales agent for Messrs. Smith & Nichols, manufacturers of waxes. Mr. Stevenson, who is well known in the electrical industry, has been engaged in almost every branch of the wire and cable business for thirty-four years. He was with the Hazard Manufacturing Company ever since it began the manufacture of insulated wire in 1899. Previous to that he spent four years as electrical engineer with the Okonite Company, and for two years previous to that he acted as consulting engineer. From 1880 to 1886 Mr. Stevenson was in the employ of the Telegraph, Construction & Maintenance Company of London, Eng., and from 1889 to 1904 he was in charge of the underground cable circuits of the old Brush Electric Illuminating Company of New York. Before going with the Brush company he spent two years with the Commercial Cable Company. Mr. Stevenson's close work in the factory fits him well for his new work. He went to England last summer to "try himself out" and made a preliminary expedition three years ago with the same object in view. The firm with which he is now connected is a very old, well-established concern and has supplied the trade with waxes from the very beginning.



E. W. STEVENSON

## Obituary

**Albert Durkee**, one of the oldest employees of the Commonwealth Edison Company, Chicago, died on Nov. 30, aged sixty-five years. He entered the service of the company about twenty-five years ago and was a lighting solicitor in the down-town district, although for the last three years he had been incapacitated by illness. Mr. Durkee was a native of the Province of Nova Scotia, Canada, and in early life was a sailor. He leaves a wife and five adult children.

**Daniel M. Barton**, general purchasing agent of the General Electric Company, died at his home in Schenectady of heart failure on Dec. 5. Mr. Barton was born in Moriah, N. Y., in 1843. His father, Silas D. Barton, a farmer by occupation, moved his family to Ware, Mass., while his children were still young. It was there that Mr. Barton spent most of his youth up to the age of nineteen, when, together with his brothers, Henry and Silas A., he enlisted in the army. After his return from the war he became a dry goods merchant in Meriden, Conn., following which he removed to Lynn, Mass., where he followed the occupation of bookkeeper and newsdealer. In 1883 the Thomson-Houston Electric Company was formed by citizens of Lynn, one of the leading spirits among them being Silas A. Barton, and the company was established in Lynn. Three years later Mr. Barton entered the employ of that company and became its first production manager, under Mr. E. W. Rice, Jr., then superintendent. During his administration of this office and inspired by the first large railway contract secured by the company for electrifying the West End Street Railway Company, Boston, he devised and inaugurated some novel and successful systems of scheduling, regulating and expediting production, which attracted wide attention. In 1893 Mr. Barton became assistant purchasing agent of the General Electric Company, which had been formed the previous year. With the removal of the department to Schenectady, after it was decided early in 1894 to make that city the headquarters of the company, Mr. Barton was appointed purchasing agent, this title being changed to general purchasing agent some years later. This position he filled ably and loyally up to the time of his death. He is survived by his widow, a daughter, and three grandchildren.

# Construction

## New England

CLARK'S MILL, ME.—The Clark Pwr. Co., of Clark's Mill, has recently completed the erection of 4 miles of transmission line. The company will probably erect more extensions next summer. Cecil F. Clark is president and manager.

BURLINGTON, VT.—The Burlington Trac. Co. will soon install transformers and erect distribution lines for supplying the town of Shelburne with about 30 tungsten street lamps and furnishing electricity for about 50 residences and also the estate of Dr. W. S. Webb with about 100 hp for lamps and motors. Carl B. Brownell is superintendent.

VERGENNES, VT.—The capital stock of the Vergennes El. Co. has been purchased by the Burlington Trac. Co. interests, which will continue to operate the local business under the same name. The old plant, consisting of a 75-kw, 133-cycle, 1,100-volt generator and a 20-lamp Thomson-Houston direct-current arc machine, will be dismantled and the lines connected with the lines of the Burlington Trac. Co.'s plant (1400-kva, 60-cycle, 2400-volt). This change will require many new transformers and a series tungsten street-lighting system.

## Middle Atlantic

ARCADE, N. Y.—The village of Arcade is installing a coal conveyor at the municipal electric-light plant. J. H. Howard is village clerk.

BUFFALO, N. Y.—Bids will be received by Francis G. Ward, commissioner of public works, Room 5, Municipal Building, Buffalo, N. Y., until Dec. 26, for furnishing labor and material required for the construction of a new 16-room fireproof school building on Oak Street, near Genesee, in accordance with plans and specifications prepared by George J. Metzger, architect, as follows: (A) Masonry, etc.; (B) structural iron and steel work, etc.; (C) fireproofing, floors, etc.; (D) carpentry work, painting, etc.; (E) roofing, sheet-metal work, etc.; (F) electrical work, telephone system, lighting fixtures, etc.; (G) heating, ventilating, radiation, etc.; (H) plumbing, drainage, gas-fitting, etc. A separate and distinct proposal must be made for each division of the work.

HANNAWA FALLS, N. Y.—The Hannawa Falls Wtr. Pwr. Co. has applied to the Public Service Commission, Second District, for permission to increase its capital stock from $300,000 to $600,000. The company has also petitioned for authority to issue its first and refunding collateral trust mortgage to the amount of $1,200,000 and to issue bonds to the amount of $800,000 to acquire and hold 1380 shares of the capital stock of the Northern Pwr. Co., of Potsdam.

ST. REGIS FALLS, N. Y.—The St. Regis Falls Lt. & Pwr. Co. is contemplating placing its wires underground next season. If the project is carried out, steel-taped cable will be used.

SYRACUSE, N. Y.—Plans for the concentration of all water-power interests along the Oswego River, it is reported, are completed. The plan provides for a central electric power plant, which will furnish sufficient electricity to operate factories which are now depending upon waterwheels for power. The project will be capitalized for more than $2,500,000. The Fulton Lt., Ht. & Pwr. Co., of Fulton, is interested in the above project.

ASHLAND, PA.—The Schuylkill Lt., Ht. & Pwr. Co., of Centralia, has applied to the Public Service Commission for permission to engage in business in Ashland. An ordinance is now awaiting action by the Ashland Council granting the Schuylkill company a franchise here.

BANGOR, PA.—Application has been made to the Town Council by the Industrial El. Co. to furnish electrical service in Bangor. The company proposes to use the poles of the Blue Mountain Tel. Co. to carry its wires. A substation will be erected by the Lehigh Navigation & El. Co., from which energy will be purchased, outside of Bangor.

BRADDOCK, PA.—Bids will be received by the Board of Education, addressed to S. D. Hamilton, secretary, until Jan. 5 for the construction of a high school building for which separate bids are to be submitted as follows: General contract construction; heating and ventilating plant; water supply equipment; plumbing and gas fitting; electric-light and power equipment, and telephone installation and vacuum-cleaning apparatus. Plans and specifications, bidding blanks and full information can be secured at the office of Carlisle & Sharrer, architects, 7119 Jenkins Arcade, Pittsburgh, Pa.

ELLWOOD CITY, PA.—The City Council has awarded the Harmony Co. a contract for furnishing the city electricity for lighting purposes for a period of ten years.

PHILADELPHIA, PA.—Bids will be received at the office of the commanding officer, Frankford Arsenal, Philadelphia, Pa., until Dec. 29, for the installation of one steam turbine generator, with exciter and switchboard, and one condensing equipment in the engine room of the power plant at the Frankford Arsenal, Philadelphia.

PHILADELPHIA, PA.—Bids will be received by M. L. Cooke, director of Department of Public Works, Room 332, City Hall, Philadelphia, until Dec. 22, for furnishing and maintaining lamps for lighting the streets, parks, bridges and public places in the city of Philadelphia. Blank forms and specifications may be obtained at the office of Bureau of Lighting, Room 332, City Hall, Philadelphia.

PHILADELPHIA, PA.—Bids will be received at the office of the Department of Health and Charities, 584 City Hall, Philadelphia, until Dec. 26, for the construction of a power plant for the Philadelphia Institution for Feeble-Minded at Byberry. Plans, specifications, form of proposal and other information may be obtained upon application to Philip H. Johnson, architect, 1824 Land Title Building, Philadelphia. Joseph S. Neff, M.D., is director.

PITTSBURGH, PA.—The City Council has authorized the director of public works to install an ornamental street-lighting system in Grandview Avenue from Wyoming Street to Republic Street.

BEDFORD CITY, VA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 26, for construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches, of the United States post office at Bedford City. Drawings and specifications may be obtained at the above office or from the custodian of site at Bedford City. O. Wenderoth is supervising architect.

CLARENDON, VA.—The Board of Supervisors of Alexandria County has awarded the contract for furnishing 100 electric lamps along the main thoroughfares of Alexandria County to M. E. Church, of Falls Church, at $15 per lamp per year.

MONTEREY, VA.—The Monterey Garage & Lt. Co. expects to purchase within the next six months 25 meters. C. W. Lunsford is manager.

WASHINGTON, D. C.—Plans are being prepared by the Treasury Department for the proposed central heating and power plant for the government buildings, provided for in the last sundry civil act.

WASHINGTON, D. C.—An American consul reports that a foreign government contemplates the development of some of its water-power resources for industrial purposes and possibly for motive power for a light railway. The cost of the work is estimated at about $3,000,000. For further information, address No. 12,105, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C.

WASHINGTON, D. C.—Bids will be received by the Secretary of the Interior, Department of the Interior, Washington, D. C., until Jan. 9, 1914, for remodeling power plant of the Government Hospital for the Insane, Anacostia, D. C., in accordance with plans and specifications, copies of which may be obtained on application to the chief clerk of the department. Bidders are to take part payment in the old machinery now in operation. Lewis C. Laylin is assistant secretary.

## North Central

DECKERVILLE, MICH.—The power plant of the Deckerville El. Lt. & Wtr. Co. was damaged by an explosion of pressure tank on Dec. 9, causing a loss of about $3,000.

DURAND, MICH.—Within the next six months the Water and Light Commission expects to install a 125-kva direct-connected unit, consisting of a three-phase, 1100/2000-volt generator with simple engine (automatic Corliss type). H. F. Rosenkrans is superintendent.

FREMONT, MICH.—A company is being organized by local citizens for the purpose of furnishing electricity in Fremont. The new company will take over the Walter Snow dam sites on Cushman Creek and White River for the purpose of building dams and a power house. The new corporation will have an authorized capital stock of $75,000.

JONESVILLE, MICH.—The Water and Light Department is installing a new 78-in. by 18-in Wicks tubular boiler in the municipal power plant. George T. Caldwell is superintendent.

WAKEFIELD, MICH.—The proposal to issue $5,000 in bonds for the purchase of electrical equipment will be submitted to the voters.

BELLAIRE, OHIO.—Bids will be received at office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 19, for construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Bellaire. Drawings and specifications may be obtained at the above office or from the custodian of site at Bellaire. O. Wenderoth is supervising architect.

BELLEFONTAINE, OHIO.—The City Council is considering the question of authorizing an issue of $36,000 in bonds, the proceeds to be used for improvements and extensions to the municipal electric-light plant.

CANTON, OHIO.—The installation of a municipal electric-light plant is under consideration. Mayor Turnbull proposes to ask the City Council to call an election to vote on the question of issuing bonds for same.

CANTON, OHIO.—The Federal Clay Products Co. is planning to expend between $60,000 and $100,000 for the construction of a new building to replace the building destroyed by fire some time ago, and for the centralization of its power system. The company has four plants in operation, and under the present system power for each is furnished separately. It is proposed to install a new 1000-hp plant to furnish power for all the buildings.

CLEVELAND, OHIO.—The Cleveland El. Illg. Co. has been granted permission to erect a power house at 2260 Canal Road, four stories high, to cost about $6,000.

CLEVELAND, OHIO.—Bids will be received at the office of W. H. Kirby, secretary to the director of public service, 204 City Hall, Cleve-

land, until Dec. 30, for steam turbine-driven exciter set for the municipal electric-light plant, in accordance with plans and specifications, which may be obtained in the office of the engineer of construction, Room 419, City Hall. W. J. Springborn is director of public service.

COLUMBUS, OHIO.—The report of Harry R. Allensworth, electrical engineer, estimates the cost of placing the overhead wires owned by the municipality in underground conduits in the downtown district at $25,000. Arrangements are also being made by the local utilities companies to begin work on placing their wires in underground conduits.

GREENVILLE, OHIO.—The Public Utilities Commission has authorized the Greenville El. Lt. & Pwr. Co. to issue $30,000 in capital stock, the proceeds to be used for the purchase of material and erection of a transmission line from Greenville to Union City, a distance of 9½ miles; also for the purchase and installation of two 300-hp Stirling boilers in the Greenville power station and for a 125-ft. radial brick stack.

MECHANICSBURG, OHIO.—The Mechanicsburg Lt. & Pwr. Co. expects to purchase within the next month some electrical appliances, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, etc. T. J. Long is general manager.

YOUNGSTOWN, OHIO.—The Public Utilities Commission has authorized the Mahoning County Lt. Co., of Youngstown, to sell $10,000 in common stock, the proceeds to be used to begin the equipment of an electric-light plant. The proposed plant will be situated at the foot of Hazel Street and when completed will cost more than $100,000. The company was recently granted a franchise to furnish electrical service in Youngstown. Paul Kaercher, of the Youngstown Steel Htg. Co., is interested in the Mahoning company.

BURNSIDE, KY.—The Kentucky Utilities Co., of Burnside, has recently finished the erection of a transmission line from Somerset to Burnside, a distance of 8 miles. J. W. Sloan is district manager.

MOUNT VERNON, KY.—The Mount Vernon El. Lt. & Ice Co., recently incorporated, is planning to install an electric-light plant and ice factory in the near future. U. G. Baker is president of the company and James Maret is secretary.

MENTONE, IND.—The Board of Trustees has granted a franchise to William P. Hollands and William C. Davis, of Mentone, owners of the local electric-light plant, to erect transmission lines for the distribution of electricity in Mentone for a period of ten years.

BUNKER HILL, ILL.—The electric light committee may purchase some meters and a few lightning arresters. Harry McPherson is chairman of the electric light committee.

CANTON, ILL.—The capital stock of the Canton Gas & El. Co. has been increased from $100,000 to $500,000.

CHICAGO, ILL.—Bids will be received by Ray Palmer, city electrician, Room 614, City Hall, Chicago, until Dec. 22, for furnishing the Department of Electricity with arc-lamp carbons for electric lamps, in accordance with specifications on file in the above office, as follows: 200,000 14-in. by 5/16-in. copper-coated carbons; 125,000 12-in. by 0.510-in. to 0.520 in. solid, high-grade carbons; 125,000 12-in. by 0.510-in. to 0.520-in. cored, high-grade carbons; 530,000 12-in. by 7/8 in. white-flame carbons for General Electric-Lynn arc lamps; 12,000 pairs white-flame carbons for Stave arc lamps, upper carbon dimensions 10¼-in. by 20 mm, lower carbon dimensions 8¾ in. by 18 mm. Proposals must be made out on blanks furnished by the city electrician.

CHICAGO, ILL.—Sealed proposals will be received by Ray Palmer, city electrician, Room 614, City Hall, Chicago, Ill., until Dec. 23, for furnishing the Department of Electricity sundry kinds and sizes of incandescent and tungsten lamps for the year 1914, in accordance with specifications on file in the above office, as follows: 6000 25-watt, 115-volt, tungsten, drawn-wire filament lamps; 25,000 80-watt, 4-amp series tungsten lamps; also lamps of such other watage as may be required from time to time during the year by the various departments of the city of Chicago. Bids will also be received at the same time and place for 1,025 dozen outer globes for arc lamps, 900 dozen inner globes, heat-resisting, for arc lamps. Specifications are on file in the above office. Proposals must be made out on blanks furnished by the city electrician.

NAUVOO, ILL.—Within the next six months the Nauvoo El. Lt. & Pwr. Co. expects to purchase some auxiliary and switching equipment, also transformers, poles, lightning arresters, wire and meters, and electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, switches, etc. Joseph Nelson is manager.

OGLESBY, ILL.—The City Council has decided to abandon the local plant and secure electricity from the Citizens' Ltg. Co., of La Salle. Under the terms of the contract the city of Oglesby is to erect the transmission line from Jonesville to this city.

GLENWOOD, WIS.—The Glenwood & Downing Lt. & Pwr. Co., of Glenwood, expects to purchase a 60-kw, 60-cycle generator to replace a 133-cycle machine. No definite action has been taken on the matter. The company has recently changed the Downing line from 1,100 volts to 2,200 volts.

GRAND RAPIDS, WIS.—Last April the city voted to purchase the plant of the Grand Rapids El. Co. An appraisal of the system is now being made by the State Railroad Commission. The street-lighting apparatus is loaded to the limit. Additions to this part of the system will be necessary in the spring. M. N. Weeks is manager.

GREENBUSH, WIS.—It is reported that Otto Herring is contemplating the construction of a concrete dam and the installation of an electric-light plant to furnish electricity for lamps in Greenbush.

LA CROSSE WIS.—A committee, consisting of Aldermen Roellig, Strauss and Worth, has been appointed by Mayor Ori J. Sorensen to investigate the advisability of establishing a municipal lighting plant.

WEST BEND, WIS.—Within the next eight months the West Bend Htg. & Ltg. Co. expects to purchase boilers and turbines and some poles. G. W. Kuehltham is president.

CLARA CITY, MINN.—A committee, consisting of M. S. Carl and E. Thien, has been appointed by the Commercial Club to investigate the matter of establishing a municipal electric-light plant.

FARMINGTON, MINN.—Within the next three months the Farmington El. Lt. & Pwr. Co. expects to erect a 55-hp producer gas engine and a gas producer of 150 hp; also a 250-volt generator and balancer set, or three-wire generator, switchboard and auxiliaries for above, and about 2 miles of transmission lines, and also to enlarge its feeders. The company recently installed a 240-amp-hr. National battery with switchboard and booster. F. H. Eddy is manager.

KERKHOVEN, MINN.—The City Council has entered into an agreement with the Kerkhoven Roller Mill Co. whereby the latter will install an electric light and power plant and furnish the city with electricity for lamps.

LYLE, MINN.—N. T. Fontun, manager of the local electric-light plant, expects to erect a new power-house and to purchase a crude-oil engine and second-hand motors and dynamo (1,100-volt, 133 cycles, three-phase) within the next year; also within the next two months to purchase some lamps.

TWO HARBORS, MINN.—The City Council expects to purchase within the next 30 days one combination anthracite and bituminous coal wagon loader and one 5 hp, 60-cycle, single-phase motor with drum for pulling coal cart. Aug. Omtvedt is city clerk.

BLOOMFIELD, IA.—The City Council and Commercial Club are considering a proposal submitted by the Centerville El. Lt. & Trac. Co., of Centerville, to furnish electricity for lamps and motors in Bloomfield.

DENNISON, IA.—The contract for installing electric equipment in the new opera house has been awarded to the James G. Bradley El. Co., of Council Bluffs.

KEOTA, IA.—The local electric-light plant has been purchased by Walsh Brothers, of Burlington. It is understood that improvements will be made to the system.

NORA SPRINGS, IA.—O. E. Jacobson, owner of the local electric-light plant, expects to make some additions to its plant during the coming year.

ROCKWELL CITY, IA.—The local electric-light plant was destroyed by fire on Dec. 2, causing a loss of about $10,000.

SHELBY, IA.—The citizens on Dec. 1 voted to grant the Avoca El. Lt. & Pwr. Co., of Avoca, a 20-year franchise to furnish electricity in Shelby. W. A. Torrey, of Avoca, is engineer in charge.

WESTGATE, IA.—It is reported that Tegmeier Brothers have closed a contract for a large engine and generator, which will be installed in their garage. They propose to furnish electricity for lamps and motors in Westgate.

CLARENCE, MO.—The city of Clarence is considering the question of installing a directly connected unit next summer, details not yet decided upon. D. McIntire is superintendent.

FULTON, MO.—The board of managers of the Missouri School for the Deaf has decided to complete the new power plant at the institution, at a cost of $9,000. Bids for the work, it is understood, will be received in January. Several new boilers and other equipment will be required.

HAMILTON, MO.—At an election held Dec. 1 the citizens voted to grant a franchise to Messrs. Miller and Gilbert, of Kansas City, Mo., to install and operate an electric-light and power plant and an electric suburban railway and terminals.

BIG STONE CITY, S. D.—Local business men, it is reported, are organizing a stock company to install and operate an electric-lighting system in Big Stone City. M. A. Benjamin is interested in the project.

MITCHELL, S. D.—The Mitchell Pwr. Co. has just completed the installation of a 225-hp Diesel engine and a 200-kw Fort Wayne generator.

ALLIANCE, NEB.—The Electric Light Commission expects to purchase within the next six months a few transformers (pole type), a carload of 25-ft. and 30-ft. poles and a small line of household electrical appliances, including heating and cooking apparatus, vacuum cleaners, washing machines, etc. Clare A. Dow is superintendent.

FRIEND, NEB.—The village of Friend expects to erect an addition to the power-house of the municipal electric-light plant and water-works system within the next six months; also to purchase a small Corliss engine and an alternating-current generator (belt-driven) and would like to receive catalogs and prices on engine and generators. L. S. Frantz is superintendent.

MEAD, NEB.—The town of Mead contemplates the installation of a municipal electric-light plant, the equipment to consist of a 25-hp oil engine and a 17½-kw generator. The plans for street-lighting system provide for five arc lamps of 250 cp and 10 incandescent lamps of 60 cp; about 1½ miles of transmission lines will be erected. Bids for construction of proposed plant will be called about Feb. 1, 1914. Bruce & Standevan, of Omaha, are designing engineers.

[illegible] for the electric light plant and [illegible] & Standevin, Bee Building, Omaha, are engineers. J. C. Work is Mayor.

[illegible] The question of the electric lighting system is being considered by the City Council. The question will probably be submitted to the voters.

SEVERANCE, IOWA.—Plans [illegible] are being prepared by C. I. Stocking, of Hiawatha, engineer, for an electric-light plant in Severance.

## Southern States

SPENCER, N. C.—The city of Spencer is contemplating the installation of a municipal electric-light plant, for which bonds have been issued and sold. Electricity for operating the system will probably be purchased from some power company. D. Fulk is city clerk.

WALLACE, N. C.—Within the next few months the Duplin Lt. & Pwr. Co., of Wallace, expects to purchase a complete generating outfit. J. W. Boney is general manager.

WASHINGTON, N. C.—An appropriation of $ [illegible] has been made for improvements to the municipal electric-light plant. Gilbert C. White, of Charlotte, N. C., is consulting engineer.

WILMINGTON, N. C.—Within the next six months the Tidewater Pwr. Co., of Wilmington, expects to erect about 6 miles of distribution lines and to purchase the usual amount of material for distribution system, including transformers, poles, lightning arresters, insulators, wires and meters; also within the next 12 months heating and cooking apparatus to the amount of about $1,000 and other electrical devices in proportion. Raymond Hunt is superintendent of electrical department.

OCALA, FLA.—J. D. Robertson, it is reported, contemplates the construction of a hydroelectric plant at Stokes Ferry on Withlacoochee River, to cost approximately $300,000.

LIVINGSTON, TENN.—The Mayor and Board of Aldermen have adopted an ordinance granting a franchise to the Livingston El. Lt. & Pwr. Co. to install and operate an electric-light plant in Livingston. An ordinance is also pending before the board granting a franchise to the T., K. & N. Railroad to use the streets of the city upon which to operate a motor car, which, it is understood, will soon be in operation upon the railroad between Livingston and Algood.

SEQUATCHIE, TENN.—A company is being organized by E. G. Wright to build a hosiery mill. The present plans provide for equipping the proposed mill for electrical operation.

BREWTON, ALA.—Within the next 30 days the city of Brewton expects to purchase one 150-kw generator, one four-valve engine, directly connected to generator, one 175-hp boiler and one electrically-operated pump; also one series street-lighting system complete. D. B. Hayes is city clerk.

GADSDEN, ALA.—The Alabama Pwr. Co. has entered into a contract with the Alabama City, Gadsden & Attalla Ry. Co. (which owns and operates the street railway and electric-lighting plants in Gadsden and the street railway lines in Attalla and Alabama City) to furnish all electricity for lamps and motors in Gadsden for a period of ten years.

UNIONTOWN, ALA.—Within the next three months the managers of the municipal light and water plant expect to install one electrically-operated air compressor. George B. Foss is superintendent.

CHELSEA, OKLA.—Arrangements are being made by the town of Chelsea for the installation of a municipal electric-light plant. Equipment for the plant has already been ordered.

STILLWATER, OKLA.—The city of Stillwater expects to rebuild within the next six months 5 miles of transmission line, which will include about five 10-kw transformers. Within the next 12 months the city expects to purchase one 150-kva, three-phase, 60-cycle (engine-type) generator, with engine and switchboard; also to install additional street lamps, part multiple, part series, all maintained by conduits, using three-lamp ornamental posts. M. W. J. Holt is commissioner of water, light and sewers.

CHANDLER, TEX.—Dabney White, who recently purchased the cotton gin of the Birdwell Brothers, will install an electric-light plant in connection with the cotton gin.

HOLLAND, TEX.—The installation of a municipal electric-light plant in Holland is under consideration.

## Pacific States

CENTRALIA, WASH.—The City Council has instructed the city engineer to prepare plans and estimates of cost for extending the lighting service to the districts lying beyond the improved section of the city known as West Main Street.

EATONVILLE, WASH.—All bids for the erection of a transmission line from the Tacoma municipal power plant at Nisqually to Eatonville have been rejected. The line will probably be built by force account. The city has decided to purchase electricity from the Tacoma plant rather than to build a municipal plant.

LIMA, WASH.—The Lima Lt. & Pwr. Co. is [illegible] making extensions and improvements to its plant about the first of the year.

RAYMOND, WASH.—Plans are being prepared by the Willapa El. Co. for the construction of a 1000-hp plant, which will be built adjoining the plant of the Willapa Lumber Co. Provision will be made for doubling the output of the plant when necessary.

SEATTLE, WASH.—The Port of Seattle Commission has awarded the contract for furnishing electricity for all port projects now in operation for the ensuing year to the Seattle municipal electric-light plant.

SEATTLE, WASH.—The County Commissioners have granted the Puget Sound Trac., Lt. & Pwr. Co., Seattle, a franchise covering portions of Lake Forest Park and Echo Lake Garden Tracts for a high-tension transmission line.

SEATTLE, WASH.—According to estimates submitted to the City Council by J. D. Ross, superintendent of lighting, the cost of complete development of the Cedar River project to develop 45,000 kw will be, in addition to the amount already expended, $3,320,000. The work includes completion of masonry dam now under construction to an elevation of 1,555 ft., adding 14,000 kw to the present output of the plant; also enlargement of the dam to an elevation of 1,590 ft., the construction of a surge tank, a new penstock, construction of a tunnel and the installation of additional machinery for generating electricity and other purposes. The cost of the full development of the Lake Cushman project to a capacity of 70,000 hp on a 12-hour load-factor, exclusive of land and water rights, is estimated at $5,063,000.

SHELTON, WASH.—The Shelton El. Co. expects to change the present flat-rate system to the meter system, and is also talking of installing a new street-lighting system. W. H. Hollenbeck is manager.

EUGENE, ORE.—Plans for the immediate development of a hydroelectric power project at Clear Dale at the headwaters of the McKenzie River, 90 miles from Eugene, to cost about $5,000,000, by the Oregon El. Ry. Co. have been announced. Work on the construction of the first two units will begin in June. Present plans provide for a development of 45,000 hp. George S. Edmonstone, of Portland, is hydraulic engineer of the Oregon El. Ry. Co.

NORTH BEND, ORE.—Wiliam Schrock, of North Bend, is contemplating the installation of a small electric plant.

REEDSPORT, ORE.—The Department of Agriculture at Washington, D. C., has granted a permit to James Lindsay, of Portland, Ore., to construct a power plant on Mill Creek, in Douglas County, within the Suislaw Forest Reserve. Mr. Lindsay proposes to transmit electricity from the plant to Reedsport, a distance of 18 miles, to operate the pulp mills here.

ALAMEDA, CAL.—The new municipal power station has recently been completed and new machinery installed, including a 1250-kw Parsons turbine with surface condensers and auxiliaries; also two 300-hp Stirling boilers with all fireroom equipment, new feed pumps, closed heater, etc.; a switchboard with high-tension wires in compartment above the ground floor; Bell circuit arrangement for operating switches and 14 voltage feeder regulators on all outgoing feeders. Joseph B. Kahn is superintendent of the Department of Electricity.

ALVISO, CAL.—Bids will be received by the clerk of the Board of Trustees until Jan. 5, 1914, for a franchise to erect transmission lines for the distribution of electricity in the town of Alviso, application for which has been made by the Pacific Gas & El. Co., of San Francisco. S. J. Maggini is clerk.

CLOVERDALE, CAL.—The State Railroad Commission has granted the California El. & Lt. Co., of Cloverdale, permission to issue $[illegible],000 in bonds and $50,000 in capital stock, the proceeds to be used for new construction and equipment and refunding indebtedness.

LINDSAY, CAL.—The Tulare County Pwr. Co., of Lindsay, has applied to the California Railroad Commission for permission to issue $80,000 in capital stock, the proceeds to be used for the erection of additional transmission lines into the orange belt of Tulare County.

LOS ANGELES, CAL.—Financial arrangements, it is reported, are being made by the Pacific Lt. & Pwr. Corpn., of Los Angeles, for large extensions to its system in Fresno County. It is understood that the company proposes to increase the height of its dam so as to double the capacity of the lake, to increase the number of units in its No. 1 and 2 power houses, and to construct two more power houses, making the No. 3 plant larger than either of the present plants. The general plan provides for increasing the height of the present dam between 50 ft. and 60 ft., which will double the capacity of the lake now in existence. The number of units to be added to power houses No. 1 and 2 is not known; power house No. 2 will be located near Stevenson Creek. The water will be taken from the San Joaquin River near Mammoth Pool and will be conveyed to the power house through a concrete conduit about 8 miles long. The No. 4 power plant will be situated near the mouth of Big Sandy. The water will be taken up below the power house No. 3 at Italian Bar and will be diverted across Patterson Bend and delivered back to the river near the mouth of the Big Sandy.

MONTAGUE, CAL.—Congress will be asked by the Shasta Valley Irrigation Association to make an appropriation of $5,000,000 for carrying out a project to irrigate 100,000 acres in 12 townships north, south and east of Montague by means of a canal to bring 40,000 miners' inches of water from the Klamath River at Keno, 36 miles distant. The intake of the proposed canal is 1400 ft. above the floor of the valley and will make possible the development of 40,000 hp of electricity.

OAKLAND, CAL.—The Great Western Pwr. Co. has applied to the State Railroad Commission for a certificate of convenience and necessity to distribute electricity in the city of Oakland. The company heretofore has been distributing electricity under franchises granted in 1909 in a portion of Oakland. It now seeks for permission to extend its distribution lines throughout the entire city.

SUSANVILLE, CAL.—The Lassen El. Co., of Susanville, has been granted a franchise by the Board of Supervisors of Lassen County to erect and operate electric transmission lines in the county of Lassen. George B. Fassett is clerk.

ST. GEORGE, UTAH.—The managers of the municipal electric-light plant expect to purchase in the near future one waterwheel and a high-pressure governor, one 5-kw, 5,500/220/110-volt transformer and twelve 5-amp wattmeters. A new penstock (800 ft. 12-in. spiral-riveted steel) is now being installed. Milo Kemp is manager.

DILLON, MONT.—The Union El. Co., of Dillon, Mont., has recently purchased two waterwheels of the James Leffell Co., of Springfield, Ohio, which will be installed during December. L. K. Adams is vice-president and manager.

ALAMOSA, COL.—Within the next six months the Mutual El. Lt. & Pwr. Co., of Alamosa, expects to purchase two carloads of poles, 8 miles of wire and a tub transformer, to rearrange its street-lighting contract, if the company secures a new contract from the city. H. A. Goodridge is manager.

LOVELAND, COL.—The Council has engaged a consulting engineer to make investigations and submit estimates of the cost of installing a municipal electric-light plant. The city already owns a site on the Big Thompson River.

STEAMBOAT SPRINGS, COL.—The Steamboat Springs Service Co. expects to purchase the usual number of incandescent lamps and a few electrical heating and cooking devices. W. L. Carver is superintendent.

TRINIDAD, COL.—The Trinidad El. Trans., Ry. & Gas Co. may install a series tungsten street-lighting system, consisting of from 50 to 60 lamps, in Walsenburg. The company expects to purchase within the next 12 months electrical devices, including heating and cooking apparatus, vacuum cleaners, washing machines, etc. Franklin P. Wood is general manager.

YUMA, COL.—The town of Yuma is contemplating calling a special election to vote on a bond issue of $10,000, the proceeds to be used for the installation of a municipal electric-light plant.

PORTALES, N. M.—The Portales Utilities Co. is contemplating extensions and improvements to its central power plant and next year will add about 25 new wells to those which it now furnishes with electricity. About 30 miles of transmission lines will be erected. A. A. Rogers is president.

## Canada

CALGARY, ALTA.—The Eau Claire Lumber Co., it is reported, has decided to increase the output of its power plant and will install two gas-driven electrical generating units, with a rating of 1500 kw, and two large turbines, to cost approximately $300,000. It is understood that the work will not be undertaken until spring.

VANCOUVER, B. C.—The British Pacific Pwr. Co., Bank of Ottawa Building, Vancouver, has applied for water rights on the Upper Powell Lake and on Powell River.

VANCOUVER, B. C.—The Council of Saanich is considering the installation of an electric-light system, to cost about $38,000, to be installed by the British Columbia El. Ry. Co., of Vancouver.

FREDERICTON, N. B.—The Eal River Lt., Ht. & Pwr. Co. has submitted a proposal to the City Council offering to furnish electricity for public services on a long-term contract at 2 cents per kw-hr. Messrs. Andrews and Murchie, of St. Stephen, and R. G. Lee, of Fredericton, are interested in the company.

NEWCASTLE, N. B.—We are informed that no improvements are contemplated at the municipal electric-light plant at present, as reported in the issue of Nov. 8. J. E. Lindon is town clerk.

SYDNEY, N. S.—The Cape Breton El. Co., Ltd., of Sydney, is installing a 300-kw motor-generator set, which is being installed in the Sydney station. Earle L. Milliken is manager.

CHATHAM, ONT.—The City Council has practically decided to purchase the gas and electric plant of the Chatham Gas Co. for $410,000. The company offered to sell the electric end of the business for $191,000. The city will use hydroelectric power.

FORT WILLIAM, ONT.—Among the by-laws to be submitted to the voters on election day is one calling for $125,000 for telephone purposes, one appropriating $115,000 for electric-lighting purposes, and one for street railway purposes carrying $238,000.

HAWKESBURY, ONT.—The Hawkesbury El. Lt. & Pwr. Co. is now constructing a power-house at Bell Falls on Rouge River, Quebec, to develop 4,000 hp and a transmission line to Hawkesbury, a distance of 13 miles. Contracts have been placed for waterwheels, generators and switching equipment. It is expected to have the plant in operation within eight months. James Ross is secretary.

OTTAWA, ONT.—Bids will be received by R. C. Desrochers, secretary Department of Public Works, Ottawa, until Jan. 15, for 10 knots of gutta-percha cable with four conductors, and 14 knots of gutta-percha with two conductors, to be delivered at Halifax, N. S., or St. John, N. B., by the first of May. Specifications and forms of tender may be obtained on application to the office of the general superintendent of the Government Telegraph Service, at the Department of Public Works, Ottawa.

PORT ARTHUR, ONT.—By-laws will be submitted to the ratepayers in January asking for an appropriation of $8,000 for extending the street-lighting system, $55,000 for extensions to the electric power system, $35,000 for improvements to telephone system, and $35,000 for street railways.

WALKERVILLE, ONT.—The ratepayers on Dec. 6 approved two by-laws relative to the adoption of hydroelectric power, one authorizing the town to enter into a contract with the Ontario Hydro-electric Commission for electricity generated at Niagara Falls and the other providing for an issue of debentures to cover the cost of constructing a distribution system.

DAVIDSON, SASK.—The town of Davidson is planning to install a small gas-electric equipment for lighting purposes. Contracts have already been placed for the machinery.

ESTEVAN, SASK.—Application has been made to the Saskatchewan Legislature for a charter for the Estevan Transit & Pwr. Co. for the purpose of developing power and building railways. The provisional directors are H. J. McNeil, W. J. Perkins, E. C. Hillborn and D. C. Dunbar, of Estevan.

## Mexico

MAZATLAN, SINALOA, MEX.—The Empresa de Corriente Electrica, S. A., of Mazatlan, expects to install within the next two months a 165 hp to 185-hp gas engine with gas producer and a 120-kw, two-phase, 60-cycle Westinghouse generator. Equipment has already been purchased. Arthur de Cima is director-general.

## Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Dec. 30, for copper condenser tubes, galvanized conduit, calcium carbide, etc. Blank and general information relating to this circular (No. 813) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

# New Incorporations

ARKADELPHIA, ARK.—The Arkansas Pwr. Co. has been incorporated with a capital stock of $500,000 for the purpose of constructing and operating hydroelectric power plants in Arkadelphia, Malvern and other places. The officers of the company are: H. C. Couch, president; J. H. Meek, vice-president; J. W. Lee, treasurer, and J. L. Longino, secretary.

EARL, ARK.—The Crittenden Pwr. Co. has been incorporated with a capital stock of $15,000. The officers are: John F. Rhodes, president; H. A. Morrison, vice-president and treasurer, and J. B. McMillon, secretary.

DOVER, DEL.—A charter has been filed with the State Department for the Aux Cayes & Jeremie El. Ltg. Co., of New York, N. Y. The company is capitalized at $1,000,000 and proposes to construct and operate electric-lighting plants and systems in Aux Cayes and Jeremie in the Republic of Haiti. The incorporators are: Louis Durand, of New York, N. Y.; Hiram O. Hance, of Plainfield, N. J., and John S. Price, of Belle vue, N. J.

CHICAGO, ILL.—The Tyrone El. Co. has been incorporated with a capital stock of $100,000 by A. A. Rolf, Alvin E. Stein and George E. Paterson. The company proposes to generate and distribute electricity for lamps, heat and motors.

AUGUSTA, MAINE.—Articles of incorporation have been filed for the Consumers' General Service Co. with a capital stock of $250,000. The company proposes to construct, equip, operate, develop and control public utilities, including railways, water, electric and other utilities. R. S. Buzzell is president and L. J. Coleman is treasurer, both of Augusta.

BROOKFIELD, N. Y.—The Brookfield El. Lt. & Pwr Co. has been incorporated with a capital stock of $2,500 by William Welch, Charles H. Brown and Edgar Harris, of Brookfield.

WINNIPEG, MAN.—The Winnipeg River Pwr. Co. has been incorporated with a capital stock of $1,000,000 by E. Firth, C. W. Campbell, A. P. Scott, E. Beadie and R. Siderfin, of Winnipeg. The company will undertake the development work at the Big Bonnet Falls on the Winnipeg River, the rights to which were recently assigned to Sir William Whyte. The Winnipeg El. Ry. Co. will take the entire output of the plant. The distance of the proposed plant from the present plant of the railway company is 12 miles. The J. G. White Co., Inc., of New York, N. Y., it is reported, has been awarded the contract for construction of the plant.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED DEC. 9, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,080,535. CIRCUIT CONTROLLER FOR ELECTRIC SIGNS; F. C. [illegible], Moose Jaw, Saskatchewan, Canada. App. filed April 3, 1913. Contacts on rotary drum may be raised into operative contact-making position.

1,080,544. WIRELESS SIGNALING SYSTEM; C. D. Ehret, Ardmore, Pa. App. filed Dec. 2, 1905. Resonator conductor with condenser associated therewith as a wave-responsive device and a local source of fluctuating energy acting on the condenser.

1,080,563. ELECTRIC SWITCH; O. M. Knoblock, South Bend, Ind. App. filed July 11, 1912. An inclined boss on the switch base forces the pivoted switch blade against a contact plate.

1,080,583. ELECTRICAL APPARATUS; H. E. Reeve, New York, N. Y. App. filed Sept. 25, 1908. Duplex metallic diaphragm supports the lever, which passes into the closed contact chamber.

1,080,584. ELECTRICAL APPARATUS; H. E. Reeve, New York, N. Y. App. filed June 2, 1909. Transmitting lever pivoted to vibrate in the plane of the diaphragm which closes the contact chamber.

1,080,585. ELECTRICAL APPARATUS; H. E. Reeve, New York, N. Y. App. filed Dec. 1, 1910. Electromagnet and vibrator contacts removable from the casing as a unit.

1,080,587. MULTIPLE CONTROL OF ELECTRIC MOTORS; R. Richter, Grünau, Germany. App. filed April 9, 1912. For insuring that the single motors are loaded according to their outputs.

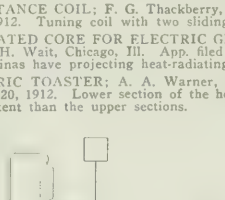
1,080,588. MULTIPLE CONTROL OF ELECTRIC MOTORS; R. Richter, Grünau, Germany. App. filed April 9, 1912. For controlling separately fed motors from one place.

1,080,589. VEHICLE SIGNAL; E. B. and G. E. Roedding, Detroit, Mich. App. filed May 19, 1913. Motor-operated rear-end auto signal.

1,080,605. INDUCTANCE COIL; F. G. Thackberry, Tampico, Ill. App. filed Aug. 7, 1912. Tuning coil with two sliding contacts.

1,080,611. LAMINATED CORE FOR ELECTRIC GENERATORS AND MOTORS; H. H. Wait, Chicago, Ill. App. filed Dec. 7, 1906. Certain of the laminas have projecting heat-radiating flanges.

1,080,667. ELECTRIC TOASTER; A. A. Warner, New Britain, Conn. App. filed May 20, 1912. Lower section of the heating unit is heated to a greater extent than the upper sections.



1,080,681—Wave Detector

1,080,681. WAVE DETECTOR; J. H. Cuntz, Hoboken, N. J. App. filed Oct. 1, 1903. Detecting means, including mercury in continuous circulation.

1,080,712. TROLLEY-WIRE CLAMP OR FASTENING DEVICE; G. A. Mead and F. S. Denneen, Mansfield, Ohio. App. filed July 19, 1909. A screw sleeve on the supporting rod forces clamp jaws against the trolley wire.

1,080,713. STRAIN INSULATOR; G. A. Mead and W. H. Kempton, Mansfield, Ohio. App. filed July 13, 1910. Shell contractible to clamp the insulating blocks therein.

1,080,730. CIRCUIT-CONTROLLING MECHANISM FOR ELECTRIC-RAILWAY SWITCHES; C. W. Squires, Beverly, Mass. App. filed July 25, 1911. For controlling circuits of electrically operated track switches by the person operating the car.

1,080,782. VARIABLE-SPEED MECHANISM FOR MOTOR VEHICLES; J. C. Riegel, Pottsville, Pa. App. filed Nov. 30, 1912. Electromagnetic coupling, including members in inductive relation, one fast to the prime mover and the other fast to the differential gearing of the motor car.

1,080,788. TIMER AND DISTRIBUTING DEVICE; J. M. Smith, Philadelphia, Pa. App. filed May 17, 1912. Novel construction of contact mounting for the make-and-break device.

1,080,807. ART OF MANUFACTURING STEEL; G. H. Benjamin, New York, N. Y. App. filed Jan. 4, 1913. Subjects purified iron and flux to effect of an electric current, introduces carbon and finally pours steel.

1,080,824. ELECTRICAL REDUCTION FURNACE; R. E. Frickey, Heroult, Cal. App. filed April 29, 1912. "Long and narrow" type of furnace for reduction of metals from their ores.

1,080,826. HEATING AND PURIFYING WATER; G. H. Gibson, Montclair, N. J. App. filed May 27, 1911. For boiler-feed purposes; treats condensate and raw make-up water with chemical, electrolyzes and filters.

1,080,830. ELECTRICAL COIL AND METHOD OF WINDING SAME; M. Helm, Berlin, Germany. App. filed Jan. 4, 1913. Wire laid in close coils in manner of "spool winding," and the insulating strands are laid with a diagonal or cross-wind.

1,080,840. ELECTRIC FURNACE; G. Massip, Levallois-Perret, France. App. filed Aug. 21, 1912. Tilting of the furnace or crucible brings the poles of the auxiliary arc into operative position.

1,080,852. STORAGE BATTERY; A. H. Snyder, Lancaster, and J. Starkenstein, New York, N. Y. App. filed Aug. 28, 1912. Means for lifting the plates without disturbing their relative operative positions.

1,080,862. ELECTRIC ZINC FURNACE WITH INTEGRAL CONDENSER; J. Thomson, New York, N. Y. App. filed Jan. 2, 1913. Resistor furnishes heat for producing metallic zinc fumes from oxide of zinc and carbon, fumes subsequently being condensed to liquid metal.

1,080,863. ELECTRIC ZINC FURNACE WITH INTEGRAL CONDENSER; J. Thomson, New York, N. Y. App. filed Jan. 2, 1913. Rod resistors with an interposed condenser adapted to receive the volatilized products.

1,080,864. ELECTRIC ZINC FURNACE WITH INTEGRAL COMPOUND CONDENSER; J. Thomson, New York, N. Y. App. filed Jan. 2, 1913. Has plurality of condensing chambers.

1,080,865. ELECTRIC ZINC FURNACE WITH INTEGRAL CONDENSER; J. Thomson, New York, N. Y. App. filed Jan. 2, 1913. Bed of carbon reaction resistor, carbon filter bed and a bath of molten metal, all contained in a common chamber.

1,080,866. ELECTRIC ZINC FURNACE WITH INTEGRAL CONDENSER; J. Thomson, New York, N. Y. App. filed Jan. 2, 1913 Carbon resistor adapted to act either by conducted heat or radiated heat or both upon charge material disposed along the vertical sides of the resistor.

1,080,871. ELECTRIC SWITCH; J. N. Wallace, La Crosse, Wis. App. filed Feb. 15, 1910. For telephone circuits; has frame plate with slidable plungers.

1,080,897. MANUFACTURE OF DOUBLE HELICAL METALLIC TUBING; H. J. Davies and T. A. Judge, Sheffield, England. App. filed Jan. 20, 1913. Welds inner and outer layers or strips on a line parallel with the junction of the outer coils.

1,080,908. THERMO-ELECTRIC SWITCH; H. Gillette, Chicago, Ill. App. filed Aug. 1, 1912. Double circuit, quick make and break.

1,080,912. METHOD OF ELECTRICALLY SMELTING VOLATILE METALS; W. McA. Johnson, Hartford, Conn. App. filed Jan. 17, 1911. Electrically heats the charge; conducts the volatile reaction products into contact heated to maximum conductivity; continuously replaces carbon and condenses metal.

1,080,947. CASING FOR RESISTANCES; A. W. Berresford, Milwaukee, Wis. App. filed July 10, 1909. Has a reflex ventilating flue.

1,080,988. BEAN ASSORTER; R. F. McWilliams, Barryton, Mich. App. filed April 3, 1912. Selenium cell affected by light reflected from the individual beans; controls an electromagnetic sorting chute.

1,081,022. ELECTRICAL SWITCH; O. L. Davis, Iowa City, Ia. App. filed July 14, 1913. Buttons which must be pushed in predetermined order to close circuit.

1,081,072. GUARD FOR SPRINGS; S. P. Wilbur, Pittsburgh, Pa. App. filed Dec. 23, 1909. Tensioning device for glowers of glower lamps.

1,081,084. DYNAMO-ELECTRIC MACHINE; V. G. Apple, Dayton, Ohio. App. filed Nov. 27, 1908. Self-governed generator for ignition systems.

1,081,099. ELECTRIC CONVERSION; S. Cabot, Brookline, Mass. App. filed Dec. 4, 1909. Apparatus for transforming low constant-potential direct current or alternating current to high-potential direct current or vice versa.

1,081,111. APPARATUS FOR HEATING LIQUIDS BY ELECTRICITY; J. von Hentzel, Zurich, Switzerland. App. filed Dec. 26, 1912. Vessel which contains the electrodes and the water path between the electrodes is connected direct in the pipe line.

1,081,119. SWITCH; A. W. Johnson, Holland, Mich. App. filed Dec. 20, 1912. Multiple-gap switch.

1,081,128. SWITCHING MECHANISM FOR TELEPHONE EXCHANGES; F. A. Lundquist, Chicago, Ill. App. filed Feb. 1, 1905. For automatic systems.

1,081,160. MULTIPLE-FUSE DEVICE; G. S. Shoupe and W. H. Palmer, Cleveland, Ohio. App. filed Dec. 20, 1912. Burned-out or mutilated fuse is automatically replaced.

1,081,164. SMELTING OR REFINING OF METALS AND THE LIKE IN CRUCIBLES; H. G. Solomon, London, England. App. filed April 9, 1912. Induction furnace applicable to the crucible process of making steel and steel alloys.

1,081,191. PROCESS FOR THE ELECTROLYTIC MANUFACTURE OF PERBORATES; K. Arndt, Charlottenburg, Germany. App. filed Dec. 30, 1912. Electrolyzes a borate solution to which has been added a soluble carbonate.

1,081,213. INCLOSED ELECTRIC FUSE; F. N. Conant, Newburyport, Mass. App. filed Feb. 28, 1910. Spring indicator to indicate blowing of fuse.

1,081,214. INCLOSED ELECTRIC FUSE; F. N. Conant, Newburyport, Mass. App. filed Jan. 2, 1912. Spring indicator.

1,081,233. ELECTRIC HEATING ELEMENT; D. Huntley, London, England. App. filed Feb. 8, 1913. Electric radiator stove.

1,081,260. DEVICE FOR ELECTROMAGNETIC SUSPENSION; H. Zoelly, Zurich, Switzerland. App. filed Oct. 29, 1912. Maintains an adjustable air space between the support and the magnet poles.

1,081,266. RESETTING CIRCUIT FOR ANNUNCIATORS; J. O. Cadieux, Meriden, Conn. App. filed Nov. 7, 1912. Special arrangement of calling or resetting magnets.

1,081,277. BATTERY ELECTRODE; J. J. Auringer, Cohoes, N. Y. App. filed Jan. 17, 1913. Electrolytic electrode having a body of gas carbon and a separate exposed body of retort carbon bonded to the gas carbon.

1,081,278. ELECTRIC BURGLAR ALARM; H. S. Bitting, Lancaster, Pa. App. filed Dec. 30, 1912. Gives continuous alarm when circuit is once tampered with, even though circuit is again restored.

# Electrical World

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**Commission Order Rescinded**

The Missouri Public Service Commission has rescinded its order directing a company under its jurisdiction to remove the manager from office. It is doubtful whether the commission had the power it thought it had when it passed its remarkable order directing the company to remove its manager. However, that is not so important now as is the fact that the commission, realizing its mistake, had the good sense and courage to admit it and, so far as it could, to correct it. In administering any regulative law a commission is imposing a new state of affairs upon managers of public utility corporations. If a commission is right in its conception of the law and a manager of a corporation is wrong, the commission is not justified in treating him in any other spirit than one of tolerance and co-operation. If a commission is wrong and a manager is right, there is all the more reason why the commission should want to have a spirit of co-operation in itself and to secure such a spirit in return from the manager. The law imposes regulation, it does not impose management by the commission. It is just as necessary for the commission to have the respect of officials of public utility corporations as it is for the officials of public utility corporations to have the respect of the commission. Antagonism on either side is unfortunate and wherever it arises every effort should be made to harmonize the differences that are responsible for it. If differences develop for which the corporation is responsible and careful consideration shows that an error was made, the best thing to do is to adopt the manly method followed by the Missouri commission in this case. Admission and rectification promote good feeling.

**Careless Station Wiring**

In many small central-station systems home-made auxiliary equipment is in use with automatic or semi-automatic service rendered to municipal pumping installations or other consumers of an intermittent or non-continuous energy input. A broad field of usefulness exists for such apparatus and for all kinds of "stunts" associated with alarms for low water and high water, abnormal variations in temperature at important points in the steam end of the station, the height of oil in lubrication systems, undue changes in frequency, and the like. In fact, there is hardly a limit to the conveniences with which a small plant may be equipped, given an ingenious manager or superintendent eager to apply his experimental skill to saving labor and time in operation. In too many cases, however, the wiring employed in work of this kind is installed without the slightest regard for mechanical fitness and with the most indifferent concern for electrical hazards. These circuits are almost invariably "slapped into place" with as little thought of danger as would be given to a buzzer circuit in an old ladies' home. Good mechanical work and first-class electrical insulation are really of great importance in temporary wiring of this sort, for serious injury to persons or property may follow a cross with higher voltage leads. Anything but first-class construction tends to introduce into the service an element which lacks reliability. Unless, therefore, the best standards are followed, the operating results may be worse than would be the case had no conveniences been installed in the first place.

**Transmission Line Innovations**

The account in this issue of the lines and substations distributing energy from the Tallulah Falls is one which should be thoroughly studied by every engineer interested in energy transmission. We have already commented on the hydraulic features of the plant, some of which are striking and unusual. The transmission system is equally a step along the highway of progress toward simplification. The main 90-mile line operated at 110,000 volts from the station of Atlanta is typical of the other circuits. It is rather noticeable for the height of the towers and the great spans between them. The average distances between towers is a little over 900 ft., and the towers themselves range from 66 ft. to as much as 105 ft. in height. There are two complete circuits, one on each side of the tower, with 9-ft. spacing between the wires. More striking, however, than the method followed in tower construction are the substation work and provisions for cross-overs between the circuits. The fundamental principle which has been followed in this part of the work is to make the high-tension switching structure part of the transmission line instead of part of the interior equipment of the substation. The switch apparatus is for the most part in the open air, and the system is so devised that the major part of all switching and transference work is done by simple open-air switches of ample size. Oil switches are used, so to speak, only in the second line of defence, for the reason that most of the work does not involve opening circuits under heavy load. When as a final resort this becomes necessary means are at hand to accomplish it, but the ordinary operations of the transmission system can be carried out on the open-air system conveniently and safely without involving the huge expense which would be entailed by a battery of oil switches sufficient to accomplish all the combinations, for the most of which they are entirely unnecessary. Similarly, substation transformers are placed out of doors, whenever convenient, on the same general theory that impels one to place transformers of lower volt-

age on poles instead of in special houses. As transmission voltages have grown higher fear of them has diminished and a great many provisions once thought necessary are now seen to be the result of over-caution. A switching system on a transmission line has certain perfectly definite work to do, and when the apparatus is fitted to do this work the ends of operative security have been met. It is unnecessary and a needless expense to provide for ringing all the possible changes upon combinations of a certain number of conductors when it is perfectly evident from the outset that only a quarter of these combinations have any operative significance. The details of these out-of-door stations are very fully given in the article, and we commend them to the attention of our readers as indicating a most instructive tendency in the progress of transmission work.

## The Electrification of Trunk Lines

In many respects the presentation and discussion of the paper by Mr. A. H. Armstrong before the Canadian Society of Civil Engineers, abstracted in this issue, are of more than passing interest and importance. In accordance with a practice which has become chronic in railway electrical engineering circles, there was displayed, perhaps as never before, the disposition to dodge the main issues and to set up imposing figures of straw for the purpose of knocking them down. It strongly calls to mind the frontier days more than a score of years back when the advocates of direct current and of alternating current for lighting were taking pot shots at each other out of the darkness and carrying knives in their boots on the few occasions when they met on a common ground of apparent amicability. These days have happily passed so far as the lighting problems are concerned, but the continuance of the old blood-feud by the second generation, which is working upon traction problems, is one of the most serious difficulties standing in the way of railway electrification. It is time for a much more open discussion of the whole situation than has yet appeared if substantial progress is to be made in the near future.

What can the ordinary railway manager think of the probability of successful electrification when he reads a paper like that before us and the discussion to which it gave rise? The author claims in the strongest terms that electrification by alternating current is to all intents and purposes impracticable, and in the discussion it was pointed out with the utmost plainness that there has never been a typical trunk-line electrification up to the present time carried out successfully by direct current. The impartial railway manager, assuming that the statements on both sides are sincere and soundly based, must necessarily come to the conclusion that neither system can in the present state of development be seriously considered, and he is quite justified if he simply says inwardly or outwardly, "A plague on both your houses," and sticks to his steam locomotives. The trouble with all such discussions, and pre-eminently with this one, is that the argument depends either on actual installations which cannot by the widest stretch of imagination be considered typical or on hypothetical installations for which the conditions set are ingeniously devised to throw down one or the other of the systems discussed.

The fact of the matter is that the data available for a fair comparison between the direct-current and the alternating-current system are highly unsatisfactory as yet, but that both systems have been successful when used within their own proper spheres. The New Haven electrification certainly cannot be considered in any sense a failure in spite of somewhat costly experience during the experimental period and the very severe handicap of having to furnish locomotives able to run with equal facility on alternating current and direct current. Similarly, any fair-minded person must grant that the New York Central and the Pennsylvania terminal equipments, within their limitations, have made excellent records; but these are strictly terminal lines not subject to the difficulties of distribution and current collection which would inevitably be met on a trunk line.

We do not desire here to discuss the details of the somewhat hypothetical comparisons in the paper before us. These can properly be left to the advocates of the competing systems to discuss among themselves. What we do desire most emphatically to point out is that the art cannot make progress by the mutual abuse of competitors, and that it is high time for the advocates of both systems to brush the dust and blood out of their eyes, to forget the ancient rancor, long past in other branches of electrical engineering, and to stand together in an effort to see clearly along the line which, up to the present, has been blocked by the débris of battle rather than by genuine obstacles.

## Disconnecting Switches

Considering its value as a preventive of serious accidents, the disconnecting switch is one of the features of a generating plant or substation handling high-voltage alternating current that should not be subjected to the blue pencil of the appropriation censor. The cost of installing such switches on both sides of every high-tension oil circuit-breaker is ordinarily a small matter per switch. In substations requiring wide spacing between conductors on account of the use of extra high voltages, the increased safety gained by providing this absolutely effective protection between buses, oil switches and transformers, lightning-arrester grounds, and even buses, should be well worth the expense. The mechanical support of every additional structure in a high-tension station doubtless increases the complications of the interior, but the actual space requirements of disconnecting switches are intrinsically small, and if a full complement is planned for in the original design they should not be omitted. The flexibility of station operation can be very greatly enhanced in some cases by the use of disconnecting switches in bus sectionalization, although they are not designed to be opened, of course, while there is a load interchange between the sides to be isolated. Under some conditions it may pay to render one side of a station inactive pending the temporary opening of such switches, to be followed by synchronizing the temporarily interrupted units and proceeding independently of trouble on the opposite side of the station. In other words, if a plant is too small to justify the installation of a bus-junction oil circuit-breaker, it still may have use for the humble disconnector.

## Exit Government Ownership, Enter Government Settlement

The irritation to business conditions caused by the Postmaster-General's personally conducted movement for federal ownership of telegraph and telephone lines was succeeded quickly by satisfaction when the friendly settlement of the government suit against the American Telephone & Telegraph Company under the Sherman law was announced. The menace of government ownership and the spirit in which President Wilson indorsed the end of the litigation against the company are as far apart as the antipodes, and business men appraised them accordingly. One was a disturbing factor, the other a reassuring one. There has been too much to disturb business, too little to reassure it. If the government pendulum will but swing the other way for awhile, it will give industry an impetus that it sorely needs. Government ownership of telegraph and telephone lines would involve an enlargement of federal activities for which there is no strong public demand. In the absence of a strong public demand, a Cabinet officer and a congressman urge the complete reversal of national policies that this step would mean. Fortunately, they do not appear to speak authoritatively for the administration. The government should not undertake things that can be done as well or better by private agencies. It should not undertake things that can be done at the same or less cost by private agencies. Its function is not to suppress or supplant private initiative. It should promote private enterprise. The American people do not want a paternal government. They want freedom of individual action.

The government has not yet attained that measure of efficiency and economy which warrant its seizure of functions now well performed by private capital. The report of even the Postmaster-General, the chief exponent of the extraordinary movement for government assumption, is open to analysis and question. He says, for instance, that the postal service for the first time since 1883 is now self-supporting. Would it have been self-supporting if it had paid the unhappy railways what it ought to have paid them for carrying the enormous additional amount of mail created by the parcel post? This leads inevitably to the question of whether, in the event of government ownership of telegraph or telephone lines, there would still be a confusion in accounts to cause distorted conclusions. Would the telephone and telegraph lines, if profitable under government ownership, be required to apply their profit to offset deficits in other lines of government activity? Or if they should be unprofitable would the railways be asked to carry a still heavier burden of mail unpaid for in order that the government accounts might pass cursory inspection? Government bureaucracy and red tape are the distress of individual business men who have to go to Washington occasionally. They would cause greater and every-day distress to the whole nation if applied to the necessary telephone. Government ownership in European countries is attended by a poverty of telephone development and service which would paralyze industry here.

Instead of exploited government ownership plans, however, it is good to record that the last word from Washington settles the suit against the American Telephone & Telegraph Company and comforts business men. In separating itself from the Western Union Telegraph Company and introducing other changes the Bell company satisfies the Attorney-General that no infraction of the law is involved in its practices. The settlement is great cause for congratulation. It means much more than the fact that long, bitter, costly litigation for one large company is avoided.

The independent telephone systems are heartily to be congratulated on having such a network thrown open to them for long-distance service. If there is anything in the common carrier law, they have always been entitled to this, and they should now make the most of it. But we can imagine that in some bosoms there will be a chill of desperate discouragement in the news that the Bell system will "never hereafter acquire control over any other competitive line or exchange." What were some of them built for? The Western Union system has been admittedly all the better for its control by the Bell system, which might perhaps eventually by its ownership have enjoyed revenge for the long period during which it paid out 20 per cent of its gross earnings to the Western Union because the latter kept out of the telephone field. At any rate, by this disjunction there will be secured full justice to the Postal Telegraph Company or any other system.

The settlement looks like a pledge of the earnest intent of the government, in the words of President Wilson, to cooperate with business men and "help to build up the business of the country upon sound and permanent lines." If the application of the administration's policies to the telephone situation is partly destructive of the present system, it is still constructive of a policy which is outspokenly acceptable to the constituted government authorities. Certainly the telephone company gains much more than it loses. Ownership of telegraph facilities could never be worth as much to it as a virtual license from the government authorizing it to go ahead in a well-defined course. It can work out its progress on approved lines of development more surely than it could on lines about whose perfect legality the government's attitude cast a doubt. Moreover, its credit is safeguarded. The chief cause for congratulation over the outcome, however, is that the business atmosphere is made a little clearer for everybody. If the telephone company has ranked as a trust in the popular mind, it has ranked as a good one and its acceptance of the government policies so stamps it. Clearly its leaders see that the administration at Washington must be lived with for the period of its tenure of office. They help both themselves and the general business situation by conforming their practices to the theory of the Sherman law now guiding the policy of the government. Such a step may not be taken by other companies whose present practices are regarded by the authorities as infractions of the law. Some cases will probably go to the final courts for decision. The settlement of one, however, affords ground for reasonable belief that its general lines may be applied in other cases. Every such dispute that is removed helps to restore the conditions of wholesome business. It is this that we need, and every business interest should speed the day of its return.

# The News of the Week

**Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.**

## Denial of Right to Fix Resale Prices

The United States Circuit Court of Appeals in a decision filed on Dec. 19 affirmed the decision of Judge Ray in the case of Charles A. Keene versus the Waltham Watch Company regarding the right to fix a resale price on watches embodying patented movements or parts. Judge Ray had held that such refixing of prices on patented goods was in violation of the Sherman act and not defensible under the patent law.

The Circuit Court of Appeals merely confirmed the decision of Judge Ray without an opinion.

## Long Acre Company Wins

The Court of Appeals of New York in a decision handed down on Dec. 19 affirmed the decision of the Appellate Division of the Supreme Court in the case of the Long Acre Electric Light & Power Company of New York versus the New York Edison Company, thereby permitting the former to proceed with its issues of stock and bonds and with plans for the development of its plant. The New York Edison Company had appealed from an order of the Appellate Division, First Department, dismissing a writ of certiorari and affirming an order of the Public Service Commission that authorized the Long Acre company to construct a plant and issue securities. The commission originally denied that application of the Long Acre company to issue securities for the construction of its plant. A long legal battle ensued, and finally the court upheld the commission by deciding that the company could not issue securities to construct its plant until the commissioners granted permission. Later the right to construct a plant was granted by the commission, and then the Edison company brought suit in an effort to annul the action of the commission.

## Conservation Conference in Albany

Governor Glynn of New York called a conference in Albany on Dec. 22 to discuss proposed legislation on conservation, which will be introduced at the coming session of the Legislature. Most of those who appeared talked in favor of fish and game conservation. Mr. George V. S. Williams, member of the New York Public Service Commission, First District, and Mr. Charles Harvey Jackson, who was formerly connected with the State Conservation Commission, urged that the State begin at once the experimental development of hydroelectric power from waste waters by utilization of the surplus barge canal waters in Saratoga County. Mr. Williams suggested the development of water-power under a plan similar to that followed in the financing of subways in New York, involving public investment and private operation. Mr. E. J. Mehren, editor of the *Engineering Record*, declared that the State had established Public Service Commissions to supervise the issue of securities of lighting and power companies and to regulate their rates, and inferentially had promised to preserve their properties. He thought that if the State built storage reservoirs it should lease the electric power to the existing corporations, as they would be subject to regulation by commissions.

## Electricity in Coal Mining

Mr. Francis S. Peabody, president of the Peabody Coal Company, of Chicago, and one of the prominent coal-mining operators of Illinois, gave an interesting address on "Coal" before the Commonwealth Edison Section of the National Electric Light Association on Dec. 16. His address was illustrated by lantern-slide and motion pictures, some of the latter being particularly interesting from the fact that they were taken underground in coal mines. Mr. Peabody described the new mine of his company at Nokomis, Ill. This is said to be the largest coal-mining plant in the world. It has an output of 8000 tons of coal in eight hours and is operated throughout by electrical energy purchased from the Central Illinois Public Service Company.

## Convention of Wisconsin Electrical Association

The annual convention of the Wisconsin Electrical Association will be held at Milwaukee Jan. 15 and 16. Among the papers to be presented are the following: "High-Efficiency Incandescent Lamps and Their Central-Station Applications," Mr. S. E. Doane, chief engineer National Lamp Association, Cleveland, Ohio; "Some Problems of Public-Utility Accounting and Rate-Making," Mr. Halford Erickson, Wisconsin Railroad Commission, Madison; "Street-Railway Traffic Surveys in Relation to Railway Operation, Management and Regulation," Mr. C. M. Larson, chief engineer Wisconsin Railroad Commission, Madison; "A Practical Accounting System for Small Central Stations," Mr. H. G. D. Nutting, Clement C. Smith Company, Milwaukee; "Voltage Regulation, Its Necessity and How Accomplished," Mr. G. G. Post, electrical engineer the Milwaukee Electric Railway & Light Company; "Review of New Laws Affecting Public Utilities," Mr. John B. Sanborn, Milwaukee. Mr. W. H. Winslow, Superior, Wis., is president of the Wisconsin association, and Mr. George Allison, Stephenson Building, Milwaukee, is secretary.

## Going Value as Basis for Computing Charges

The United States Circuit Court for the District of Arizona recently handed down its decision in the case of the stockholders of the Pacific Gas & Electric Company of Phoenix, Ariz., for a preliminary injunction to restrain the enforcement of certain gas and electric rates prescribed by the corporation commission of the State of Arizona. The injunction was granted on the basis that the commission erred in the depreciation charged against the reproduction value of the property to ascertain the present value. The court stated that a property that was at present in an efficient operating condition could not possibly have depreciated by 49 per cent of its original value, that the commission erred in allowing $23,000 for working capital, that $50,000 for such purposes was entirely reasonable, and that the commission erred in not allowing the company a value for its contract with the reclamation service for the furnishing of electricity, an item which the commission omitted in its valuation. The court also held that the commission erred in not allowing the company some going concern value, and in commenting upon this

feature Judge Morrow said: "The courts recognize a difference in the value of a plant that has been fully established and connected up with a municipal lighting system and with the houses, business places and factories of regular customers. The present corporation was in August of last year a going concern; it was connected up with a municipal lighting system, the houses, business places, factories and other institutions of a prosperous community, and there was nothing more to do except to deliver the service for which the corporation was fully and efficiently equipped. We think this element of valuation should be considered in connection with the other elements of valuation, with the view of determining the actual present value of the whole plant."

## President Wilson on Effect of Currency Bill

In signing the currency bill on Dec. 23 President Wilson made an address in which he said in part:

"As for the bill itself, I feel that we can say that it is the first of a series of constructive measures by which the Democratic party will show that it knows how to serve the country.

"I myself have always felt, when the Democratic party was criticised as not knowing how to serve the business interests of the country, that there was no use of replying to that in words. The only satisfactory reply was in action. We have written the first chapter of that reply.

"What we are proceeding to do now is to organize our peace, is to make our prosperity not only stable but free to have an unimpeded momentum.

"It is so obvious that it should not need to be stated that nothing can be good for the country which is not good for all of the country. Nothing can be for the interest of the country which is not in the interest of everybody; therefore, the day of accommodation and of concession and of common understanding is the day of peace and achievement of necessity.

"We have come to the beginning of that day. Men are no longer resisting the conclusions which the nation has arrived at as to the necessity of readjustment of its business. Business men of all sorts are showing their willingness to come into this arrangement, which I venture to characterize as the constitution of peace. So that, by common counsel and by the accumulating force of co-operation, we are going to seek more and more to serve the country."

## Missouri Commission Reconsiders Decision Removing Manager

The Public Service Commission of Missouri has passed an order rescinding its previous decision directing the Fort Scott & Nevada Light, Heat, Water & Power Company to remove its manager at Nevada, Mo. The amendatory decision, as written by Mr. Kennish and concurred in by all of the members except Chairman Atkinson, expresses the opinion that the conduct of the manager in his business relations with the people of Nevada, who were customers of the water company, was arbitrary. However, a more thorough consideration of the case upon the motion for rehearing caused Mr. Kennish to doubt the soundness of that part of the opinion requiring the removal of the manager, and he thought that it should be modified in that respect.

Mr. Kennish, continuing, said that the fact should not be overlooked that the offending as shown by the testimony was not the result of bad faith or dishonesty but rather of bad judgment and a failure to understand the character and spirit of the people with whom the company dealt. The decision concludes:

"It is shown by the testimony that the greater part of this property is owned or controlled by Mr. Weiss, and to remove him from its management for the misconduct proved and without an opportunity to make amends is, in my opinion, an unduly harsh exercise of the power of this commission, and the order should be modified by omitting therefrom that part directing his removal."

## Direct-Current Traction for Chicago, Milwaukee & St. Paul

Mr. C. A. Goodnow, vice-president Chicago, Milwaukee & St. Paul Railroad, who is in charge of the proposed electrification of the railroad between Avery, Idaho, and Harlowton, Mont., a distance of 440 miles, informed a representative of the *Electrical World* on Tuesday that it had been decided to use 2400-volt direct current and overhead construction. The installation will be substantially the same as that of the Butte, Anaconda & Pacific. Mr. Goodnow also stated that no contract has been awarded for the apparatus and that it will go to the most satisfactory bidder.

## International Electrical Congress at San Francisco

Attention is drawn to the distinction between the International Electrical Congress to be held at San Francisco, Sept. 13 to 18, 1915, during the Panama-Pacific International Exposition, as already noted in these columns, and the International Engineering Congress scheduled for the same city during the week immediately following the Electrical Congress.

The proceedings of the Electrical Congress will deal exclusively with electricity and electrical applications. Its work will be divided into twelve sections and about 250 papers will be presented. This congress is held under the auspices of the American Institute of Electrical Engineers by authority of the International Electrotechnical Commission. Dr. C. P. Steinmetz, Schenectady, N. Y., has accepted its honorary presidency, and Dr. E. B. Rosa, Washington, D. C., its honorary secretaryship. Mr. H. G. Stott, New York, is chairman of the executive committee on organization, and Mr. Preston S. Millar, New York, is secretary-treasurer.

The International Engineering Congress, on the other hand, will deal with engineering in a general sense, its electrical-engineering subjects being limited to one of its eleven sections, before which about twelve papers will be presented treating more particularly of the use of electricity in engineering work. The engineering congress is supported by the Societies of Civil, Mechanical and Marine Engineers and by the Institutes of Mining and Electrical Engineers, as well as by prominent Pacific Coast engineers who are actively engaged in organizing it.

The meeting of the International Electrotechnical Commission will be held at San Francisco during the week preceding that of the Electrical Congress.

## New York State Automobile Census

Net receipts of $1,275,000 were received for licenses and registration certificates for the year up to Dec. 12 by the New York State Automobile Bureau. For the corresponding period in 1912 the total was $1,060,000, and in 1911 $905,000. This year there were registered 133,000 owners of motor vehicles, 57,000 chauffeurs and 1800 dealers, against 105,000 owners, 45,000 chauffeurs and 1700 dealers in 1912. The increased use of commercial cars is one of the most notable features of the year. There are over 13,000 of these, which shows a gain of 61 per cent over last year.

## Christmas Decorations at Davenport, Ia.

Electrical merchants on Second Street, Davenport, Ia., are among the city's most enterprising "boosters" and let no opportunity escape for seasonable advertising. The Christmas season of 1913 found them attracting the attention of the public by means of the novel electrical display illustrated herewith.

On both sides of the street the top globes and lamps were removed from the five-lamp ornamental standards and were



CHRISTMAS DECORATIONS AT DAVENPORT, IOWA

replaced by small Christmas trees firmly attached to the tops of the posts. Wound about each tree a circuit of miniature red and green lamps, supplied with energy from the unused top sockets, lent holiday cheer to the street decorations during evening shopping hours. Wreaths of green festooned about the shafts of the standards added to the effectiveness of the display by daylight.

Other neighboring merchants adopted a somewhat different method of Christmas decorations. In addition to stringing the festoons and wreaths on the posts, colored lamps were inserted in the Alba globes of the standards so that at night the top globe of each post glowed a deep red while the four lower lamps beamed with an emerald-green color. In some individual instances strings of red, green and yellow incandescent lamps were also added to the decorations.

The displays were paid for by the retail dealers, each subscribing equally to the outlay. Credit is also due the People's Light Company, of Davenport, from whose mains the energy was taken, for its assistance in carrying out the merchants' plans.

## Secretary of the Interior on Water-Power Development

The annual report of Mr. Franklin K. Lane, Secretary of the Interior, says in reference to water-power development:

"Within a generation I believe the people will be as alive to the value of public ownership of hydroelectric power plants as they are to-day to municipally owned water-works. The people not being prepared, however, to proceed to put these lands to their highest use, I am not in favor of keeping them from being utilized by private capital in the public interest. That we do not know what is best to be done is not a reason either for doing nothing or for getting rid of the trouble as soon as possible, on the old 'land-is-land' policy.

"What return shall the federal government have for its lands? My answer would be, no return whatsoever, provided the plant reverted to the government without cost at the end of fifty or sixty years, or so much of the plant as was based on the land itself and the improvements directly attached thereto, such as reservoirs, dams, water rights, and rights-of-way. For the tangible property of the plant, such as the distributing system and machinery, the government might well agree to pay an appraised price so as to insure its being maintained and extended during the later years of the life of the franchise. The right to buy the complete plant at an appraisal figure at any time after twenty years would be a further protection and one not burdensome, while for better service it would seem advisable that all plants be permitted, in fact encouraged, to combine physically, but they should not be allowed either to agree as to rates or to merge their capitalization or their identity."

## Municipal Plant at Deckerville, Mich., Wrecked by Explosion

As the result of an explosion of the pressure tank at the municipal electric plant in the village of Deckerville, Mich., on Dec. 9, the building was partly wrecked and the whole plant was put out of commission. Mr. C. A. Sink, the village electrician, and his assistants narrowly escaped death from falling wreckage and escaping steam. The explosion came without any warning. The pressure tank is of considerable size and normally it contains water under an air pressure of about 75 lb. The cause of the accident is unknown. Superintendent Sink had just arrived at the plant a few minutes before the accident occurred. He made an examination of the steam, water and air gages and found all of them indicating normal pressure. Then he proceeded to inspect a shaft bearing within a few feet of the pressure tank. He was standing between two large belts when the explosion occurred and was unable to give any explanation of the manner in which he escaped from the wreckage.

The accompanying picture of the ruins was taken on the morning after the explosion. Measures were taken at once to repair the damage, and within two weeks the plant was again placed in operation. Electrical energy from this plant is used to operate the village water-works and for several days the town was without a water supply. By utilizing



DECKERVILLE (MICH.) MUNICIPAL ELECTRIC & WATER PLANT AFTER EXPLOSION OF DEC. 9

some old steam pumps, however, the water supply was resumed within four or five days, but for two weeks the village was without electric light, and several local industries, as the grain elevator and grist mill, were without energy for motors. The Deckerville *Recorder* was unable to obtain electricity to operate its linotype machine and presses during that period.

## Joint Meeting of Engineers at Boston

fore a joint meeting of the Boston Society of Civil ieers and the Boston sections of the American Insti- of Electrical Engineers and the American Society of anical Engineers on Dec. 18, Mr. B. A. Behrend, of n, Mass., gave an illustrated lecture upon a dis- which occurred in the spring of 1908 in the house of the Niagara Falls Hydraulic Power & facturing Company, when a 12,000-hp generator was ed while undergoing a speed test prior to acceptance e purchaser. The speaker discussed the accident in formal manner and drew a number of lessons from the rence which he contended must be heeded in success- handling the design and construction of large gen- g units. Among these are the importance of thorough ion to details of design on the part of engineering tives in manufacturing plants; the most careful se- n and accurate testing of materials, particularly alloy subjected to heavy mechanical and magnetic strains; ence upon the taking of test samples at specified loca- a broader knowledge of the weakening effects of im- r machining and the use of unsuitable tools in the ration of castings and forgings; the value of the cold ng test as compared with tensile strength observa- the study of the capabilities of subordinates; need of ific shop inspection, and the exercise of eternal vigi- in dealing with the enormous forces involved in mod- igh-powered machinery.

## Water-Power Conservation Hearings in Massachusetts

e special legislative commission on water-power con- tion created by a resolve at the 1913 session of the achusetts Legislature held a series of hearings last at Springfield, Pittsfield and Greenfield, a final hear- eing conducted at Boston on Dec. 18. Hon. W. S. ary, chairman of the Massachusetts Harbor and Land nission, presided at each session. At the Springfield ng, which was given on the morning of Dec. 15, Her- Myrick, of Springfield, addressed the board on behalf e acquisition of water rights by the State, contend- hat by this method small power users would be enabled njoy the benefits of cheap hydroelectric service. rs. F. G. Hodskins and A. W. Gilbert also spoke in f of a more public development of the streams. Mr. es H. Tenney, head of the Tenney central-station anies, whose headquarters are at Boston, favored con- tion of water-power, but maintained that it should be oped by private capital so far as possible. The point nade that the development of such power by respon- private corporations is of sufficient value to the public whole to justify its sale upon a wholesale basis. Pittsfield Frederick N. Fowler, a hydraulic engineer, asized the importance of water conservation along the atonic River. Representatives of large paper-manu- ring plants appeared in favor of improved control of waters. Selectman T. J. Kearin, of Great Barring- said that in his opinion the residents of that town l willingly contribute their share of a tax for the con- ng of the waters of the Housatonic River by the State. C. H. Wright, representing the General Electric Com- and other manufacturers, urged that the same laws be ed to Massachusetts water-power development as to s under federal control. the Greenfield sitting of the board Mr. C. S. Davis, el for the Turners Falls Power Company, cited the its of storage reservoirs on streams subject to sharp tions in flow, pointing out that in some instances the power of a river is lost through insufficient stor- Mr. Clarke C. Fitts, of Brattleboro, Vt., stated that there lies unused in Vermont at present the water-power equivalent of 500,000,000 tons of coal per year, which should be developed by proper conservation.

The final hearing of the commission was held at Boston on Dec. 18. President Henry I. Harriman of the Connecticut River Transmission Company, Boston, outlined the developments of the New England Power Company on the Deerfield River, emphasizing the value of storage at the head of a high fall. The Connecticut River, New England's largest stream, is not well adapted to large storage plans.

Mr. Harriman opposed the direct creation of storage by the State unless it can be shown that other plans fail to conserve the public interests. He also objected to the plan set forth in the Millers River bill by which the functions of the State would be delegated to private interests under close control. A paper-mill owner cannot afford to pay as much for water as a textile manufacturer or an electric-service company. Water-power has a variable value among different industries. In closing Mr. Harriman said that not more than 15 per cent of the water-powers of Massachusetts would pay the cost of development.

## Settlement of American Telephone & Telegraph Suit

An announcement was made at Washington on Dec. 19 of a settlement between the American Telephone & Telegraph Company and the government, represented by Mr. James C. McReynolds, Attorney-General, of the litigation against the company under the Sherman anti-trust law. Letters confirming the settlement passed between Mr. N. C. Kingsbury, vice-president of the company, and Attorney-General McReynolds. Statements in reference to the matter were made by President Wilson and Mr. Theodore N. Vail, president of the company.

In his letter to the Attorney-General, Mr. Kingsbury stated the basis of the plan of agreement. The company will dispose of its Western Union Telegraph Company stock, so as to leave the control and management of the latter company entirely independent of any company in the Bell system. No company in the Bell system will hereafter acquire, either directly or through purchase of securities, control over any other telephone company owning, controlling or operating any exchange or line which is or may be operated in competition with any exchange or line included in the Bell system, or which constitutes or may constitute a link or portion of any system so operated, or which may be so operated in competition with any exchange or line included in the Bell system. Where control of the properties or securities of any other telephone company has been acquired heretofore and no physical union or consolidation has been effected, or where binding obligations for the acquisition of the properties or securities of any other telephone company have been entered into by or in the interest of any company in the Bell system and no physical union or consolidation has been effected, the question as to the course to be pursued in such cases will be submitted to the Attorney-General and to the Interstate Commerce Commission for advice and directions. Arrangements will be made promptly under which all other telephone companies may secure for their subscribers toll service over the lines of the companies in the Bell system.

In his letter Attorney-General McReynolds said:

"May I take this occasion to say that the administration earnestly desires to co-operate with and to promote all business conducted in harmony with law and that, without abating the insistence that the statutes must be obeyed, it will always welcome opportunity to aid in bringing about whatever adjustments are necessary for the re-establishment of lawful conditions without litigation?"

Mr. Vail said that the company is complying with the wishes of the government because it desires that its opera-

tions shall continue to be, as it has always believed them to be, in strict conformity to the law, and for that reason it is now adjusting them to the law as understood and interpreted by the Attorney-General. He said that he is confident that under the proposed changes neither the Bell system nor the Western Union company will suffer. Some economies and some services which were contemplated under the complementary operation of the two companies cannot now be realized, but it is hoped that all now in operation will, after thorough consideration, be found to be within the law. In relinquishing the Western Union Company, the American company does so with the satisfaction of knowing that it is in better physical and financial condition than when it was taken over, and that the shareholders will soon be benefited in some measure by what has been done.

In speaking of the working relations between the two companies Mr. Vail said that the two organizations had been kept separate, so that no disorganization will result from this separation.

The letter of President Wilson to Attorney-General McReynolds said: "It is very gratifying that the company should thus volunteer to adjust its business to the conditions of competition. I gain the impression more and more from week to week that the business men of the country are sincerely desirous of conforming with the law, and it is very gratifying indeed to have occasion, as in this instance, to deal with them in complete frankness and to be able to show them that all we desire is an opportunity to co-operate with them. So long as we are dealt with in this spirit, we can help to build up the business of the country upon sound and permanent lines."

Notwithstanding the settlement of the suit, Congressman Lewis, of Maryland, delivered a long speech in the House of Representatives on Dec. 22 in support of his resolution providing for government ownership of telegraph and telephone lines.

## The Electric Vehicle at Boston

The New England Section of the Electric Vehicle Association of America held a meeting at Boston on Dec. 18, Chairman J. A. Hunnewell presiding. Mr. Charles F. Smith, of the Boston Edison Company, read a paper describing the new electric garage of the company at the Massachusetts Avenue service buildings and outlined the work of the transportation department. The automobile equipment of the company now consists of 116 machines in use and 29 on order, 87 of which are electric vehicles. A full description of the garage will be published in a later issue. In a brief discussion which followed the paper garage practice in Salem and Lowell, Mass., was described. In the latter city the central-station company successfully charges ignition and lighting batteries at a rate about 30 per cent above that of private garages. Mr. H. H. Skinner, of the Narragansett Electric Lighting Company, Providence, R. I., reviewed the growth of the electric-truck business in that city and stated that during 1914 at least ten more trucks would probably be purchased by a single department store.

The Electric Motor Car Club of Boston held its Christmas meeting at the Hotel Thorndike on Dec. 22, sixty members and guests being on hand to enjoy the festivities incidental to the holiday season. During a brief business session General Superintendent W. H. Atkins of the Boston Edison Company offered the use of a 100-ft. by 60-ft. tent for an out-door exhibition of electric vehicles next spring in various New England cities, such as Worcester, Providence and Springfield, where the local central stations are vigorously co-operating with the Boston campaigners. Mr. S. Fred Smith, of Salem, and Mr. J. A. Hunnewell, of Lowell, Mass., expressed the interest of the Tenney and Stone & Webster local properties in the plan and offered to co-operate in the supply of electricity, labor and in loc publicity in making the tent show a success. Two-d "stands" are contemplated.

## Electrification System Discussion

In a paper presented by Mr. A. H. Armstrong, Schene tady, N. Y., before the Canadian Society of Civil Engine at Montreal on Dec. 18, statistics were given to show th of the twenty-eight single-phase railway systems placed service in the United States and Canada between 1904 a 1911 nine have been replaced by direct-current systems a that thirty direct-current installations have been placed successful operation at voltages ranging from 1200 to 24 since October, 1907. The author stated that all of the la mentioned equipments are giving satisfaction and that change of type of equipment has been made or conte plated.

In the accompanying table is shown the author's list converted steam lines where the service consists in hauli main-line passenger and freight trains behind large electr locomotives. The author remarked that the use of t single-phase motor has not extended beyond the two ori inal roads installing this type of equipment, the Gra Trunk and the New York, New Haven & Hartford (inclu ing the Hoosac Tunnel installation), whereas direct-curre motors have been universally adopted in all the more rece electrifications with the single exception of the propos split-phase installation on the Norfolk & Western Railwa He said that the so-called "split-phase" system is compar tively a newcomer in the electric traction field and it h not yet been subjected to the test of actual operation. Tl proposed system offers many attractive features, howeve and it is worthy of careful study in order to understand i fitness for heavy electric railway service. From expe mental tests made, it seems reasonably certain that t split-phase locomotive can meet the demands of commerci operation with satisfactory reliability. The split-pha locomotive was described on page 367 of our issue dat Aug. 23, 1913, and on page 731 of the issue for Oct. 1 1913.

MAIN-LINE ELECTRIFICATION—UNITED STATES AND CANAD

| Installation | Year | Type Locomotive | System | Voltag |
|---|---|---|---|---|
| St. Clair Tunnel | 1908 | Geared | Single-phase alternating | 3,30 |
| N. Y., N. H. & H. | 1907 | Gearless | Single phase-alternating | 11,00 |
| Hoosac Tunnel | 1911 | Geared | Single-phase alternating | 11,00 |
| Cascade Tunnel | 1909 | Geared | Three-phase alternating | 6,60 |
| *Norfolk & Western | 1914 | Geared side rod | Split-phase alternating | 16,50 |
| B. & O. Tunnel | 1895 | Geared | Direct current | 60 |
| New York Central | 1906 | Gearless | Direct current | 60 |
| Detroit Tunnel | 1910 | Geared | Direct current | 60 |
| Pennsylvania Terminal | 1910 | Side rod | Direct current | 60 |
| Butte, Anaconda & Pacific | 1913 | Geared | Direct current | 2,40 |
| *Canadian Northern | 1914 | Geared | Direct current | 2,40 |
| *Canadian Pacific | 1914 | Geared | Direct current | 2,40 |

*Under construction.

The paper was devoted largely to a comparison of alte nating-current and direct-current locomotives. The autho claimed that lack of appreciation of the fundamental fact involved has perhaps been the basis of the false hope raised as to the possible advantages resulting from th installation of the single-phase trolley. He said that i surely does look attractive to install a system employin 15,000 volts on the trolley, no feeder copper and no rotat ing substation apparatus. But investigation and experienc disclose the fact that the single-phase trolley is a decide menace to neighboring circuits, feeder copper is require for return circuit, substations are comparable as to first cos and efficiency with direct-current substations and, finally the alternating-current locomotive of the most promisin

pe, the so-called split-phase combination of induction otors, transformer and phase converter, is heavy expenve, complicated and inefficient to a degree that would not e tolerated in direct-current construction. Assuming that e favorable results of factory experiments are borne out the success of later commercial operation, there appear be no controlling advantages of alternating-current locootive traction which cannot be secured at less expense d with greater reliability in operation with direct-current otive power.

The high-voltage direct-current motor has now been eveloped, built and proved completely successful under the ost exacting service conditions. The trolley potential has en raised to 2400 volts which seems sufficiently high to sure a distribution system of reasonable first cost and not o high to handicap the locomotive as regards its first cost, liability and operating efficiency. Experimental results ready obtained with direct-current apparatus tested at otentials higher than 2400 volts indicate that no construcon difficulties apparently exist and the installation of a gher voltage becomes an economic question rather than engineering problem.

With 2400 volts direct current both protected third-rail nstruction and multiple-unit car operation are feasible. he third-rail offers advantages in accessibility and low st of maintenance on single-track roads and multiple-unit r operation is without question the proper way to take re of local traffic. Furthermore, 2400-volt equipments n be successfully operated upon the lower voltage terinal zone that local restrictions may make necessary.

It is popularly supposed among electrical engineers that e cause of electric traction is retarded by any openly exessed divergence of views as to the relative merits of fferent systems of electrification. The opinion is adanced, on the contrary, that a free presentation of the cts available, but not always made public, will do much clarify the situation. No one contributing cause has ne more to hurt the electric railway industry than the ilure of the single-phase system to make good the too otimistic claims of its early advocates.

The direct-current motor is fully able to meet all the quirements of the heaviest passenger and freight train eration, as proved by the entirely successful installations w running and which afford convincing facts upon which atements of costs and operation are based. The author aintained that no such condition exists with any alternatg-current locomotive system and that the operating facts tainable are not of a nature to inspire confidence selecting such a system to meet the exacting requirents of heavy electric railroading.

*Discussion*

In the discussion which followed the presentation of the per Mr. H. H. Vaughan, vice-president of the Canadian cific Railroad, referred to the adoption of high-tension rect current for a section of that railroad. This instalion involved 30 miles of route and 43 miles of track with ong 4 per cent grade, the operation being carried on by ar locomotives. The battle of the systems, he said, had erred steam railroad men from adopting electricity for tive power; but in the case cited the two systems were nd to be practically alike in first cost and in mainteance, direct current being chosen because it was consid- d more advantageous to use a system in which the larger t of the investment was involved in the cost of copper feeders, rather than in locomotives which might soon ome obsolete. Moreover, the development of the gear- locomotive and the improved methods of collecting ge currents had helped toward the decision in favor of ect current.

In a written communication Mr. George Gibbs, New rk, stated that practical railway men have been unable til recently to obtain any clear idea of the possibilities of heavy electrification because of the befogging of the whole problem by the controversial attitude of conflicting interests. Each system has been set forth by its promoter as having all the virtues and none of the faults of the other systems, and this has raised doubts in the minds of railway men if any system is really reliable. During the last year or two, however, there has appeared an inclination on all sides to admit that the art is a developing one and that each system had its own particular field of best employment. He remarked that the paper appeared to have gone back to the old method of special pleading for some particular system, setting forth in an unfavorable light the defects of competing systems, while the disadvantages of the system advocated are not even referred to. The engineer should set forth, as completely as his space will permit, the advantages of each system and make his recommendation in accordance with all the facts set forth. The reader, having the balance sheet before him, can then check the conclusions.

The author dismissed the single-phase system as unsuitable for main-line traction, apparently from unsatisfactory results on a number of interurban traction lines which found it advantageous to change over from single-phase to direct current. Probably these roads never should have used single-phase because their conditions did not suit this form of power, and, in any event, their case is not parallel to that of heavy steam traction.

After summarily dismissing the single-phase motor, the author then proceeded to advocate high-tension direct current, apparently for all classes of work, and appeared to think the split-phase locomotive its only serious competitor. The fact that single-phase contact and split-phase locomotives were adopted on the Norfolk & Western Railway for the heaviest electric traction work yet undertaken anywhere requires some explaining away, because there are presumably reasons to believe that the adoption of this system was made after some study of the local situation and the conclusion arrived at that the system had preponderating advantages for the work in question.

Mr. Gibbs upset the author's "safe prediction" that "no more single-phase motor equipments will be placed in operation in this country on new roads unless these roads virtually form an extension of existing systems" by calling attention to the very recent adoption of the single-phase motor-car system of operation for the Pennsylvania Railroad suburban lines out of Philadelphia.

Mr. Edwin B. Katté, chief engineer of traction New York Central & Hudson River Railroad, submitted a written communication in which he stated that an electric locomotive capable of hauling an 800-ton passenger train at 60 miles per hour is too small to be seriously considered by steam railroad men operating important trunk lines. The modern electric passenger locomotive must be able to haul a train of cars weighing from 1000 to 1200 tons. Electric companies frequently confuse railroad men by including the locomotives when they refer to a train of a given weight. Moreover, such a locomotive should be capable of performing the regular service practically continuously and not after a few hours of operation be laid up in the terminal from one to three hours to allow the motors to cool off. Mr. Katté said that electric operation is a good thing in the proper place, although it does cost considerable money and has some limitations.

Mr. W. S. Murray, New Haven, referred to Mr. Armstrong's paper as the highest card yet played in favor of single-phase for main-line traction and direct current for interurban and local railroad service. He claimed that the actual power required to carry a given weight is 22 per cent more with direct current than with alternating current. A direct-current locomotive may be excellent, but one must not ignore other features of the system as a whole.

Mr. Murray noted the omission by Mr. Armstrong of mention of the single-phase installations on the Spokane & Inland Empire Railroad and the New York, Westchester & Boston Railroad, on which steam would have been used had electricity not been at hand. Mr. Murray attributed to the paper the merit of marking plainly the desirability of using the single-phase system in the field where all engineers who are free from commercial bias have already placed it.

## Public Service Commission News

### Illinois Commission

Governor Dunne of Illinois has appointed Mr. Frank H. Funk, of Bloomington, Ill., a member of the Railroad and Warehouse Commission. It is believed that this means that Mr. Funk will be a member of the State Public Utilities Commission of Illinois, which will come into existence after Jan. 1, succeeding the Railroad and Warehouse Commission.

### Wisconsin Commission

The Wisconsin Railroad Commission has passed upon the application of the Waukesha Gas & Electric Company for an increase in rates and has issued a decision ordering a reduction in rates for electric service and a revision of the rates for gas service.

The decision notes that the American Gas Company, which controls the property, is primarily interested in the gas business. Its effort has been directed toward the extension of the gas business and little or nothing has been done, except recently, to further the sale of electricity, with the result that the company has one of the best-developed gas businesses in the State and about the most poorly developed electric business. In commenting upon this condition of affairs, the commission says: "Companies holding indeterminate permits, whether for single or joint utilities, have assumed the responsibility for the highest reasonable development of their business as well as for adequate distribution and sale."

The utility contended that it was entitled to a considerable amount for going value. In view of the existing conditions, the commission held that it would be an injustice to force the consumers to bear the costs resulting from "what might be termed the neglect of the management to stimulate properly the sale of the utility's product."

An analysis of the electric consumer data showed that the number of consumers is considerably less than it should be and that, furthermore, the consumption per consumer is unreasonably low.

In view of these facts, the commission held the opinion that a schedule of rates designed to develop the business in the way of increased lighting consumption would be more advisable than a schedule formulated to produce an adequate return under existing circumstances. Attention was called to the fact that the motor service, with a consumption of over five and one-half times that of lighting, contributed only 9 per cent more to the total revenues. The high rates for lighting service as well and the failure of the company in the past to push the sale of electrical energy are held responsible for the very poor development of the business. The present rates for electric lighting range from 15 cents per kw-hr. to 10 cents per kw-hr. The schedule prescribed by the commission is as follows: Primary rate, 12 cents for the first thirty hours' use per month of the active connected load; secondary rate, 9 cents for the next sixty hours' use; excess rate, 6 cents. The classification of consumers, according to the percentage of their active connected load, is the same as was employed by the commission in past decisions. On the basis of last year's sales, the schedule as prescribed will effect a considerable reduction in revenue.

# Current News Notes

New Idaho Electric Plant.—According to prese plans, the hydroelectric plant of the Utah Power & Ligl Company at Grace, Idaho, will be placed in service on Ja 1, 1914. Energy from this plant will be transmitted to th new substation at Salt Lake City, 135 miles, over a stee tower line now being erected.

* * *

Electricians Ask Raise.—Employers throughout Ne York City have received circulars from the Inside Ele trical Workers of Greater New York, signed by Mr. ( Whitford, secretary, informing them that on and aft Jan. 1, 1914, the wages of those workers will be increase 30 cents a day. The present wages of the inside electric workers are $4.50 a day.

* * *

Boiler-Feed Water by Rail.—A severe shortage c water in central Kentucky has necessitated that the Lai caster Electric Light Company arrange to have its suppl furnished by rail. Two storage tanks each of 8000-ga capacity have been provided, and all the boiler-feed wate will be brought from outside until local conditions improv The service has not suffered interruption thus far.

* * *

Vice Versus Light.—"Most of the wickedness of th world is committed after dark," writes Dr. Orison Swe Marden in a recent practical preachment on purity. "A fraction of the frightful expense in great cities caused b crime, if expended in lighting up all the dark, dismal place of the city, especially the slums, making the streets an alleyways as nearly light as possible, would diminish crim immensely and would prove a tremendous investment fo the city."

* * *

Study Niagara Water-Power.—The legislative commit tee for the purpose of studying the diversion of Niagar Falls water for power purposes and reporting back to th New York State Legislature, to the end that the State ma formulate a settled policy for dealing with the problem held a preliminary session in Buffalo on Dec. 15. Th committee made an inspection of the power plants a Niagara Falls and held a public hearing in Buffalo o Dec. 17. Senator Henry P. Velte is chairman of th committee.

* * *

Inquiry Into the Generation and Utilization o Electricity.—The Oregon Hydroelectric Commission which had its inception in a plan advanced at the common wealth conference at the University of Oregon last spring held its initial meeting at the Portland Chamber of Com merce on Dec. 13. The purpose of the commission is t arrange for funds to conduct a world-wide study of elec tric power and the methods and cost of its production an application to manufacturing industries, with the view t formulating a basis on which the vast water-power re sources of Oregon may be developed.

* * *

International Joint Commission to Meet.—A meeting of the International Joint Commission will be hel in Washington, beginning on the morning of Jan. 13. The commission will consider the application of the Michiga Northern Power Company for authority to build a dam for power purposes at Sault Ste. Marie; also the applica tion of the Greater Winnipeg water district to divert wate from Shoal Lake, west of the Lake of the Woods, for the purpose of a water supply for Winnipeg. The commis sion will also take up the report of the sanitary experts in connection with the pollution of boundary waters inves tigation.

Eye Strain and Telephone Switchboards.—According to a recent report of the American Medical Association, eye strain is to blame for the harm to the health of telephone-switchboard operators, whose average length of service even under good conditions does not exceed three years. To complete one call means four flashes of light, and investigations show the operator's eyes are exposed to from 500 to 1000 flashes of light every hour. Headache, dullness, indigestion, exhaustion, nervous strain, insomnia and colds are some of the symptoms that follow this work.

* * *

Examination for Laboratory Assistant.—An open competitive examination for laboratory assistant will be held by the United States Civil Service Commission on Jan. 21 and 22, 1914. From the successful candidates selection will be made to fill vacancies in the Bureau of Standards, Department of Commerce and Labor. The work is similar to that in the better class of industrial and scientific research laboratories. Applicants must be between the ages of twenty and thirty-five years. The salaries range from $900 to $1,200 per annum. Those interested should send for Form 1312 to the United States Civil Service Commission, Washington, D. C.

* * *

Patent Commission Indorsed by Chamber of Commerce of State of New York.—The following resolutions bearing on the patent bills now pending in Congress and the movement for the appointment of a patent commission were recently adopted by the Chamber of Commerce of the State of New York: "The Chamber of Commerce of the State of New York favors the creation of a competent expert commission to study the subject and to recommend such changes in the patent laws, the Patent Office procedure and the court review of patent cases as may appear necessary to promote the interests of inventors and give substantial justice to the public."

* * *

Telephone Operators and Electric Shock.—In two recent cases carried to the Appellate Court of the First District of Illinois the Chicago Telephone Company was defendant, the plaintiffs being young women employed by the company as telephone switchboard operators who had brought suit for injuries received in the discharge of their duty and alleged to be due to electric shock. The verdict of the lower court awarding one girl $2,000 damages for a shock which caused an abscess to form in her left ear was sustained. Another operator asserted that she sustained a shock by reason of a cord which was not insulated. In this case the company was found not guilty in the lower court, and that verdict was upheld also.

* * *

Radio and Brain.—Mr. Burton F. Babcock, Syracuse, N. Y., has called our attention to some interesting original observations concerning radio-telephony, as follows: "I believe it has been my good fortune to make a discovery in regard to wireless electricity which will astonish the civilized world when it has been thoroughly tested. A few hundred volts of wireless, controlled into small strong continuous current only a few inches in diameter, will not only convey sound in the form of ordinary conversation, but will transfer thought from brain to brain. When accustomed to this method of communication a conversation can be carried on at a distance of several miles without any audible sounds whatever. Bodily pain inflicted on one person in the current is instantly felt by the other to almost an equal extent. Please notify some expert electricians in order that all may learn its possibilities."

* * *

A Gas-Electric Train for the Khedive of Egypt.—For the use of the Khedive of Egypt a gas-electric train of two cars has just been completed, the unusual feature of which is the equipment of both cars with individual gasoline-engine-generator sets, the entire driving equipment being susceptible of control from either end. Each four-cylinder engine is rated at 120 hp and runs at 700 r.p.m. For safety, the gasoline fuel is stored under gas pressure in a tank beneath the car. The generators are rated at 80 kw and at 300 volts can be drawn upon for currents up to 500 amp during starting. Each coach is gear-driven by a pair of 80-hp auxiliary-pole motors. The complete 100-ton train is capable of speeds up to 40 miles per hour with both sets in operation, although in case of accident either unit can be used to propel the pair. The compartments of the cars are lavishly equipped, as the train will be used by the Khedive in his official journeys.

* * *

Public Ownership in Wisconsin.—With the order of the Wisconsin Railroad Commission for turning over the property of the Beaver Dam Water Company to the city at $133,000, thirteen plants have been purchased by cities under the Wisconsin utilities law. In three cities the properties have been taken over in the last few weeks, and three cases are pending in which the valuation has been almost completed. The cities paid an aggregate of $2,404,900 for the plants. Among the purchases were: Electric plant at Cashton, $3,100; electric plant at Brodhead, $40,000; electric plant at Manitowoc, $137,500, and the electric plant at Kaukauna, $50,000. The commission is now valuing the Racine water plant, worth nearly $1,000,000; the Janesville water works, and the electric plant of the Grand Rapids Electric Company. In Manitowoc there is some agitation favoring the city purchasing the gas plant in addition to the electric plant and water-works already acquired.

* * *

Conservation Through Railway Electrification.—Mr. G. Percy Cole, of the Canadian General Electric Company, addressed the members of the Canadian Railway Club recently on "The Conservation of Natural Resources Through the Electrification of Railways." He spoke of the enormous cost of running locomotives by coal and estimated that the annual consumption of coal by locomotives in Canada and the United States is approximately 110,000,000 tons. If it were possible, he said, to save two-thirds of this, valued at $2 per ton, a yearly saving of roughly $147,000,000 would be effected, which would go a long way toward paying for electrification of railways. Dr. L. A. Herdt and Professor McKay, of McGill University; L. C. Ord, of the Canadian Pacific Railway; W. H. Winterrod, electrical engineer of the Canadian Pacific Railway, and R. H. Wheeler, electrical engineer of the Canadian Northern Railway, took part in the discussion which followed the address.

* * *

Veterans of Chicago Bureau of Electrical Inspection.—Dec. 10, 1913, was the thirtieth anniversary of the passing of the ordinance creating the bureau of electrical inspection for the city of Chicago, and employees of the bureau, former city electricians, with a few invited guests, celebrated the event with a banquet. As a part of the evening's program, silver stars were presented to each employee of the bureau who has been in the service more than fifteen years. Messrs. Daniel Battle, Arthur Demond, Edward La Plante, Charles Van Cleaf, Henry Horstmann and J. J. Finan were recipients of this honor. As a mark of the appreciation of the services of Mr. Victor H. Tousley, present chief electrical inspector, a gold star was presented to him. Mr. E. B. Ellicott, first city electrician for Chicago, made the presentation speech. In his remarks as toastmaster Mr. Tousley sketched the growth of the bureau from its beginning in 1883, when there was but one electrical inspector and the entire expenses of the bureau were about $1,000 annually, up to the present date, when the institution has sixty-seven employees and spends $100,000 a year.

Flat Rates for Apartment Houses.—A woman customer giving the address of an uptown apartment recently approached the window clerk in the Duquesne Light Company's office, Pittsburgh, Pa., and complained that the company was not charging her a "flat rate." She thought surely she was entitled to a flat rate, she said, because she lived in a flat.

* * *

Des Plaines River Water-Power Litigation.—Briefs were filed for both sides in the United States Supreme Court at Washington on Dec. 15 on the writ of error taken by the State of Illinois in the case against the Economy Light & Power Company of Joliet, now merged into the Public Service Company of Northern Illinois. The decision from which appeal was taken was the result of action brought by the Governor for the State of Illinois to enjoin the company from building a dam across the Des Plaines River at Dresden Heights, Ill., and to set aside a deed from the commissioners of the Illinois & Michigan Canal. The action was brought on the ground that the Des Plaines River is a navigable river. On a hearing in the state courts the bill of the State of Illinois was dismissed for want of equity and the state Supreme Court sustained this decree.

* * *

Electric Company Liable for Damages to Shade Trees.—Inasmuch as electric light companies do a great deal of tree trimming at this time of the year, the case recently decided by the Supreme Court of North Carolina (Moore vs. Carolina Power & Light Company, 79 S. E. Rep., 596) is of interest. The plaintiffs were abutting owners of property on a city street. The electric light company, for the purpose of facilitating the use and operation of its lines and poles, trimmed certain shade trees bordering on the street in front of plaintiffs' property. Suit was brought for damages alleging depreciation of plaintiffs' property because of the impairment of its use and enjoyment resulting from the above depredation. The defense was interposed that as the fee in the streets belonged to the State, and as defendant company was a quasi-public corporation, plaintiffs had no rights against the company that could interfere with any impairment of the trees for its convenience. The Supreme Court of North Carolina, however, while holding that a municipal corporation which enjoys the possession of its streets has absolute control over bordering trees provided that no oppression is exercised impairing the rights of abutting owners in their easements in the shade of the trees, yet decided that this municipal power of control was not delegable and could not be conferred upon even a quasi-public corporation, with the result that defendant company was required to be responsible for any damages resulting.

* * *

## SOCIETY MEETINGS

Revised Dates for Southwestern Convention.—The annual convention of the Southwestern Electrical & Gas Association is to be held at Galveston, Tex., Wednesday to Saturday, May 20 to 23, 1914, instead of on the dates previously announced. Mr. H. S. Cooper, 405 Slaughter Building, Dallas, Tex., is secretary of the association.

* * *

January Meeting, Chicago Section, I. E. S.—The January meeting of the Chicago Section of the Illuminating Engineering Society will be held jointly with the Chicago Architectural Business Men's Association. Mr. J. B. Jackson, of the Illuminating Engineering Society, will address the joint session on the subject "Planning Lighting Installations."

* * *

Independent Telephone Association Meeting.—The seventeenth annual meeting of the National Independent Telephone Association is to be held at the Hotel La Salle, Chicago, from Jan. 13 to 15, 1914. A program of special interest to telephone men is being arranged. Mr. J. B. Earle, Waco, Tex., is the new secretary-treasurer of the society. Mr. N. Thompson, 1404 McCormick Building, Chicago, Ill., is assistant secretary.

* * *

Seattle Section, A. I. E. E.—The annual meeting of the Seattle Section of the American Institute of Electrical Engineers was held in Seattle Nov. 18. Mr. S. C. Lindsey, electrical engineer for the Puget Sound Traction, Light & Power Company, was elected chairman as successor to Mr. J. D. Ross, of the Seattle municipal plant, and Mr. E. A. Loew, assistant professor of electrical engineering at the University of Washington, was elected secretary-treasurer, succeeding Mr. Magnus T. Crawford.

* * *

New York Section, I. E. S.—At the meeting of the New York Section of the Illuminating Engineering Society to be held Jan. 8 the topic of "Residence Lighting" will be discussed by Messrs. A. L. Powell and Thomas Schofield. Mr. Powell will treat the subject from the electric-lighting standpoint and Mr. Schofield will describe recent progress made with the use of gas. On Feb. 11 the section will hold a joint meeting with the New York Municipal Art Society, when Mr. C. F. Lacombe, chief engineer of light and power for the city of New York, will present a paper entitled "Street Lighting Abroad."

* * *

Depreciation of Utility Properties.—A paper on "The Depreciation of Public Utility Properties as Affecting Their Valuation and Fair Return" was presented on Dec. 17 by Mr. John W. Alvord, of Chicago, before the New York Section of the American Society of Civil Engineers. The paper was discussed by Messrs. Alexander C. Humphreys, Frederick Lavis, Henry Floy and Charles Rufus Harte. A written discussion by Mr. W. J. Wilgus was read. Owing to lack of time written discussions by the following were read by titles: Messrs. J. E. Willoughby, Frank C. Boes, Allen Hazen, H. C. Vensano and Leonard Metcalf.

* * *

St. Louis Engineers Enjoy Themselves.—Largely owing to the efforts of an entertainment committee, of which Mr. H. Spoehrer, of the Union Electric Light & Power Company, was chairman, the annual dinner of the Engineers' Club of St. Louis on Dec. 17 was a particularly enjoyable affair. The invitations were in the form of a contract drawn up in regular form, by which the club agreed to furnish the party of the first part one jovial evening in consideration of a certain sum of money in hand paid. The specifications were set forth "as follows, to wit" (with accent on the "wit"). Mr. John Hunter, chief engineer of power plants for the Union Electric Light & Power Company, was the retiring president, and with some flourish he was invested with a Royal Order decoration, Mr. J. Von Mauer making a humorous speech. Mr. A. P. Greensfelder was elected president for the ensuing year. Other speakers were Messrs. C. P. Walbridge, president of the City Plan Commission; J. L. Messmore, president Merchants' Exchange; M. L. Holman, Captain Robert Hunt and Mr. J. W. Peters, assistant secretary of the club, who dwelt on the future development of the organization and also referred to the *Journal* of the Association of Engineering Societies, published in St. Louis. Humorous suggestions relating to the Free Bridge, the *Journal* and the membership plan were made by Messrs. Eugene H. Abadie, George Johns, O. F. Harting, Ralph Toensfeldt, W. Bryan, W. E. Rolfe and John C. Pritchard. The menu of the dinner was printed on a sheet of asbestos roofing material, and it set forth such items as "Keokuk essence d'hydraulique," "City Hall plums," "Free Bridge salad with $C_2H_2O_2$ dressing," "assorted hex. nuts," "cocktail $H_2SO_4$," and so on. Music was furnished by the Union Electric Orchestra.

# Hydroelectric Development at Tallulah Falls, Ga.—II.

**Transmission line and outdoor substations of the Georgia Railway & Power Company—Detailed description of Atlanta substation, which is the largest of its kind ever built**

IN the *Electrical World* of Dec. 20 a description of the hydroelectric development of the Georgia Railway & Power Company at Tallulah Falls, Ga., was published, and in the present issue the transmission of the electrical energy and its distribution through substations of the outdoor type are described.

### Transmission Lines

The energy from the Tallulah Falls station is transmitted over a steel tower line from Tallulah Falls to Atlanta, a distance of 90 miles; from Atlanta to Lindale, a distance of 80 miles, and also from Atlanta to Newnan, a distance of 50 miles. The main line from Atlanta to Tallulah Falls is constructed with six No. 4/0 copper conductors and two 7/16-in. seven-strand galvanized iron-ground wires, the latter being mounted on the ends of a cross-arm at the top of the towers above the cross-arms carrying the main lines. The transmission lines from Atlanta to Lindale and from Atlanta to Newnan are constructed with No. 2/0 copper, the same general type of construction as on the main line prevailing. The insulators are all of the suspension type—four-disk, two-part insulators manufactured by R. Thomas & Sons Company, of East Liverpool, Ohio, being used on the main line from Tallulah Falls to Atlanta, and insulators with five 10-in. disks, manufactured by the Ohio Brass Company, Mansfield, Ohio, on the other circuits. A telephone circuit of No. 4 special 30 per cent copper-clad wire is also strung on the towers and insulated by 15,000-volt Thomas insulators.

### Telephone Circuit

The telephone line is continuous from the power house to all of the substations, and at each interval of 4 miles a small telephone booth supplied with a high-voltage switch of the Burke type, which completely isolates the telephone apparatus when not in use, is provided. The switch is operated from the interior of the booth and is placed on its roof together with one-to-one insulating transformer, arrester and fuses. At the various terminals and at the Boulevard substation in Atlanta there is located a special high-frequency or tuned calling circuit for signaling the specific points desired without interfering with the magneto calling stations. The telephone line is protected by the use of horn-gaps to ground on the high-voltage side and by a new multi-cylinder type of oil-filled arrester.

A novel method of transposition is accomplished by hav-

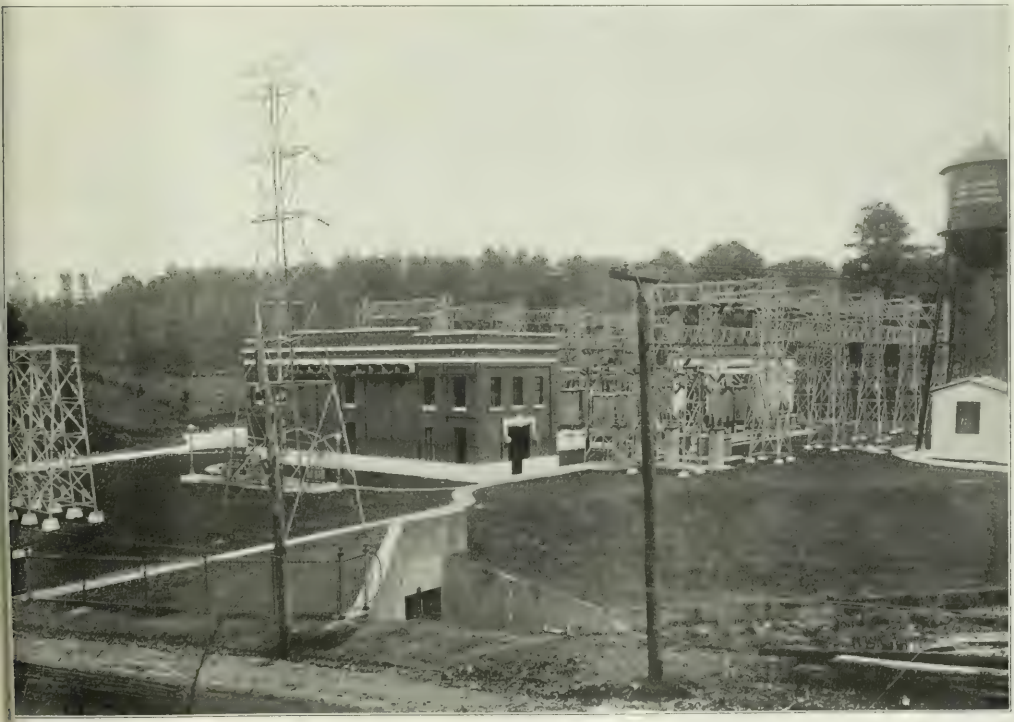


FIG. 1—BOULEVARD SUBSTATION OF THE GEORGIA RAILWAY & POWER COMPANY AT ATLANTA, GA.

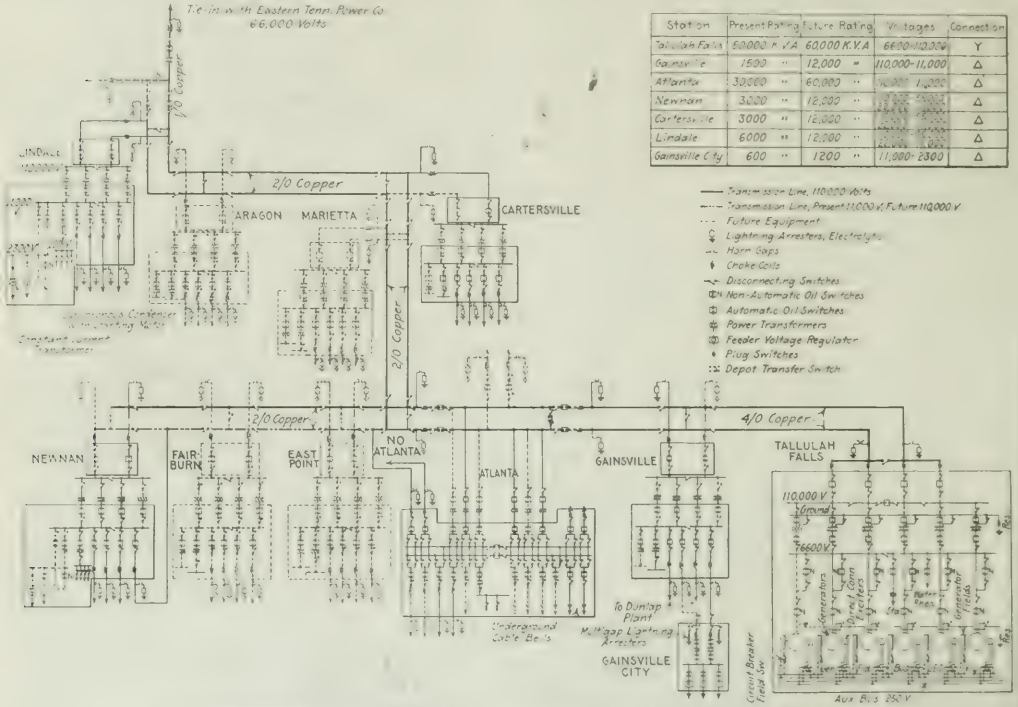
ing the telephone circuits placed on insulators with pins of different heights. The wires enter the tower in a horizontal plane—one on a high pin and the other on a low pin; that of the high pin crosses diagonally to another high pin on the far side of the tower, and that on the low pin crosses to a low pin, the wires clearing each other by about 5 in. This method of making transpositions does away with the customary dead-ending of the line and connecting opposite wires with a jumper.

### Towers

The towers used on the line are spaced about seventeen to each 2 miles and were built by the American Bridge Company. Three standard types, 66 ft, 70 ft. and 80 ft. in height, are used, the first for the No. 4/0 copper circuits of the main line, the second for the No. 2/0 circuits of the lines running to Newnan and to Lindale, and the third to carry the high-tension and low-tension circuits around the outer zone of the city of Atlanta. The bases of the towers, which are square, have side dimensions of 16 ft., 20 ft. and 18.5 ft. respectively.

The 110,000-volt wires are spaced on 9-ft. centers suspended vertically, one three-wire circuit on each side of the structure. The towers on the main line weigh 5554 lb., those on the branch lines weigh 4721 lb., and the special towers used around the city of Atlanta weigh approximately 8000 lb. The cross-arms are of standard channel-iron section and the tower legs are of angle-iron section. Special U bolts secure the suspension insulators to the cross-arms. The footings are made by extending the tower corner angles into the ground to a depth of about 7 ft., and footing angles are bolted to the bottom ends. In addition to the standard towers, special angle towers are used for line angles above 10 deg. The latter towers are of the same design as the standard tower, but of heavier section, and have eccentric cross-arms to take care of clearances for angle location. The strain towers on the main line weigh 6880 lb., and those on the branch lines weigh 6680 lb. In a number of places towers 105 ft. high are used.

The towers, of which there are all told 1754, were tested for vertical, horizontal and torsional loads before shipment. All material was shipped "knocked down" and assembled at the site by the Northern Contracting Company, the general contractor for the development. The towers for the main lines were designed for a longitudinal pull of 4300 lb. at right angles to the end of any one cross-arm, a vertical load of 1500 lb. at the end of any or all cross-arms, a load of 1500 lb. pulling at the top of the towers in any direction, and a load of 10,000 lb. pulling at right angles to the line or parallel to the cross-arms; at the same time, a pull vertical to the line or at right angles to the cross-arms of 8000 lb.—that is, 4000 lb. at the ends of any single cross-arm or at one end of any two cross-arms. The towers for the branch lines were designed for a longitudinal pull of 3000 lb., a vertical load of 1200 lb., a load of 1200 lb. pulling in any direction at the top of the tower, a load of 8000 lb. pulling at right angles to a line, and at the same time a pull longitudinal to the line or at right angles to the cross-arms of 5000 lb. The cross-arms are proportioned for a combined load of a longitudinal pull of 3000 lb., a vertical load of 1200 lb. and a horizontal thrust of 1000 lb. at the ends. The material used in the construction is all thoroughly galvanized, and sherardized bolts were employed in assembling the various parts.




| Station | Present Rating | Future Rating | Voltages | Connection |
|---|---|---|---|---|
| Tallulah Falls | 60,000 K.V.A | 60,000 K.V.A | 66000-110,000 | Y |
| Gainsville | 1500 " | 12,000 " | 110,000-11,000 | Δ |
| Atlanta | 30,000 " | 60,000 " | 110,000-11,000 | Δ |
| Newnan | 3000 " | 12,000 " | [illegible] | Δ |
| Cartersville | 3000 " | 12,000 " | [illegible] | Δ |
| Lindale | 6000 " | 12,000 " | [illegible] | Δ |
| Gainsville City | 600 " | 1200 " | 11,000-2300 | Δ |

FIG. 2.—DIAGRAM OF CONNECTIONS OF THE TALLULAH FALLS GENERATING SYSTEM

### Substations

The substations are of the semi-outdoor type, all being so designed that the high-tension switching structure forms an integral part of the transmission line. At each substation the high-tension structure was erected with the transmission towers. In this way the advantage of a sectionalizing and cross-over station was obtained from the very start, and any shut-down of the lines when it became

necessary to equip the complete substation was avoided.

Nine of these sectionalizing structures have been installed at strategic points in the lines, and five are now built as complete transformer stations with ratings varying from 1500 kva to 6000 kva.

Simplicity and symmetry have been the guiding principles of design, and a standard outdoor high-tension struc-



FIG. 3—OUTDOOR STATION AT NEWNAN

ture and low-tension building have been evolved to take care of a maximum ultimate rating of 12,000 kva in four banks of three 1000-kva oil-insulated, self-cooled 110,000/11,000-volt transformers. Each transformer has four 2.5 per cent taps on both the high-tension and low-tension winding, thus allowing for a 10 per cent variation in voltage either way. The sectionalizing and cross-over features are effected by the use of horn-gap disconnecting switches mounted on the lateral trusses of the latticed tower structures, all three poles of any switch being operated simultaneously by a lever and rod mechanism at the base of the

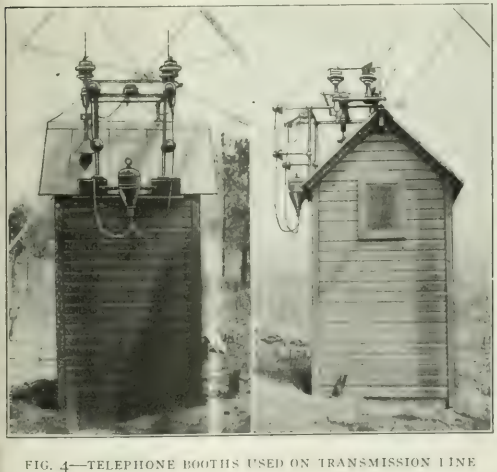


FIG. 4—TELEPHONE BOOTHS USED ON TRANSMISSION LINE

tower. It is the intention of the designers that these switches shall be used only for breaking the charging current on very light loads. In this way a very flexible arrangement is obtained without the expense and complication of high-tension oil switches at every sectionalizing or cross-over point. At each substation there are two oil switches connecting the 110,000-volt lines to the transformer bus, to which bus any bank of transformers may be connected by means of a triple-pole horn-gap disk switch. Each oil switch is protected from the weather by a sheet-steel house of simple construction, and lightning protection is afforded by an outdoor-type electrolytic arrester. Additional protection from lightning discharge is obtained by continuing the tower-line ground wires over the substation tower structures.

The standard low-tension building is of brick, built for an ultimate rating of 12,000 kva at 11,000 volts. Provision is made for four incoming three-phase lines and four outgoing three-phase feeders. All lines enter and leave the building overhead, and 11,000-volt wall entrances of standardized design have been provided on all four sides of the buildings. In addition to the above 12,000 kva, each substation has provision for a synchronous condenser, a 600-kw bank of 11,000/2300 volt transformers for local distribution and a constant-current transformer for series lighting. At each

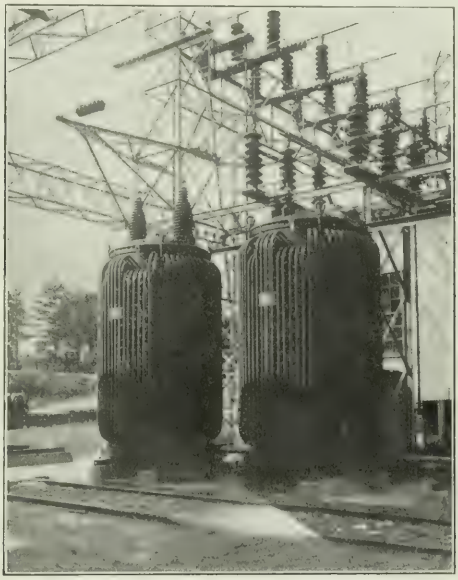


FIG. 5—OUTDOOR TRANSFORMERS AT NEWNAN STATION

substation there is also installed a hoist tower for transformer inspection and repair.

### SUBSTATION AT ATLANTA

The Atlanta substation is located on the north side of Atlanta, on Boulevard Avenue, adjacent to the city limits, and is the largest in the country. It is of the outdoor type of design, having an ultimate rating of 60,000 kw in 110,000/11,000-volt transformer equipment. The present rating is 30,000 kw, consisting of nine 3333-kva transformers. There are now two outgoing and two incoming lines connected with the station, with arrangements provided for additional outgoing or incoming lines, or a total of six 110,000-volt lines. The two present lines come from Tallulah Falls, and the two outgoing high-voltage lines lead to Newnan, and to Lindale.

The high-tension wiring is divided into two sections, known as the north high-tension busbars and south high-tension busbars, which are electrically joined together by a tie switch. These busbars are carried upon latticed steel structures of a design similar to that of the steel towers—that is, angles, channels and standard sections, bolted together. All of the high-tension wiring, as well as the trans-

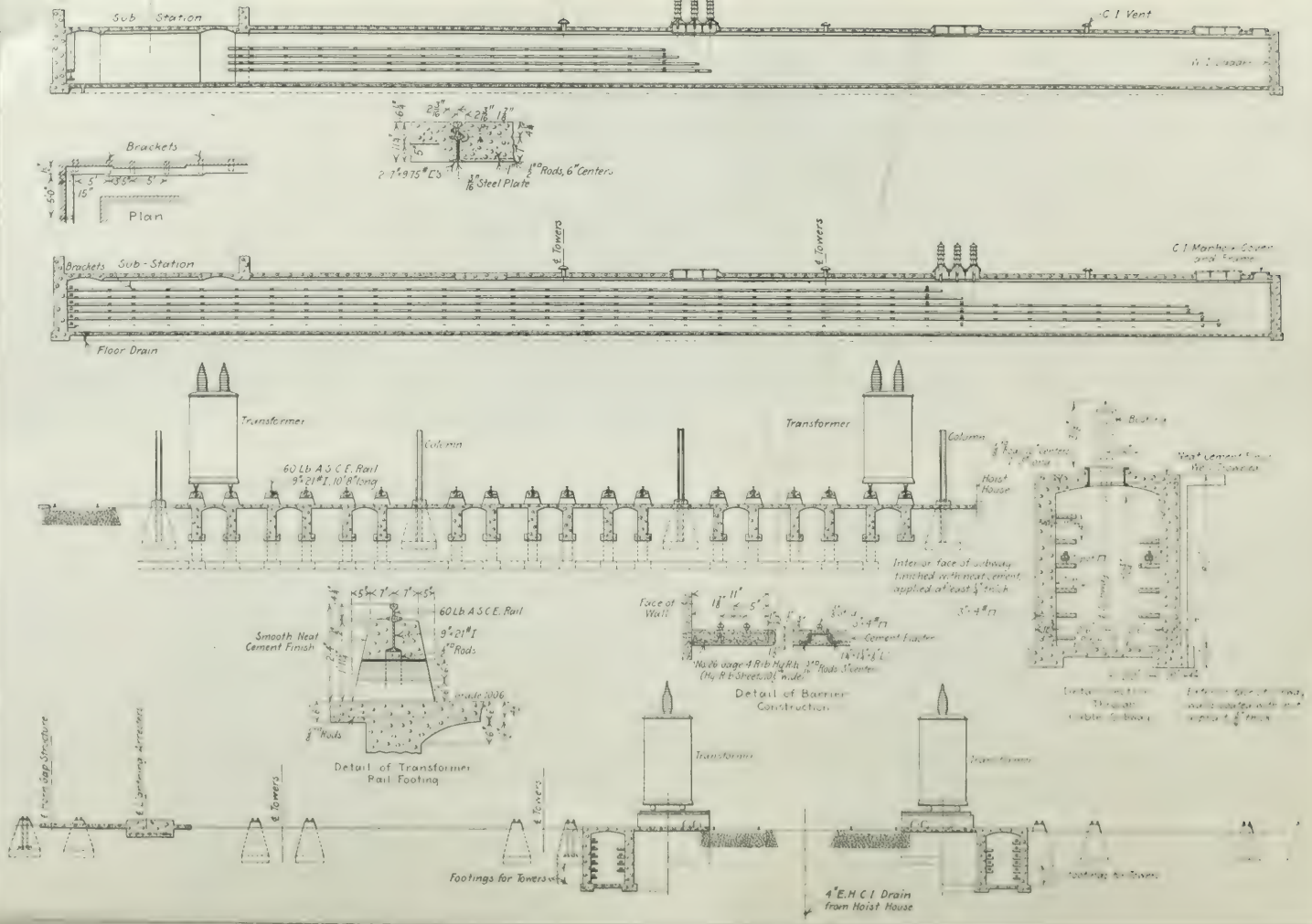



FIG. 6.—DETAILS OF OUTDOOR SUBSTATION OF GEORGIA RAILWAY & POWER COMPANY AT ATLANTA.

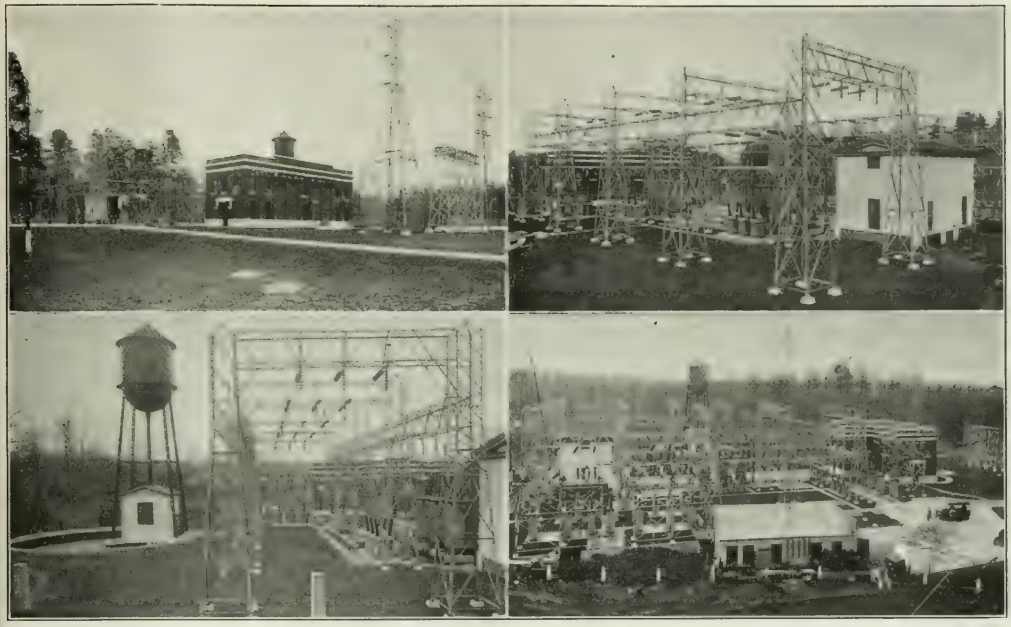


FIG. 7—OUTDOOR-TYPE SUBSTATION OF THE GEORGIA RAILWAY & POWER COMPANY AT ATLANTA

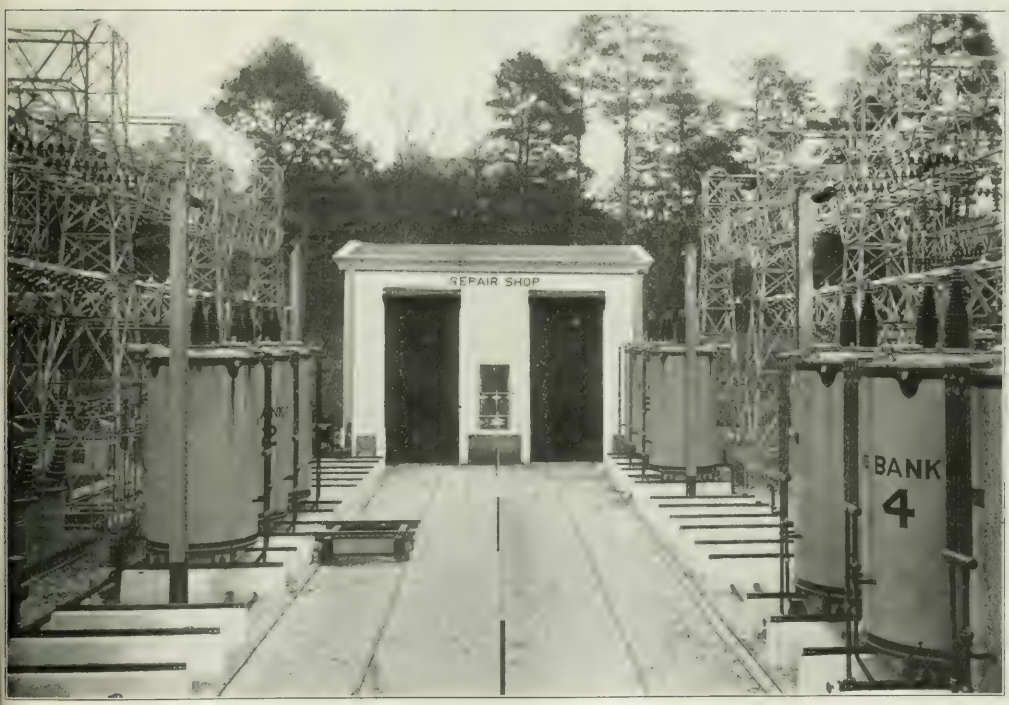



FIG. 8—ARRANGEMENTS FOR HANDLING AND REPAIRING TRANSFORMERS, ETC., AT ATLANTA SUBSTATION

circuits and their circuit breakers, are located on the outside with no protection whatever against the weather. In order to make the construction as permanent and stable as possible, the high-tension wiring has been strung along the lines of the standard catenary construction, with copper tubing busbars supported by hangers from a ½-in. copper-clad messenger, which is in turn insulated from the steel framework.

Fig. 1 shows in general the entire lay-out, consisting of high-tension frames, repair shop, water-storage tank and storage basin, low-tension or 11,000-volt building and 11,000-volt outgoing-line frame. The entire property has been graded and sodded, with concrete sidewalks and crushed-stone driveways. An ornamental picket fence has been put up on the front of the property, and one consisting of concrete posts with wire strung between them surrounds the other sides of the station.

necting switches are carried upon triangular trusses so as to place the blades at such an angle that they may be easily operated from the ground. The upper jaw of the switch is covered with a cast-iron covering and has a special spring-latch catch to hold the blade in position when the switch is closed. The sleet hood makes it possible to open or close the switch even during a sleet storm when it is covered with a film of ice.

All of the exterior equipment has been painted a dull marine gray with black striping. This was done to provide a more non-absorbing medium when exposed to the hot rays of the summer sun. The foundations for the ultimate equipment are already installed, so that when it becomes necessary to add to the equipment from time to time the only apparatus necessary will be the electrical equipment itself.

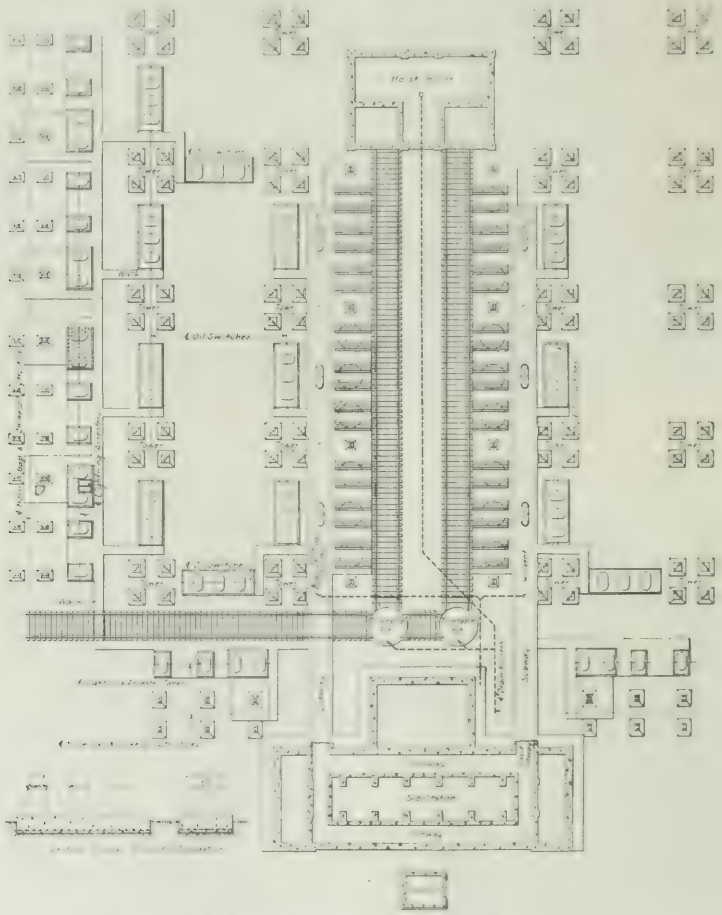


FIG. 1—PLAN OF 40,000-VOLT SUBSTATION AT ATLANTA

## Protection for Switch Jaws

Fig. 7 shows one side of the high-tension bus structure and the catenary arrangement of the busbars supported by the trusses. One feature of the high-tension wiring which was given special thought, and which is installed, is the disconnecting switch, which has a protection against sleet over the jaws or contact-making surfaces. These disconnecting switches are carried upon triangular trusses so as to place the blades at such an angle that they may be easily operated from the ground. The upper jaw of the switch is covered with a cast-iron covering and has a special spring-latch catch to hold the blade in position when the switch is closed. The sleet hood makes it possible to open or close the switch even during a sleet storm when it is covered with a film of ice.

Lighting fixtures have been installed throughout the entire structure so that the grounds are well illuminated at night. The reflectors over each lamp are of enameled porcelain of special design, so arranged that they cannot throw the light on the high-tension wiring. It was thought that with such an arrangement defective insulators could be easily detected at night. There are also waterproof plugs at different parts of the exterior to which a portable plug can be attached in making repairs.

### ARRANGEMENT OF APPARATUS

The high-tension structure was all thoroughly galvanized before erection and the base of each rectangular column is bonded by an expanded rail bond of No. 4/0 wire to a set of grounded ring buses, which are in turn connected to each other. There are four of these ring buses, and all the apparatus is also thoroughly bonded to them.

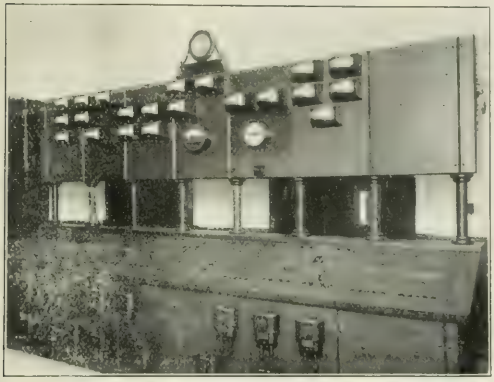


FIG. 10—BENCHBOARD AT ATLANTA SUBSTATION

Fig. 9 shows the space allotted to eighteen single-phase 110,000/11,000-volt transformers, nine of which have already been installed. Running alongside of and parallel to the transformer foundations are main transfer tracks with a suitable truck for handling the transformers. At the end of the two main transfer tracks opposite the repair house, or adjacent to the low-tension building, are two turntables, with a connecting track between them. This arrangement makes it possible to take a transformer from one bank to replace one in any other bank by means of the transfer truck. Leading from the turntables at 90 deg. to the main



FIG. 11—ARRANGEMENT OF LEADS IN SUBWAY

tracks is the track which extends to the main roadway, so that equipment can be unloaded from wagons on to the truck and thence hauled direct to the repair shop.

The repair shop is constructed of steel, "hy-rib" and plaster with two large doors of the steel-curtain type on the front side. This building is used for making repairs to the large transformers in bad weather or when it is necessary to dissect a damaged transformer. There is installed on the interior of this building a hand-operated 10-ton crane, oil filter press, and necessary oil storage tanks, as well as a small machine shop. Having this house available for repairs obviates the use of space in the main low-tension building for this purpose, and thus does away with the dirt, grease, etc., which is necessarily present where repair work is done.

### TRANSFORMER EQUIPMENT AND CONNECTIONS

The transformers are of the water-cooled type, and suitable headers are carried along parallel to the main transfer tracks with the necessary valves for letting the water in and out of the different transformers. There are also oil mains connecting the different transformers with the filter press and oil-storage tank, so piped that the oil may be forced in either direction through the system.

The low-tension leads are carried from the rear side of the top of the transformers over to a delta bus supported on pipe framework, and from this framework down through roof entrance bushings set in iron castings of special design into the top of the tunnel, which runs parallel to the line of transformer banks. In Fig. 11, which is a view in the 7-ft. tunnel, can be noticed several of these roof entrance bushings. The leads after entering the tunnel through these roof entrance bushings are carried along concrete



FIG. 12—SWITCH ROOM IN ATLANTA SUBSTATION

shelves, and supported by porcelain insulators, into the low-tension building where they are connected to the respective oil switches. All of these leads are made of 15/16-in. tubing so as to give the necessary mechanical strength.

### LOW-TENSION BUILDING

Each and every phase of the low-tension wiring is isolated by masonry barriers so that in case contact should occur at any one place it will involve only the one phase. Fig. 13 shows an end view of the bus structure on the first floor of the low-tension building. This structure is made of buff pressed brick and alberene stone, and the barriers at the top of transite are held in place by iron clips. The walls are corbeled out near the ceiling to carry these barriers.

Fig. 10 shows the control switchboard from which the operation of the entire station is controlled by means of pull-button switches. The high-tension mimic buses are designated on the board by brass strips, and the low-tension buses by copper strips. All of the switches are operated by a 250-volt, 40-amp-hr. storage battery, and two 10-kw motor-generator sets are used to recharge these batteries. This battery equipment was installed so that should any interruption occur to the high-voltage service the switches could still be operated.

Fig. 12 shows the second floor of the low-tension build-

ing, which contains the 11,000-volt oil switches, and shows also the location of the outgoing lines on the side walls. There is a total of fifteen 200-amp, 11,000-volt outgoing lines, nine of which are underground and six overhead, and also a station group switch. Two banks of three 10-kva, 11,000/110/220-volt and three 25-kva, 11,000/440-volt auxiliary transformers furnish the energy for lighting, pumps, motor-generator sets, etc. At each end of this room are placed the arresters of electrolytic design, which are connected to the ends of the four bus sections. The general arrangement of the switches consists of two bus sections each containing two busbars the ends of which are cross-connected through an oil switch forming a double-U bus arrangement, the feeders of which can then be switched to either section of the section bus. Facing the front of the oil switch, there is mounted on the left of the motor on each of these switches a four-pole knife switch which is used to isolate the control by cutting out the close and trip and the lamp circuits, making it impossible for an operator to throw this switch from the control board when it is intentionally cut out for repairs. All of the masonry on this



FIG. 13—BUS STRUCTURE IN ATLANTA SUBSTATION

floor is also of buff pressed brick and alberene slabs. The shunt transformers are carried in separate compartments of the same general design and construction as those of the switch structure.

The low-tension building has concrete foundations and the superstructure is of red-faced brick with white-marble trim and parapet. The roof is of concrete slab and tar and gravel construction. The window frames are of steel and are top-hinged. It is possible to view the entire outdoor equipment from the control room. This building is 81 ft. by 25.75 ft., and the control room annex 27 ft. by 18.5 ft. The first floor of the annex contains the battery room, shower baths, toilet, etc. The second floor consists of the control room itself, which contains the control board, the motor-generator sets, charging switchboard and telephone equipment, as well as a general office for the operators in dispatching the loads of the system and operating the station.

All of the incoming and outgoing high-tension lines are fitted with lightning arresters, standard horn-gaps and choke coils. The high-tension choke coils are so placed that their connection with the line is by means of a right-angle bend, while the connection through to the electrolytic tank is a straight through connection, along the direct path to and across the horns and into the arrester bushing. Between the low-tension building and dead-ending frame, as can be seen in Fig. 7, the outgoing 11,000-volt lines are fitted with an insulator. From the front of this insulator down to the lightning-arrester frame and back again to the rear of the insulator is a No. 4/0 copper wire, forming a somewhat original scheme known as the inverted hairpin. At the sharp bend at the bottom of the pin the connection is made to the lightning-arrester frame, and it is supposed that a discharge or surge coming in along the line, instead of making the sharp bend at the point where this connection is made, will go through the lightning-arrester tank. This arrangement is being tried out.

### Water Supply

In order to secure water for cooling the transformers, it was necessary to drill wells, and four have been driven to a depth of about 450 ft., and two of them piped up for use in connection with compressed air for forcing the water from the well to the concrete catch basin at the top. These catch basins are at an elevation of several feet above that of the main storage basin, and the water is allowed to feed from them into the main storage basin by gravity. In Fig. 7 can be seen the main reservoir, which is about 11 ft. deep and 61 ft. in diameter. Above this reservoir and resting on a concrete base is the 50,000-gal. elevated storage tank, about 75 ft. above the water level in the main reservoir. A vertical submerged centrifugal pump forces the water from the reservoir into the tank against the head of water there, whence it is fed by gravity through the system of cooling pipes. There is installed in the house directly under the storage tank, known as the pump house, an air compressor with a capacity of 150 cu. ft. for pumping air for the deep wells, with provision made for the installation of additional equipment similar to that now installed. An arrangement is also provided for discharging the water from the tank directly into the main reservoir without going through the piping system, or, should it be desirable to do so, the water may be discharged from the tank into waste and cooler water pumped into the tank for cooling the transformers during the hot summer months. The reservoir and tank are both provided with electrical float switches for regulating the depth of water. The pump and air compressor are supplied with energy from the three-phase, 75-kw, 440-volt bank of transformers.

Most of the electrical equipment in this station has been supplied and installed by the General Electric Company. This includes the transformers, lightning arresters, low-tension oil switches, control equipment and four of the high-tension oil switches. The latter are known as Type K-22 and are the first 110,000-volt switches for outdoor service that this company has built. Four of the high-tension breakers were furnished and installed by the Westinghouse Electric & Manufacturing Company and are of its standard GA type. The air-compressor and deep-well equipment was furnished by the Ingersoll Rand Company and is fitted with Cutler-Hammer control. The large storage tank was furnished and erected by the Chicago Bridge & Iron Company, and the local lighting, miscellaneous motor equipment and oil and water piping were installed by the Tucker Electrical Construction Company, of New York City. The grading, construction work, etc., was done by the Northern Contracting Company. The steel structures were furnished by the Alfred E. Norton Company, of Philadelphia, and some miscellaneous steel equipment by R. D. Coombs & Company, of New York. The design and construction of the station was carried out under the direction of the chief engineer, Mr. Charles O. Lenz, of 71 Broadway, New York City, for the Georgia Railway & Power Company. Mr. C. E. Bennett is the electrical engineer.

# Control Equipment for the Panama Canal Locks

**Elaborate provisions made to safeguard operation of main and intermediate gates, valves, chains, miter-forcing machines, etc.—Use of synchronous indicators on control boards**

ELECTRICAL energy for the locks, towing locomotives and lighting of the Panama Canal will be furnished by the 7500-kw, 2200-volt hydroelectric plant at Gatun and in case of emergency by the 4500-kw steam-turbine station at Miraflores, which has heretofore been used for construction purposes. A double 44,000-volt transmission line crosses the Isthmus, connecting the two power plants with Cristobal and Balboa through four transforming substations. In addition there are some thirty-six 2200/240-volt substations in the lock walls serving to supply the Gatun, Pedro Miguel and Miraflores locks with power, traction and light.

The system of connections employed throughout makes use of a double-bus, double-switch scheme, with provision for disconnecting any oil switch for cleaning or repairs without interrupting its circuit. In the power house and in the four 44,000/2200-volt substations the oil switches are solenoid-operated and are installed in concrete cells, above which are concrete fireproof compartments containing the two sets of buses.

### Energy Supply for Lock-Machinery Motors

Energy for the lock machinery and towing locomotives is in each case transformed from the 2200-volt system in the immediate vicinity of the place it is to be used. Each of the thirty-six transformer stations contains duplicate 200-kva, three-phase, 2200/240-volt transformers for motor service and one single-phase, 25-kva, 2200/220-110-volt transformer for lighting. These substations, although normally fed from the 2200-volt buses in the main 44,000 2200-volt substations, can also be operated directly from the power plants if necessary.

Some idea of the number and sizes of the motors to be controlled in operating the lock machinery is afforded by the accompanying table.

In general, these motors are started and controlled by contactor panels placed near them and operated from the central control house. The smaller motors, including those for the cylindrical valves and the auxiliary culvert valves, and for miter forcing, are started by being thrown directly on the line. In the case of the larger motors for miter-gate moving, and for the rising stem valves and guard valves, a starting point is provided having resistance in two legs of the three-phase circuit.

In all cases the contactors are operated from the control boards by three wires, one for forward, one for reverse and the third for the common return. For panels having a starting point the period during which the motor remains in circuit with resistance is automatically governed by a dashpot. Each individual machine may also be controlled locally in case of emergency.

From an operating standpoint the machinery is placed below the coping of the lock walls, thus affording a clear space for maneuvering ships and protecting the apparatus from the weather without the erection of numerous houses.

### Operation of Mitering Gates

The mitering gates consist of two massive leaves pivoted on the lock walls and operating independently of each other. In addition to these lock gates, at the lake and

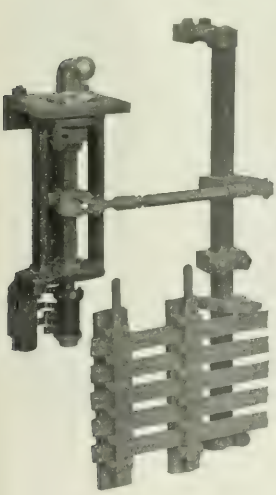


FIG. 1—CONTROL SWITCH AND INTERLOCK MECHANISM

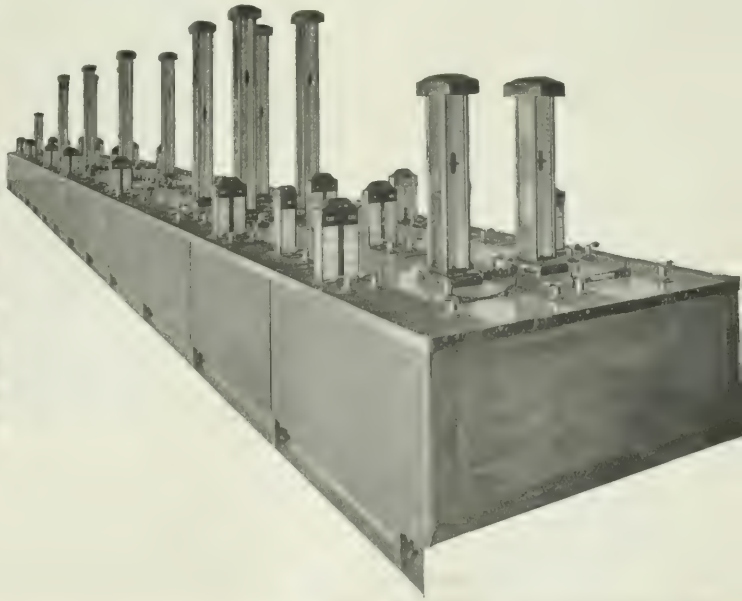


FIG. 2—CONTROL BOARD FOR MIRAFLORES LOCKS COMPLETE

... duplicate pairs of gates are provided as guard gates. Furthermore, to handle vessels of various sizes with the minimum use of water, intermediate mitering gates divide each 1000-ft. lock into two compartments. When the mitering gates are closed they are clamped in position by a "miter-forcing" machine.

On the top of all mitering gates foot-walks with hand

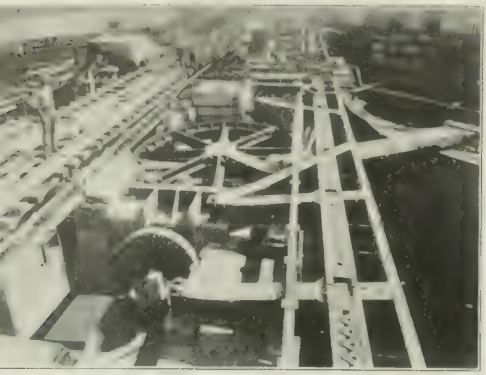


FIG. 3—MITER-GATE-MOVING MACHINERY

rails are provided. Since when the gates are opened these rails would interfere with the towing locomotives, the rails are made to be raised and lowered by a motor controlled from foot pushes on the lock walls. If the hand-rails have been left up and the gates are opened from the control

MOTORS CONTROLLING PANAMA LOCKS

| Machines | Motor Hp | Number of Motors: Gatun | Pedro Miguel | Miraflores | Total | Total Hp |
|---|---|---|---|---|---|---|
| Miter gate, moving, each leaf | 25 | 40 | 24 | 28 | 92 | 2,300 |
| Miter gate, miter-forcing | 7 | 20 | 12 | 14 | 46 | 322 |
| Fender chain, main pump | 70 | 16 | 16 | 16 | 48 | 3,360 |
| [illegible] | 0.5 | 16 | 16 | 16 | 48 | 24 |
| Rising stem gate valve | 40 | 56 | 24 | 36 | 116 | 4,640 |
| [illegible] | 7 | 60 | 20 | 40 | 120 | 840 |
| [illegible] | 25 | 6 | 6 | 6 | 18 | 450 |
| Auxiliary culvert valve | 7 | 4 | 4 | 4 | 12 | 84 |
| Totals | | 218 | 122 | 160 | 500 | 12,020 |

house, the rails will be automatically lowered and cannot be raised while the gates are open.

Chain fenders are stretched across the canal in front of all mitering gates exposed to the upper lock level. These chains are maintained taut when the gates behind are closed but are dropped clear when the gates are opened. The chains are raised and lowered by a construction similar to that used in hydraulic elevators. Should a ship approach the gates at a dangerous speed and ram into the chain, the latter will be paid out so as gradually to stop the vessel. Movement of the chain is controlled by two motors, one driving the pump supplying water under pressure and the other operating a valve which controls the direction of movement of the chain.

The filling and emptying of the locks is accomplished by three culverts, one in the middle wall and one in each side wall, the flow of water being controlled by rising stem valves. These 8-ft. by 18-ft. valves are installed in pairs, and each pair is in duplicate. Since the culvert in the middle wall must serve the locks on both sides, cylindrical valves are placed in the ten lateral culverts at each lock.

At the upper end of each lock are two auxiliary culvert valves for regulating at an intermediate height the water between the upper gate and the upper guard gate.

The flight of locks at Gatun, for instance, extends over all approximately 6200 ft. and its principal operating machines are distributed over a distance about 4000 ft. in length. The lock-control situation therefore resolved itself into centralized electrical manipulation, thus reducing the number of operators, operating expense and liability to accident. The control boards for each lock have all their switches so mechanically interlocked as to minimize, if not entirely prevent, the errors of human manipulation.

These boards are installed in control houses located on the middle walls at points which afford the best view of the locks. The control boards are themselves arranged as operating miniatures of the locks and have indicating devices which show the position of valves, lock gates, chains and water levels in the various chambers.

### Operation of Synchronous Indicators

The indicators on the Panama control boards were developed especially for this undertaking and show accurately and synchronously every movement. Both transmitter and receiver have a stationary and a rotating part. The stators consist of three-phase windings which are energized by induction from the rotors. The latter are bipolar and are energized in multiple from a 110-volt, 25-cycle, single-phase source.

Movement of the transmitter rotor produces a voltage



FIG. 4—CONTROL HOUSE ON GATUN LOCKS

in the stator coils which is transmitted to the receiver stator coils. Here the voltage is duplicated, but in the reverse direction. Any difference in the position of the transmitter and receiver rotors causes a difference of potential between the stator windings, with a consequent flow of current and a resultant torque moving the receiver rotor to the same relative position as that of the transmitter rotor. The re-

ceiver rotor follows closely and smoothly the movement of the transmitter, although on a scale reduced to the requirements of the control board.

In the case of the mitering gates, the indicator used comprises a pair of small aluminum leaves, which travel horizontally just above the top of the board.

For the chain fender the indicator transmitter is driven by the limit-switch shaft and the indication at the board is given by a miniature aluminum chain, which is raised and lowered like the large chain, each end operating independently. The ends of the miniature chain are fastened to semaphore arms, the angle of which also shows the position of the large chain.

As the rising stem valves are arranged in pairs, their position indicators occur in pairs also and are similar to small elevators, in which aluminum cages are used to indicate the positions of the valve gates. To make the indications more easily visible the little elevator shaft under each car is illuminated while the portion above it is dark.

### Water-Level Indicators

The specifications covering the water-level indicators required an accuracy within 0.1 per cent or 0.05 ft. of actual water level. Since, in the transmitters and receivers for the machines previously described the rotors turn less than 180 deg., with an inherent lag of 1.5 per cent, the same arrangement was obviously not suitable for giving the accurate water-level indications required.

It was found, however, that if the rotors were revolved ten complete revolutions the required accuracy could be obtained. But since this would make it possible for the rotors to be in synchronism every 180 deg., or in twenty different positions during the entire travel, the indicators might not indicate correctly if for some reason the transmitter rotors were turned more than one-half revolution with the excitation off. The required accuracy was finally obtained by employing two sets of transmitters and receivers, one connected to a fine index, in which the rotors make ten com-

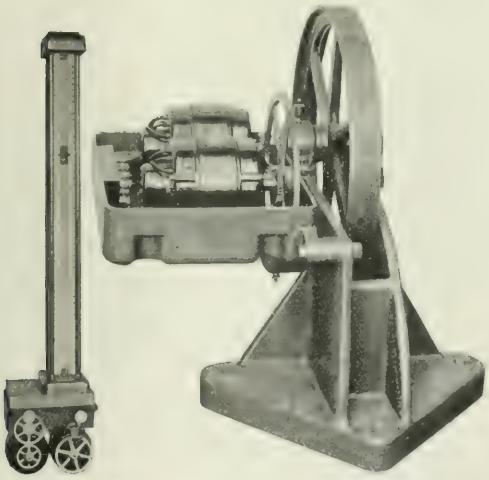


FIG. 5—RECEIVER AND TRANSMITTER OF SYNCHRONOUS WATER-LEVEL INDICATOR

plete revolutions, and the other connected to a coarse index operating through less than 180 deg.

The fine index is a hollow cylinder carrying a pointer, the length of the cylinder being such that when the aluminum ball representing the coarse index is within the limits of the cylinder the reading of the fine index is correct within the limits specified.

For water-level indication, wells 36 in. square, molded in the lock walls, communicate with the locks by small openings which serve to dampen surges. Each well contains a welded-steel box float, 30 in. square by 9 in. deep. A non-slipping phosphor bronze belt transmits the movement of the float to a sheave on the transmitter mechanism. Each miter-towing machine has its open and closed positions

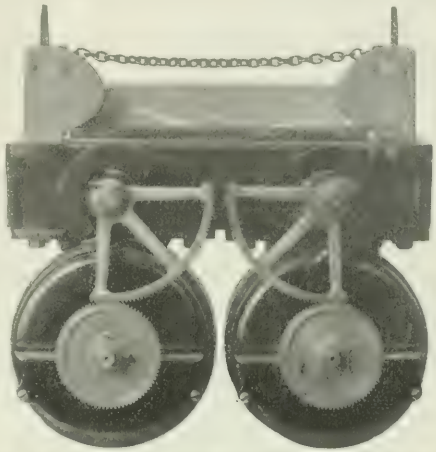


FIG. 6—RECEIVER INDICATING POSITION OF FENDER CHAINS

shown by red and green lamps and a mechanical indicator.

### Control Boards Reproduce Locks in Miniature

The control boards are of the flat-top benchboard type, 32 in. high by 54 in. wide, and were built in sections with total lengths as follows: Gatun, 64 ft.; Pedro Miguel, 36 ft.; Miraflores, 52 ft.

The side and center walls of the locks are represented by cast-iron plates and the water in the locks by blue Vermont marble slabs.

The control-switch handles are mounted above the surface of the board and operate through an angle of 90 deg. They are provided with name-plates for the "open," "closed" and "off" positions. The space immediately below the flat top is occupied by the contact fingers of the control switches and the synchronous receivers and their cable connections. The receivers, transmitters and lamps are operated at 110 volts and the control circuits at 220 volts. Both use 25-cycle alternating current.

In order to insure that the operator will maneuver the control switch handles always in a certain order, corresponding to a predetermined sequence of operation of the lock machinery, and to prevent the operator in control of one channel from interfering with the operation of the other channel, the control switches are provided with interlocks. These interlocks are arranged in two vertical racks beneath and at some distance below the control board, so that they may be inspected and oiled from a lower floor. The interlock system is made up essentially of bell-crank and rod mechanisms each connecting the shaft of a control switch to a vertical operating shaft which can or cannot move according to the relative positions of the interlocking bars and dogs. These bars and dogs are of hard, extruded brass. The special shape used keeps the dogs in line with the axis of the bars when under pressure by being engaged with another dog on a vertical bar. Every control switch uses a horizontal bar 3 ft. to 50 ft. in length.

Interlocks prevent the chain fender from being lowered until adjacent mitering gates have been opened, and also prevent the gates being opened until the chain is in the raised position. In this way the chain fender will always

[illegible] position to protect the gate when the latter is closed. After the mitering gates are closed, the miter-forcing machine is operated by its control handle and locks the ends of the gates closed. This machine cannot be started, however, until the gates are closed.

The rising stem valves of the side wall next above or below a miter gate must also be closed while the miter-forcing machine is open. As the miter-forcing machine cannot be closed until after the gates, the valves either above or below the gate must remain closed until the gate itself is closed. This feature prevents the operator from creating a current of water around the gates while open.

Either pair of rising stem valves may be opened first, at the choice of the operator, an interlock becoming effective when the first valve of the second pair of duplicates is opened. This is done by a novel arrangement of equalizing levers acting against the ends of the interlock bars. There is a definite amount of lost motion which is taken up on opening the first pair of valves and thus puts the interlocks in operation on the next pair.

To illustrate this operation, the reader may consider a side-wall culvert at Gatun with its principal rising stem valves at each change of level from one lock to the next.

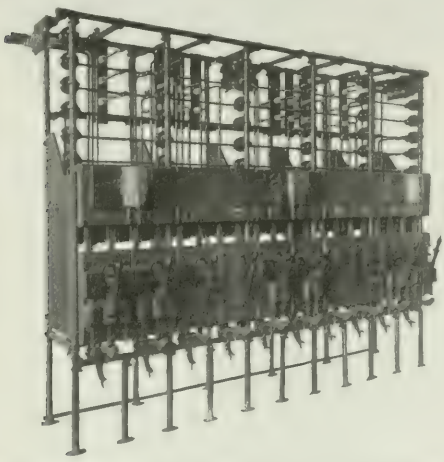


FIG. 7—TRANSFORMER SWITCHBOARD IN LOCK SUBSTATION

The control of these valves is interlocked so that if the valves are opened at one particular point the valves a lock-length upstream or downstream cannot be opened. Thus the operator is limited to equalizing the water between locks and cannot allow water to flow from the upper lock past the middle lock into the lower lock, which operation, if permitted, might flood the lower lock walls and the machinery chambers in them. The cylindrical valves are interlocked so that if those on one side are opened the ones on the other side are locked closed, and the opening of one switch on a side will lock the opposite ten. This prevents careless cross-filling between locks, an operation which might be combined with the regular method and produce flooding. There may be dry seasons, however, when it will be desirable to employ cross filling to economize water, so therefore the interlock is made removable by the use of a key deposited with the chief operator.

In most cases the locks are divided into two unequal parts by the intermediate mitering gates. This arrangement makes it necessary to divide the ten cylindrical valves into two groups of seven and three respectively for the long and short lengths. A selecting lever is provided for these interlocks and may be set as indicated by a name-plate on the lever to "three," "seven" or "ten" respectively. Thereafter the corresponding valves are subject to that interlock, and the others of the group of ten are locked closed if three or seven only are to be used. This arrangement permits handling small vessels without waste of water in the large chambers. If a short vessel were being passed downstream, it would first pass into the chamber having three cylindrical valves. The group selective lever would then be placed on the "three" position, which would permit the opening of three valves above the intermediate gate but would lock closed the other seven valves above it. After the vessel had been passed below the gate the handle would be reversed, releasing the lever and locking three switches. There are intermediate rising-stem valves in the side walls at each intermediate gate, but no interlocks are provided for these valves.

In case a large vessel is to be passed, the interlocks on the intermediate gates can be made ineffective by the operation of a Yale key which disconnects the central switch from the operating mechanism. Turning the key removes the interlock and permits the intermediate gates to be thrown open to obtain a 1000-ft. level. The valves can then be operated independently of these gates.

To obviate the possibility of flooding the locks when valves are in a certain position, diagonal interlocking is introduced between the rising stem valves of the side wall and those of the middle wall a lock length away. This interlocking between valves diagonally across a lock when the cylindrical valves are open is needed to prevent the flow of water from, say, the upper lock by way of a side wall culvert to the middle lock, thence by way of the middle wall culvert to the lower lock, which might allow a careless operator to flood the lower lock walls.

### Impregnation of Insulated Parts

To withstand the humid atmosphere of the Isthmus, all insulated parts, such as the coils of solenoids, relays, circuit-breakers and other apparatus, have been impregnated with non-hygroscopic compounds. All small parts are made of brass, copper, monel metal, bronze or sherardized iron or steel. Mica and treated asbestos lumber have been used largely in place of fiber or wood.

The combined weight of the centralized control boards for Gatun, Pedro Miguel and Miraflores is about 39 tons. In their construction there has been employed about 6,000,000 ft. of control leads, made up in five-conductor and eight-conductor cables; 732 indicator motors and 464 control switches.

The specifications for the entire generating, lock-controlling and distribution system for operating the Panama Canal were prepared under the supervision of Mr. Edward Schildhauer, electrical and mechanical engineer for the Canal Commission, assisted by a staff of electrical engineers including Mr. C. B. Larzelere, who was closely identified with the lock-control problems, and Mr. W. R. McCann, who was concerned with the generation and distribution of power.

The equipment described in the foregoing account was furnished by the General Electric Company.

## Electric Lighting and the Balkan War

The new electric-lighting system in Uskub, Macedonia, underwent many vicissitudes during recent months while the city was being captured and recaptured by Servians, Turks and Bulgarians. Uskub's street-lighting installation was almost finished in September of last year just before the war broke out. During the period of fighting and siege the plant remained inoperative. Finally the city was carried by the Servian army, and with the establishment of military rule the engineers of the Servian signal corps put the lighting plant into operating order. Since that time electric service has been installed in many private homes.

## Cost Figures from Brookings, S. D.

BY E. M. SORENG

Brookings, S. D., a pretty city of 4000 population and the seat of the state college, is served with electricity and steam heat from a municipally operated plant which has been made a financial success as the result of intelligent and conservative management.

The plant building is a one-story brick structure, 30 ft. by 50 ft. in plan, with a wooden coal shed at the back where fuel is unloaded from wagons and wheeled into the boiler room as needed. The shed has a large storage capacity so that a considerable supply can be laid in at one time. A better price can be obtained by buying in large quantities, and advantage can be taken of any change in the market price. The boiler room contains three 100-hp hand-fired, return-tubular boilers. The smokestack is of brick 80 ft. high and 5 ft. in diameter. Two units comprise the generating equipment. One consists of a 12-in. by 36-in. 100-r.p.m. simple engine, built by the Minneapolis Steel & Machinery Company, belted to a 60-kw, 2200-volt, 60-cycle, two-phase alternator of the Stanley induction type, the exciter being belted to the shaft of the alternator. The other unit consists of a 16-in. by 36-in. engine of the same make, belted to a similar 150-kw alternator. An exhaust-steam heating system was installed in 1904 and heats the public-school buildings situated within a block of the plant, the city hall and a number of business buildings. In the daytime during cold weather not enough steam is available from the exhaust, and live steam is used to supply the deficiency.

The total cost of the present plant was $41,000, of which $28,000 is invested in the plant and steam-heating system and $13,000 in the lines, transformers and meters. The alternating-current system as first installed cost $14,000, which included the building, smokestack, two boilers, the 60-kw alternator, switchboard, some auxiliary apparatus in the plant, and some additional line construction and transformers. This money was raised from the sale of 5 per cent bonds appropriated from a sixty-thousand-dollar water-works issue.

In the last ten years $30,000 worth of bonds and warrants have been retired from the earnings of the plant, and $2,000

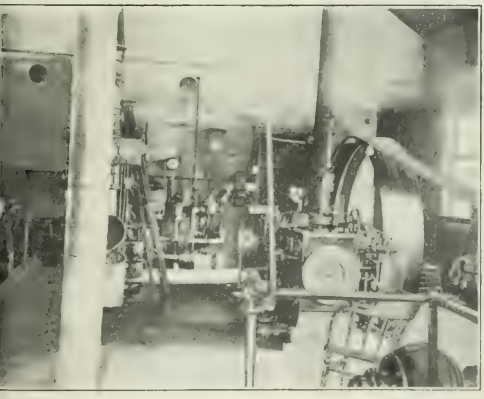


FIG. 1—ENGINE ROOM IN MUNICIPAL PLANT, BROOKINGS, S. D.

of the earnings has been applied to street improvements. The street lighting has not always been credited to the plant and has never been metered, so that the amount to be credited to the plant from this source can only be estimated by comparison with similar cities near by. A conservative estimate of the amount to be credited to the plant for this service is $1,500 a year, which, with interest, would amount to at least $18,000 in ten years. This makes a total revenue of the plant in ten years $50,000; or, in other words, during ten years the plant has earned $9,000 above its cost, after paying expenses.

The gross revenue from lighting in 1912, exclusive of street-lamp service, was $15,600, representing about 200,000 kw-hr. at the switchboard and a load-factor of 11 per

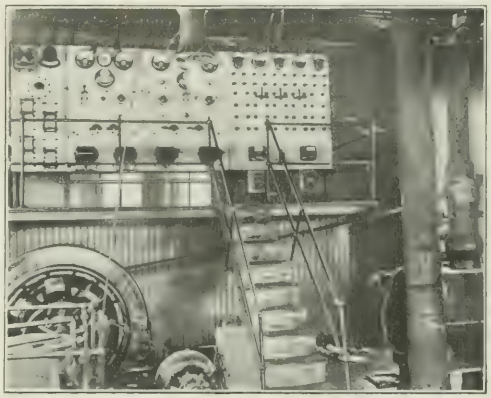


FIG. 2—SWITCHBOARD IN MUNICIPAL PLANT, BROOKINGS, S. D.

cent. The revenue from heating was $5,600, making the total revenue $21,200.

A good grade of Iowa or Illinois coal is used and in cost averages $4.50 a ton, delivered in the bins. In 1912 the cost for coal was $9,000. The city employs one superintendent of light, heat and water, most of his time being charged to the lighting and heating. Two engineers work twelve-hour shifts and one fireman works from noon to midnight. During the rest of the day the engineer on duty does his own firing. One lineman is employed continuously and part of the time has an assistant. These men also read the meters. One of the linemen spends half of his time at the pumping plant of the city water-works, so that the time of four men besides the superintendent is charged to the light and heat plant. One-third of the salary of the city auditor and his clerk is also charged to the lighting and heating plant.

The cost of electrical energy at the switchboard is 4.5 cents per kw-hr., not including fixed charges, or about 6 cents including all fixed charges. The sum of the readings of the customers' meters is 70 per cent of the reading of the station instruments, so that the total cost of energy is about 9 cents per kw-hr. to the customer, which includes the fixed charges on the distributing system. The total connected motor load is only about 50 hp, so that the revenue from this source is small and has been included with the lighting in giving the income.

The rate for lighting, up to April, 1913, has been 12.5 cents per kw-hr. and for motor service 8 cents per kw-hr., in any quantity. The present rate for lighting is 10 cents per kw-hr. up to 30 kw-hr. per month and 8 cents for all above this amount and for motors 8 cents per kw-hr. up to 100 kw-hr., and 5 cents for all above this amount. The present rate is lower than in most cities in this section of the country, the old rates having been as low as or lower than most. The municipality also operates its own central-energy telephone exchange, which has about 650 subscribers. The total cost of the system was $35,000, and the monthly revenue of the plant is $900.

For the success of the Brookings plant much credit is due to Prof. H. H. Hoy, of the electrical-engineering department of the state college, who has served on the local committee for many years.

## Handling, Sampling and Testing of Transformer Oil

By George E. Armstrong

In a large electrical distribution system, such as that of the Southern California Edison Company, transmitting energy at potentials of from 10,000 volts to 75,000 volts, much dependence must be placed on the station and substation transformers in order that service shall be uninterrupted. Modern transformer design tends toward greater dependence on oil for insulation and less on mica or other mechanically strong types of insulation. If the temperature of the transformer is controlled either by means of the water-cooled method or the forced-oil method, there is an opportunity for moisture to enter the oil and thereby decrease its value as an insulator.

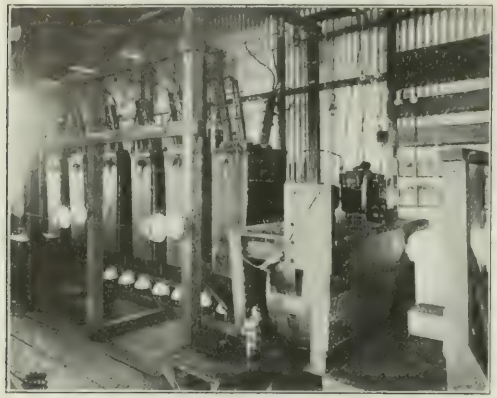


FIG. 1—SET USED IN TESTING TRANSFORMER OIL.

The oil in use at the present time as a transformer cooling and insulating medium is obtained by fractional distillation of crude petroleum until it has approximately the following properties, which are averages of those standard for oil intended for use in a 60,000-volt transformer:

Specific gravity—70 deg. to 85 deg. Baumé.
Color—As light as possible for an untreated oil.
Base—Preferably a paraffin base.
Viscosity—50 seconds at 40 deg. C. (Saybolt).
Per cent of sulphur—0.
Reaction—Neutral.
Moisture—One part in 200,000 or less.

Practice has shown that transformer oil deteriorates upon use and heating. If the oil is not up to standard, it will throw down an asphalt-like deposit. Water, sulphur or other foreign matter also mixes with the oil, resulting in the lowering of the dielectric strength to such a value that the transformer is at any time liable to break down electrically. Every possible precaution should therefore be taken in handling the oil and it should be tested frequently and with extreme care in order to check any deterioration that may be starting. In varying degrees the oils obtained from the manufacturers are liable to have water dissolved in them, and therefore moisture is the most important of the foreign substances to be guarded against in the handling.

The Southern California Edison Company has experienced trouble with the oil used in its transformers in the past, and, as a result, it has recently instituted a transformer oil department which has supervision over the handling, sampling and testing of transformer oil to the end that transformer failures may be decreased. The writer is in charge of the testing of oil and, even in a few months, has been able to show that the establishment of this department was well advised because a considerable number of the transformers which make up a total rating of over 200,000 kw have been found to have defective oil.

Shipment of oil in either tank cars or steel drums introduces the possibility of moisture or other foreign substances entering the oil. Consequently the rule should be that all oil should be filtered immediately before placing it in transformers. When this is impracticable the drums should be subjected to the following treatment: They should be placed in such a position that the bunghole is lowest and a blast of hot, dry air should then be circulated within the drum until it has reached a temperature of 80 deg. C. After this temperature has been maintained five hours, the drum may be filled with the desired oil, which has been previously dried and sealed tightly. The drums should be kept on their sides in order that no moisture can collect on the heads.

Transformers should be dried as soon as they are received from the manufacturer or before being placed in service, and the best method yet evolved for doing this is by means of a blast of air which is electrically heated to a temperature of from 80 deg. C. to 85 deg. C. The air should be forced through the large valve at the bottom of the transformer and allowed to escape through the manhole in the top. After the temperature of the interior of the transformer has reached 68 deg. C. it should be held at that temperature for from twenty-four hours to ninety hours, depending on the size of the transformer. For a 100-kw transformer twenty-four hours is sufficient; for a 1500-kw transformer ninety hours is needed.

After the transformer is dried the oil to be used should be pumped into it through a filter press, care being taken that the manufacturer's instructions as to heating the paper be rigidly adhered to. It should be heated to 85 deg. C. for twenty-four hours. The Southern California Edison Company uses a General Electric portable filter having a rating of 30 gal. per minute. It is desirable—in fact, imperative—that a metal hose be used in preference to one made of rubber. A rubber hose breaks, leaks and, what is more important, is liable to contain sulphur or other impurities, which enter the oil passing through such a hose and thereby contaminate it.

The following results of introducing sulphur into oil were experimentally determined: Some pieces of commercial rubber were put into a sample of transformer oil of specific gravity 0.857, testing 48,600 volts, and left there for 18.5 hours. At the end of this period the oil was re-tested and showed an average of 12,900 volts on four tests. Further experiment showed that neither heating nor double filtration, or both, would again raise the breakdown value of the oil above 30,000 volts. The conclusion was that the quantity of sulphur in the rubber was sufficient to spoil the oil permanently and that if rubber hose is used to convey oil a similar result may be expected.

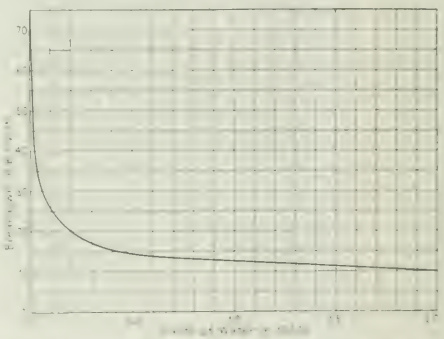


FIG. 2—CURVE SHOWING EFFECT OF WATER ON OIL.

Samples of the oil should be tested frequently while it is being filtered into the transformer. When the oil is run through a filter which contains fresh filter papers it becomes filled with minute air bubbles which are invisible to the naked eye but which are discernible through a microscope. The bubbles of air remain in the oil even for from twenty-four to forty-eight hours, and during this time a

TABLE I—PROPERTIES OF FOUR SAMPLES OF OIL

| Sample | Specific Gravity | Flash Point, Deg. C. | Viscosity | Color | Breakdown, in Kv |
|---|---|---|---|---|---|
| A | 0.85 | 160 | 60 | Light amber | 42 |
| B | 0.76 | 120 | 30 | White | 37 |
| C | 0.86 | 170 | 75 | Dark brown | 44 |
| D | 0.857 | 174 | 77 | Dark amber | 40 |

sample tested will break down at a low value. Consequently, in order to obtain a true value of breakdown voltage of the oil after it has been placed in a transformer, the oil should stand at least twenty-four hours, and preferably forty-eight hours, before testing if the exigencies of the work permit. At the end of this time the oil should be tested as follows:

### Testing Transformer Oil

Samples taken from both the top and bottom of the transformer should be tested. Top samples may be taken from the gage-glass valve, and samples from the bottom may be removed through a small sampling valve (preferably) which should be located as near to the bottom of the tank as possible and never over one-tenth of the distance from the bottom to the top. Drain valves are often placed in the very bottom and samples may be taken from it. If necessary, the large drain valve may be opened, but this is undesirable because the oil pressure forces a flow which is not easily controlled, and besides a large valve cannot be easily cleaned. The gage valve and sampling valve, or whatever may be used, should be thoroughly cleaned by wiping it with a clean dry cloth (not waste) until the attendant is confident that neither moisture nor dirt is on any exposed surface with which the oil may come in contact. If the sample is to be tested on the spot, it should be drawn directly into the test box without intermediate contact with any other container. The test box should be half filled, shaken and the oil thrown out. This should be repeated and then the test box should be filled and permitted to stand at least ten minutes before testing. Care should be taken not to insert the fingers into the oil nor to touch the inside surfaces of the test box. Precaution should also be exercised so that no water is liable to splash into the oil or dust collect on it.

If the oil is to be transported before testing, it can be drawn into one-quart Mason fruit jars which have been cleaned and had the inside glass tops removed. The sample jars may be cleaned as follows: Before using wash the jar

TABLE II—BREAKDOWN IN KILOVOLTS

| Sample | First | Second | Third | Fourth | Mean |
|---|---|---|---|---|---|
| A | 9.9 | 10.3 | 27.9 | 28.8 | 19.2 |
| B | 27.3 | 24.6 | 42.0 | 34.2 | 31.9 |
| C | 15.0 | 30.0 | 28.8 | 32.8 | 24.1 |
| D | 16.2 | 14.8 | 16.4 | 17.1 | 16.1 |

and cover with gasoline and heat them until they are too hot to hold comfortably. While still hot fill the jar half full of the oil to be tested. Then screw on the cover and shake violently. Discard the oil and fill the jar completely with fresh oil and screw the cover down tightly on a new dry jar rubber.

Samples should always be drawn directly into the sample jar without contact with any intermediate container, if possible. If any other container is used, it should receive the same preliminary treatment as the jar itself. Labels should be attached to the jars giving rating, voltages, serial number, and whether the oil is a top or bottom sample.

The standard test box used has inside dimensions of 2½ in. by 3 in. by 6 in. and will hold slightly less than one quart of oil. The center of the terminals is 1.5 in. under the surface of the oil when the box is filled. It is important that the same level be always maintained in it so that comparisons shall be accurate, because it has been found that a difference in the head causes a difference in the breakdown value, the highest head giving a correspondingly higher value. It is immaterial whether the terminals in the test box are both flat and ½ in. in diameter or one flat and one hemispherical.

A change from the usual test box was tried when a piece of apparatus consisting of two ½-in. terminals with connecting wires was made for insertion into the oil while in the sampling jar. The wires were insulated by hard-glass tubes having an outside diameter of ¾ in. and an inside diameter of 1/16 in. The apparatus was unsatisfactory because of flash-overs between the upper terminals and also because the oil tested had such a high dielectric strength as to cause an arc to start through the glass in preference to the 0.2-in. oil gap. Oil has been tested which did not break down until a tension of 76,000 volts was applied. A value of 44,600 volts was found to be the average of the tests

TABLE III—RESULTS OF FINAL EXPERIMENT

| Sample | First | Second | Third | Fourth | Mean |
|---|---|---|---|---|---|
| A | 30.8 | 31.6 | 31.6 | 28.0 | 30.5 |
| B | 28.0 | 30.8 | 40.8 | 40.8 | 34.9 |
| C | 15.2 | 17.0 | 15.6 | 15.4 | 15.7 |
| D | 13.2 | 13.2 | 13.4 | 14.2 | 13.5 |

made on fifty samples of oil taken at random from 400 samples out of 60,000-volt transformers.

Experiment has shown that the size of the testing set does not affect the breakdown point of the oil. A testing set, half of which is shown in the illustration, was used and a small set having two shunt transformers of a combined rating of 400 watts was experimented with. Comparisons of breakdowns agree closely for values above 15,000 volts, below which the larger set gave the lower values. Mean results follow:

| | VOLTS | | | | |
|---|---|---|---|---|---|
| 10-kw set | 38,500 | 21,600 | 25,600 | 24,900 | 8,500 |
| 400-watt set | 38,100 | 21,900 | 22,400 | 32,700 | 11,300 |

Therefore it will be seen that test results are comparable even when made by different test sets, and different test boxes having terminals of different kinds, provided the gaps are constant.

When samples are collected in jars to be tested, a small quantity of the oil should be poured over the gap to rinse the box, and then discarded. The gap is adjusted by a 0.2-in. gage, the box filled and the voltage applied until at least three successive check tests are made on each sample. The oil may or may not be stirred between tests, since it has been found that an action takes place which causes the oil to circulate, because of the impressed emf.

After using the test box it should be completely filled with oil and covered with glass in order to keep out moisture and dust. The face of the terminals should be dressed at least once a week if tests are made every day in order that practically parallel faces shall be presented. The quart sample jars should be left full of good oil and the covers screwed down. Nothing except transformer oil should ever be put into these jars.

Extensive experiments were made to determine the effect

water on oil so that a curve could be drawn comparing e quantity of water in a given amount of oil and break-wn values. An experiment was also made in order to termine to what extent various makes and grades of oil teriorate when placed in contact with water. The value the experiment lay in the fact that the conditions were ite similar to those when a small leak develops in the oling coil of a transformer and the water is precipitated minute drops through the oil and finally collects in the ttom. Four 1-gal. samples, known as A, B, C and D, ere selected which had the properties given in Table I.

Each of these samples was subjected to the following eatment: One pint of water and one pint of oil were aken thoroughly together in a gallon bottle until the mix-re was milky-white. The bottle was then filled with the me oil and the whole was placed in a quiet place where would remain undisturbed. Tests were made fifty-six ys later on samples which were siphoned from the top rt of the gallon bottle from a point at least 7 in. above e surface of the water.

Additional water was then shaken up with the remainder the samples and allowed to stand for 160 days in order permit all the water which was not held in solution to ecipitate. Table III gives the final results of this experi-ent.

Thus it is seen that somewhat similar oils are affected to ite wide degrees when in contact with water and that l can be, and is, produced which is better suited for trans-rmer insulation than that required by some of the present anufacturers.

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## A Triumph in Central-Station Diplomacy

Here is an account of how an impoverished plant in the nds of a receiver was put on its feet financially with a iblic demand for a 25 per cent increase in rates. The ntral station in question supplied electricity to a small wn in the East with a winter population of 4500. It as taken from the receiver and gained a new lease of life nder the management of a small syndicate of public-utility erators which saw in the property an opportunity to velop business along modern lines. The task was accom-ished after a thorough study of the local conditions had en made and after the consuming public had been thor-ghly canvassed as to the needs of the situation.

The method employed in achieving these results involved rsonal conferences with consumers. Good use was also ade of letters sent to every user of service setting forth e exact status of affairs and the need of higher rates. the following paragraphs are given the essential features the statement addressed to each consumer, which re-lted in a four to one vote by the company's customers at the price of electricity be raised from 16 to 20 cents r kw-hr., in order that the new concern might take up e rehabilitation of the property.

### Text of Letter to Consumers

By way of introduction in its letter, the syndicate ex-ained to each consumer that it had been invited to ad-nce the funds necessary to put the lighting company in condition to give satisfactory and reliable service and so the money necessary to enlarge the electric plant and stribution system so that the town might have a thor-ghly modern installation serving the entire community. ne statement then proceeded in part as follows:

"As you doubtless know, the company is in financial fficulties and is in the hands of a receiver. We are ad-sed that the service in the past has been far from satis-ctory. We have had the plant and distribution lines of e company examined by competent engineers, who advise that the plant is in bad condition and unable to give tisfactory service. It is impossible to start one of the l engines, and the other oil engine has to be constantly repaired to keep it in an operating condition. This condition, we are told, has resulted in frequent shut-downs which have caused the street, house and store lamps to go out, thus destroying the usefulness of the service and causing great inconvenience and some danger. Further than this, in some cases the distribution lines of the company are so small that they will not carry electricity enough to serve all customers, causing lamps to grow dim and power to diminish when more than a certain number of customers are using electricity at the same time.

### Poor Service Result of Insufficient Return

"The deplorable condition of the plant and distribution lines of the company and of the service furnished by it is not due necessarily to lack of desire on the part of the present owners of that property to give satisfactory service and keep it up to modern standards of efficiency. The financial and operating difficulties of the company are primarily due to the fact that it has not been receiving a living price for its electricity from the consumers whom it serves. The insistent bills such as wages, fuel and taxes have, of course, been paid, but because of the low prices received there was not money enough to keep the lines and machinery in repair and little by little the service got into its present unsatisfactory and unreliable condition. It has simply been a case of selling service at less than cost.

"It will be a difficult and expensive task to put the electric lighting property in Blanktown on a basis which can satisfy the proper demands of the consumers. A large amount of engineering must be done; new machinery must be installed; the lines must be enlarged and extended. Since we have been invited to undertake to supply the money for this work, we have had the entire situation carefully examined by our engineers, and we are of the opinion that it will not be possible for us to do anything in the matter unless on a basis of hearty co-operation with the people of Blanktown. In our opinion, the only plan which can succeed is a co-operative one.

### Conditions Necessary to Rehabilitation

"We will form the Blank Electric Light Company and pay into it in cash $35,000, which will be necessary (1) to buy and install a modern steam and electric plant; (2) to buy the present distribution system and old plant of the Blank Company; (3) to make the necessary extensions and improvements on the distribution system, and (4) to furnish the company with proper working capital so that it will not have to place a mortgage on its property or become involved in debt as did the Blank Company. We agree that this $35,000 will be used for these purposes if this plan is adopted.

"This is the smallest amount of money that our engineers figure will accomplish these four things which are absolutely necessary if the Blank Electric Light Company is to become one of the useful institutions of Blanktown. We will also agree that one or two Blanktown men shall be added to the board of directors of the company, so that Blanktown shall be properly represented at all business meetings of the company. We will also agree that arrangements shall be made with local contractors so that they can wire the houses and other buildings of those desiring electricity at low prices and upon convenient terms. The foregoing offer is conditioned upon the willingness of the consumers of electricity in Blanktown to co-operate with us and pay the rates necessary to allow the company to meet its obligations, including labor and all operating expenses, interest, taxes and cost of maintenance and depreciation.

"Our engineers estimate that to give the town a reliable electric lighting service a net rate of 20 cents per kw-hr. will have to be established as the price for energy for lighting, and $20 per annum for each street light of the same candle-power as is now being used and burning the same number of hours and nights each year as at the pres-

ent time. The good service that these prices will make possible will save you the expense and inconvenience of maintaining and using kerosene lamps and other emergency lighting outfits.

### Co-operative Features of the Plan

"As this plan that we propose is on a co-operative basis, it will be agreed that at the close of the fiscal year, June 30, 1914, earnings and expenditures for the year will be computed, and if there is an amount left after deducting the cost of operation, maintenance, taxes and a fair return on the value of the plant and the proper amount for depreciation, the balance will be credited to the customers on their monthly bills pro rata. The same plan will be followed each year until it is found that the present rates can again be safely established. In this way the company will absolutely insure to the users of electricity the return of every cent beyond the necessary cost of doing the business. The prices mentioned above are the lowest which can possibly be adopted and still enable the company to fulfil its necessary obligations to the public, to itself and to the money invested in its property.

"We are willing to become interested in the property only on the basis that the people of Blanktown want us to do so, and provided we can start doing business on a co-operative basis as suggested above or on some similar basis if a better one can be devised. We should be pleased to have your suggestions in the matter. By active co-operation, the business of the company should be increased, enabling future reductions in rates. If it is your desire to secure reliable service at fair prices, we are ready to do our best to give it to you. We ask that you indicate upon the inclosed slip whether or not you want us to invest our money and our efforts to improve the electric-light plant and system in your town. Please return this slip filled in as requested not later than Aug. 20, 1913. Our Mr. R and Mr. T are planning to be in Blanktown on Aug. 18 and 19 and will be pleased to meet you to answer any questions you may wish to ask if you will return the inclosed slip."

### Appendix Defining Terms Used

Accompanying the foregoing letter there was inclosed an appendix sheet giving definitions of the terms "operating expense," "reasonable rate of interest," "maintenance" and "depreciation," with the following discussion:

"It is not as difficult now as formerly to estimate just what the obligations of a lighting company are. Recently the United States Supreme Court and the Court of Appeals in the State of New York, as well as other important courts, have passed upon these questions. Briefly these obligations are as follows:

"First, the actual cost of operating the plant and producing and distributing the electricity, including the expense of management and the cost of maintaining or keeping in repair the producing plant and distribution system, must be met.

"Second, an amount of money must be set aside each year which will be sufficient ultimately to replace the various parts of the plant and distribution system as they wear out. With the best of care, all machinery and apparatus ultimately become useless, and the company must be gradually building up a fund to replace this machinery and apparatus as it wears out, otherwise it will be in financial and operating difficulties in the course of a few years when the machinery and apparatus start to become useless. There should be set aside each year for the purpose of replacing the property not less than 7 per cent of the value of the property. This percentage is based on long experience of manufacturing and electrical engineers from an observation of the actual workings of electric lighting plants. Some parts of the property will become practically useless in a much shorter length of time than other parts, but at the end of approximately fifteen years practically all of it will be useless or unreliable. Those parts which have not been replaced during the fifteen years will have to be replaced by that time. If they are not so replaced, the efficiency and service of the company will be handicapped.

"And, third, a fair return on the value of the property must be made to the owners who have put their money into the business and who take the business risk of the investment. It is impossible to make improvements and extensions if the money with which to make them cannot be secured, and the persons who have this money to invest or loan will not do it unless they get what is generally considered a fair return. The question as to what is a fair return on money invested in a public lighting business has been considered by the courts we have referred to above. In New York City, where there is held to be the smallest risk of any place in the country to those having their capital invested in the manufacture and distribution of gas or electricity, the fair rate is considered to be 6 per cent per annum upon the money actually invested or upon the value of the property, which, as the court states, is the replacement value of the property plus a reasonable allowance for the cost of the necessary engineering and incidentals. In Kings County, a part of New York City, a 7.5 per cent return on the value of the property is a fair return. In the smaller municipalities in Massachusetts a return of 8 to 10 per cent is necessary to take care of these business risks."

## The Science and Art of the Pupin Coil

Dr. Michael I. Pupin, of Columbia University, addressed the New York Electrical Society, Dec. 18, on the topic "The Science and Art of the Pupin Coil." In the course of his interesting lecture Dr. Pupin made striking use of mechanical analogies to explain some of the phenomena of telephonic transmission.

To transmit mechanically a given amount of energy to a distant point, he explained, one has the choice of using a small mass at high velocity or a large mass at low velocity. When transmission takes place through a frictional medium the high-velocity small mass dissipates much of its energy in the intervening medium. Electrically as well as mechanically, therefore, it is advantageous to employ low-velocity heavy masses and, similarly, electric circuits having large magnetic mass (inductance). Nature has failed to provide a material affording the required large inductance per unit of length, but the desired result can be obtained by inserting inductance coils at intervals in the line, provided that these intervals are well within the wavelength employed. The result is similar to that of loading a cord with small lead weights; the cord will transmit transverse waves of large amplitude much as if it were itself of large and uniformly distributed mass.

In the practical loading of lines the coils are now inserted about eight to the wave-length, although accurate spacing need not be preserved. To prevent "cross-talk" where groups of loading coils are installed together in constricted space, the toroidal or ring-shaped core was developed. Such coils are devoid of leakage flux. Eddy currents, which add to the apparent ohmic resistance of the windings, are minimized by building the cores of insulated laminations or fine iron wires. Iron of rather low permeability is preferably used, the core being worked at a very low density involving only the lowest portion of the permeability curve below the first knee. Great skill and experience are required in the design and construction of the coils themselves, although the matter of installing them in the line requires little care. The Pupin coils are built in America by the Western Electric Company and in Germany by Siemens & Halske. Use of the loading coils on aerial lines has incidentally pointed out the need of better insulation for the higher voltages employed on loaded lines.

# Central Station Management

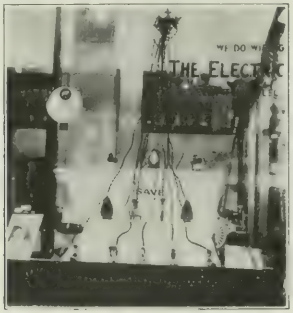
**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Performance of Battery-Driven Street Cars

In New York City one of the street-railway companies is now operating 120 battery-propelled cars, each with a seating capacity of twenty-eight persons. The average travel of these cars is between 60 miles and 70 miles per day, with an operating cost approximating 7 cents per mile. This charge includes battery maintenance, oil, grease and mechanical repairs, but not the motorman's or conductor's wages. The average daily consumption of each car is 35 kw-hr.

## Inside Information in Iron Displays

A window display recently exhibited in the electric shop of the Consolidated Gas & Electric Company, Youngstown, Ohio, attracted considerable attention because it imparted to the passing public a bit of information on electric-iron construction which had not previously been put before it in such an attractive manner. As shown in the illustration, several electric irons were arranged in the window of the




ELECTRIC-IRON DISPLAY, YOUNGSTOWN, OHIO

shop. The sole of the center iron of the upper tier was removed, baring to view the heating element incased in its transparent mica covering. A small electric lamp in the body of the iron lighted the heating element in bold relief, revealing the details of the iron's construction. The display told in a simple way something which practically every user was interested in knowing, and it was only through the offices of a policeman, who kept the pedestrians moving, that the accompanying night picture was made possible.

## Electricity in a Big Louisville Garage

The Southern Motors Company, of Louisville, Ky., which recently opened a garage and service station, said to be the largest in the South, is using the central-station service of the Louisville Gas & Electric Company. The automobile company acts as agent for electric pleasure cars, charges electric vehicles, and builds and remodels electric batteries. Every gasoline car it sells is equipped with electric lighting and nearly every one is fitted with an electric starter. While the company's new building was in course of erection, electric lighting was used to facilitate construction and electric hoists were used for handling the material. Electric motors operated the concrete mixers and provided power for various other purposes. The garage lighting comprises 200 tungsten lamps, many of them 100-watt capacity. Six large motors are installed for operating elevators, cleaning machinery, charging batteries, etc.

## New-Business Outlay and Return

One progressive central station makes a policy of appropriating about 2.5 per cent of its gross revenue in soliciting and advertising. In getting new business it is sometimes found to be necessary to spend about 25 cents for each $1 of increased revenue. On this basis the central station would be warranted in spending $45 to obtain an electric-vehicle customer. And when the desirable nature of the load receives full consideration and the general improvement in commercial and civic conditions is taken into account, the outlay of as much as $60 is often justified on each commercial truck and $25 on each pleasure vehicle sold. In connection with this topic it has been suggested that central-station salesmen should furnish the makers of electric vehicles with "tips" concerning prospective customers and that the salesmen be credited with sales of such electric cars on the same basis as that on which they are credited for the sale of other motor-driven apparatus.

## Obtaining a Pumping Load in Irrigated Territory

A speaker at the recent Glenwood Springs convention of the Colorado Electric Light, Power & Railway Association pointed out that the central-station problem of developing a pumping-plant territory is one meriting much attention, as the load is extremely desirable. First, the cost of the line to serve the territory and the minimum sum returnable from the investment must be determined. A thorough personal canvass of farmers in the territory should be made. The prospective customer will raise innumerable practical questions, and the central-station man must be prepared to answer these questions in language intelligible to the layman. The electrical man must not talk "above" the farmer's comprehension, but should use such terms as "horse-power" and "second-feet," the "rate per acre-foot," etc.

Frequently it is rather difficult to explain to the average farmer why he should pay $10 a month for a 10-hp motor whether he uses it or not, and in addition a certain rate per kilowatt-hour for energy consumed. Assuming that the cost of the line is $750 a mile and that this cost must be returned in gross receipts in three years' time, the minimum gross earnings must be at the rate of $250 a mile. It is reasonable to suppose that at least two pumping plants can be secured per mile of line and that they will care for at least 320 acres. Thus these 320 acres should guarantee a minimum return on the investment of $250 a year.

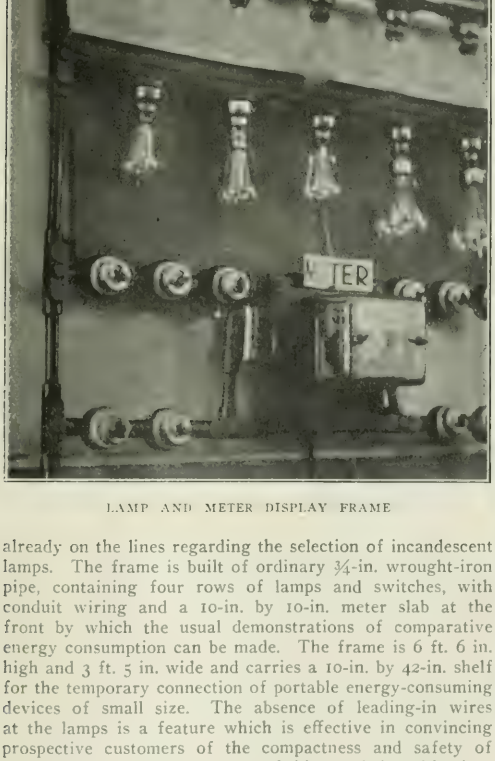
The speaker told of making fourteen contracts this year based on a minimum charge of 75 cents an acre of irrigable land, with a flat rate for energy consumed of 4 cents per kw-hr. At this rate the minimum return would be $240 per annum. In some seasons this minimum would be all that would be returned. But in an ordinary year, when

the usual amount of irrigating is done, the return would be approximately $450 from the 320 acres, this figure being based on a 4-cent rate and a 16-ft. lift, making the average return $1.40 an acre.

By the other plan there would be a fixed charge of $20 a month on the two 10-hp plants for six months, and with a further 3-cent rate the probable return in an average year would be $456. This is $6 more than by the first plan. However, in a year of heavy rainfall when little or no irrigation is done the income to the central station would be little more than the fixed charge of $120, or about $120 less than the receipts under the second plan.

## A Simple Lamp Display Frame

In the offices of the Worcester (Mass.) Electric Light Company the simple lamp and meter display frame shown in the accompanying photograph is frequently utilized in connection with new lighting customers or in advising those



LAMP AND METER DISPLAY FRAME

already on the lines regarding the selection of incandescent lamps. The frame is built of ordinary ¾-in. wrought-iron pipe, containing four rows of lamps and switches, with conduit wiring and a 10-in. by 10-in. meter slab at the front by which the usual demonstrations of comparative energy consumption can be made. The frame is 6 ft. 6 in. high and 3 ft. 5 in. wide and carries a 10-in. by 42-in. shelf for the temporary connection of portable energy-consuming devices of small size. The absence of leading-in wires at the lamps is a feature which is effective in convincing prospective customers of the compactness and safety of electrical service, many frames of this sort being objectionable on account of the failure of the demonstrating company to conceal its wiring. An additional feature not ordinarily found is a set of white, yellow and green roller curtains at the rear of the frame, by which the effect of different sizes and types of lamps against backgrounds of varying color can be studied. Near the frame the company has posted a sign advertising in well-chosen sentences the extended use of electricity.

## Motor-Driven Blowers in Automobile-Engine Factory

Dodge Brothers, of Detroit, Mich., manufacturers of th Ford automobile engines, are using motor-driven centrifuga compressors to supply air for their forge furnaces, anneal ing furnaces and cupolas. Formerly positive-pressur blowers geared to motors were used, but these have sinc been replaced by combination compressor motor sets

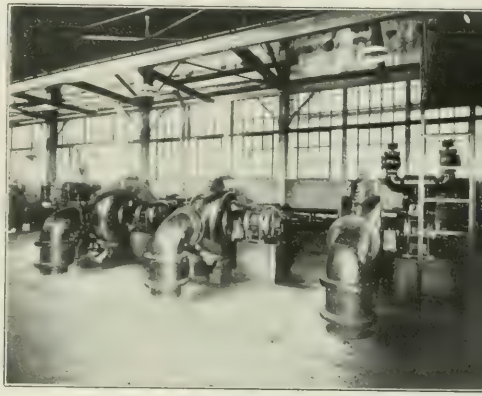


FIG. 1—MOTOR-DRIVEN COMPRESSORS FURNISHING AIR FO FORGE AND ANNEALING FURNACES

These sets, shown in Fig. 1, deliver into a common dis charge pipe, from which the air is distributed to the indi vidual forge and annealing furnaces. Each compressor i driven by a 50-hp motor and is designed to deliver 420 cu. ft. of air against a pressure of 2 lb. per sq. in. whe running at 3450 r.p.m. The load on the compressors i constantly changing owing to the varying number of forge and annealing furnaces in use at the same time. Flap valve are therefore installed in the discharge pipes from eac



FIG. 2—CUPOLAS RECEIVING AIR FROM MOTOR-DRIVEN COM PRESSORS

unit to prevent air from flowing backward into the com pressors.

Three more compressor sets, duplicates of those in use will be installed soon to provide air for additional furnaces which will be added.

The two 10-ton cupolas shown in Fig. 2 are supplied with air from two smaller compressor sets installed on the raised platform. The piping is arranged so that either com-

ssor set can deliver air to either cupola. The com-
ssors will deliver 4500 cu. ft. of air per minute at 1 lb.
sq. in. pressure when running at 3450 r.p.m. The
ors are rated at 30 hp.
odge Brothers contemplate erecting two more 115-ton
las, each of which will be equipped with electrically
ated blowers.

## ntral-Station Activity Near Springfield, Mass.

connection with the introduction of hydroelectric
ice in the outskirts of Springfield, Mass., by the Am-
t Power Company, various subsidiary central-station
nizations are undergoing rapid expansion. The Aga-
n (Mass.) Electric Company, with headquarters in the
tineague district on the west side of the Connecticut
er, has recently been acquired by Philip Cabot and his
ciates, of Boston, who own the controlling interest in
Turners Falls Power Company, Easthampton Gas Com-
, Amherst Power Company and other utilities. Coin-
ntally with this change in ownership, the Agawam cor-
ation has become a distributing company of diversified
ut.
transformer substation of the outdoor type has just
completed, where energy from the Amherst company's
smission line is reduced in pressure from 66,000 volts
3,200 volts for local industrial distribution to large
s. Among such motor-service users now supplied by
secondary network are the Northern Connecticut

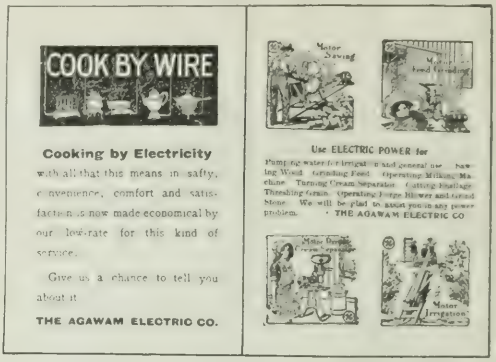



CENTRAL-STATION MOTOR-SERVICE SIGN

nt & Power Company, the Ramapogue Ice Company, the
ipal pumping plant at West Springfield and the Lane
rries. A number of other large power contracts are in
t.
ince the acquisition of the property by the Cabot inter-
, the cost of lighting has been reduced 2 cents per kw-hr.
maximum net rate of 11.7 cents per kw-hr., and the maxi-
n motor rate has been cut from 10 cents to 4 cents per kw-hr. The lighting and motor rates diminish according to a sliding scale to minima of 7.2 cents and 1.8 cents respectively. The company has adopted the slogan "Cook by wire" on its lighting-bill stubs and sells energy at motor-service rates for heating and cooking service. On the studs of its motor-service bills are printed effective illustrated advertisements of electricity in farm service.

## An Effective Central-Station Motor-Service Sign

The accompanying photograph illustrates a large electric sign advertising the motor service of the Edison Electric Illuminating Company of Boston, Mass., the sign being located on the roof of a building in South Boston immediately opposite the entrance to the South Station yard,




REVERSE SIDE OF STUB ON CUSTOMERS' LIGHTING BILL

where it is visible to all passengers on the railroad lines entering the city by this terminal. The sign is about 30 ft. high and 45 ft. long and is of the movable display type, carrying the words "Edison Power Best and Cheapest," with flasher connection, and a view of a mechanic in a motor-driven shop sharpening a tool at a grinder.

The lighting equipment of the sign is as follows: Mechanic's coat and head, thirty-one lamps, white and red, 30 watts each; mechanic's trousers, seventeen 30-watt blue lamps; tool, one 30-watt blue lamp; emery wheel, thirty 30-watt blue and red lamps; spark display, twenty-seven 10-watt amber lamps; two belts, each fifty-four 10-watt lamps, the motor belt being amber and the drive from the countershaft white lamps; countershaft, seven 30-watt red lamps and twenty-four 10-watt amber lamps; motor, thirty 30-watt blue lamps; sign letters, 343 10-watt plain white. The cost of the equipped sign complete was about $1,000. All the lamps in its service are of the carbon-filament type, and the outfit is carried on an angle-iron frame as shown. Nearly 1000 trains per day enter and leave the Boston South Station in full view of this display.

## Large Output of Electric Coal Breaker

By the substitution of mechanical devices for human labor in the Truesdale breaker of the Delaware, Lackawanna & Western Coal Company, the largest output ever scored by a breaker in the anthracite fields of Pennsylvania was made last month, when 108,220 tons of coal were prepared, 105,020 of which were shipped, or 4040 tons a day. The breaker has a capacity for twice the output when the coal can be supplied at that rate. Every unit of machinery in it has its individual electric motor, and it is estimated that the output of the breaker for the year will be approximately 1,060,000 tons, or considerably over one-seventh of the entire anthracite output of the country.

## A Central-Station Service Code

The following paragraphs are extracted from the admirable and inspiring service code of the Union Electric Light & Power Company, St. Louis, Mo., and reflect the frank spirit which characterizes the company's printed statement issued as a yellow-bound booklet of eight 3.25-in. by 6.25-in. text pages:

"Without consumers there would be no Union Electric Light & Power Company.

"These are simple facts easily understood. It therefore behooves every man and woman in our employ to remember this always, and to see that every customer is treated with courtesy and proper consideration.

"Any member of the force who lacks the intelligence to interpret the feeling of good will and fair treatment the Union Electric Light & Power Company holds toward its customers cannot stay very long with us.

### The Employee and the Customer

"New customers are just as valuable to us as old customers—remember that; for each new customer is an old customer in the making.

"See that you do your part to make the customer feel that everybody's business is appreciated.

"Impress upon him the fine good-fellowship in our company, the no-trouble-to-show-you spirit.

"When a customer walks in meet him half way by showing an interest in what he wants or in any information he may be seeking.

"You must take the customer and handle him according to conditions and the particular mood in which you find him.

"The stranger in antiquated raiment may be one of the best customers on our books.

"Always remember, the customer pays your salary. He is your immediate benefactor.

### Arguments with Customers Prohibited

"At rare intervals some perverse member of our force disagrees with some customer as to the rightness of this or that. He maintains that he had no instructions to make a quick connection when the customer says he had; or that the order was for 60-watt lamps instead of 40-watt; or that it was a 16-in. fan and not a 12-in. fan; or that this was ordered and not that. Either may be right. But these are permanent instructions: No employee of the Union Electric Light & Power Company is allowed the privilege of arguing the point with the customer. He must adjust the matter at once in a pleasant and satisfactory manner to the customer, or call his superior to adjust it. Wrangling should have no place in the Union Electric Light & Power Company.

"Our business is successful, and there is good reason for it.

"The reason is that we give good service at reasonable prices and with the right kind of people to handle the business.

"Everyone from the errand boy up to the boss is working all the time to give the customer the service he wants.

"Ike Milliken says: 'Most of the big men got the big jobs by making the little jobs bigger.'

### The Central-Station Idea of "Service"

"The company has incorporated in its trade-mark the word 'service.'

"Upon this word 'service' rests the reputation of the company.

"Back of this word 'service' is a water-power plant of 120,000 hp and a central steam generating station of 100,000-hp capacity, with a record of twenty-four hours a day for seven years without five minutes' loss of time; an underground and overhead distributing system second to none; a highly efficient and well-trained corps of trouble men with a fleet of automobiles on duty day and night; an organization of officials, salesmen and clerks trained to the highest degree of efficiency.

"We have a reputation for rendering service which the head of every department is instructed to maintain.

"This reputation has cost us and the men before our time untold labor in building it up to this perfection.

"Filling orders as given and making deliveries as promised is good service.

"It is the object of the Union Electric Light & Power Company to sell its customers just what is wanted and with the very best service.

"The service of a company like ours is not a thing supplied by any single individual. It is not special attention to any one customer.

"Service means the limit of courteous, efficient attention from each particular customer or order.

### Taking Pains to Please the Individual

"It rests with every employee of this company (errand boy, order clerk, salesman, telephone operator, cashier, manager) whether the customer goes away disappointed or pleased.

"The clerk can wait on a customer in a 'What-do-you-want?' manner that will stick in the customer's 'crop' and make him feel that there is something radically wrong with the business and make him regret he came in, or he can wait on the customer in such a manner that he will go out of his way to do business with us.

"If the customer asks for a quick connection, don't get rid of the matter by answering, 'It will be made right away,' without knowing or getting information from the operating department whether it is possible to accommodate the customer.

"Sometimes it is impossible to make delivery that the customer wants, and sometimes no trouble at all when you explain the importance of the delivery to the proper department.

"For it would be better to lose the order than to have a disappointed customer on account of not being able to carry out your promise.

"An operator or clerk who is quick to answer telephone calls and does not keep a customer holding a cold receiver to his ear, listening intently to nothing, can swell the appreciation of our service and swell our appreciation of himself or herself.

"The courageous salesman asserts his belief with great frankness, and the frank man carries conviction.

"Every employee is advanced according to the service rendered to customers of the Union Electric Light & Power Company.

"If a customer is not able to make up his mind regarding what he wants, make up your mind to assist him."

## Vacuum Cleaning Recommended for Chicago Schools

In the report of the Chicago Civil Service Commission on engineer and janitor service the commission has recommended that the Board of Education consider electric vacuum cleaning for 300 of Chicago's largest schools. With energy costing 3.5 cents per kw-hr., it is estimated that the interest, depreciation, maintenance and cost of energy will be about $100,000 annually for these buildings. However, the commission balances against this cost the advantages of more sanitary and thorough cleaning, relief from much of the dusting necessary at present, and the fact that teachers and pupils might stay after the close of school if desirable, whereas now they are driven out by janitors wishing to sweep. It is further asserted that with vacuum cleaners the engineers' assistants would be able to work several hours more per day than at present, since they could clean certain schoolrooms while teachers were still using others.

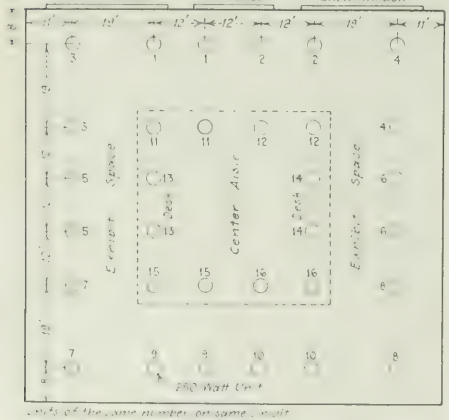
# Illumination and Wiring

## rtificial Illumination on Another Poultry Farm

An increase of 30 to 40 per cent in the number of eggs
ed on the poultry farm of Mr. W. H. Cook, Orpington,
ent, England, as the result of installing electric lamps in
e hen-houses, is reported in a recent issue of the weekly
lletin of the Canadian Department of Trade and Com-
erce, Ottawa. The Cook farm has nearly 200 yd. of
owl-houses, containing about 6000 birds, and these runs
ave been artificially lighted during the dark mornings and
rly nights of the last year. The fowl-houses are lighted
300 lamps, divided into 32-cp, 16-cp and 8-cp sizes.
hese are switched on at 6 o'clock in the evening.
fter 9.30 the 16-cp lamps are employed, and at 10 o'clock
e 8-cp lamps are substituted for a quarter of an hour
fore the hens are left in darkness. Mr. Cook explains
at it is necessary to give thus a rough imitation of the
tting sun, otherwise the hens would go to sleep on the
round and become a prey to parasites. In the case of
oung artificially incubated chickens the electric light is
nployed to make them feed longer, and this Mr. Cook has
und accelerates their growth during the winter months
almost one-third.

## Lighting of an Automobile Salesroom

The recently completed service station and salesroom of
e White Company at 930 Commonwealth Avenue, Bos-
n, Mass., represents an advanced type of building de-
oted to motor-car marketing. Electric service is supplied
the Edison Electric Illuminating Company of Boston,
d the lighting of the salesroom has been worked out with
nusual care. The accompanying photographs show the
lesroom interior by daylight and the same room seen from
tside the building at dusk with the inside lamps in opera-
on. The salesroom is approximately 90 ft. wide by 96 ft.




G. 1 ARRANGEMENT OF LIGHTING UNITS IN AUTOMOBILE SALESROOM

ng and its height is about 23 ft. It is provided with a
ment floor and the walls are decorated with a cream-
lored tile border extending about 9 ft. from the floor, the
mainder of the space between the border and the ceiling
ing treated in white and green with nature scenes painted
soft tints. Thirty-six 250-watt lamps are installed for
e general interior lighting, each being housed in a Holo-

phane No. 1215 Veluria semi-indirect bowl reflector hung about 13.5 ft. above the floor.

The lamps are controlled in parts by built-in switches located in a wall cabinet in one corner of the room and are operated from a 110-volt circuit, all wiring being in concealed conduit. Twelve of the lamps are hung below a central skylight as shown in the accompanying drawing.




FIG. 2—AUTOMOBILE SALES BUILDING AT BOSTON SHOWING INTERIOR LIGHTING

This central area is devoted to office purposes, two rows of desks being placed on each side of a center aisle leading from the main entrance to the rear of the room. The space outside the skylight projection is devoted to displays of pleasure cars and trucks, there being twenty lamps hung around the outside of the room to provide for easy inspection of the machines exhibited. Outlets for portable lamps are installed at various points in the walls and floors as well as on two sides of each of the four central columns supporting the roof at the outside points of the skylight section.

Each of the two show windows is equipped with two trough reflectors, one being installed at the bottom of the



FIG. 3—INTERIOR OF SALESROOM, SHOWING INDIRECT FIXTURES

window in a recess sloping upward toward the main floor of the room and the other being set as a cross-bar near the top of the lower window section. Each trough is provided with twenty 40-watt lamps with clear bulbs, located 12 in. apart on a horizontal axis parallel to the window. The lower section of the window in each case is 14 ft. high, the upper portion being 5 ft. high, and the total length 21 ft.

The lamps are screened by their inclosing reflectors so that no glare reaches the eyes of persons viewing the cars from outside the building or at a reasonable distance from the window. The installation of the lower reflector troughs in a recess helps materially in securing this result.

The reflector lamps are controlled by flush switches installed in the wall on either side of the main entrance, and the supply of energy to the upper reflector lamps in each window is effected from outlets at the top of the window, with inconspicuous leads to the lamps. Each desk is equipped with both a telephone and a 20-cp portable lamp with adjustable brass-finished reflector, two floor outlets for these services being located below each desk. Outside the building a fixed electric sign equipped with 112 10-volt, 5-watt lamps and two five-lamp ornamental standards are in regular service. The Lord Electric Company, of Boston, was the wiring contractor for the installation.

## Construction of Concrete Lighting Standards at Eldorado, Kan.

Eldorado, Kan., recently installed an ornamental lighting system, using concrete standards of an inexpensive type. The installation was financed by the Eldorado Electric & Refrigeration Company, which now charges for the street lighting at a yearly rate which, besides defraying the cost



FIG. 1—STREET-LIGHTING POLE INSTALLED IN ELDORADO, KAN.

operation, will in ten years repay the original outlay in installation expense.

Before selecting the concrete posts finally used, cast-iron standards of various types were considered, but their cost was found to be prohibitive. No trolley poles were available for supporting the lamps so it was decided to design an ornamental concrete post which could be made on the job. Fig. 2 is a working drawing of the standard installed.

The posts are octagonal in cross-section and measure 12 ft. in height above the concrete base to which they are anchored. Fig. 1 shows one of the posts completely equipped. The post is made in four parts, viz., a concrete base of a square cross-section, the column proper which is reinforced by a 1.25-in. pipe through its center, a concrete cross-arm supporting two inverted lamps and one upright lamp, and an octagonal collar which joins the top of the column to the cross-arm, adding to the appearance of the pole. The cross-arm is reinforced by a 0.75-in. pipe, which is connected with the vertical 1.25-in. pipe, as shown in the detail drawing. These pipes also serve as conduits for the wires. A 0.75-in. cross-pipe fitting connects the reinforcing pipe in the arm with the upright lamp outlet and also with the vertical conduit.



FIG. 2—DETAIL OF ORNAMENTAL CONCRETE POLE

Each post is equipped with three 60-watt tungsten lamps inclosed in milk-glass globes. The two lower globes are 10 in. in diameter and the upper one is 12 in. in diameter. The lamps are supplied from two separate 110-volt circuits, so that only part can be turned on if desired.

Concrete consisting of sand and cement in the ratio of 3 to 1 was used for the columns, collars and cross-arms in order to give these parts a smooth appearance. For the base a mixture of cement, sand and crushed rock in the ratio of 1, 3, 4 was used, to insure a more rugged construction. Five forms were made up of 1-in. cypress in which to mold the parts. These forms were made in halves, and before the concrete was poured they were clamped together with 0.25-in. by 0.75-in. bands. The ornamental collar is constructed with a central core, which makes it a simple matter to fasten the pipe from the cross-arm to the vertical pipe by means of a 0.75/1.25-in. reducer.

The arms and poles were assembled and wired before the posts were erected, the joints being closed with fresh cement.

Fifty-four posts were constructed in this manner, erected and fitted with lamps, globes and holders at a total expense of $441.41, or $8.17 per standard. According to the bids submitted for other concrete and iron poles, the lowest price for which the poles alone could have been purchased without fixtures was $1,134. A saving of $864 was thus realized by the electric service company in making its own poles.

The lamp standards are located at distances of about 91 ft., measured center to center, along six blocks of the city's business district. This arrangement allows eight posts to the block, four being placed on each side of the street. The system has been designed for a 5 per cent voltage drop. At present only twenty of the lamps burn all night, the remainder being extinguished at midnight.

The system has been installed since Feb. 1, 1913. No trouble has been experienced from disintegration of the cement and the maintenance to date has totaled only $23.50. Thirty-six lamps have burned out in that time and two

globes have been broken. The total cost of the installation, including the underground system (which consists of two 110-volt circuits carried in 600-volt lead-incased cable inclosed in fiber conduit), amounted to about $2,000, or 43 cents per foot of frontage, including street crossings.

A ten-year contract for lighting the city has been secured and Mr. F. A. Pielsticker, general manager of the

... OF CONSTRUCTING AND INSTALLING 54 CONCRETE STANDARDS

| | |
|---|---|
| Cement, 9,400 lb. at 45 cents | $42 |
| Sand, 29,430 lb. at 7.5 cents | 22 |
| [illegible] | [illegible] |
| [illegible] | [illegible] |
| [illegible] | [illegible] |
| Forms, five, at $4.00 | 20 |
| Labor | [illegible] |
| [illegible] | [illegible] |
| Wire, 1,500 ft. | 2 |
| Lamps, 153 | [illegible] |
| Total | $441.41 |
| Cost per pole | $8.1 |

Eldorado Electric & Refrigeration Company, feels sure that the poles will outlast the contract. The rate for lighting has been made on the basis of 10 per cent depreciation. Seven cents per kw-hr. is charged, but this rate varies according to the number of hours which the lamps burn. The annual rate is $10.50 per year for lamps burning until midnight. The city defrays about one-third the cost and the merchants benefited by the illumination pay the other two-thirds.

## Lighting of the Cleveland Art Loan Exposition

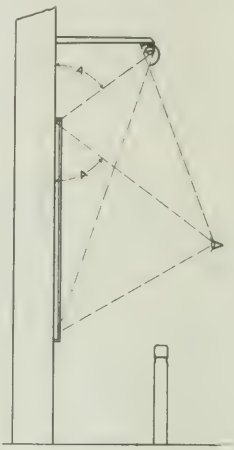
While lighting alone does not make a painting, improper lighting can rob a masterpiece of the effect the artist wishes to produce. He sees and paints a scene under conditions of natural light which will hardly ever be exactly duplicated in nature, for the spectrum of natural light is in a state of continuous change. So the artist must look to artificial light to show his work at all times to the best advantage—to have his picture give to the observer the impression he received from nature when he painted it. In addition to using light sources of proper color, it is necessary that these sources be so placed as to give proper direction to the light rays and so eliminate glare and reflected images. Only by carefully applying the principles of illuminating engineering in the design of a lighting installation for art galleries can the proper results be realized.

The lighting of the art loan exposition held recently in Cleveland, Ohio, furnished an excellent example of the application of scientific principles in the illumination of art. This exhibit contained paintings valued at about $3,500,000, and each of the paintings was lighted separately with a view to its own requirements.

The accompanying diagram shows the type of construction used. A trough, containing the light sources, was placed above and in front of the paintings in such a manner that under ordinary conditions the light sources were entirely cut off from the view of the observer. This trough was painted black on the inside to prevent reflection. Inside of the trough a line of conduits was arranged with incandescent lamp outlets spaced at intervals of 1 ft. The lamps were inserted in a horizontal position and were equipped with half-shade reflectors. As shown in the sketch, the angles of incidence and reflection being the same, no directly reflected light from the lamps could reach the observer's eye. The use of these reflectors gave a flexible arrangement whereby the distribution of light on various parts of the picture could be readily controlled. Each alternate socket was equipped with a 40-watt, 105-volt tungsten lamp. Colored lamps, corresponding to the tones which it was desired to accentuate in the picture, were selected and placed in the remaining sockets. The amount of light of various kinds thrown on different parts of the picture was controlled by rotating the reflectors about the axes of the lamps. Although the line emf is approximately 116 volts, 105-volt lamps were used, and this color value of the light was considerably improved by the over-voltage operation.

There was no general illumination in the exhibit hall, practically all the light coming from the pictures themselves, and the effect was unusually pleasing. In fact, many of the pictures appeared to much better advantage under the artificial light than when viewed in daylight of the average quality. This was especially true in the case of early morning or evening pictures where red tones predominated.

The installation which is described above was designed by the engineering department and the physical laboratory



SCIENTIFIC ART GALLERY ILLUMINATION

of the National Lamp Works of the General Electric Company, at the request of the Electrical League of Cleveland, which was placed in charge of the lighting by the art exhibit committee.

## Railroad Utilizes Brilliant Street Lighting for Advertising

One of the best lighted business streets in the Loop District of Chicago is Dearborn Street from Lake Street to Polk Street. Flame-arc lamps are used and they are suspended by brackets from the poles supporting the span wires of the street railway. This method of lighting was described in the *Electrical World* of April 19, 1913, page 833. At the south end of this brightly illuminated portion of the street is Dearborn railway station, used as a terminal by the Wabash, among other railroads. It is interesting to note that this railroad in recent advertising literature takes advantage of the illumination as making the principal avenue of approach to the station more attractive. "Patrons of the Wabash Railroad," it says, "will be pleased to find Dearborn Street, from Wabash station north through the heart of the business district, one of the best lighted streets in the whole world. You can read your newspaper at midnight anywhere on this 'new white way.'" This advertising literature has made Dearborn Street's good lighting familiar to thousands of travelers.

### Recent Telephone Patents

The selective system patented by Mr. J. H. Mattice, of yde, Kan., is provided with a controller which will fail on ther too small or too large a direct current, and selection effected by controlling the quantity of current.

Mr. W. A. Morse, of North Grosvenor Dale, Conn., has tented a telephone lockout system in which the locking ature is under the control of the calling station. In his stem the lockout apparatus is arranged in a special case lapted to be secured to an ordinary telephone. All stations e locked out unless the line is released by the calling party r the response of another station.

It frequently happens that the same transmitter must be ed almost continuously by several different persons usually the exclusion of other persons. Mr. C. S. Warren, of ilford, Ohio, has provided an antiseptic mouthpiece de- ce for such a condition, consisting of a clamp adapted to e case of the transmitter, upon which are mounted several dividual mouthpieces, any one of which may be swung ross the face of the regular mouthpiece at will.

# Letters to the Editors

### Hotel-Room Lighting

*o the Editors of the Electrical World:*

SIRS:—On page 1015 of the issue of the *Electrical World* ated Nov. 15, 1913, appears an article entitled "A Study f Hotel-Room Lighting" in which the author calls atten- on to the "poor standards of illumination still in vogue id the need for better service." I heartily echo those sen- ments and suggest that if the room switch were placed n the lock side of the door, instead of behind it, the rrangement would give much "better service." Every rummer who must fumble and search behind the door for ie lamp switch will express his thoughts in unprintable nguage.

The lighting designer's attention should be called to the ict that a man usually shaves himself before the bathroom irror. When lamps are placed both above and behind m his face is necessarily in the shadow, a condition for aving not conducive to good humor or productive of tisfactory results.

*Vallejo, Cal.* H. D. AUSTIN.

### The N. E. L. A. and Motor Service

*o the Editors of the Electrical World:*

SIRS:—In line with recent comments appearing in your olumns, I believe with Mr. Stratton that the National lectric Light Association could well afford to lay more ress on the motor-service end of the central-station busi- ess.

While the electrification of factories of various kinds has ncreased by leaps and bounds, there remain to-day a sur- risingly large number of manufacturers who still persist n sticking in the old rut. Solution of this condition is rgely a matter of education. Were the matter forcibly rought to such a manufacturer's attention through some hannel other than the central station (which has the axe to rind), the suggestion would undoubtedly receive consid- ration. It is here that the N. E. L. A. as a disinterested arty could be of material assistance.

Just what form such activities should take is a matter or discussion. I would make the following suggestions: 1) Publication of literature specializing in various kinds f manufacture and giving detailed data on electrification ethods applicable to each. (2) Organization of a clear- ng house for the interchange of ideas, experiences and re- ults obtained by member companies in providing motor rive for various industries. (3) Collection of recommen- dations from manufacturers of electrical apparatus con- cerning types of motors and the results and economies to be obtained therefrom, for application to the special indus- tries.

C. S. DAWSON,
*Power Engineer, Scranton Electric Company*
*Scranton, Pa.*

### Ozone Machines and Public Health

*To the Editors of the Electrical World:*

SIRS:—Referring to the article in your issue of Nov. 15 entitled "Ozone Machines and Public Health," abstracted from a recent issue of the *Journal of the American Medical Association*, I wish to emphasize the caution already expressed by Dr. Charles P. Steinmetz in your issue dated Nov. 29, that the reader should not accept the conclusions of experimenters noted in the above-mentioned article without further evidence. After a careful study of their reports, I am convinced that many of the conclusions are imaginary and not proved by the results obtained. For example, tests were made on three men by placing them individually in front of a large ozone generator and delivering a strong blast of ozonized air at high concentration, the face of the victim being only a few inches from the outlet of the ozone generator. One of the victims had a "sore throat" ("cold") at the beginning of the experiments. The experimenters concluded, from the results of the test, that breathing ozone in strong concentrations produces sore throat. When we consider the probable effect of the blast of air on the face and head, the wind pressure on the nasal passages and the dust carried by the blast, it seems rather far-fetched to make any definite conclusions regarding the effect of ozone, especially from such a small number of tests and subjects. Furthermore, the conditions of the tests were extremely abnormal, it not having been proposed to use in ventilation concentrations exceeding one-tenth of that used in these tests.

The results of the bactericidal tests indicate that ozone in dry air has little germicidal effect. There is, however, overwhelming evidence which proves beyond a doubt that it will destroy germs in water. This fact has been thoroughly established by the best scientific authorities in Europe, in connection with the many municipal ozone water purification plants, as well as by the Pasteur Institute and the German Imperial Board of Health. The latter were able to destroy by means of ozone practically all germs in water containing as many as 30,000 cholera and 60,000 typhoid bacteria per cubic centimeter. As there is always considerable moisture in the respiratory passages, it is perfectly logical to suppose that the breathing of ozonized air may have some beneficial effect.

The fact that guineapigs died in an atmosphere of strongly concentrated ozone is not surprising, as there is no substance known to science which will destroy bacteria without also destroying animal tissue. For this same reason antiseptics cannot be used in full strength, and the best that is expected from their use is to stunt the growth and prevent the propagation of the bacteria.

The tests on the animals in the cages supplied with mild concentrations of ozone showed practically neutral results; that is, no pronounced beneficial or detrimental effects were noted. The duration of the tests was entirely too short to be conclusive.

The experimenters blew ozonized air on paper covered with lampblack to determine the effect of ozone on tobacco smoke. It seems to me the proper way to make such a test would be to use tobacco smoke instead of lampblack. Particles of carbon in lampblack are many times as large as the floating particles of tobacco smoke, and hence the oxidation of the latter in its very finely divided state might take place when lampblack would not be appreciably affected.

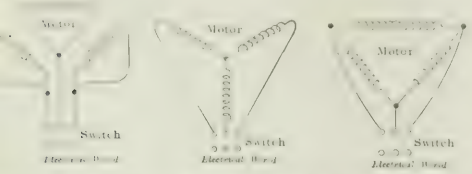
*East Pittsburgh, Pa.* W. H. THOMPSON.

# Field of the Operating Engineer

**A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers**

## Three-Phase Motor Switch Connections

One familiar with the details of a particular line of ork may fail to appreciate the smallness of things likely puzzle the novice. Note an instance where the water pply of a large summer hotel depended upon a three-phase otor, operated from double-throw switch that had six rminals, corresponding to the six leads brought out from




S. 1, 2 AND 3—DIAGRAMS OF CONNECTIONS FOR THREE-PHASE MOTOR SWITCHES

e three-phase windings of the motor. The original ob-ct of the six terminal, double-throw switch was to permit arting the motor delta-connected and then to throw it er to a star connection for operating. Slight repairs cessitated sending away the switch; the hotel man arked the wires before disconnecting them and, ordinarily, ould have had no trouble in reconnecting; but the switch turned had but three terminals to which to connect the x motor wires. This meant that the motor phase leads ld to be jumped together in pairs, either at the motor at the switch. With the assistance of the local elec-ician, the hotel man rang out the motor leads and he nnected together the leads that rang together, thereby tting the open-circuit result indicated in Fig. 1. The in-pector finally called in used the connections of Fig. 2 tar) in preference to those of Fig. 3 (delta), because the ar connection is the easier on the motor phase winding sulation.

## Failure to Generate Due to Many Causes

Any one of several faults may prevent a dynamo from nerating, but seldom do several exist to complicate mat-rs. A large summer hotel was preparing for a record ening crowd. At 3 p. m. of the day of the assembly the namo gave out, and as a consequence the moving-picture achine could not be operated. An inspector was sent for, id when he arrived at 5:30 he tried reversing the connec-ons of field at the generator, but could not get a spark. e noticed that the home-installed pilot lamp on the ma-ine was burned out and further inspection revealed a ort-circuited lamp socket. As the lamp was connected side of the series field, this fault alone would have pre-nted generation. He disconnected the socket and turned it the shunt-field rheostat, but still the machine would not enerate. Short-circuiting the rheostat with a wire was no avail, so he went back to the machine, connected the unt field across the brushes and rocked the brush holders he pole arc. The machine picked up promptly. The in-ector then restored the former shunt-field connections to e switchboard and reversed the positions of the rheostat id shunt-field wires at the busbars; but when he turned on the rheostat the machine would not generate . . . thereupon short-circuited the rheostat with a wire and the machine immediately picked up voltage. The rheostat was replaced by a good one, the rheostat and shunt-field busbar wires were interchanged, and the brushes were rocked back to their original positions. The machine was made ready for the load forty minutes after the inspector laid down his [illegible]

## Designing Motor Installations for Improved Power-Factor

The speed of a motor has an important bearing on the power-factor obtained. In selecting a motor of the proper speed to drive a line shaft, as pointed out by Mr. W. J. Fitzgerald, of the Detroit Edison Company, before the recent Michigan convention, the designer should first decide on the maximum speed of the shaft, then using as large a speed reduction as practicable, but preferably not over five to one. The ratio is usually limited, however, by such conditions as the clearance between shaft and ceiling, and so usually works out at a three-to-one reduction, although four to one is possible in some cases.

Motors of as high a speed as each condition will warrant should be installed to reap the advantages of increased efficiency and power-factor and lower price. Yet it is not an uncommon thing to see a slow-speed motor belted to a

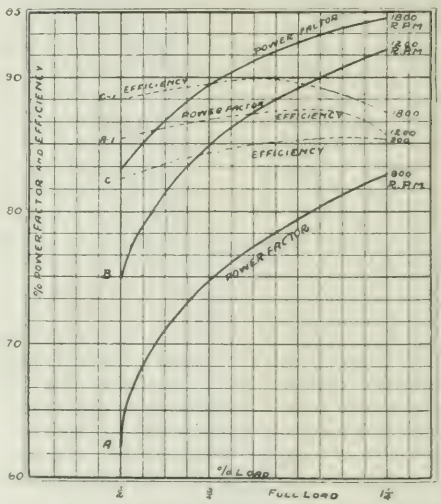



FIG. 1—RELATION BETWEEN MOTOR SPEED AND POWER-FACTOR

line shaft running at the usual speed, which in turn drives high-speed machinery. This operation of first decreasing the speed and then increasing it to meet the requirements of the high-speed machines means large losses in belt friction and slippage, besides the poor power-factor inherent in the slow-speed motor. Such practice, commented Mr. Fitzgerald, is deplorable when one realizes the benefits and

vings which can be secured by the use of high-speed otors and higher shaft speeds.

The accompanying curves show at a glance the difference power-factor and motor first-cost for motor speeds of o, 1200 and 1800 r. p. m. It will be noticed also that the ficiency changes only slightly, but while this makes little fference to the customer the improved power-factor ob-

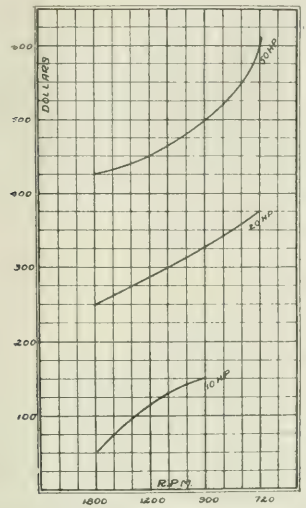



FIG. 2—RELATION BETWEEN MOTOR SPEED AND FIRST COST

ined is of vital importance to the central-station man. To demonstrate how little a change in size of pulley is ecessary to use a 1200-r. p. m. instead of a 900-r. p. m. otor, take the example of a 10-in. pulley on an 840-r.p.m. otor which with a 40-in. shaft pulley will drive the shaft 210 r.p.m. To use an 1120-r.p.m. motor and have the haft speed remain the same we must use a 7.5-in. motor ulley and 40-in. shaft pulley. To increase the shaft speed 250 r. p. m. a 10-in. motor pulley and a 44-in. shaft pulley ill give the desired result. Where the reduction cannot e accomplished in one step, a countershaft is frequently esirable. Back-geared motors also serve this purpose well here the right combinations can be secured with direct-onnected or chain-driven machines.

## Eddy Current

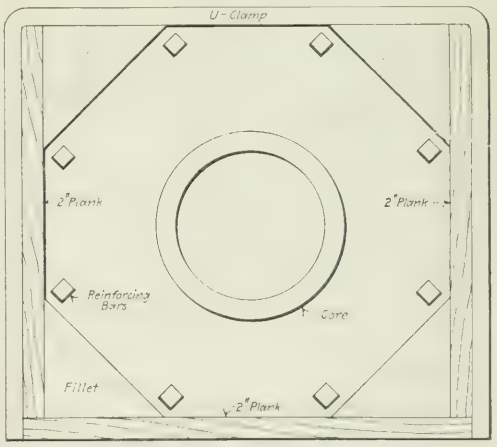
A mill operator claimed that a three-phase, slip-ring in-uction motor, operating a centrifugal drier in carpet orks, had no torque. He further stated, what the in-pector found to be true, that the motor, even when free, ould not start on applying the voltage, but if started by and it would continue to run at about half speed, al-ough it could then be easily stopped by applying the palm f the hand to the pulley. The trouble was evident at a ance. The slip-ring motor required that an external esistor be connected across the rings by means of brushes nd holders provided for that purpose and this external re-stor was missing. All motors previously installed in the ork were of the squirrel-cage type with the speed con-olled from a variable resistor installed in the supply ires. Accordingly, the operator had installed the slip-ng motor in the same way, with the result that the motor ould not start because its defined pole rotor was open-rcuited. The fact that the rotor would run at reduced eed when started free by hand was due to the dynamic tion of the eddy currents induced in the rotor core. The torque due to reaction between the stator field and that of the eddy currents was sufficient to keep such a small rotor turning against its bearing friction, but the least extra work imposed upon the shaft would overcome the turning torque and stop rotation. On very small motors equipped with ball bearings the friction losses are so small that the torque due to eddy-current reaction may be sufficient to start the motor and to bring the speed almost to synchronism, but the torque is not sufficient to do any useful work.

## Concrete Poles for Distribution Lines

Owing to the limited supply of good timber for pole purposes and to the cost of maintaining wooden-pole lines, the Riverside Light & Power Company, of Abilene, Kan., recently decided to engage in the manufacture of hollow reinforced-concrete poles for its own use. Square poles with chamfered corners were found to be very heavy with respect to their strength, so that octagonal poles are now being made. Incidentally, the electric-service company is also utilizing its line-construction force to better efficiency, employing the men during odd hours in the manufacture of the new poles. Four different sizes of poles are being made, ranging from 20 ft. to 35 ft. in length. All of the poles have 6-in. tops and the butts measure from 10 in. to 13 in. in diameter, according to the height.

Three-piece wooden molds are used, as shown in cross-section in the accompanying sketch. The form consists of a bottom plank and two side parts, one right-handed and the other left-handed. Strips having triangular cross-sections are fastened to the side pieces as shown, to give an octagonal shape to the pole.

Cement mortar, consisting of Portland cement and sand, in the ratio 1 to 3, is used in pouring the poles. Reinforcement is furnished by twisted square high-carbon steel rods placed longitudinally in the mold and spaced symmetrically. To prevent spreading, U-shaped irons are placed over the top of the form. To provide for bolting cross-arms on




CROSS-SECTION OF FORM WITH CORE AND REINFORCING IN PLACE

to the poles removable plugs extending diametrically through the forms may be used, but U-bolts passing around the pole and through the cross-arms are considered preferable by the company. Gains for the arms are formed by inserting blocks, while provision is made for steps by placing bolts in the form so that nuts may be supported at the center of the pole. The bolts are then backed out of the

ts after the mortar has set, and steps are screwed in in eir place.

When the mold is about one-third poured, a hollow, nical galvanized iron core having a base diameter of 6 and a top diameter of 2.5 in., is inserted in the mold d the remainder of the mortar and reinforcement is t in place. The core is wrapped loosely with a spiral of ilding paper, which facilitates the removal of the core ter the mortar has set. The poles are constructed in a rizontal position and reinforced with four, six and eight rs as desired. The top of the mold is left open for pour- g the mortar, and when it is filled the mortar is tamped wn and troweled off smooth.

TABLE SHOWING COMPARATIVE COST OF POLES

| Height | Concrete | Cedar |
|---|---|---|
| 20 feet | $2.43 | $ 2.00 |
| 25 feet | 3.85 | 3.95 |
| 30 feet | 5.86 | 6.65 |
| 35 feet | 7.57 | 10.20 |

After the form is filled, the mortar is allowed to set r several hours, the core is then partially removed and e pole is allowed to set from twenty-four to forty-eight urs longer. For twenty-five to thirty days after the al set the pole is cured by wetting it thoroughly each y.

These concrete poles, while more costly than cedar poles the small sizes, are considerably less expensive in the eater length, as indicated in the table. Erection of con- ete poles is more expensive than erecting cedar poles, t the former are practically indestructible and present a tter appearance. Pike poles may be used in erecting the aller concrete poles, but a pole-raising machine is re- ired with the larger ones on account of their weight. sand or wet soil the company finds it advisable to set e poles in grout.

## emoving Soot and Other Deposits from Boiler Tubes

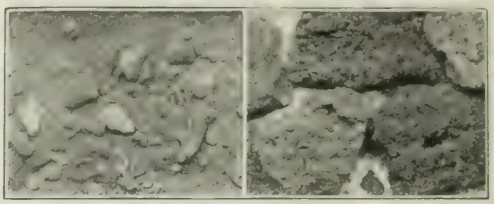
In estimating the heat-insulating effects of soot forma- ns on boiler tubes engineers are likely to consider these lues the same as for lampblack, although they are really gher. Deposits on boiler tubes vary widely in composi- n, and in addition to considerable ash carried over by e draft they contain much inorganic matter, which after ng volatilized in the fire condenses on coming in contact th the comparatively cool tubes.

When the deposits first occur the ash is in the form of lust or powder, but if allowed to accumulate the layers id to fuse together and finally break up into clinkers. e formation of these clinkers is probably due to the ct that as the deposit becomes thicker its heat-insulating alities increase, and as a result the hot gases cannot ne into contact with the cool tubes; therefore, when the ers become thick enough a temperature is reached that sufficient to fuse the material on the outside.

Soft coal is not the only fuel which forms soot deposits, shown by the illustrations. Practically all boilers, both rtical and horizontal, irrespective of the kind of material rned, are subject to these deposits.

Deposits found in modern boilers may be classified into e different kinds of formations, as follows: (1) molten g, which forms as stalactites on the lower row of tubes ien set close to the fire (this formation is not common d cannot be blown off); (2) clinker on the top of the pe, found only in the first pass (Fig. 2); (3) cemented ass of clinker, found only in the lower rows of the first ss (Fig. 7); (4) scaly deposit due to moisture in prod- ucts of combustion cementing the ash deposit, found frequently throughout the boiler (Fig. 3), and (5) loose soot, fine ash, clay and other earthy matter.

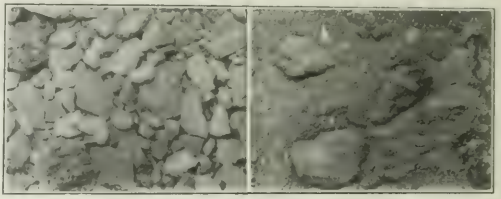
In Fig. 1 is shown a deposit taken from the first and second passes of an Edge Moor boiler, where garbage was used as fuel. The deposit is made up largely of a fine powder with small cakes fused together. It is gritty and



FIGS. 1 AND 2—SOOT TAKEN FROM BOILER USING GARBAGE AS FUEL

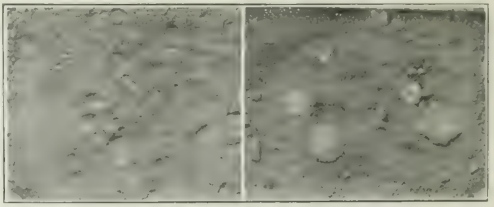
light gray in color. The powder is non-combustible and when heated to a moderate degree will fuse. Fig. 2 shows a sample of deposit taken from the lower row of tubes of this same boiler. The deposit is a light porous clinker forming on top of the first deposit and shows how the first powdery deposit, which can be easily removed, will fuse together and clinker under the action of heat.

A deposit taken from a hand-fired Babcock & Wilcox



FIGS. 3 AND 4—DEPOSIT ON FLUES WHERE BUCKWHEAT COAL IS USED

boiler using buckwheat coal with an ash content of approximately 16 per cent is shown in Fig. 3. This deposit has the appearance of scale, being white and soft and made up almost entirely of ashes. The small cakes can easily be pulverized in the fingers, giving a powder as smooth and fine as talcum. It is non-combustible and cakes around the entire tube. It can be easily blown off. Fig. 4 shows a deposit which was formed on the top of that shown in Fig.



FIGS. 5 AND 6—DEPOSIT IN STOKE-FIRED BOILER USING SHAWMUT COAL

3. It is gritty and is formed from the ash carried over by the draft. It clinkers slightly, forming a light porous substance, and if not blown off finally bridges over the tubes.

The deposit shown in Fig. 5 was taken from the tubes of a Babcock & Wilcox boiler using Shawmut coal fired by Roney stokers. Although this is soft coal, the deposit is gritty and made up largely of ash. In Fig. 6 the deposit

shown was taken from a boiler in the same plant as that in Fig. 5. It is nearly black and is made up of ashes and soot. The soot will burn out and the ashes will clinker when subjected to heat. In Fig. 7 is shown a deposit taken from the lower rows of tubes in another boiler in the same plant as that from which the samples shown in Figs. 5 and 6 were taken. It is hard, brittle and porous and looks like slag. It is a good example of what results if the first layers of soot and other deposits are not removed frequently.

Use of high drafts and the forcing of boilers at continuous overloads tend to increase the deposits on boiler tubes. The high drafts take up the lighter non-combustible particles from the fire, carrying them over and depositing them on the tubes. The same result is obtained with stokers and the consequent use of large quantities of fuel per square foot of grate area. A high rate of driving also produces higher gas temperatures throughout the boiler, making fusing more probable.

Besides the direct heat insulation resulting from these deposits, the gases of combustion are retained in the cells of the porous clinker formations, thus greatly increasing the depth of the stagnant gas film around the boiler tubes and further reducing the heat transmission. The formation of this porous clinker also renders ineffective the scrubbing action of high-velocity gases in removing the film. Furthermore, when the clinker gets thick enough to bridge over adjacent tubes, as shown by the sample in Fig. 7, it seriously interferes with the draft.

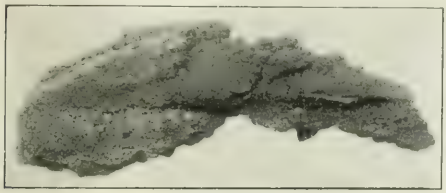


FIG. 7—SAMPLE OF LARGE CLINKER

Most boilers are not designed so that the cleaning of the tubes can be done properly. Usually the only provisions for removing the deposits are a few portholes in the sidewalls of the setting. Through these doors, some of them at a great height from the floor, the fireman is supposed to insert a perforated steam pipe and blow off the soot and other matter. This is an awkward and dangerous job because the pipe is hot, and the task will be shirked as much as possible. The method is also inefficient, since only the parts of the tube near the blow doors are cleaned, the soot being blown away to tubes more distant. In fact, no boiler 10 ft. or more wide can be cleaned by hand unless spaces at the side are unusually ample, thus wasting valuable ground space. More satisfactory results can be obtained with a cleaner installed as part of the boiler equipment. In this case steam may be discharged through perforated pipes and nozzles to the tube surfaces, in that manner cleaning the tubes in the center of the boiler as well as those at the sides.

## Outdoor Testing of Insulators

The Western Electric Company's engineering department in New York City is conducting an interesting comparative study of pole-line insulators. Over 3000 insulators of different shapes and materials are mounted on a low roof in one corner of the West Street building. A special selective mechanism is mounted on a pole near the center of the insulator rack, which permits the insulation resistance of each group of insulators to be measured with instruments that are in the physical laboratory. The laboratory is several hundred feet away and only a few very heavily insulated wires connect the selector to the laboratory. Dust from the street and smoke and soot from nearby factory chimneys gradually accumulate on the insulators and their insulation resistance measured during wet weather decreases. The ability of the insulators to maintain high insulation under these severe conditions determines clearly their relative merit for use on telephone lines and in telegraphic service.

## Blasting by Electricity as a Means of Reducing Miner's Phthisis

During the last six months some of the leading gold-mining companies in the South African Rand have been conducting experiments with electric blasting to test the theory that this method will assist in minimizing the fine dust from blasting—accepted as the most direct cause of miner's phthisis, which is at present so widespread in the Rand field. The management of one large company has decided to introduce the electric system throughout its mine. It is hoped to have the electric system of firing so introduced that blasting can be done by pressing a button on the surface. This will insure that the miners will not be forced to inhale the fine dust and vitiated air which result from blasting carried on underground.

## The Inverse-Square Law in Illumination

If a certain object is 20 ft. from a source of light, to what extent will the illumination falling on it be reduced if it is removed to a distance of 60 ft.?

A. W. W.

The intensity of illumination varies inversely as the square of the distance from the source. If an object is removed to three times its former distance, as in the case cited, the intensity of the light falling on its surface will be in accordance with this rule reduced to one-ninth the value that it formerly possessed.

## Failure of Polyphase Meter to Operate

I have a three-phase, 25-cycle, 110-volt, 5/60 amp watt-hour meter connected in circuit with a 50-hp motor which is operating at three-fifths its rated load, and still the meter fails to record. The connections are correct, I believe, the grounded terminals of the potential and current transformers being connected to one side of the meter and the two remaining wires on the potential and current transformers to the other side. Am I correct in saying that a three-phase meter will not register with 50 per cent power-factor? The magnets and current coils in the meter are in good condition.

J. W. C.

When a three-phase watt-hour meter is connected in circuit properly it should register the energy consumed independently in every respect of the power-factor. Your statement that the three-phase meter will not register when the power-factor is below 50 per cent is probably based on the fact that when two separate meters are employed to measure three-phase energy one of the meters registers zero when the power-factor is 50 per cent and gives a negative reading when the power-factor is below this value. No doubt the meter referred to in your inquiry is incorrectly connected in circuit. A convenient method of determining the proper connections to the meter is to operate one element of it (that is, one series coil with the corresponding shunt coil) as in a single-phase meter. In this case the meter should operate in one direction or the other, except when the power-factor is exactly 50 per cent. By testing in this way two separate single-phase circuits you should be able to determine whether the meter is operating correctly, and if not what changes to make.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*Power-factor Effects of Railway Motor-Generators and Rotary Converters.*—NICHOLAS STAHL.—An article comparing the power-factor effects of synchronous motors and rotary converters. The synchronous motor, commonly utilized as part of a motor-generator set, has come to be accepted as an excellent agent for improving the power-factor of systems. But such a synchronous motor will fulfil expectations only if it is operated properly; simply putting the motor on the system and turning it over to the care of the average station operator will in most cases give results that fall far short of expectations with regard to corrective effects. The curves given indicate the necessity of careful attendance and show that the field strength must be varied with changing conditions of load if the desired results are to follow. The rotary converter, on the other hand, while not inherently designed for power-factor correction, is shown to be an excellent medium for the automatic maintenance of constant power-factor. The article then goes further in demonstrating that in cases where a wide variation in load occurs the best average condition is obtained through the use of a rotary converter rather than through a motor-generator set as ordinarily manipulated.—*Elec. Journal*, Dec., 1913.

*Frequency Changers.*—G. HARRIS AND L. B. BONNETT.—The need of frequency-changer sets is experienced where, for instance, a 25-cycle system is to supply lighting to the communities in its neighborhood, or where a 60-cycle system must furnish energy at 25 cycles or less for railway operation, or where two systems of different frequencies are to be tied together. The authors discuss the types of frequency-changer sets which have been commercially developed, describing in particular the synchronous-synchronous sets and the induction-synchronous sets. Reference is made to the matter of the most suitable speed for a given set of conditions and the limitations on rating imposed thereby, and to the more important features embodied in present-day construction. The proper procedure to be followed in starting synchronous sets is fully described, and this is followed by an outline of the operations necessary to secure parallel operation of frequency-changer sets, together with a discussion of the interrelations between the machines on the motor end and on the generator end.—*Gen. Elec. Review*, Dec., 1913.

*Turbo-Alternator.*—An illustrated description of a 4200-kw Oerlikon turbo-alternator in a British central station, running at 3000 r. p. m.—London *Electrician*, Dec. 5, 1913.

### Lamps and Lighting

*Incandescent-Lamp Manufacture.*—H. D. ERB.—The author comments on the very small margin of profit which can accrue to manufacturers of metal-filament lamps in view of the low level to which retail prices have now been reduced. The manufacture of low-voltage lamps is still much simpler than the manufacture of high-voltage types, and in view of the increasing demand for 14-volt (or other low-pressure) lamps for advertising and decorating work, it would probably pay some firms to specialize on low-voltage lamp manufacture. The problem of grading lamps for series operation has been solved well enough to permit of sign and other low-voltage lamps being run in series. But there is yet room for further improvement in this direction. The figures below summarize the manufacturing cost per thousand 220-volt, 25-watt lamps, as given by the author. These data are said to be drawn from actual factory records, and their arrangement shows how the value of the lamp increases as its manufacture proceeds, at what stage of its manufacture the greatest outlay in material and wages is required, the percentage of breakages in each stage, and the value of the pieces broken.

DATA ON LAMP-MANUFACTURING COST

| Item. | Brought Forward* | Materials | Wages | Breakage Per Cent | Breakage Value |
|---|---|---|---|---|---|
| Bulb | | $9.00 | $1.10 | 1 5 | $0 153 |
| Crown | | 1 09 | 0 37 | 5 0 | 0.078 |
| Electrodes | | 7.05 | 0.55 | 1.0 | 0.071 |
| Stem | | 10.01 | 1.73 | 1.0 | 1.020 |
| Star | $11.80 | 6.40 | 3.20 | | 1.230 |
| Attachment | 21.40 | 32.40 | 7.80 | 2 0 | |
| Melting-on | 61.90 | 9.05 | 2.36 | 5.3 | 3.830 |
| Pumping | 73.00 | ..... | 2.87 | 6 0 | 4 680 |
| Flashing | 76 00 | 0.14 | 0.48 | 1.5 | 1.142 |
| Adjustment and completion | 76.50 | 5.30 | 2.27 | 2.0 | 1 680 |

*Cross total of cols. 2, 3 and 4 of previous line.

Up to a certain stage in manufacture, pieces are prepared which may subsequently be used in any one of a number of types of lamp, but beyond this stage parts are selected and assembled and true lamp manufacture commences. In the above table, no allowance is made for the cost of gas, electricity, standing charges and unproductive labor; in practice, these items should be reduced to a minimum. The figures in column 2 show the value per 1000 lamps of the materials in and wages spent on the lamps at various stages of their manufacture. As manufacture proceeds, the value of the piece handled during any particular operation increases rapidly since it becomes a complex structure, damage to which involves a greater wastage of time and material than is accounted for by the member actually broken.—From an article in *Elek. Anz.*, translated in abstract in London *Elec. Review*, Dec. 5, 1913.

### Generation, Transmission and Distribution

*Transformation of Two-Phase to Three-Phase.*—H. DE PISTOYE.—The first part of an article, illustrated by diagrams, on methods of transformation from two-phase to three-phase. Either a two-phase magnetic circuit may be used (Scott system) or a three-phase magnetic circuit (Leblanc system). In the present instalment the Scott system is discussed. The author explains its general principles, the special conditions which the transformers must fulfil, the utilization of the magnetic circuits in the Scott system, and, in the case of an unbalanced system, whether the neutral point is accessible or not. The article is to be concluded.—*La Lumière Elec.*, Nov. 29, 1913.

*High-Voltage Engineering.*—F. W. PEEK, JR.—A Franklin Institute paper discussing the general subject of high-voltage engineering under the following headings: the dielectric circuit, gaseous insulation (air; laws of corona losses), solid insulation, etc. In conclusion the author deals briefly with some special high-voltage problems like breakdowns caused by the addition of stronger insulation; the combination of insulations; occurrence of "static" and

"leakage" over insulation; dielectric flux control; dielectrics in multiple; effect of altitude on spark-over of insulation and bushings; methods of measuring high voltages; probable limits of voltage in transmission (possibly the whole country could be tied together at 200,000 volts); voltage regulation of transmission lines; high reactance in transformers; arcs and short-circuits, and high-voltage switching.—*Journal Franklin Inst.*, December, 1913.

### Traction

*Electric Automobiles.*—F. W. Moock.—The first of an illustrated article on electric automobiles and gasoline-electric automobiles in Europe. The article is to be concluded.—*Elek. Zeit.*, Dec. 4, 1913.

*Electrical Equipment of Automobiles.*—C. E. Wilson.—An illustrated article on the electrical equipment of gasoline automobiles for ignition, lighting, starting, gear-shifting, etc., with detailed illustratons of typical apparatus.—*Elec. Journal*, December, 1913.

### Installations, Systems and Appliances

*Improving the Power-Factor.* R. Nagel.—Finding that the power-factor of German central stations has decreased in recent years, the author urges that steps be taken to improve this condition and recommends that large energy users be allowed a discount on the basis of their mean annual power-factor. Such an inducement would lead them to operate their installations at as high power-factors as possible. In order to measure the mean annual power-factor the author recommends the use not of three-phase meters but of single-phase meters, connecting these so as to get the mean annual power-factor directly from the ratio of the readings of the two meters.—*Elek. Zeit.*, Dec. 4, 1913.

*Diversity Factor.*—An editorial on the fact that diversity factor is defined in different ways by different authors and authorities. According to the definition of the International Electrotechnical Commission, the diversity factor is a number obtained by dividing the sum of the maximum loads of the individual consumers supplied from a central station during a given period of time by the maximum load delivered from that station during the same period. The National Electric Light Association of the United States has adopted the inverse expression, and the London *Electrical Times* makes use of the latter value as a percentage. For instance, if the sum of the maximum loads of the individual consumers supplied from any plant during a given period of time is 200 kw and the maximum load delivered from that station during the same period is 100 kw, the diversity factor will be 2, 0.5 or 50 per cent, according to which of the three definitions just given is to be used. It is urged that universal support be given to the definition of the International Electrotechnical Commission.—London *Electrician*, Dec. 5, 1913.

*Phase-Balancer for Single-Phase Loads on Polyphase Systems.*—E. F. W. Alexanderson.—The demands for single-phase energy from polyphase systems often reach such a point as to produce serious heating of the generators and troublesome unbalancing of the voltage. Especially is this true when single-phase energy is supplied for traction purposes or for electric furnaces. The author describes a machine that has been developed to counteract these undesirable influences. Its function is to absorb the unbalanced component of the load and to redistribute it to give a resultant balanced polyphase load. The phase-balancer consists essentially of a synchronous condenser provided with a polyphase booster connected in series with it, but in such a manner that its phase rotation is in the opposite direction to that of the synchronous condenser.—*Gen. Elec. Review*, December, 1913.

*Breaking Capacities of Oil Switches.*—S. Ferguson.—An illustrated article in which the conditions arising on short-circuit and the action of oil switches are first briefly reviewed, after which the causes of explosions in oil switches are stated. An analysis of the results of tests on breaking capacities is given, and the factors governing breaking capacities of oil switches are considered. In conclusion the author deals with the rating, the selection and the location of oil switches.—London *Electrician*, Dec. 5, 1913.

### Electrophysics and Magnetism

*Distribution of Energy in the Spectra of Gases.*—H. L. P. Jolly.—An account of an experimental investigation of the manner in which the energy distribution among the lines of a bright-line spectrum varies when the intensity of excitation is changed. If the current in a discharge tube be small, the radiation from it is proportional to the current density, both for the whole spectrum and for any portion of it. In heavy discharges, such as that produced by a large condenser in parallel with the discharge tube, there is strong evidence that the energy shifts toward the longer wave-lengths when the current density increases. Whether the energy of any portion of the spectrum increases at a rate greater or smaller than the current has not been determined, owing to the difficulties in the way of measuring these currents. When the pressure at which a condensed discharge is sent through the tube is increased the energy shifts toward the longer wave-lengths. A continuous spectrum makes its appearance in these discharges and becomes more marked the higher the pressure.—*Philos. Mag.*, November, 1913.

*Constitution of Atoms and Molecules.*—N. Bohr.—A theoretical paper in which an attempt is made to develop a theory of the constitution of atoms and molecules on the basis of the ideas which Planck introduced to account for the radiation from a black body, and the theory of the structure of atoms which Rutherford proposed to explain the scattering of alpha particles by matter. Planck's theory deals with the emission and absorption of radiation from an atomic vibrator of a constant frequency, independent of the amount of energy possessed by the system at the moment considered. The assumption of such vibrators, however, involves the assumption of quasi-elastic forces and is inconsistent with Rutherford's theory, according to which all the forces between the particles of an atomic system vary inversely as the square of the distance separating them. In order to apply the main results obtained by Planck, it is therefore necessary to introduce new assumptions concerning the emission and absorption of radiation by an atomic system. The main assumptions made in the present paper are: (1) That energy radiation is not emitted (or absorbed) in the continuous way assumed in ordinary electrodynamics, but only during the passing of the systems between different "stationary" states; (2) that the dynamical equilibrium of the systems in the stationary states is governed by the ordinary laws of mechanics, while these laws do not hold for the passing of the systems between the different stationary states; (3) that the radiation emitted during the transition of a system between two stationary states is homogeneous, and that the relation between the frequency $\nu$ and the total amount of energy emitted $E$ is given by $E = h\nu$, where $h$ is Planck's constant; (4) that the different stationary states of a simple system consisting of an electron rotating round a positive nucleus are determined by the condition that the ratio between the total energy emitted during the formation of the configuration and the frequency of revolution of the electron is an entire multiple of $h/2$; (5) that the "permanent" state of any atomic system—that is, the state in which the energy emitted is maximum—is determined by the condition that the angular momentum of every electron round the center of its orbit is equal to $h/2$. It is shown that, applying these assumptions to Rutherford's atom model, it is possible to account for the laws of Balmer and Rydberg connecting the frequency of the different lines in the line spectrum of an element. Further, outlines are given of a theory of the

nstitution on the atoms of the elements and of the rmation of molecules of chemical combinations, which several points is shown to be in approximate agreeent with experiments.—*Philos. Mag.*, November, 1913.

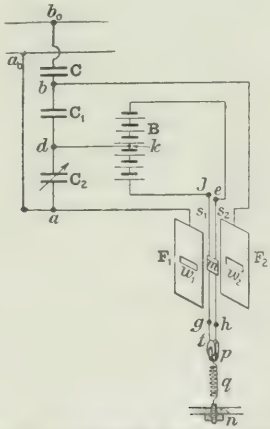
### Units, Measurements and Instruments

*nsulation Resistance.*—S. EVERSHED.—The conclusion of s paper read before the (British) Institution of Elecal Engineers. The author discusses the laws of the oisture curve. The experiments on absorbent insulars suggest that underlying the phenomena there is some certainable law of conduction by moisture. The fact that is possible to compare one curve with another without king the potential gradient in the insulator into account sufficient proof that the curves have some simple propy in common. In fact, in every case in which moisture nduction alone controls the resistance curve it is found at over a considerable length along the curve the ratio : $R_{10v}$ ($R_v$ and $R_{10v}$ being the insulation resistances at and $10v$ volts respectively) is fairly constant whatever ay be the value of $v$ in volts. Hence, although the inators may vary widely in thickness, the ratio $R50 : R500$ rves quite well as a rough guide for comparing the difrent curves. The law is expressed empirically by the rmula

$$R = k\left(\frac{1}{v}\right)^{\frac{1}{x}}$$

d in each particular case a value may be chosen for which will express the law of the individual curve over great part of its length, and hence when the ratio : $R_{10\,v}$ has been found by experiment, the formula may found to ascertain any other ratio $R_v : R_{nv}$ for values $n$ lying between 1 and 10. The author of the paper en proceeds to discuss "compound insulation," consistg of a non-absorbent dielectric insulator in series with absorbent insulator. While for absorbent insulators the io $R_v : R_{10v}$ is 2.2 on the average, the same ratio has a an value of a little less than 1.4 for absorbent insulars. The author finally discusses the properties of a model sulator.—London *Electrician*, Dec. 5, 1913.

*Electrostatic Oscillograph.*—H. HO AND S. KOTO.—An ab-




1 GENERAL ARRANGEMENT OF ELECTROSTATIC OSCILLOGRAPH

act of a (British) Physical Society paper. The general rangement is shown in Fig. 1, in which the potential difrence between $a_0$ and $b_0$ is required to be recorded. $C$ an oil condenser, to be used, if necessary, for reducing e above voltage to a suitable value at the terminals $a\,b$ the oscillograph. Two bronze strips, $s_1$ and $s_2$, are etched between two parallel metallic plates, $F_1$ and $F_2$, called "field plates." These strips are parallel to one another and to the plates and carry a small mirror $m$ in the center, the tension being adjustable in the manner usually adopted. Contrary to the method used in an ordinary oscillograph, the strips are insulated from each other by a silk thread $t$, which connects them and passes over an ivory pulley $p$, thus forming two electrically independent

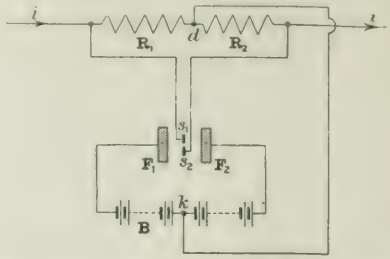



FIG. 2—CONNECTIONS FOR RECORDING SMALL CURRENTS

conductors in the electric field of the parallel-plate condenser $F_1$, $F_2$. The plate $F_1$ has an opening $w_1$ for the passage of the light ray to and from the mirror, and an exactly similar opening is cut on the other plate, $F_2$, to maintain the symmetry of the electric field. The plates and the strips mounted on an ebonite frame complete the vibrator, which is immersed in an oil bath provided with the necessary number of terminals with suitable insulating bushings for the pressure to be employed. Two oil condensers, $C_1$ and $C_2$ in series, are connected to the points $a\,b$, in multiple with the field plates as in Fig. 1. One of these condensers must, however, be adjustable. $B$ represents a number of small dry cells, connected in series and mounted on an insulating stand, the electrical center $k$ of this battery being connected to the point $d$ between $C_1$ and $C_2$. Its terminals are connected to the two strips $s_1$, $s_2$ in order to charge them for the same purpose as the needle of a quadrant electrometer is charged. Oil plays a very important part in this oscillograph, since it serves as the damping agent and as the insulator. Its high specific inductive capacity increases the sensitiveness. In order to record very small currents, the connections of Fig 2 may be used, in which $R_1$ and $R_2$ are two exactly equal resistances with as little inductance and capacity as possible, connected in series in the circuit of the current to be recorded, the middle point $d$ being connected to $k$, the center point of emf of the high-tension battery $B$.—London *Electrician*, Nov. 21, 1913.

*Bismuth Thermopiles.*—W. W. COBLENTZ.—The author first discusses the relation between external and internal resistance. The older theories held that the maximum efficiency is attained when the external (the galvanometer) resistance is the same as the (internal) resistance of the thermopile. But this has recently been questioned. The problem was subjected by the author to a test with a thermopile having a resistance of 6.8 ohms. When the external resistance was four times (i. e., 26 ohms) that of the thermopile, the radiation sensitivity was 16.4 to 17 per cent less than when the external resistance (6.5 ohms) was the same as the internal (thermopile) resistance. In view of the facts that there was a loss of only 16.5 per cent in efficiency when the external resistance was four times the internal resistance, and also that one rarely meets with conditions where the galvanometer resistance is more than twice the resistance of the thermopile, it is evident that this question proves to be of minor importance. The author then discusses critically the several factors which determine the radiation sensitivity of a thermopile. In the case of eight samples of bismuth wire tested (diameters 0.06, 0.08, 0.1 and 0.15 mm), the thermoelectric emf against

silver varied from 75 to 82 microvolts. This function seems to depend on the purity of the material. Some experiments were also made with different bismuth alloys.—*Journal Franklin Inst.*, December, 1913.

*Precision Pendulum.*—K. SIEGEL.—The author has previously described the use of electrolytic condensers to prevent sparking at the contacts in the operation of electric clocks. For such installations electrolytic condensers consisting of nickel electrodes in caustic potash solution have proved satisfactory in practice. In the present illustrated article the author describes a precision pendulum in which electrolytic condensers are also used for preventing sparking at the contacts. An additional feature of this pendulum is the fact that the driving force of the pendulum is absolutely independent of the electric current.—*Elek. Zeit.*, Dec. 4, 1913.

*Resistors of Very High Resistance.*—NORMAN CAMPBELL.—An article giving further data on resistors of very high resistance made of mixtures of xylol and alcohol contained in glass cells, with hints as to the practical construction of such resistors. The resistance of the cells made by the author varies between $10^3$ and $10^{13}$ ohms.—*Philos. Mag.*, December, 1913.

*Watt-Hour Meters.*—An account of the discussion at Birmingham which followed the reading of the paper by Holden recommending modifications for the British standard specification of consumers' watt-hour meters.—London *Electrician*, Nov. 28, 1913.

### Telegraphy, Telephony and Signals

*Cable Systems of the World.*—MAX ROSCHER.—A statistical article, with numerous tables, covering the development of the cable systems of the world from 1898 to 1913. The total cable length installed in the world was 318,026 km in 1898, 412,032 km in 1903, 464,852 km in 1908, and 519,347 km in 1913. Of this mileage 93,486 km was owned by governments and 425,861 was owned by private companies. Great Britain owns 281,828 km, the United States 100,831 km, France 43,680 km, Germany 43,294 km, and Denmark 17,516 km. Japan, Holland, Spain and Italy follow, each with less than 10,000 km.—*Elek. Zeit.*, Nov. 27, 1913.

*Single-Phase Traction and Telephony.*—G. GIROUSSE.—The first part of an article in which the author discusses the troubles caused in telephone lines by single-phase traction lines in the neighborhood affecting either the operation of the apparatus or the safety of persons. Remedies for these troubles are outlined. The article is to be continued.—*La Lumière Elec.*, Nov. 29, 1913.

*Gott System of Telegraphy.*—HEINRICH DREISBACH.—An illustrated article on the Gott system adopted by the (British) Commercial Cable Company for increasing the speed of cable telegraphy by using successive impulses of opposite signs (as has been described in detail in these columns). Much larger batteries must, however, be used if the advantages of the new system are to be obtained. In any cable of medium length operated on the Wheatstone, Hughes or other system the Gott method permits a certain moderate increase of the speed of telegraphy.—*Elek. Zeit.*, Dec. 4, 1913.

*Locomotive Signals.*—An illustrated article on a system of automatic audible electric signals for locomotives in use on a British railroad.—London *Electrician*, Dec. 5, 1913.

### Miscellaneous

*Association of German Central Stations.*—A report of the thirty-second general convention of the German Association of Central Stations, held last summer at Trier. The attendance was 300. The number of central stations represented in the association is 507, of which 119 are outside of Germany. Papers were read by Schulte on theory and practice in the statistics of central stations, by Passavant on accident liability of central stations, by Wikander on the business policy of central stations and methods of increasing energy consumption, by Steinmueller on boilers for electric-lighting stations, by Henney on aluminum transmission lines, and by Matthias on limiting devices for keeping the watt consumption of consumers below a predescribed maximum.—*Elek. Kraftbet. u. Bahnen*, Nov. 24, 1913.

*Japan.*—A. A. BRANDT.—A statistical article on Japanese electric undertakings in 1912. The total number of workingmen in Japan is 793,885, of which number only 3300 are employed in electrical factories. Installation material, wires and incandescent lamps are made in Japan, as there is a prohibitive import tariff. The wages of the workingmen have increased by 50 per cent to 75 per cent since 1900. The number of electric-lighting companies was 155 in 1911, against 122 in 1910. The number of electric railways was forty-seven in 1912, with 558 miles in operation and 200 miles in course of equipment. In 1911-12 there were 4657 telegraph stations and 1958 public telephone stations.—*Elek. Zeit.*, Nov. 27, 1913.

*Ghent.*—J. REYVAL.—The first part of an article on generating sets and the Ghent exhibition. The present instalment gives details of a 1000-hp four-cylinder Carels-Diesel oil engine which drives a 600-kw alternator.—*La Lumière Elec.*, Nov. 8, 1913.

*Young Electrical Engineers.*—A long editorial on the prospects of the young electrical engineer in Great Britain.—London *Electrician*, Nov. 14, 1913.

# Book Reviews

THE POLYTECHNIC ENGINEER. Published annually by the students of the Polytechnic Institute of Brooklyn. 138 pages, illus. Price, $1.25.

A number of short papers are printed in this year's volume. Some of them appear to possess considerable merit and originality. They also bear the evidence of having been carefully edited. The following is a list of the papers and theses, excluding editorials and regular formal announcements: History of bridge building; thickness of films of silver upon glass; oscillation transformers; lattice bars; the industries of Detroit; the vector diagrams of electric discharges; senior inspection trip; diffusion of light by mechanical means; blue and iridescent gelatine-copper; the Pitot tube; Chinese wood oil; engineering education in America; résumé of the lectures of Sir William Ramsay; predetermination of voltage; regulation in alternators. An excellent photographic portrait of Prof. Samuel Sheldon appears on the opening page.

ACUMULADORES ELÉCTRICOS. By Gaston Ossa. Santiago, Chili: Sociedad Imprenta y Litografia Universo. 103 pages, illus. Price, 7 francs.

A good practical work on electric storage batteries of both the lead and steel types, and one of the very few books on the subject printed in Spanish. The author mentions in his excellent preface the difficulty encountered in finding information in Chili upon the subject of the installation, maintenance and testing of storage batteries except in books of reference written in foreign languages. He therefore decided to collect this material, guided by his own practical experience on the subject, and to publish the collection in book form. The eight chapters of the book relate to the following topics, after the introduction: General principles; electrodes; the electrolyte; installation; operation and tests; causes, symptoms and remedies for troubles; principal applications and connections with lighting networks; predetermination of a battery for a stated service, and the alkaline storage battery. A good bibliography and an index are appended. The book is much the best on the subject we have yet seen in Spanish. Some of the illustrations might be improved in the next edition. The description is clear and straight to the point from the standpoint of the engineer.

# New Apparatus and Appliances

**An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers**

## Fire Extinguisher

The fire extinguisher shown in the accompanying illustration operates by means of self-contained compressed air, no mechanical force being necessary. Carbon tetrachloride is the basis of the extinguishing fluid used. The turning of an outlet valve with the device in an upright position will cause the fluid to flow out, and it can be aimed accurately at any desired spot. The extinguisher is designed to throw a spray as well as a stream, the former going a distance of 10 ft. and the latter 25 ft. The spray is most effective on small fires scattered over a comparatively large area; the stream is usually best for small fires concentrated in one spot. This extinguisher, which is known as the "J-M Fyro," consists of only ten working parts. It is made of heavy seamless brass, is cylindrical in form, measures 15 in. high by 5 in. in diameter, and weighs 5 lb. At the top is the valve through which the extinguishing fluid is discharged. Running through the center from the outlet valve almost to the bottom is a siphon tube. The air pressure forces the carbon tetrachloride up this tube and it is said to hold it permanently against the outlet valve, thus forming a "liquid seal," which prevents any leakage of air pressure. The extinguisher has a capacity of 7 qt.

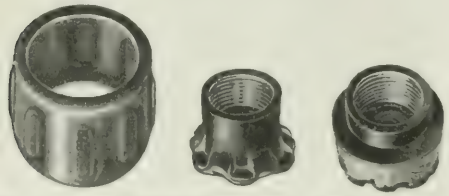


FIRE EXTINGUISHER

The "J-M Fyro" extinguisher is manufactured by the H. W. Johns-Manville, Company, New York.

## Drawn-Steel Pipe Insulators

The insulating couplings shown herewith are called "insulating joints" in the fixture trade. Fixtures of this type were originally made of cast iron or brass, then of malleable iron, and now those illustrated are made of drawn steel. Fig. 1 represents a drawn-steel shell inwardly flanged and corrugated to afford a grip for pipe-tongs or wrench. Fig.



FIGS. 1, 2 AND 3—DRAWN-STEEL SHELL AND THIMBLE, AND THIMBLE AFTER BREAK

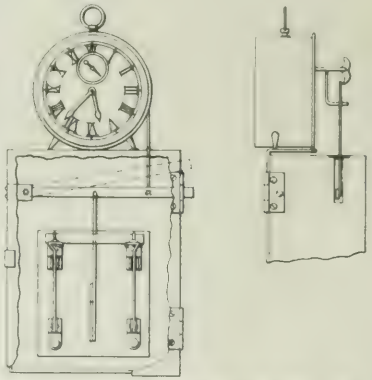
shows a drawn-steel thimble consisting of a threaded cap with a "pie-crust" fluted flange.

Fig. 3 shows a drawn-steel thimble broken in a test. The specimen was pulled apart by the shearing of the insulation. A 0.375-in. pipe size carried under test a straight pull of 8000 lb. before breaking. These fixtures are provided with double insulation and will withstand a test at either end of 4000 volts, alternating current, for five minutes, according to the Underwriters' specifications. The insulation is of the nature of artificial stone, being molded in place and subsequently hardened, and it has been named "Di-el-ite."

These insulating couplings are the product of the Wirt Company, Germantown, Pa.

## Alarm-Clock Time-Switch for Window and Sign Circuits

An inexpensive time switch for extinguishing or lighting window displays or electric signs has recently been put on the market by Mr. Victor G. Jensen, 1105 East Sixty-third Street, Chicago. This device, as shown on the accompanying sketches, consists of a standard cabinet knock-out box 6 in. wide by 8 in. high by 3.5 in. deep. On a slate base in this box are mounted a double-pole single-throw switch and a safety-pin spring made of cold-drawn steel. The spring engages a lever which in turn engages the alarm winding key. To set the time switch, the spring



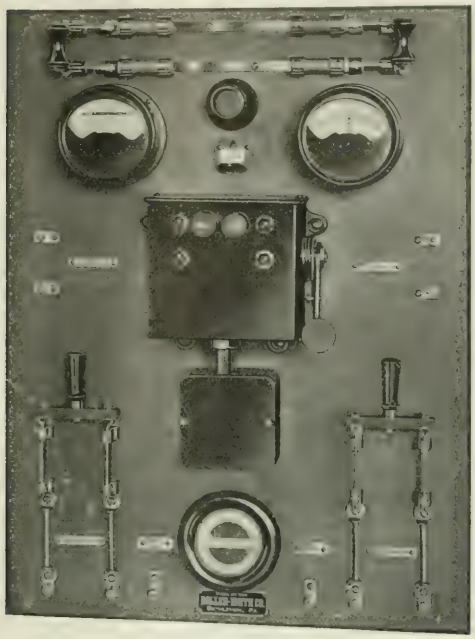
ALARM-CLOCK-OPERATED SWITCH FOR SIGN AND SHOW-WINDOW CIRCUIT

is first depressed, being held in that position by the lever. This allows the switch to be closed without touching the spring. At the predetermined hour the operation of the alarm mechanism revolves the key crank and raises the lever, disengaging the spring. This spring strikes the double-pole single-throw switch a heavy blow, opening it sharply. To turn on lamps the spring may be reversed in the time switch.

The cabinet boxes are made by the George Cutter Company, South Bend, Ind., the switches by the Trumbull Electric Manufacturing Company, Plainville, Conn., and the clocks by the Ansonia Clock Company. The standard switch here described is designed to carry 30 amp at 250 volts, but the boxes may be furnished with switches of any size varying from 3 amp to 200 amp. A pull of but 1 oz. releases the spring, although the latter strikes the switch with a force of from 6 lb. to 10 lb. Aside from the clock, the switch has but three moving parts, all of which are readily accessible.

## Automatic Charging and Lighting Panel

A simple automatic charging and lighting panel for small isolated plants using oil or gasoline engines has been designed by the Roller-Smith Company, 203 Broadway, New York. By its use the charge is delivered to the battery at the most desirable tapered rate, being heavy at the start and gradually reducing to a low rate at the finish so as to



AUTOMATIC CHARGING PANEL

avoid overheating, injurious gassing or spraying and injury to the battery plates. Long life and maximum efficiency of the battery are thus assured. The control described is accomplished without any adjustment or supervision after the charge is started.

The panel, illustrated herewith, is equipped with black-enameled instruments mounted on a natural black-slate base supported on angle-iron frames. At the right near the top is a battery ammeter with a double scale, indicating the amount of charge or discharge current. At the left is a voltage relay identical in appearance with the ammeter. This has two platinum contact-making pins, one of which, on completion of a charge, makes contact with the needle of the relay, causing an automatic circuit-breaker and a throw-over switch to open and stop the charge, at the same time breaking the ignition circuit of the gas engine so that the latter also stops. The circuit-breaker connects the lamp circuit direct to the battery at the same instant the dynamo is disconnected, so that there will be no interruption at the lamps. The other platinum pin of the relay makes contact when the battery is discharged, operating a drop which is the signal to recharge. The volt relay is also a voltmeter, showing on its scale the voltage of the battery during charge and discharge. A pilot lamp, which is automatically connected during charge, illuminates the instrument dials.

Below the instruments is the automatic switch or circuit-breaker inclosed in a black-enameled iron case and operating in oil. A shunt trip coil for releasing this circuit-breaker is inclosed in the case. This oil switch makes all necessary operating connections and no handling of the knife switches is required. Pushing the button on its handle completely down makes connections from the battery to the dynamo for starting, and as soon as the engine begins to run and the ammeter shows that the current is changed from "discharge" to "charge," the handle may be released. The switch is then in the charging position, where it will ordinarily remain until the completion of the charge. A hand trip button is provided on this switch so that it can be opened at will, and a combined overload and reverse-current relay is situated just below the switch, opening it in case of overload or if the engine slows down or stops, which would cause the battery to discharge back into the generator.

## Flame-Arc Lamp for Long-Hour Burning

The Electro Development Company of New York City is putting on the market a long-burning inclosed flame-arc lamp which, it is stated, will operate for 200 hours on a single trim. The floating feed mechanism of the lamp is controlled by a single series solenoid, which advances the lower electrode, a 9-in. by 1-in. treated carbon. The upper electrode is a 2-in. by 2.5-in. piece of untreated carbon and for direct-current operation is connected to the negative side of the line. In order that this large piece of carbon shall not be burned away more rapidly on one side than on the other a ratchet has been arranged to revolve it by small increments as the side on which the arc is burning becomes lower than the surrounding parts. The use of this short heavy piece of carbon also does away with the necessity of allowing the upper electrode to protrude into the mechanism of the lamp. No economizers or blow magnets are used with the carbons. The size of the upper electrode keeps the arc in nearly the same horizontal plane throughout its life, which is between 400 and 600 hours, so that the lamp is really of the focusing type although without



LONG-BURNING INCLOSED ARC LAMP

focusing apparatus. It is declared that the lamp will operate without flicker throughout each entire trim.

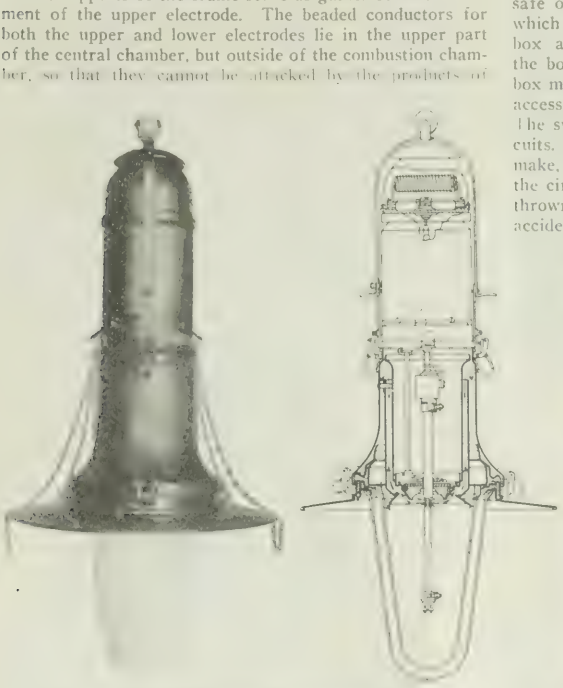
On direct-current multiple circuits the lamp requires 5 amp with 80 volts at the arc, while the alternating-current lamp takes 7 amp with 78 volts at the arc. Series lamps of this type are also manufactured. All of these lamps are equipped with an improved condensing chamber made of a case of solid copper having a gun-metal outside finish.

## Long-Burning Inclosed Flaming-Arc Lamp

The long-burning inclosed flaming-arc lamp shown in the accompanying illustrations is of the Siemens type, of which H. M. Hirschberg Company, 30 East Twentieth Street, New York City, is the sole importer. While the unit shown is of the direct-current type, these lamps are also furnished for operation two in series on 110 volts, either direct or alternating current. An alternating-current multiple lamp with inclosed choke coil for use on 110-volt circuits is also available.

As the drawing shows, this long-burning direct-current lamp is of the differential type, with vertical carbons and inclosed arc chamber. The regulating mechanism is contained in the housing at the top; by loosening four screws the upper internal cap may be removed, thus giving access to the regulating resistor. Adjustment is made by means of the several screws shown. These make connection with the lead wires, which pass through a porcelain insulator. The lamp housing has two porcelain bushings for the binding posts inside the casing. The connections are seated in sturdy porcelain parts which insure good insulation.

Side supports of the frame serve as guides for the movement of the upper electrode. The beaded conductors for both the upper and lower electrodes lie in the upper part of the central chamber, but outside of the combustion chamber, so that they cannot be attacked by the products of



FIGS. 1 AND 2—INCLOSED FLAMING-ARC LAMP

combustion given off during the operation of the arc. Moving conductors in the combustion chamber are thus completely avoided.

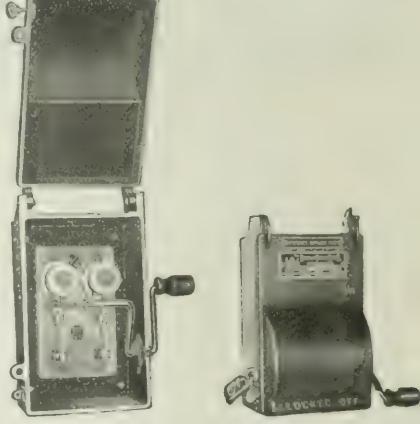
The chamber surrounding the feed mechanism consists of an outer and an inner casing and an outer and an inner globe. These outer and inner casings are fastened together at the top, while the whole armature section is supported from the upper casing by eccentric clutches. By means of the hollow cylindrical construction shown the space between the outer and inner casings is divided into two circular channels. A bayonet-joint construction connects the inner casing with the cylinder so that the casing can be easily

the horizontal, making it available as useful illumination.

The gases produced during combustion are conducted upward through the annular opening surrounding the arc, rising through this cylindrical chamber and then passing down again between the partition and the outer casing. After following the path shown by the arrows, they finally again enter the inner globe in a purified state. During the course of this circulation the gases are cooled and the products of combustion are deposited on the walls of the circulation chambers. Any material that chances to come over is dropped into the lowest part of the inner globe, thus assuring at all times cleanliness and transparency in those parts of the glass through which light is transmitted.

## Ironclad Entrance Switch

The Detroit Fuse & Manufacturing Company has designed an ironclad switch for entrance work which has the live metal parts inclosed in a housing so as to give both safety to the operator and protection to property. At the same time it provides means, outside the housing, for the safe operation of the switching mechanism. The switch, which is illustrated herewith, is inclosed in a cast-iron box and is operated from the outside. The cover of the box is designed so that it will close by gravity. The box may be sealed to prevent unauthorized persons gaining access to the fuses and the live metal parts of the switch. The switch is made for both two-wire and three-wire circuits. A spring device is provided for making a "positive-make, quick-break" action. This device automatically opens the circuit if good contact is not made when the switch is thrown "on." There is no possibility of the switch opening accidentally, however, when good contact is made. The




FIGS. 1 AND 2—IRONCLAD SWITCH, OPEN AND CLOSED

handle can be made detachable. This handle is so constructed that when placed on the operating shaft it will indicate the position of the interior mechanism the same as is done by a fixed lever.

The switch may be locked "off" by the use of a padlock making it impossible to operate the switch until the lock has been removed. With such a switch in use, it is not necessary, therefore, for central stations to remove meters and connections in apartments or other rented properties every time they are vacated. Fig. 2 shows the box closed and equipped with a padlock.

Although this switch is designed primarily for entrance

## Water Purification by Ozone in Large Office Building

An interesting mechanical and electrical equipment for water purification is in service in the recently erected office building of the Chicago, Burlington & Quincy Railroad Company in Chicago. The water used for drinking purposes, which is obtained from Lake Michigan through the city mains, is first clarified by being passed through three sand filters and one paper filter, after which ozone is applied to sterilize it.

This ozone is produced by two generators manufactured by the Held Company, Chicago, Ill., and is mixed with the water by a patented process developed by the same company. Each ozone generator contains ten tubes, an ozone-tube unit consisting of a vacuum tube, which contains an electrode, and an outer tube in which the vacuum tube is placed. This outer tube has a covering that acts as an electrode. Alternating current at 5500 volts is passed through the ozone tubes, and the action of the discharge in these tubes breaks up the oxygen molecules and produces the ozone. The construction of the tubes is such that there is no sparking or arcing, and the manufacturer declares that no nitrous oxide is formed when the ozone is generated.

Water enters the mixing device from the top and is then broken up into a fine spray. The ozone as generated is pumped to a mixer and is brought into contact with the water three different times. The water comes out in a continuous stream as it entered.

The action of the ozone coming into contact with disease-producing bacteria in water is asserted to be something like that which happens when fire and gunpowder are brought together, the ozone "burning" the carbon in the bacteria into carbonic acid, which passes out of the water in the form of bubbles, leaving no residue. This method of sterilizing, it is stated, does not affect the original mineral properties of

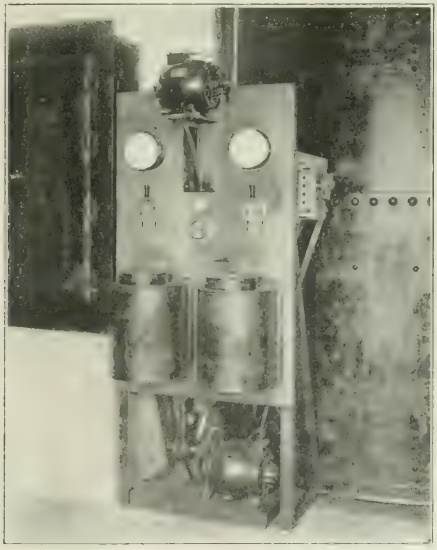


FIG. 1—ELECTRICAL EQUIPMENT FOR OZONE INSTALLATION

the water and leaves it clear, sparkling and sterile. The manufacturer says that the cost of treating 700 gal. of water by this method is less than 1 cent for the actual electrical energy necessary.

Fig. 1 shows part of the electrical equipment of the installation referred to. The motor-generator at the top of the switchboard changes the direct current of the building mains to alternating current. This is raised to 5500 volts in a transformer on the back of the board. At this voltage the energy goes through the two ozone generators attached to the front of the board. Below the switchboard is an electrically driven air pump which forces air through the ozone generators. The ozone passes through a pipe to the bottom of the mixer, shown above the large tank at the

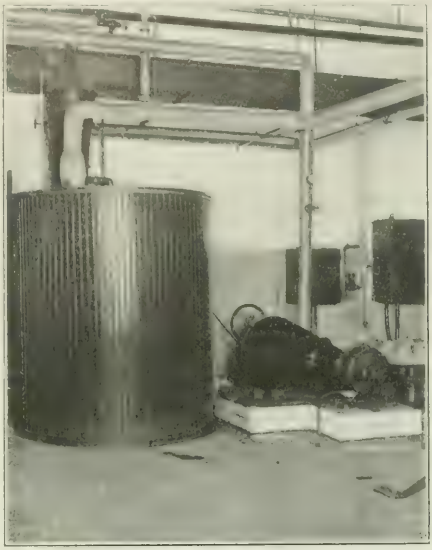


FIG. 2—TANK AND PUMPING EQUIPMENT

left in Fig. 2. The water is introduced at the top of the mixer. It comes from the filters shown at the right in Fig. 2 near the electrically driven circulating pump. The tank contains the storage supply of filtered and ozonized water.

## Electric Trucks for Parcels-Post Service

To make parcel-post deliveries with the greatest efficiency and lowest possible cost the United States Post Office Department has been conducting experiments with different kinds of vehicles. For the past ten months the post office at Indianapolis has employed two gasoline cars and two Waverley electric vehicles in this service. On Sept. 1 a third Waverley was installed, and since then the use of the two gasoline cars has been discontinued.

A comparison of the average daily results from the

COMPARISON BETWEEN GASOLINE AND ELECTRIC TRUCK PARCELS-POST SERVICE

| | Gasoline | Electric |
|---|---|---|
| Total number of parcels delivered per car | 136.5 | 271.5 |
| Stops made | 138 | 189 |
| Mileage | 45.6 | 18.75 |
| Time, hours | 8.5 | 7.035 |
| | $8.50 | $5.60 |
| Cost per parcel | $0.0623 | $0.02062 |
| Cost per stop | $0.0930 | $0.0326 |
| Cost per parcel-mile | $0.00187 | $0.0011 |
| Parcels per mile | 2.96 | 6.02 |

methods of delivery is given in the table, from which it will be seen that the cost per parcel-mile with the gasoline cars was 25 per cent higher than with the electric vehicle and this fact had much to do with abandoning the use of gas cars in this service.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Addition to Manufacturing Plant of National Carbon Company.**—The National Carbon Company, of Cleveland, Ohio, is building an addition to its Jersey City (N. J.) manufacturing plant. The increased business in the East, as well as the larger export trade which it is handling from New York and the feeling that Atlantic Coast customers should have the benefit of prompt deliveries, made necessary the new plant. With the new building, the Jersey City works will be the largest battery-manufacturing plant in the East. The building is at the present time under cover, and all contracts have been placed, so that work on it is progressing rapidly.

**Pipe Manufacturer Enters the Lighting Post Field.**—The Central Foundry Company, 90 West Street, New York, large manufacturer of piping, valve boxes and other power-plant accessory equipment, has been developing for some time a line of arc and incandescent lamp-posts and lighting standards of cast iron, for use by central stations and municipalities in ornamental street-lighting work. Installations of these posts have already been made in the East. The Central Foundry Company has had a long experience in the manufacture and handling of cast iron and has foundries, warehouses and branch offices in over a dozen cities throughout the United States.

**Bankruptcy of the D. L. Bates & Brothers Company.**—Mr. W. S. McConnaughey, referee in bankruptcy, has notified the creditors of the D. L. Bates & Brothers Company, of Dayton, Ohio, bankrupt, that the trustee has filed an application for an order to sell the goods of the company at the office of the referee, 605 Citizens' National Bank Building, Dayton, on Dec. 29 at 2 p. m. The trustee requests that sealed bids be asked for the goods of the bankrupt company, either in parcels or as a whole, and that the bidders have the privilege of raising their bids orally, if desired, at the time of sale. This application for an order of sale will come up for hearing before the referee on Dec. 29 at 9 a. m.

**Expansion of Electric Service in the South.**—Manufacturers of electrical equipment state that the outlook for business in the Central South is excellent, owing to the large number of electric-light plants to be built in towns and villages in the farming districts. "The South is an agricultural community," said the sales manager of a leading manufacturing concern, "and good prices for cotton have made that section prosperous. The establishment of electric-light plants in country towns all over the South is going forward at a rapid rate, and I do not look for these improvements to be interfered with by the tight money market or the business uncertainty which is hampering trade in some other parts of the country."

**Terry Turbo-Generator Set Used to Operate Lifting Magnet.**—To eliminate the necessity of dragging power wires along the track on which locomotive cranes using electromagnets work back and forth, experiments have been made in the way of fitting these cranes with small engine-driven generator sets to furnish current for the magnet. Trouble experienced with reciprocating sets has led to the use of small turbo-generator sets. Such an application has been made by the Brown Hoisting Machinery Company, of Cleveland, to a 15-ton crane with a 40-ft. boom, using a 5-kw turbo-generator set built by the Terry Steam Turbine Co., of Hartford, Conn. The magnet, energized from this unit, is used for handling pig iron and scrap within the reach of the boom. The set is driven by a reciprocating engine in the usual way when the raising and elevation of the boom are taken care of by the crane motor. The generator set is installed in a pit beneath the floor of the operator's cab, where it is entirely out of the way. Fitted with sight feed lubricators, the bearings are kept flooded with oil.

**Pro and Con of the Fixed-Price Question.**—Quite a lively discussion was drawn forth at the recent convention of the National Civic Federation, in a session devoted to the subject of regulation of industrial corporations, by the presenting of different sides of the "fixed-price" question. W. H. Ingersoll, of the American Fair Trade League, stated that it is a common thing for retailers who have stocks of goods of poor quality which they wish to sell to buy limited stocks of high-grade, well-known products and advertise their sale at ridiculously low prices simply to draw crowds, who are expected incidentally to buy up the other stocks of inferior goods while on the premises. The whole strength of this plan lies in the quality and reputation of the goods on which the price is cut, and Mr. Ingersoll explained how the operation of the above scheme works to the detriment of these high-grade goods. First there is a rush to get the article at the large reduction; then the public begins to ask why it should pay the regular price, if the article can be sold at a much lower figure, and refuses to buy it at its original price. The sale of the article at a cut price cannot be permanently continued, since it involves a loss to the dealer, so finally its sale in the community stops altogether. Mr. Ingersoll favored the fixing of prices on high-grade goods. Against fixed prices were E. W. Bloomingdale, counsel for the Retail Dry Goods Association, and E. E. Wise, who won the recent case before the Supreme Court of the United States in which R. H. Macy & Company were upheld in their right to sell copyrighted books below their list prices. The substance of the arguments presented by Messrs. Bloomingdale and Wise was that a fixed price need not have any relation at all to the actual value of the article on which it is placed, and, as retailers are primarily concerned with values, they should not be placed where the manufacturer of any article can dictate absolutely its terms of sale, regardless of the factor of actual value. It was argued that if price fixing is allowed on articles of big reputation and high grade it will inevitably be extended to cover or include all goods. The contentions of both parties are excellent and worthy to form parts of a single argument. They do not interfere in any way. The solution of the whole problem seems to lie in a determination of the actual value of goods and the fixing of a fair price below which they cannot be sold. Incidentally the interests of the manufacturer, dealer and consumer will all be advanced if the price set is low enough to give a fair profit and at the same time reach the largest possible buying field.

**Large Electric Vehicle Sale for Novel Service System.**—The Baker Motor Vehicle Company, of Cleveland, has just reported the sale of twenty-five electric trucks, ranging in capacity from 1000 lb to 4 tons, to the Delivery Company, of that city. The latter concern is operating a novel delivery service system. About half of its trucks are rented on a yearly basis to Cleveland concerns for their exclusive use. In connection with the continuous daily guaranteed operation of the trucks these companies have no expense other than the contract rental charge, based upon the size of the car. The other trucks are used in delivering packages, in varying quantities, for a number of Cleveland concerns, on the basis of a per package charge, depending upon the distance the package has to be carried. At the present time the Delivery Company is handling the retail delivery problems of 175 Cleveland firms, and during the month of November its cars averaged 41 miles per day and carried an average of 181 packages per car per day. On about Feb. 1, 1914, this company expects to occupy a building of its own now under construction, which will measure 100 feet by 140 ft. and will be one of the largest garages in the city. The

building, when completed, will have accommodations for seventy-five trucks, and the Delivery Company is planning to have in operation by the end of 1914 at least that number of cars of the above make. Three gasoline cars are in use for long-haul service to the suburbs.

**General Electric Company's Industrial Sales.**—Some idea of the variety and extent of the General Electric Company's business in the industrial field can be gained from the following list of companies which have recently placed with it orders for electrical equipment of various kinds: D. Auerbach & Sons, of New York City, candy manufacturers, have arranged to operate their plant with directly connected electrically driven machinery, for which 103 motors, ranging in capacity from 1 hp to 30 hp, with necessary control panels and accessories, will be employed. The American Zinc & Chemical Company, Burgettstown, Pa., will place in operation in its power plant two 2000-kw Curtis turbo-generators with 35-kw turbo-exciters, a 435-kva motor-generator set, a 300-kw generator, switchboard and auxiliary apparatus. The Firestone Tire & Rubber Company, Akron, Ohio, will add to the equipment of its plant for electric drive five large three-phase, 60-cycle, 440-volt motors, one of 400-hp, two of 500-hp and two of 700-hp rating, together with control panels. The Lehigh Portland Cement Company, Allentown, Pa., will add to the equipment of its power station a 1250-kva alternating-current generator and switchboard. The Linde Air Products Company, New York City, has ordered for installation on its plant at Kansas City, Mo., five motors ranging in size from 10 hp to 100 hp, with switchboard panels.

**Foreign Electrical Fields.**—A project is now under way for the development of a water-power site in Afghanistan and for the transmission of electrical energy at 44,000 volts to the capital city of that country, Kabul, about 40 miles from the falls. The work is in charge of A. C. Jewett, an American engineer, formerly with the General Electric Company. An outlay of between $500,000 and $600,000 will be required for the completion of this project, and approximately $300,000 will be put into machinery and materials. The electrical energy generated will be supplied to the industries of Kabul, including among others a gun factory, a woolen mill and a shoe factory. Street lighting and interior electric illumination will also be furnished to a limited extent. The machinery and material for the generating station and transmission line are being furnished by American companies, through F. & C. Osler, of Bombay, India, and Birmingham, England. With the completion of this enterprise there will probably be a demand for electrical cooking appliances in Kabul. In Edinburgh, Scotland, the municipal corporation has a monopoly of the production and distribution of electric energy for public use within the city, and the rates are comparatively low for both lighting and motor service. Electrical fittings of English, American and German make are all in use. The bayonet type of lamp and socket is most generally seen here, although the screw type is gaining in favor. Lock sockets are practically unknown and would probably find a fairly good market if offered. Metal-filament lamps are in demand, and the most common rating is 25 cp and 230 volts. The corporation does no wiring and does not handle electrical fixtures or appliances. These, with other electrical supplies and wiring devices, are obtained directly from the English and German manufacturers or from the English branches of American electrical companies.

**Private Concern Installs Sign Bearing Electrical Development Society Emblem.**—The Electrical Construction & Machinery Company, of Rock Island, Ill., is preparing to enter its new quarters at 1828 Third Avenue, Rock Island, and has planned some unusual publicity work in that connection. The building to be occupied after Jan. 1 was formerly a Y. M. C. A. branch, and the company is preparing a large roof sign, containing over 400 lamps, to call attention to the fact that the structure is no longer used for the purpose mentioned, but is now devoted to the electrical business. A 150-lamp sign over the Third Avenue entrance to the building will explain the company's field, and over the old cornerstone two attractive copper plates will be fastened, bearing the official emblem of the Society for Electrical Development, Inc. Part of the new building will be given up to the manufacture of fixtures and another section will be devoted to the exhibition of farm-lighting equ ment. The Trio Manufacturing Company will occupy p of the structure in connection with its panelboard a switchboard business. In response to an inquiry as to dustrial conditions in Rock Island and vicinity, the follo ing statement was made by the first-mentioned compa "Referring to the electrical conditions generally arou this part of the country, they are very satisfactory and one has any cause for complaint. We have three cities h (Rock Island and Moline, Ill., and Davenport, Ia.), wit total population of about 150,000, all served by the Tri-C Railway & Light Company. This concern, within the l two years, has been extending its lines through the ru districts and has taken on about a dozen small towns wit a radius of 30 miles from Rock Island. Its business alo these lines is very satisfactory. It is also picking up qu a number of farmers as the extensions progress. Not o that, but farmers who are not on its lines are installi storage-battery plants of their own, so that the business prospect from this one source should be very satisfacto within the next year."

**Electrical and Allied Imports in 1912-1913.**—Some id of the extent of the electrical import business as a wh and of the relative importance of the several branches that industry can be gained from the following table sho ing the values of imports of a number of materials for t year, July 1, 1912, to June 30, 1913, obtained from a tabu tion recently issued by the Department of Commer Washington, D. C.:

VALUES OF ELECTRICAL AND ALLIED IMPORTS IN 1912-13.

| Items | Valuation | Duty |
|---|---|---|
| Aluminum: | | |
| Crude form, scrap and alloys | $4,187,580 | $1,864, |
| Plates, sheets, bars and rods | 347,490 | 166, |
| Apparatus: | | |
| Orthopedical and scientific | 572,726 | .. . |
| Asbestos: | | |
| Unmanufactured | 1,760,845 | ... |
| Woven | 94,562 | 37, |
| Carbons: | | |
| Electric-light, lampblack or retort carbon | 363,656 | 114, |
| Electrodes and brushes | 185,590 | 55, |
| Coal: | | |
| Bituminous and shale | 3,560,893 | 526, |
| Culm and slack | 807,472 | 61, |
| Copper: | | |
| Pigs, ingots and bars | 44,579,920 | ... |
| China and porcelain wares, not decorated | 1,086,841 | 597, |
| Electric lamps: | | |
| Arc | 27,561 | 12, |
| Metal filament | 384,246 | 172, |
| Carbon filament | 78,070 | 35, |
| India rubber and gutta percha: | | |
| Crude | 101,377,290 | ... |
| Manufactured | 947,235 | 331 |
| Hard rubber | 254,444 | 89, |
| Iron or steel sheets | 28,120 | 6, |
| Mica: | | |
| Unmanufactured | 819,902 | 280 |
| Ground | 6,592 | 1, |
| Manufactured | 107,028 | 28, |
| Models of inventions | 27,574 | ... |
| Nickel: | | |
| Alloys, ingots and pigs | 123,323 | 19, |

NEW YORK METAL MARKET PRICES

| | Dec. 16 | | Dec. 22 | |
|---|---|---|---|---|
| | Bid. | Asked | Bid. | Asked |
| Copper | | | | |
| Standard spot* | Selling Prices | | Selling Prices | |
| | £ s d | | £ s d | |
| London, standard, spot* | 65 0 0 | | 64 3 9 | |
| Prime Lake | 14.50 to 14.75 | | 14.50 to 14.75 | |
| Electrolytic | 14.25 to 14.37½ | | 14.12½ to 14.3 | |
| Casting | 14.00 to 14.12½ | | 13.87½ to 14.0 | |
| Copper wire base | 15.50 to 15.75 | | 15.50 | ... |
| Lead | 4.00 | | 4.00 | |
| Nickel | 40.00 to 45.00 | | 40.00 to 45.0 | |
| Sheet zinc, f.o.b. smelter | 7.25 | | 7.25 | |
| Spelter, spot | 5.15 to 5.25 | | 5.15 to 5.2 | |
| Tin, spot | 37.70 to 37.95 | | 36.62½ to 37.0 | |
| Aluminum: | | | | |
| Prompt delivery | 18.75 to 19.00 | | 18.50 to 19.0 | |
| Future | 18.50 to 19.00 | | 18.50 to 19.0 | |

*COPPER EXPORTS

| | |
|---|---|
| Heavy copper and wire | 13.50 |
| Brass, heavy | 8.75 |
| Brass, light | 7.75 |
| Lead, heavy | 3.95 |
| Zinc, scrap | 4.37½ |

*OLD METALS

| | |
|---|---|
| Total tons to Dec. | 24,5 |

*From daily quotations of the New York Metal Exchange.

# Corporate and Financial

Good Report from Milwaukee.—The Milwaukee Elec- Railway & Light Company's gross earnings for twelve ths ended Oct. 31 last were about $5,970,000, in com- son with $5,620,000 in the preceding year. There was a nce of surplus over interest charges of over $1,000,000. dends are paid on the $14,350,000 outstanding capital k at the rate of 6 per cent.

**zark Power & Water Company Supplying Large Terri-**.—The large hydroelectric generating station of the rk Power & Water Company, on the White River in souri, has been in successful operation for about three ths and the transmission lines, recently completed, are ibuting electricity to a large area. The rating of this on is 15,000 kw and the electrical equipment was sup- l by the General Electric Company. The Ambursen raulic Construction Company, of Boston, Mass., built dam and power house, and the S. Norman Smith Com- furnished the hydraulic machinery. A 66,000-volt smission line, carried in part on steel towers, connects station with Springfield, Aurora, Monett and Joplin.

**curities of Keokuk Electric Company.**—Stone & Web- offer for sale $250,000 worth of the 6 per cent cumula- preferred stock of the Keokuk Electric Company, an ois corporation. This company does the electric-rail- electric-lighting, electric-motor-service and gas busi- of Keokuk, Ia., receiving electrical energy from the t hydroelectric plant of the Mississippi River Power pany in Keokuk. It also does the electric-railway and ric-lighting business of Hamilton and Warsaw, Ill., and ates an interurban electric railway between Keokuk, ilton and Warsaw. The population served is about o. It is said that the present earnings are over four a half times the preferred stock dividend requirements

**ock Issue of the Ottawa Light, Heat & Power Com-**, Ltd.—The directors of the Ottawa (Can.) Light, Heat ower Company, Ltd., will offer to the stockholders of rd March 1, 1914, the right to subscribe to a new stock , amounting to $700,000, on a basis of one new share ach four shares held. These subscriptions will be pay- in five equal monthly instalments, on the first of each th, from April to August, inclusive. An extra dividend per cent, in addition to the regular quarterly 2 per cent end, will be paid to stockholders on Jan. 1, 1914. A ar bonus was paid on July 2 last, so the yield on the for the past year has been 10 per cent. The proceeds e sale of the new stock referred to above are to be used tensions of the company's gas and electric properties.

**hio Utility Merger Approved.**—The Public Utilities mission of Ohio has approved the plans recently made ne merging of the Dayton Power & Light Company, the nington Water & Light Company and the Xenia Gas & tric Company, a proceeding which will involve the ac- tion of the entire outstanding stocks and bonds of the latter companies by the former. In connection with consolidation permission has been granted to the Day- company to issue 5 per cent bonds to the amount of 000 and 6 per cent cumulative preferred stock to the alue of $50,000 to be exchanged for the $125,000 5 per mortgage bonds and the $124,500 par value common of the Wilmington company. The Dayton Power & Company owns already all of the outstanding bonds all but five shares of the stock of the Xenia company

**ase of Distributing Systems in Los Angeles.**—Arrange- ts are being perfected for the temporary lease and final isition by the city of Los Angeles, Cal., of the electric ibuting systems within its limits now owned by the Los eles Gas & Electric Company, the Pacific Light & Power pany and the Southern California Edison Company city is planning to build a municipal hydroelectric plant onnection with its new aqueduct and will furnish elec ty for use in side city limits. If the present plans are ied out, the city will lease the above-mentioned systems five years, bearing all the expense of extension and uni ion during that period. At the end of that time the ems will be sold to the city. This plan, while providing companies with an opportunity to extend their lines out th [illegible] territory, at the same time removes the necessity for the issue of over $5,000,000 of municipal bonds to pay for the systems as they stand, at a time when heavy expense is planned in connection with the construction of the generating station.

**Baltimore Utility Financing.**—The Consolidated Gas, Electric Light & Power Company, of Baltimore, last week applied to the Maryland Public Service Commission for permission to issue $1,416,000 in common stock. Proceeds from the sale of this stock are to be used in paying off a number of short-term notes and other existing obligations. The petition was filed by Gans & Haman and signed by Vice-president Wagner of the company. Its directors will meet early next month to ratify the application officially. The petition recites that the amended charter of the corporation provides for a total capitalization of $20,000,000. Of this amount $14,160,088 is already represented by outstanding common and preferred stock. Further, the petition says that the company has recently made extensive improvements for which bills are payable. By issuing the amount of the stock asked for at present, which will be disposed of for cash only, the company will be enabled to save large amounts of interest which it is now paying on loans and short-term notes. At the offices of the company last week it was announced that a definite date for the stock sale has not as yet been set.

**Southwestern Holding Company Financing.** — Several months ago a new holding company was formed to take over the properties of the following electric light, power and ice companies operating in the southwestern part of the United States: The Comanche Light & Power Company and the Comanche Ice Company, of Lawton, Okla.; the Mangum (Okla.) Electric Company, the Pecos Valley Gas & Electric Company of New Mexico, Artesia, N. M.; the Quanah (Tex.) Light & Ice Company, the Chillicothe (Tex.) Light & Power Company and the Duncan (Okla.) Electric & Ice Company. The new holding concern is known as the Southwestern Cities Electric Company. Operation of the properties is in charge of J. C. Keys, who has been prominently connected with similar enterprises at Scranton, Pa., and Cleveland, Ohio, and with several of the above subsidiary concerns. With a capitalization of $6,000,000, the Southwestern Cities Electric Company has $4,000,000 in common and the remainder in cumulative preferred stock, bearing interest at 6 per cent per annum to September, 1915, and 7 per cent thereafter, and participating equally with the common stock after each has received 7 per cent

**Reorganization of the East St. Louis & Suburban Company Proposed.**—Reorganization and a change in capitalization of the East St. Louis & Suburban Company are proposed in a notice recently sent out to stockholders of that concern by E. W. Clark & Company, of Philadelphia, Pa. To escape the effects of recent legislation in New Jersey it is planned to organize under the laws of Maine a new company to be known by the same name, which will take over the assets and liabilities of the present concern. The latter controls the street-railway and electric-light properties in East St. Louis and Alton, Ill., together with interurban lines between those two points and to Belleville, O'Fallon, Collinsville and Edwardsville. Including St. Louis, the terminus of the company's line over Eads Bridge, the population served is approximately 875,000. Forty-five million passengers were carried over the company's lines in 1912, and 11,821,089 kw-hr. of electricity sold. This company has recently contracted for the sale of 5000 hp additional to large consumers in its territory, and the extensions and improvements made necessary by its increasing business require the additional funds which the reorganization will provide. The outstanding capitalization of the company is $14,000,000, divided equally between common and preferred stock. Under the new scheme, if it is approved, the same total capital will be divided into $6,000,000 common and an equal amount of 5 per cent cumulative preferred stock, with $2,000,000 of 6 per cent five-year convertible bonds. The $2,000,000 bonds, which are part of an issue of $3,000,000, will be convertible up to July 1, 1918, into an equal par value of 6 per cent cumulative preferred stock plus 33⅓ per cent of par value in common stock. The 5 per cent preferred shares may at any time be exchanged one-half into 6 per cent cumulative preferred and one-half into common stock.

## Business Notes

**The Wagner Electric Manufacturing Company,** of St. Louis, Mo., has appointed T. T. Richards assistant sales manager, instead of assistant manager, as stated in the Dec. 20 issue of the *Electrical World*

**The Wright-Howard Electric Company,** of 430 Chamber of Commerce Building, Los Angeles, Cal., is at present engaged in the electrical contracting and repair business. Its officers are W. F. Howard, president, and G. C. Wright, secretary and treasurer.

**The Brookfield Glass Company,** of 2 Rector Street, New York, manufacturer of glass insulators, announces the opening of a Southern office at 415 Fourth National Bank Building, Atlanta, Ga. D. R. Peteet, who was formerly connected with the Southern Bell Telephone & Telegraph Company, will have charge of this office, and the company is providing every facility for rendering quick service to its customers.

**The Roland Gas Electric Vehicle Corporation,** with plant and offices at Twentieth Street and Avenue B, New York City, is making a gas-electric truck of new design. The gas engine on this company's car drives an electric generator which supplies in turn two motors, one of which is geared to each of the rear wheels. H. B. Weaver is president of the concern, and its secretary is H. H. Miller. P. K. Hexter, the designer of the car, is vice-president and general manager of the company

**The Lumley Denly Company,** of Ashtabula, Ohio, has recently been incorporated to take over the business of the Ashtabula Manufacturing Company. The new concern will continue the manufacture of various hardware supplies and will in addition undertake the fabrication of a line of electrical specialties. The president of the new concern is Wilfred Lumley, for several years chief engineer of the Tungstolier Works of the General Electric Company. He will serve also as general manager in charge of the factory at Ashtabula. C. T. Denly, formerly with Austin & Denly, will be secretary of the new company

## New Industrial Companies

**The Ellis Electric Company,** of Rockford, Ill., has been incorporated by T. C. and G. Ellis and A. D. Linton. The company is capitalized at $15,000 and proposes to do a general electrical contracting business.

**The Miners' Safety Electrical Lamp Company,** of Newark, N. J., has been incorporated by E. O. Bannick, F. E. Seiler and E. Barnes, of Newark. The company is capitalized at $125,000 and proposes to manufacture miners' safety electric lamps.

**The Lucas Electric Device Company,** of Chicago, Ill., has been incorporated with a capital stock of $10,000 to manufacture and sell electrical and mechanical machinery, devices, etc. The incorporators are Mellen C. Martin, Herbert Bobb and Earl O. Taylor.

**The Button Bell Manufacturing Company,** of New York, N. Y., has been incorporated with a capital stock of $25,000 to manufacture electrical appliances. The incorporators are John McGullan, Robert Logan and Thomas Cassidy, 641 Fifty-third Street, Brooklyn, N. Y.

**The Federal Heating Company,** of Buffalo, N. Y., has been granted a charter with a capital stock of $15,000 to do a general contracting and electrical engineering business The incorporators are George C. Fox, Jeremiah A. Sullivan and Julius A. Schreiber, all of Buffalo.

**The United Gas & Electric Engineering Corporation,** of New York, N. Y., has been incorporated with a capital stock of $100,000 to do a consulting and contracting engineering business. The incorporators are H. Morgan, G. H. Olney and W. M. Clark, of New York, N. Y.

**The Newburgh Supply Company,** of New York, N. Y., has been incorporated by W. M. Hackland, of New York, N. Y.; B. W. Dole, of Newark, N. J., and J. W. Lane, of East Orange, N. J. The company is capitalized at $25,000 and proposes to do a general contracting business, deal in sand, cement, concrete, electrical construction, etc.

## Trade Publications

**Electric Signs.**—The Valentine Electric Sign Company, Atlantic City, N. J., has issued a card, size 7 in. x 9 in., referring to its electric signs. It contains a picture of the first "Do it electrically" sign that was installed by the Valentine Company for the Toledo Railways & Light Company.

**Bushings.**—A leaflet issued by the New Process Specialty Company, Enterprise Building, Milwaukee, Wis., refers to its Universal bushings. Two types are shown, one for use in switch boxes, loom boxes and all ⅝-in. knockouts and another for holding flexible tubing in cabinets, junction boxes and in all ½-in. conduit knockouts. A price list is given.

**Direct-Current Generators.**—Special Bulletin 22.5 of the Western Electric Company, New York, has for its subject direct-current generators. The bulletin gives a fully illustrated description of a very complete line of this class of apparatus, among the machines mentioned being engine-driven generators, three-wire engine-driven generators, marine generating sets, belt-driven direct-current generators and other types.

**Motors.**—Bulletin No. 247 of the Sprague Electric Works of the General Electric Company, 527 West Thirty-fourth Street, New York, refers to its round-type direct-current motors. These motors are manufactured in nine sizes of frames, ranging from 0.25 hp to 7.5 hp in output. Their general construction is fully described. A table showing the ratings of these motors and another giving the dimensions are included.

**Globes.**—The H. Northwood Company, Wheeling, W. Va., has issued an attractive catalog illustrating and briefly describing its "Luna" illuminating glassware. The soft-toned paper offers an excellent medium for showing to advantage illustrations of its various types and designs in globes. Charts are given of tests made by the Electrical Testing Laboratories, New York, showing the vertical distribution of light of a number of types of reflectors.

**House-Lighting Plants.**—The Edison Storage Battery Company, Orange, N. J., has issued an instruction book for installing and operating the Edison storage-battery house-lighting plant. It contains twenty-four pages, and the instructions are given in a lucid manner readily understood by the non-technical man. The illustrations and the carefully prepared wiring diagrams cannot fail to be of assistance to the owner of the individual lighting plant equipped with Edison batteries.

**Gifts Electrical.**—The Electric Shop of Chicago issued recently an interesting twenty-four-page booklet illustrated with pen-and-ink sketches telling of the convenience and usefulness of electrical appliances as Christmas gifts. As inquiries by mail were not solicited from the prospective customers to whom this particular pamphlet was sent, the quoting of specific prices was avoided. The object of the booklet was to impress upon its recipients the facilities of the Electric Shop and to bring them to the store for their Christmas selections.

**Storage Batteries.**—A pamphlet of twenty-four pages devoted to the general subject of Edison storage batteries in industrial transportation has recently been issued by the Edison Storage Battery Company, Orange, N. J. Industrial trucks, industrial railway locomotives, baggage trucks, freight trucks, tractors, cranes, engines and mining locomotives, equipped with Edison batteries, are briefly described and illustrated. The booklet is interesting as showing the extent to which the storage-battery equipment of trucks has succeeded other methods of haulage.

**Railway Line Material.**—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued a number of pamphlets covering railway line material. Catalog Section DS840 covers suspensions, ears and splicers. Section DS841 covers frogs, crossings, section insulators, switches and lightning arresters which are fully described and illustrated. Section DS844 covers strain insulators of various types and for different kinds of service. Section DS850 covers rail bonds and bonding tools and gives in some detail the methods of the manufacture and the selection of rail bonds.

# Personal Mention

Ir. **A. A. Hinton,** formerly connected with the Kaufman x.) Light & Power Company, has become manager of De Queen (Ark.) Ice & Light Company.

Ir. **Charles E. Bush,** of Tulsa, Ariz., has taken a position general manager of the Tulare County Power Company, are, Cal., vice Mr. C. E. Taylor, resigned.

Ir. **R. A. Wood,** of Warren, Ohio, has been appointed -business manager of the Brush Electric Company of veston, Tex., as successor to Mr. A. K. Young.

Ir. **A. H. Rich** has been appointed general manager of local office of the Coast Valleys Gas & Electric Com- y at Salinas, Cal., vice Mr. M. H. Gregg, resigned.

Ir. **A. K. Young,** who for the past two years has been in rge of the new-business department of the Brush Elec- Company of Galveston, Tex., has joined the New York f of Henry L. Doherty & Company.

Ir. **Aldis E. Hibner** has resigned as commercial man- r of the Empire Gas & Electric Company, Auburn, N. Y., has become associated with the Cumberland County ver & Light Company, Portland, Me., as sales manager.

Ir. **J. R. Evans,** who for the past four years has been nager of the Yorktown (Tex.) Light & Ice Company, has n retained in his present position by Mr. E. A. Clousnit- who purchased the system and who will make extensive rovements to the generating and transmission equip- nt after the first of the year.

Ir. **M. S. Sloan,** who has been assistant to Mr. A. H. d, president of the Birmingham (Ala.) Railway, Light Power Company, has been made assistant to Mr. J. S. ier, vice-president of the New Orleans (La.) Railway & ht Company and chairman of the executive committee he American Cities Company.

Dr. **Walter A. Rigg** has tendered his resignation as gen- manager of the Reading (Pa.) Transit & Light Com- y, effective Jan. 1. Although retiring from active man- ment, Dr. Rigg will retain his interest and holdings in underlying companies which were leased to the Read- (Pa.) Transit & Light Company.

Ir. **Milo R. Maltbie,** public service commissioner of the st District, New York, has been chosen as head of the -committee of the National Association of Railway mmissioners which will work with the Interstate Com- rce Commission in the valuation of railroad properties oughout the country. This appointment will involve a t amount of detail work without remuneration and will upy whatever of Mr. Maltbie's time is not now required his work as public service commissioner.

Ir. **Edward Schildhauer,** electrical and mechanical engi- r for the Isthmian Canal Commission, who has had ervision of the design and construction of the entire ctrical generating, distrib- ng and lock-control systems the Panama Canal, is a duate of the electrical engi ring school of the Univer of Wisconsin at Madison. llowing graduation Mr. ildhauer joined the engi- ering staff of the then Chi- o Edison Company and ntinued in its service for eral years. When the canal rk was started he was sum- ned to Panama and under- k the design of the elabo- e electrical equipment re- red for the operation of this at work. Since being sta- ned in the Canal Zone, with adquarters at Culebra, Mr. Schildhauer has made several its to the United States, during one of which the degree electrical engineer was accorded to him by his alma mater Madison. Since 1901 Mr. Schildhauer has been a member the American Institute of Electrical Engineers, and early the present year he was made a Fellow. He is a member the American Society of Mechanical Engineers.



EDWARD SCHILDHAUER

**Mr. M. H. Gregg** has resigned as general manager of the local office of the Coast Valleys Gas & Electric Company, Salinas, Cal., and accepted a position as secretary of the joint-pole committee which includes representatives of all of the large electric corporations now doing business in Oakland, Cal.

**Mr. John Bellamy Taylor,** after fourteen years' connection with the General Electric Company, has resigned as engineer of the foreign department in order to take up work independently as a consulting electrical engineer. Mr. Taylor, who was born in Brookline, Mass., in 1875, was graduated from the Massachusetts Institute of Technology in 1897. Following his graduation he became connected with the New England Telephone & Telegraph Company, and afterward was manager of the Burlington (Vt.) exchange and assistant to the division superintendent at Lowell, Mass. His connection with the General Electric Company began in 1899, when he joined the staff of the district engineer of the Boston office. There he remained until 1902, when he was transferred to the railway engineering department at Schenectady. In that department, and until appointed one of the company's consulting engineers in 1910, Mr. Taylor had to do with the details and problems of power house and substation design, transformer and rotary converter operation, parallel operation of alternating-current machinery, systems of connections for transmission and distribution and like work. At the time the single-phase railway system began to attract public attention Mr. Taylor's previous telephone experience led him to foresee many of the difficulties to be encountered in the telegraph and telephone problems presented, and he devoted himself actively to tests in the laboratory and in the field on points bearing on the signal and power relations. He presented a paper to the American Institute of Electrical Engineers in 1909 on "Telephone and Telegraph Systems as Affected by Alternating-Current Lines," and his services were sought by the Western Union Telegraph Company as an expert adviser in connection with the electrification of the New York, New Haven & Hartford. Bearing on the above problem, and perhaps related more closely to physics than to electrical engineering, may be mentioned Mr. Taylor's long-continued interest in acoustical matters. Before graduating, parts of his summer vacations were spent in church-organ factories, and, incidentally to his other work, he has advised on and supervised organ work. He was one of the first to demonstrate the possibilities of the oscillograph in studying telephone and telegraph problems and for sound analysis. With other engineers of the General Electric Company, he applied the oscillograph to a study of some of the electrical and acoustical problems of the "telharmonium." In the optical branch of physics Mr. Taylor was the first to demonstrate the much-discussed phenomenon of more than normal candle-power for a very brief interval from a tungsten lamp when first switched into circuit, to which he assigned the now familiar term of "overshooting." Soon after the placing on the market of the "autochrome" plate, he took up color photography and has done much work in this line with stereoscope, spectroscope and microscope, recently presenting papers to the American Physical Society showing some results of his investigations. In 1905 Mr. Taylor was awarded a prize of 1000 francs by the Association des Industriels de France contre les Accidents du Travail for his indicator showing the state of charge of an electrical conductor. He has taken an active interest in the work of the American Institute of Electrical Engineers and other scientific and engineering societies. The past year he was chairman of the Schenectady Section of the A. I. E. E. He is an honorary member of the Association of Railway Telegraph Superintendents. Mr. Taylor will continue to live in Schenectady, where he has his laboratory, and expects to divide his time between that place and New York City.



JOHN B. TAYLOR

# Construction

## New England

BOSTON, MASS.—Bids will be received by the Commissioner of Public Works of the city of Boston, 49 City Hall, Boston, until Jan. 15, 1914, for furnishing and erecting an electrically operated pumping plant for high-pressure fire service in the proposed underground pumping station in Charles Street, between Beacon and Boylston Streets. Forms of proposals and a set of two plans showing general arrangements and details may be obtained at Room 49, City Hall. L. K. Rourke is commissioner of public works.

NORWICH, CONN.—Within the next two months the Board of Lighting Commissioners expect to erect a concrete pumping station, 13 ft. by 15 ft. by 18 ft., at the municipal electric plant to provide space for pumping machinery to pump water for turbo units. S. J. Kehoe is manager.

WALLINGFORD, CONN.—The Board of Electric Light Commissioners expects to purchase within the next two months an additional two-phase panel for switchboard, 150-kw transformer (to convert energy from two-phase to three-phase) for the municipal electric-light plant, and to erect about 1 mile of transmission line; also within the next ten months to erect an addition to plant to provide space for office, storage and workrooms, etc., to cost about $7,000. A. L. Pierce is manager of the municipal electric-light plant.

## Middle Atlantic

BROOKLYN, N. Y.—Bids will be received by Henry S. Thompson, commissioner Department of Water, Gas and Electricity, Room 1904, 13 to 21 Park Row Building, New York, until Dec. 30 for furnishing and maintaining electric lamps for lighting streets, avenues, public buildings, parks and public places from Jan. 1, 1914, to Dec. 31, 1914, both inclusive. Blank forms may be obtained at the office of the department, Room 2339, Park Row Building, New York.

BROOKLYN, N. Y.—Bids will be received by Henry S. Thompson, commissioner Department of Water Supply, Gas and Electricity, Room 1904, Park Row Building, New York, until Dec. 30 for furnishing, installing, maintaining and reserving for the use of the high-pressure fire service all apparatus and equipment necessary for generating and transmitting 1830 kw of three-phase, 6600-volt, 25-cycle electrical power and furnishing and delivering this power, under the terms of this contract, from Jan. 1, 1914, to Dec. 31, 1914, both inclusive, at each of the high-pressure fire-service pumping stations in Brooklyn, at Furman and Joralemon Streets and at Willoughby and St. Edward's Streets respectively. Blank forms may be obtained at the office of the department, Room 2339, Park Row Building, New York.

COHOES, N. Y.—The State Conservation Commission has approved the application of the Cohoes Co. for the construction of a dam forming the forebay connecting the Cohoes Co.'s canal in Cohoes with the hydro-electric plant now under construction in the Mohawk River.

DUNKIRK, N. Y.—Steps have been taken by the Board of Water Commissioners to issue $15,000 in bonds to purchase two 400-hp boilers and a new condenser for the municipal water and electric-light plant and for payment of current bills.

EAST ROCHESTER, N. Y.—The Dispatch Ht., Lt. & Pwr. Co., of East Rochester, has applied to the Town Board of Perinton for permission to furnish electricity in that town.

FULTON, N. Y.—The Board of Public Works has awarded the contract for wiring and lighting the Broadway Bridge to the Fulton Lt., Ht. & Pwr. Co. for a period of 10 years at $26.15 per lamp standard. The plans provide for 30 standards.

GENESEO, N. Y.—The Geneseo Gas Lt. Co. has recently placed contracts for new engine, generator and street lamps. O. W. Landon is superintendent.

JAMAICA, N. Y.—Bids will be received by Maurice E. Connolly, president of the borough of Queens, Borough Hall, Fifth and Jackson Streets, Long Island City, N. Y., until Dec. 30 for furnishing labor and material for electric equipment for the town hall in Jamaica. Bids and blank forms may be obtained and plans and drawings seen at the above office.

JAMESTOWN, N. Y.—The Board of Park Commissioners has received a report from the General El. Co. outlining plans and recommendations for the proposed ornamental street-lighting system. The plans were submitted as follows: (A) For the installation of 105 6.6-amp luminous arc lamps to be suspended by brackets from trolley poles; the cost is estimated at $7,505 and maintenance at $5,022 per year; (B) for 89 6.6-amp luminous arc lamps, to be erected on ornamental standards, maintained by underground wires, to cost $13,727 and maintenance $4,256 per year; (C) provides for the erection of 213 ornamental lamp standards, to be equipped with either a single 500-watt lamp or five smaller units of 100 watts each, to cost $15,471 and maintenance $11,789 per year. The board has taken the matter under consideration.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities, foot of East Twenty-sixth Street, New York, until Jan. 5, 1914, for furnishing all labor and material required for the erection and completion of the general contract and electric work for the additions and alterations to storehouse at Blackwell's Island. Blank forms and further information may be obtained at the office of Frank J. Helmle, architect, 190 Montague Street, Brooklyn, where plans and specifications may be seen. Michael J. Drummond is commissioner.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities, foot of East Twenty-sixth Street, New York, until Jan. 5, 1914, for furnishing all labor and material required for electric wiring, gas piping and fixture work for the training school for nurses, maternity ward, reception building and boiler house, City Hospital, Blackwell's Island. Blank forms and information may be obtained at the office of Frank Sutton, consulting engineer, 80 Broadway, New York, where plans and specifications may be seen. Michael J. Drummond is commissioner.

NEW YORK, N. Y.—Bids will be received by Henry S. Thompson, commissoner of Department of Water, Gas and Electricity, Room 1904, 13 to 21 Park Row Building, New York, until Dec. 30, for furnishing and maintaining electric lamps for lighting streets, avenues, public buildings, parks and public places from Jan. 1, 1914, to Dec. 31, 1914, as follows: No. 1, for borough of Manhattan; No. 2, borough of the Bronx; No. 3, borough of Manhattan and the Bronx; No. 4, borough of Queens; No. 5, borough of Richmond. Blank forms may be obtained at the office of the department, Room 2339, Park Row Building, New York.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, N. Y., until Dec. 29 for installing electric-lighting equipment in the grand stands and on the athletic fields, Avenues K and L and East Seventeenth Street, borough of Brooklyn; Orchard Avenue and Munson Street, Astoria, borough of Queens; Hamilton Avenue and St. Mark's Place, New Brighton, borough of Richmond. A separate proposal must be submitted for each item. Blank forms, plans and specifications may be obtained or seen at the above office, also at the branch office, 69 Broadway, Flushing.

NEW YORK, N. Y.—Bids will be received by Henry S. Thompson, commissioner of Department of Water, Gas and Electricity, Room 1904, 13 to 21 Park Row Building, New York, until Dec. 30 for furnishing and installing, maintaining and reserving for the use of the high-pressure fire service all apparatus and equipment necessary for generating and transmitting 3250 kw of three-phase, 6600-volt, 25-cycle electrical power, under the terms of this contract, from Jan. 1, 1914, to Dec. 31, 1914, both inclusive, at each of the high-pressure fire-service pumping stations in the borough of Manhattan at Oliver and South Streets and at Gansevoort and West Streets respectively. Blank forms may be obtained at the office of the department, Room 2339, Park Row Building, New York.

ONTARIO, N. Y.—The New State Rys. Co. has awarded contract for construction of new building to replace its substation in Ontario destroyed by fire in November; also for equipment, including one 500-kw, 25-cycle rotary with necessary transformers to step down from 11,000 volts, switchboard apparatus, etc., and one 500-kva frequency changer, 25 to 60 cycles, for furnishing electricity to the Sodus Gas & El. Lt. Co. for distribution to its customers within a radius of approximately 10 miles. C. L. Cadle is electrical engineer.

SHERMAN, N. Y.—The Sherman El. Lt. Co. is erecting a storage battery to use on peak load. C. E. Cobb is president and manager.

BARNESBORO, PA.—Notice has been filed by John Barnes, Ernest L. Clark and Harry E. Bird that application will be made to the Governor for a charter for the Barnesboro-Spangler El. Lt. Co. It is expected that the Barnesboro and Spangler companies will be consolidated.

CAMBRIDGE SPRINGS, PA.—The Cambridge Springs El. Lt. Co. expects to purchase within the next 12 months 50 meters. C. W. Young is general manager.

CLEARFIELD, PA.—Papers have been filed announcing the consolidation of the Bellefonte El. Co., the Moshannon El. Co. and the Tussey Gas Co. with the Poe Steam Co., of Clearfield. The new company will be known as the State Centre El. Co. and will be capitalized at $575,000. The incorporators are: A. W. Lee, president; J. W. Wrigley, A. J. Musser and P. T. Davis, of Clearfield, Pa., and John S. Fisher, of Indiana, Pa.

LEBANON, PA.—The American Iron & Steel Co., of Lebanon, has closed a contract with Siemens & Halske, of Berlin, Germany, through their New York office, for two 20-ton induction furnaces of the Frick type. The furnaces will be of the double-ring type and will run on five cycle, single-phase and about 5000 volts. The power requirements will be about 1800 kw each. Two new generators will probably be installed by the company to operate the furnaces. The method of drive for the generators has not yet been decided upon.

MOUNT CARMEL, PA.—The Edison El. Ltg. Co., of Mount Carmel, expects to increase the generating capacity of its plant within the next ten months and will install generators with either engine or turbine. I. W. Keiser is superintendent.

PITTSBURGH, PA.—The Southside El. Co., of Pittsburgh, has surrendered its franchises and privileges to the local authorities. The company will sell its power plant and equipment to the Duquesne Lt. Co., of Pittsburgh.

READING, PA.—The County Commissioners have awarded the contract for lighting the new Penn Street Bridge to the Metropolitan El. Co., of Reading, for a period of five years. The company has sub-

[illegible] $2,[illegible] per year, to [illegible] have not made a selection [illegible] have been submitted to the new [illegible] the cost of installing and operating a municipal [illegible]-light plant, the power to be supplied from the water-works plant.

[illegible] The Board of Trade is negotiating with the Town [illegible] to install a flaming arc lamp lighting [illegible] Riverside Avenue, from Davis Avenue to the Bridge Street [illegible].

TRENTON, N. J.—The Board of Public Utility Commissioners has [illegible] an ordinance granting permission to the Western Union Tel. Co. to place its wires underground in the streets of Trenton.

WARK, DEL.—Within the next six months the Water and Light [illegible]issioners expect to purchase some wire, meters and tungsten lamps. [illegible] Hindman is secretary.

BALTIMORE, MD.—The Public Service Commission has authorized the [illegible] Gas, El Lt & Pwr. Co., Baltimore, to issue $743,000 in bonds [illegible]mprovements and extensions to its electric and gas distribution sys[illegible]nd enlarging plant. Of the proceeds $606,000 will be used for the [illegible]c system and $137,000 for the gas department.

CHAPMAN, W. VA.—The Ohio Valley Co., recently incorporated, it is [illegible]ed, contemplates the construction of an electric power plant, the [illegible]nent to consist (ultimately) of six 5000-kw turbo-generator units, [illegible]ed by a battery of boilers with automatic stokers. Present plans [illegible]le for an initial installation of one 5000-kw unit, the others to be [illegible]ed as demands require. From 27 to 60 miles of transmission lines [illegible]e erected. The cost of the power plant and distributing system is [illegible]ted at $750,000. J. M. Ashley is president and Godfrey M. S[illegible]s manager, 1413 G Street, N. W., Washington, D. C., and 90 West [illegible], New York, N. Y.

CHARLOTTE, VA.—Bids will be received by the Town Council until Jan. 5 [illegible] franchise to install and operate an electric-light system. J. F. Stin[illegible] acting mayor.

FREDERICKSBURG, VA.—Within the next 12 months the [illegible]El. Gener[illegible]Co., of Fredericksburg, expects to do some concrete work, install [illegible] etc., at its dam, 2 miles from town; also to purchase material [illegible]stribution system, including poles, wire, meters, transformers, etc.: [illegible]iring supplies as needed. W. Key Howard is superintendent.

RICHMOND, VA.—Superintendent E. W. Trafford in his report sub[illegible] to the administrative board asks for $125,452 for the municipal [illegible]c-light plant for the coming year. He estimates the cost of oper[illegible]at $46,066, and the remainder is for extensions, which include the [illegible]ation of three new feeders, extending from the electric plant to the [illegible]vest and central parts of the city, and transformers to install three [illegible]onal arc-lamp circuits; $3,700 is asked for the purchase of 100 addi[illegible] arc lamps.

WASHINGTON, D. C.—Bids will be received at the office of the chief [illegible] officer, War Department, Washington, D. C., until Jan. 5, 1914, [illegible]rnishing to the Signal Corps under proposal 686 the following [illegible]s: 75 large-interval time bells, 35 small-interval time bells, 400 [illegible] fuses, 500 1-amp fuses, 150 10-amp fuses, 40 Stromberg-Carlson [illegible]nging extension bells, etc. For further information address Major [illegible] Clarke, disbursing officer.

WASHINGTON, D. C.—Bids will be received at the Bureau of Sup[illegible]nd Accounts, Navy Department, Washington, D. C., until Jan. 6, [illegible] for supplies to be delivered at the various navy yards and naval [illegible]s as follows: Newport, R. I., Schedule 6144—5000 lb. of phosphide [illegible]cium. Key West, Fla., Schedule 6140—16 miscellaneous watt-hour [illegible]. Washington, D. C., Schedule 6142—miscellaneous drawn-brass [illegible], 780 lb. 4-in. I.D. Tobin bronze tubing, 53½ ft. 14-in. steel tubing. [illegible] will also be received until Jan. 13, 1914, as follows: Portsmouth, [illegible], Schedule 6157—two motor-driven pressure blowers. Philadelphia, [illegible]chedule 6150—one 60-hp vertical tubular boiler and erecting the [illegible] Bids will also be received until Jan. 20, 1914, Brooklyn, N. Y., [illegible]le 6132—six 5-kw radio sets for ship installation. T. J. Cowie is [illegible]ster-general, U. S. N.

## North Central

CRYSTAL FALLS, MICH.—Within the next eight months the Light [illegible]Gates Department expects to purchase a 300-kw generator and water[illegible]. J. H. Saunders is superintendent.

DETROIT, MICH.—Plans, it is reported, are being prepared for an [illegible]n to the power plant of the Convent of the Sacred Heart, Grosse [illegible].

DETROIT, MICH.—The Detroit Edison Co. on Dec. 19 took out a [illegible] for the construction of a reinforced-concrete power station, to [illegible]400,000, to be built on Lycasre Street near River Street. This is [illegible]a part of the new East Side plant of the company, designed to [illegible]te the Delray plant. Work on construction will begin at once.

DETROIT, MICH.—The stockholders of the Detroit Edison Co. have [illegible]ed the proposal authorizing an issue of $6,000,000 in bonds and to [illegible]e the capital stock from $15,000,000 to $25,000,000. It is proposed [illegible]e $3,500,000 of the bonds at par to the stockholders, the proceeds [illegible]used for reimbursing the treasury for expenditures for improve[illegible] etc., already made and to provide funds for extensions, etc., con[illegible]ted for the immediate future.

GREENVILLE, MICH.—Within the next eight months the R. J. Tower El. Co., of Greenville, expects to build a new concrete dam and pen[illegible]stock and reset turbines; also to purchase waterwheels. The company is purchasing constantly electrical appliances, including heating and cook[illegible]ing apparatus, washing machines, wiring supplies, etc. S. L. Tower is manager.

HIGHLAND PARK, MICH.—All bids submitted Nov. 3 for the instal[illegible]lation of an ornamental street-lighting system in Highland Park were rejected. The village may take up the question in 1914. R. M. Ford is clerk.

JACKSON, MICH.—Application has been made to the Michigan State Railroad Commission by John Carton, attorney, of Flint, representing the Commonwealth Pwr. Co., for permission to issue $349,000 in bonds for improvements to the systems of the following companies: The Saginaw Pwr. Co., $10,000; Consumers' Pwr. Co., $69,000; Pontiac Pwr. Co., $3,000; Bay City Pwr. Co., $6,000; Flint El. Co., $4,000; Grand Rapids & Muskegon Pwr. Co., $29,000; Au Sable El. Co., $87,000; Economy Pwr. Co., $133,000.

MOUNT CLEMENS, MICH.—The Eastern Michigan Edison Co., it is reported, will erect a new transmission line to Northern cities, including Richmond, New Haven, Lenox and other towns. The cost of the line is estimated at $9,000.

OXFORD, MICH.—The Eastern Michigan Edison Co., of Detroit, has been granted a franchise to operate in this township.

SAULT STE. MARIE, MICH.—The Edison Sault El. Co., of Sault Ste Marie, is constructing an addition to its power plant. Orders have already been placed for equipment. William Chandler is vice-president and general manager.

STURGIS, MICH.—The Board of Public Works expects to purchase within the next six months 30 ornamental lamp standards (for clusters or for single lamp, probably single series tungsten or nitrogen lamps); also within the next 12 months to purchase 150 meters, line material and transformers, costing approximately $4,000, and to purchase heating and cooking apparatus, vacuum cleaners and washing machines as demands require.

VICKSBURG, MICH.—At a special election held Dec. 15 the proposal to sell the municipal electric-light plant was defeated. The lighting plant will require extensive repairs, and funds to provide for same will necessitate the calling of a special election in the near future.

ALLIANCE, OHIO.—The Alliance Gas & Pwr. Co. has recently completed the construction of a new central station having an output of 2500 kw. The equipment consists of six boilers with a rating of 375 hp each, a coal-handling device arranged with an elevator carrying coal to the hopper bins in side cars, and a 1250-kw General Electric steam turbine. W. J. Rose is general manager.

CANTON, OHIO.—The Knight Tire & Rubber Co., of Canton, is installing additional equipment in its power plant, including a 650-hp generating unit, consisting of a Crocker-Wheeler generator, a Cooper-Corliss engine, a Cutler-Hammer switchboard, and three General Electric transformers (two 15-kva and one 20-kva). Melbourne Brothers, of Canton, are contractors.

CLEVELAND, OHIO.—The Cleveland El. Illg. Co. will furnish the street-lighting service during the year 1914 at the same rate given this year.

CLEVELAND, OHIO.—Work, it is understood, will be commenced by the city on the installation of a lighting system in the down-town district early next year. Cables will be laid under the street and 500 standards will be erected in the business district.

CLEVELAND, OHIO.—Plans are being considered by Mayor Baker, Director of Public Service Springborn and City Electrician Sarbinsky to compel the public utilities companies to eliminate all overhead wiring along the streets on which street cars are operated. It is estimated that approximately 125 miles of wires would have to be placed underground.

CLEVELAND, OHIO.—The City Council has authorized an expenditure of $60,000 for general piping and motor-driven pumping apparatus and accessories for the new municipal lighting plant. The sum of $45,000 has been set aside for the purchase and installation of transformers, foundations, wiring, instruments, switchboards, etc. J. W. Springborn is director of public service.

CLEVELAND, OHIO.—Bids will be received at the office of the secretary to the director of public service, No. 204 City Hall, Cleveland, until Jan. 7, 1914, for economizers, fans, etc., for the municipal electric-light plant in accordance with plans and specifications, which may be obtained in the office of the engineer of construction, Room 419, City Hall. Bids must be submitted on blanks furnished by the engineer of construction. W. J. Springborn is director of public service and W. H. Kirby, secretary.

EATON, OHIO.—Within the next two months the Eaton Ltg. Co expects to purchase one 72-in. by 18-ft. horizontal tubular boiler. F. J. Jackle is superintendent.

FREMONT, OHIO.—Application has been made by the Ohio Lt. & Pwr. Co., which controls plants in Fremont, Fostoria, Newark, Mount Vernon, Lancaster, Logan, Lexington and other towns in the State, to the Ohio Public Utilities Commission for permission to issue $1,300,000 in bonds and $720,000 in capital stock, the proceeds to be used for extensions and improvements to its properties.

GREENWICH, OHIO.—The Board of Public Affairs has recently installed in the municipal electric-light plant one 100-kva. alternating

current generator and exciter, also one switchboard panel for same, one 6-kva street-lighting regulator and switchboard panel. The company has replaced 27 arc lamps with 100 series tungsten lamps of 125 cp. I. H. Daniels is clerk.

LEIPSIC, OHIO.—The Leipsic El. Lt. Co. has recently purchased material for one-half mile of three-phase pole transmission line and three 7.5-kw transformers. J. W. Cottingham is proprietor.

LIMA, OHIO.—The contract for the electric light and power plant for the county infirmary, including the wiring of the buildings, has been awarded to the Sackett Mine Supply Co., Columbus, Ohio, at $1,785.

NELSONVILLE, OHIO.—The city of Nelsonville expects to purchase within the next 12 months material for distribution system, including transformers, poles, insulators, wire and meters and about $600 worth of incandescent lamps. C. C. Sharp is director of public service.

OBERLIN, OHIO.—The Oberlin Gas & El. Co. has just purchased a motor-generator, exciter and material for distribution system. Paul M. Loewe is general manager.

PORT CLINTON, OHIO.—The City Council has engaged the United Engineering Construction Co., Schofield Building, Cleveland, to prepare plans for the construction of the new municipal electric-light plant, for which bonds to the amount of $30,000 were authorized.

RAVENNA, OHIO.—Bids will be received at the office of the director of service until Dec. 29 for furnishing the necessary machinery, material and labor for the construction of a pumping plant at Muzzy Lake and Crystal Lake stations, in accordance with plans and specifications on file in the office of the director of public service. Work at Muzzy Lake station includes a new fireproof (brick and concrete) building, two motor-driven centrifugal pumps of 2000 gal. per minute capacity, one motor-driven centrifugal sump pump, intake and discharge pipes and 6000 linear ft. of transmission line, consisting of two three-phase lines complete. At the Crystal Lake station: one turbo-generator unit with a normal rating of 150 kw or 300 kw with exciter and condenser; one switchboard and one pump of 2000 gal. per minute normal capacity. Bids for this pump will be received on a crank and flywheel steam pump Corliss gear, a steam-turbine-driven centrifugal pump or a motor-driven centrifugal pump. John S. Mallette is director of service.

SHERWOOD, OHIO.—During the past year the gas engine in the municipal power plant has been replaced with a steam plant, at a cost of about $2,000. The equipment of the plant includes a 55-hp horizontal tubular boiler, one 35-hp automatic engine (boiler and engine manufactured by Houston, Stanwood & Gamble Co.), directly connected to a 40-kw, 125-volt Westinghouse generator. G. W. Woodworth is manager.

SHILOH, OHIO.—We are informed that the village of Shiloh does not contemplate the installation of a municipal electric-light plant as reported in the issue of Nov. 15. Electricity for operating the local system is obtained from the plant in Plymouth. H. S. Maring is village clerk.

SWANTON, OHIO.—The Swanton Lt. & Pwr. Co. is erecting a substation at Swanton, the equipment to include one five-panel General Electric switchboard and three 75-kva transformers. Ten miles of No. 4, 6, and 8 wire and 35-ft. (7-in.-top) poles will be used. All material has been purchased. Electricity for operating the system will be obtained from the plant of the Auglaize Pwr. Co., of Defiance. T. J. Pilliod is secretary.

WILMINGTON, OHIO.—The Dayton Pwr. & Lt. Co. has applied to the Public Utilities Commission for permission to take over by Jan. 1 the properties of the Xenia Gas & El. Co., of Xenia, and the Wilmington Wtr. & Lt. Co., of Wilmington. The Dayton company will operate both holdings separately, but will maintain transmission lines connecting all three systems. A line is nearly completed between Dayton and Xenia and from Xenia to Wilmington; a line will also be erected to supplement the electrical generating capacity of each plant. Electricity will also be furnished to farmers residing along the transmission lines.

WOOSTER, OHIO.—The installation of an ornamental street-lighting system in the business section is under consideration by the Board of City Commissioners.

ASHLAND, KY.—The name of the Ashland El. Lt. Co. has been changed to the Boyd County El. Lt. Co. and the limit of its indebtedness placed at $200,000.

BARBOURVILLE, KY.—The installation of a municipal electric-light plant in Barbourville is reported to be under consideration.

HORSE CAVE, KY.—J. T. Morton and P. T. Vaughn, of Horse Cave, are installing an electric-light plant in connection with their business to furnish electricity for lamps and motors here. The equipment will include one 50-hp Voght boiler, one 30-hp Gardiner engin and a 250-kw direct-current Clarke generator with switchboard for same and 150 poles. About 75 meters have been spoken for; lamps and meters have not yet been purchased.

IRVINE, KY.—Plans are being considered by V. M. Gaines, of Irvine, for the installation of an electric-light plant here. A franchise, it is understood, will be sold within 30 days.

MURRAY, KY.—The City Council has entered into a contract with the City Lt. Co., of Murray, for lighting the streets of the city for a period of 20 years. Under the terms of the contract new lamps and fixtures are to be installed throughout the city. Wires in the business section will be placed underground and ornamental standards carrying four-lamp (60-watt-tungsten) clusters will be erected.

BATESVILLE, IND.—The Batesville El. Lt. & Pwr. Co. is completing a new power plant having an output of 750 kw. A. W. Rodaweer is purchasing agent.

COLUMBIA CITY, IND.—Within the next year the managers of the municipal electric-light plant will erect a coal conveyor to carry coal from the railroad track to the boiler room. F. T. Schultz is superintendent.

KNIGHTSTOWN, IND.—The town of Knightstown has recently purchased a 100-kw Curtis steam turbine and a new air compressor. N. Hiatt is superintendent.

ASTORIA, ILL.—The Central Illinois Public Ser. Co., of Mattoon, has purchased the property of the Astoria El. Lt., Ht. & Pwr. Co.

BLANDISVILLE, ILL.—Within the next six months C. R. Huston, owner of the local electric-light plant, expects to purchase some 4-ft. by 18-in. flues.

CAIRO, ILL.—The Cairo Ry. and Lt. System is erecting a 16,000-volt transmission line from Cairo to Mounds City and to Mounds. All material has been purchased.

CLAYTON, ILL.—During the next year the Central Illinois Pub. Ser. Co., of Mattoon, Ill., expects to change the local power house to a substation. As yet no plans have been decided upon. Edward B. Doocy is local manager.

EARLVILLE, ILL.—The City Council has granted the Illinois Northern Utilities Co., of 137 South La Salle Street, Chicago, a franchise to furnish electricity in Earlville and also a contract for street lighting. The company exepects to erect a new distribution system and install tungsten lamps on gooseneck posts for street lighting, except in the business district, where the city is contemplating installing an ornamental street-lighting system. Mr. Danielson, of Mendota, is engineer in charge. O. E. Fischer is city clerk.

GALESBURG ILL.—The capital stock of the Galesburg Ry., Ltg. & Pwr. Co. has been increased from $50,000 to $3,500,000. W. H. Carnahan is president.

JACKSONVILLE, ILL.—The City Council has adopted a resolution providing that if the $50,000 bond issue for the construction of an electric-light plant is approved at the election to be held Dec. 20 it will favor the construction of the series tungsten street-lighting system as outlined in Proposal B, details of which were published in the issue of Nov. 22.

MASCOUTAH, ILL.—The managers of the municipal electric-light plant expect to purchase some poles within the next six months. Charles Sparn is superintendent.

MORRISONVILLE, ILL.—The Southern Illinois Lt. & Pwr. Co., of Morrisonville, is erecting 4 miles of 16,000-volt transmission line to Palmer and substation with distribution lines and street lamps. The company is also installing a 200-kva Terry turbine with generating equipment, three-phase, 16,000-volt transformers and lamps, arresters and 2300-volt switchboard with General Electric regulator, and 3,000 ft. of steam-heating mains to supply 15,000 ft. radiation (American District Steam Co. has contract). The company is also installing Westinghouse street-lighting regulator and equipment for 150 series tungsten lamps. Paul Dewitt is manager.

OQUAWKA, ILL.—The managers of the municipal electric-light plant have recently purchased a 60-kw direct-current generator. Charles L. Brooks is manager.

BLACK RIVER FALLS, WIS.—The municipal electric-light plant, which was entirely destroyed by flood on Oct. 19, 1913, has been rebuilt. H. H. Parsons is city clerk.

CLINTONVILLE, WIS.—Within the next 12 months the town of Clintonville expects to purchase one 12-in. by 24-in. Corliss engine, one 150-kw, 60-cycle, three-phase, 2300-volt generator, three-pole, double-throw switches for 2300 volts, one Tirrill regulator, two switchboards and integrating wattmeters for the municipal electric-light plant. George C. Stewart is superintendent.

EAU CLAIRE, WIS.—Within the next six months the Chippewa Valley Ry., Lt. & Pwr. Co., of Eau Claire, expects to erect 30 miles of 30,000 volt transmission lines. George B. Wheeler is secretary and general manager.

KILBOURN, WIS.—The Electric Light Commission expects to purchase within the next six months one 100-kva or 125-kva frequency changer set; also within the next three months one small motor-driven centrifugal pump of about 75 gal. per minute capacity, heating and cooking apparatus, coffee mills, vacuum cleaners, washing machines and other labor-saving devices. David G. Howey is manager.

LANCASTER, WIS.—The Lancaster El. Lt. Co. has been reorganized and the name changed to the Lancaster Lt. & Pwr. Co.; the capital stock has been increased to $100,000. Arrangements are being made to erect a transmission line from Lancaster to Fennimore, for which material has been purchased. The erection of a transmission line to at least one other town is contemplated. The company, it is understood, is also planning to increase the output of the plant and will install new equipment, including engine, boilers, etc. The new officers are: H. L. Clarke of Chicago, president; George P. Angus, vice-president and manager; Benjamin Squire, secretary and treasurer.

MARSHFIELD, WIS.—The Water and Light Commission expects to put into operation the new cross-compound Corliss engine directly connected to a 375-kva, 2300-volt generator, purchased from the Allis-Chalmers Co., within the next 30 days. T. N. Young is superintendent.

[illegible] ... Within the next 12 months the local electric [illegible] ... waterwheel and pump, also elec[illegible] ... switches, etc. Joseph Chandler is treasurer and manager.

[illegible] PRAIRIE, MINN.—Within the next eight months the [illegible] Mfg. Co., at Pleasant Prairie, expects to purchase a [illegible] ... Thomas Liscomb is superintendent.

[illegible]WOOD, MINN.—Investigations are being made by the Flood [illegible] ... cost of establishing and operating [illegible] ... M. W. Hegeley is president.

[illegible]PARK, MINN.—The installation of an electric light plant in Oak [illegible] ... under consideration. Leon C. Wiley is interested.

[illegible]HAM, MINN.—A committee, consisting of Amos Marshall, Dr. [illegible]ld and others, has been appointed by the City Council to make [illegible]zation relative to improving and enlarging the municipal electric [illegible]plant or to purchase electricity to operate the municipal electric [illegible]ystem.

[illegible]RIEN, MINN.—The City Council expects to erect within the [illegible]ght months an addition to power-house and to purchase one boiler, [illegible]50-kw. 250-volt generator, one 250-hp engine, feed-water heater, [illegible]tack, condenser and a switchboard panel with recording instruments. [illegible]he Council will engage a consulting engineer at once to take charge [illegible] proposed work. W. R. Haney is superintendent.

[illegible]AR RAPIDS, IA.—The Iowa Rv. & Lt. Co., of Cedar Rapids, has [illegible] for a franchise to erect a high-tension transmission line from [illegible] Rapids to Tama and Toledo, a distance of 52 miles, which, it is [illegible]tood, will ultimately provide for a high-tension transmission line, [illegible]ing from Anamosa to Perry, 184 miles long.

[illegible] MOINES, IA.—The City Council, we are informed, does not con[illegible]e the installation of a municipal electric-light plant as reported [illegible] issue of Nov. 29. Horace Susong is city clerk.

[illegible]UQUE, IA.—The Union El. Co. is now installing a 5000-kw tur[illegible]urchased last spring. All auxiliaries were purchased at the same

[illegible]LVILLE, IA.—At a special election held recently the proposal to [illegible]onds for the installation of a municipal electric light plant was

[illegible]A, IA.—Within the next eight months the managers of the munici[illegible]ctric-light plant expect to purchase one 60-in. by 16-ft. high-pressure [illegible] with all necessary fittings. Frank Gue, Jr., is superintendent.

[illegible]ALOOSA, IA.—The Oskaloosa Trac. & Lt. Co. expects to pur[illegible] within the next 12 months a 750-kw alternator and engine and a [illegible] boiler; also to erect additional transmission lines. H. W. Garner is [illegible] manager.

[illegible]OT MOUND, IA.—The contract for the construction of the pro[illegible] municipal electric-light plant has been awarded to Martin & [illegible]s El. Co., of Des Moines. W. H. Groves, of Ames, Ia., is engineer [illegible]rge; L. C. Calson is city clerk.

[illegible] CITY, IA.—The Sac City El. Co. expects to erect within the [illegible]x months 17 miles of 13,200-volt, three-phase transmission line and [illegible]chase one 250-hp Corliss engine. H. W. Deminger is general [illegible]r.

[illegible]TON, MO.—Bids will be received by the board of managers of [illegible]issouri School for the Deaf at Fulton until Jan. 13, 1914, for [illegible]ing two new horizontal tubular boilers, complete, moving present [illegible] engines, pumps, etc.; resetting same, rearranging main and heat[illegible]es, filling, grading and concreting floors in new power house, as [illegible]d in special specifications and all to be included in one propo[illegible]. Plans and specifications are on file at the institution and also [illegible] office of M. F. Bell, architect, Fulton. D. A. Sharp is president [illegible]rd.

[illegible]LIN, MO.—The Empire District El. Co., of Joplin, has applied to [illegible]te Public Utilities Commission of Kansas for permission to issue [illegible]0 to $200,000 in bonds to extend its transmission lines and enlarge [illegible] plants at Joplin and Lowell, Kan. The company is now installing [illegible]ressure steam-driven turbine at Lowell.

[illegible]SHALL, MO.—The City Council has called a special election to [illegible] Dec. 18 to submit the proposal to issue $70,000 in bonds for the [illegible]ction of a municipal electric-light plant to the voters. The propo[illegible]was recently defeated.

[illegible]RYVILLE, MO.—The power house and distribution system of the [illegible]County Public Utilities Co. were completed in July. A deep well [illegible] will serve the electric plant and from which the city may be [illegible]d is nearly finished. A. D. Brinkerhoff is secretary and treasurer [illegible] National Lt. & Pwr. Co., of St. Louis, which controls the Perry [illegible] company.

[illegible]CHARLES, MO.—The American Lt. & Pwr. Co., of St. Charles, [illegible]plied to the Missouri Public Service Commission for permission [illegible]t transmission lines in St. Charles County outside of the incorpo[illegible]oundaries of St. Charles, in order to furnish electrical service to [illegible]s and unincorporated villages in this county.

[illegible]ST PLAINS, MO.—The Board of Public Works expects to pur[illegible] within the next 12 months about 25 meters. W. P. Britain is [illegible]tendent.

[illegible]IR, NEB.—At an election held Nov. 28 the proposal to issue [illegible] in bonds for the construction of a municipal electric-light plant was defeated. An item was published in the issue of Oct. 25 stating that the proposal to issue bonds for a municipal electric-light plant and for extensions to water-works system had been carried.

PRAGUE, NEB.—Within the next 10 months the village of Prague expects to erect a new building for the municipal electric-light system. Anton Kasper is village clerk.

SEWARD, NEB.—The city of Seward expects to purchase within the next six months one 150-hp high-pressure boiler, one 125-hp, three-phase generator and switchboard, and one 42-in. by 125-ft. smokestack; also within the next three months it expects to purchase one carload of 25-ft. and 30-ft. (7-in. top) poles. J. Martz is superintendent.

STRATTON, NEB.—The Board of Trustees is contemplating the purchase of a 15-hp, 220-volt direct-current motor within the next six months. Elmer Martin is engineer.

HANOVER, KAN.—Within the next nine months the managers of the municipal electric-light plant expect to purchase a boiler and engine, or oil engines, switchboard panels, poles, insulators, wires, meters, incandescent lamps, posts, transformers, heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, etc.; also to erect extensions to transmission line. J. G. Granzer is superintendent.

OTTAWA, KAN.—The Board of Water and Light Commissioners may possibly purchase within the next 10 months a water-tube boiler, and possibly a steam turbine within the next 18 months. W. O. Myers.

## Southern States

FAIRMONT, N. C.—The town of Fairmont is contemplating the installation of a municipal electric-light plant, to cost about $10,000.

LILLINGTON, N. C.—Plans are being considered by W. T. Brown, of Lillington, and associates to build an electric-light plant to furnish electricity in Lillington. The proposed plant will have an output of about 50 kw. Boiler, engine, generator, switchboard, wire, poles, etc., are to be purchased. Mr. Brown would like to receive estimates of cost of the proposed equipment.

ROXBORO, N. C.—The Roxboro Lt. & Pwr. Co. has recently installed a horizontal, double-acting plunger pump (Dean Brothers) and a stationary heater. M. R. Long is secretary and manager.

SPRAY, N. C.—The Marshall Field Co., of Spray, it is reported, contemplates the installation of a steam power plant, to cost $150,000, to operate its cotton mills.

TARBORO, N. C.—Improvements are being made to the municipal electric-light plant, involving an expenditure of about $10,000. New engines and generator will be installed. J. H. Jococks is city clerk and treasurer.

WILMINGTON, N. C.—The City Council is contemplating engaging an engineer to make a survey and prepare estimate of cost of the installation of a municipal electric-light plant.

TIMMONSVILLE, S. C.—The Carolina Lumber & Pwr. Co., of Timmonsville, has recently installed a 150-hp high-pressure boiler. A. I. Broom is secretary and treasurer.

WALTERBORO, S. C.—A proposal for the installation of an electric-light plant in Walterboro has been submitted to the City Council by the Walterboro Ice. & Lt. Co. and Mr. Ingraham, of Savannah, Ga.

GLENNVILLE, GA.—Bonds for the construction of a municipal electric-light plant have recently been voted. Dr. L. A. De Loach is Mayor.

MADISON, GA.—Within the next six months the electric-light commission expects to rebuild one-half mile of transmission line and to purchase within the next eight months one motor-driven pump, one car load of 35-ft. poles, and a car load of 45-ft., 50-ft. and 60-ft. poles. G. W. Hubbard is superintendent.

BARTOW, FLA.—The City Council has adopted an ordinance authorizing an expenditure of $20,000 for extensions and improvements to the municipal electric-light plant and $6,000 to extend the lighting system and to establish an ornamental street-lighting system.

DAVENPORT, FLA.—Within the next two months the Davenport Lt. & Ice Co. expects to erect an 85-line telephone system. The company also expects to purchase within the next 30 days all kinds of household appliances, such as a central station would use to build up a load factor. It will also need some small singe-phase, 110/220-volt motors, from 1/12 hp to 3 hp. H. T. Natziger is secretary.

JACKSONVILLE, FLA.—New equipment is now being installed in the municipal electric-light plant, including two 520-hp Babcock & Wilcox boilers, eight switchboard panels and 14 50-magnetite-arc-lamp tub transformers; also three 1000-kva, 6600/2300-volt transformers in substation and six three-phase, 2300-volt regulators. W. H. Tucker is superintendent.

LABELLE, FLA.—An extension has recently been completed to the E. E. Goodno electric-light and ice plant and a 150-hp boiler installed.

LEESBURG, FLA.—The Leesburg Ice Co. is extending its transmission line to the next town, a distance of 5 miles. Material for the extension has been contracted for. J. Y. Clark is president.

OCALA, FLA.—The Florida Pwr. Co., of Ocala, has recently closed a contract with the Dunnellon Phosphate Co. to furnish six of its plants with hydroelectric power and also five overburden outfits. The company will also install motors in its machine and railway shops. In order

to supply this service the Florida Pwr. Co. will erect a substation at Hernando, the equipment to consist of three 500-kva water-cooled, single-phase transformers, stepping down from 60,000 volts to 11,000 volts. The distribution lines will carry 11,000 volts and at each one of the plants the energy will be stepped down from 11,000 to 2200 volts. Orders have recently been placed with the Westinghouse El. & Mfg. Co., of Pittsburgh, Pa., for high-tension breaker, lightning arresters, 11,000-volt breakers and other necessary auxiliary apparatus, B. C. Camp is president of the Florida Company.

TAMPA, FLA.—The Tampa El. Co. has called a meeting of the stockholders to be held Jan. 5, 1914, to vote on the proposal to increase the capital stock of the company by $374,000, the proceeds to be used to pay for improvements and extensions during the present year and for further improvements during the coming year.

BIRMINGHAM, ALA.—The Birmingham Ry., Lt. & Pwr. Co., it is reported, contemplates extensions and improvements to its system, for which estimates are now being prepared. Ford, Bacon & Davis, of New York, N. Y., are chief engineers.

CARBON HILL, ALA.—Within the next two or three months the managers of the municipal electric-light plant expect to purchase deep-well pumping equipment; also within the next two months one 35-hp motor to drive a gin and possibly a 15-hp motor for another industrial plant. L. C. Smith is superintendent.

EUFAULA, ALA.—Within the next two months the Electric Light and Gas Department of the city of Eufaula expects to install a condenser connected to engine, purchased from the Wheeler Condenser & Engine Co. J. L. Skinner is superintendent.

OZARK, ALA.—Within the next 12 months the city of Ozark Water and Light Department expects to purchase three 100-hp boilers, one 200-kw generator and switchboard, one 300-hp Corliss engine, one water heater, one boiler-feed pump, one 10-in. deep well, one air compressor, one large pump, etc. B. C. Dowling is superintendent.

BELZONA, MISS.—The Electric Light Commissioners expect to purchase within the next 12 months some electrical appliances, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, switches, etc. J. J. Sislof is superintendent.

CLARKSDALE, MISS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 27 for construction complete, including mechanical equipment and approaches, of the United States post office and court house at Clarksdale, Miss. Drawings and specifications may be obtained from the above office or from the custodian of site at Clarksdale. O. Wenderoth is supervising architect.

MERIDIAN, MISS.—The Meridian Lt. & Ry. Co. has recently completed an extention to its power-house and is now installing a 2,000-kw turbine and erecting a smokestack (180 ft. by 8 ft. 6 in.).

TYLERTOWN, MISS.—The Tylertown Lt. & Pwr. Co. expects to purchase within the next 12 months a 60-hp engine. C. A. Stevens is secretary and treasurer.

YAZOO CITY, MISS.—The Public Service Commission has purchased for January delivery a motor-generator and a six-panel switchboard. James S. Butler is superintendent.

BRINKLEY, ARK.—The Brinkley Wtr. & Lt. Co. expects to change its system from direct to alternating current and to lay about 12,000 ft. of 4-in. water mains. The company has not yet decided when this will be done. J. W. Neff is superintendent.

DE QUEEN, ARK.—The De Queen Ice & Lt. Co. expects to purchase within the next six months a 25-kva, or 35-kva, single-phase, 60-cycle revolving-field generator, and exciter, switchboard, instruments, etc. A. A. Hinton is manager.

FORT SMITH, ARK.—A movement has been started for the establishment of a municipally-owned electric plant.

LITTLE ROCK, ARK.—Within the next six months the Merchants' Ltg. Co., of Little Rock, expects to install a 1200-hp boiler and necessary piping, also one 2500-kva turbine and generator, one 50-kw motor-generator exciter set and switching apparatus for same. C. E. Rose is secretary and manager.

MENA, ARK.—Within the next few months the Mena El. Lt. & Pwr. Co. expects to purchase a series tungsten street-lamp regulator and 150 hoods for street lamps.

BOYCE, LA.—The town of Boyce expects to award contracts on Jan. 12 for one 60-hp or 65-hp oil engine and one 50-kva, 60-cycle, 2300-volt generator complete. W. L. Thompson is superintendent.

HUGO, OKLA.—Improvements are contemplated to the plant of the Hugo Ice & Lt. Co., recently taken over by the American Pub. Ser. Co. Material, including weatherproof wire, transformers, poles and insulators, will probably be purchased within the next 30 to 60 days. Additional equipment for the plant has not yet been decided upon. H. E. Mole, engineer, 55 Liberty Street, New York, N. Y., is purchasing agent. J. W. Dawley is vice-president and general manager.

MEDFORD, OKLA.—The new brick power-house for the municipal electric-light plant has been completed, replacing the one destroyed by fire on Aug. 12. Charles Berger is superintendent.

GILMER, TEX.—The Texas Pub. Ser. Co. has recently completed the erection of a power house and ice-storage plant. Theodore Dienst is business manager.

HOUSTON, TEX.—The Houston Ltg. & Pwr. Co. has recently built an addition to its boiler room and an extension to the engine and turbine room is now under way. The company has placed orders for one 6,250-kva generator and turbine; also pump and condenser. W. W. Reed is superintendent.

KERRVILLE, TEX.—The Kerrville El. Lt., Ht. & Pwr. Co. has recently installed a small engine and a 13½-kw, 2,300-volt, three-phase, 60-cycle alternator (belted). T. Holdsworth is proprietor and manager.

## Pacific States

CENTRALIA, WASH.—The Commissioners of Lewis County have granted the Washington Pub. Ser. Co. a franchise to erect a pole transmission line on the old Chehalis Road between this city and Chehalis, and along Harrison Avenue in Centralia, northwest to the county line. The company proposes to transmit electricity from its plant at White Salmon on the Columbia River.

SPOKANE, WASH.—The capital stock of the Washington Wtr. Pwr. Co., of Spokane, has been increased from $15,000,000 to $20,000,000. The larger portion of proceeds will be used in the construction of a power plant at Long Lake and the remainder in connecting up several small towns in the Cœur d'Alene mining district with transmission lines.

WILBUR, WASH.—The Wilbur Electrical Co. has sold its plant and holdings to the Washington Wtr. Pwr. Co., of Spokane, which will take over the property Jan. 1, 1914. The Washington Wtr. Pwr. Co. will furnish electrical service here from its plant on the Spokane River.

CARLTON, ORE.—The Yamhill El. Co., of Newberg, is extending its 11,000-volt transmission line from Lafayette to Carlton to furnish electrical service here. An outside substation will be erected to meet the requirements for about 100 kw. About 200 poles and No. 4 B. & S. copper wire will be required for the distributing system and about 100 meters. The work is being done by the company and is well under way. C. J. Edwards is manager.

PORTLAND, ORE.—The commissioner of public utilities has recently instructed the Portland Ry., Lt. & Pwr. Co. to install arc lamps in the Laurelhurst district to take the place of the cluster lamps now in use.

ST. JOHNS, ORE.—Property owners have recently petitioned the City Council for the installation of arc lamps on certain streets in the city.

COACHELLA, CAL.—The Coachella Valley Ice & El. Co. has applied to the Public Service Commission for authority to issue $300,000 in bonds, the proceeds to be used for extensions to its system. The company proposes to erect a transmission line from the high-tension transmission line of the Southern Sierras Pwr. Co. in Banning through Coachella, where a substation is to be erected, at a cost of about $11,000. The transmission line, which will be carried into the Imperial Valley, will cost $211,887. The company also expects to erect a 55,000-volt transmission line from Banning to El Centro, connecting with the high tension line from San Bernardino at Banning. The Coachella company proposes to furnish electricty to the Holton Pwr. Co., of Holton, to be distributed in the Imperial Valley. W. F. Holt, of Redlands, represented the Coachella company.

GRIDLEY, CAL.—The city of Gridley expects to purchase within the next 12 months 100 meters, 50 kva in transformers, some No. 600 wire and 50 street-lamp globes. E. R. Fagan is superintendent.

TUCSON, ARIZ.—A hydroelectric power company, headed by Ralph Cameron, Col. Epes Randolph and Eugene S. Ives, has been tentatively organized in Tucson for the purpose of constructing a large power dam across the Colorado River in the Grand Canyon near Bright Angel trail. Electricity generated at the plant would be transmitted to towns, mining camps and irrigation districts in every part of the State. The reservoir would also furnish water to irrigate large tracts of land. Mr. Cameron holds water rights at the proposed site at the foot of Bright Angel trail.

ELY, NEV.—The Ely Lt. & Pwr. Co. may install an additional engine in its plant soon. L. B. Hedge is chief electrician.

## Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Jan. 10, 1914, for furnishing switchboard, electric cable, conduit and fittings and miscellaneous electrical apparatus, oil-burning galvanizing pots and motor-driven dry-kiln and dry-room equipment. Blanks and general information relating to this circular (No. 815) may be obtained at the above office. For details see proposal columns. Major F. C. Boggs is general purchasing officer.

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Jan. 13, 1914, for furnishing cold-rolled steel, wire cable, chain, sheet brass, sheet copper, brass tubing, etc. Blanks and general information pertaining to this circular (No. 814) may be obtained from the above office or from the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing agent.

## New Incorporations

[illegible] E. DALE, Inc. Immedale Wtr., Lt. & Pwr. Co. has [illegible] a capital stock of $150,000 to establish a plant in Immedale. The incorporators are C. M. Hill, D. F. Sullivan, Otto Zimmerman and S. H. Clawson.

LA SALLE, ILL.—The La Salle-Peru Gas & El. Co., of La Salle, has been incorporated with a capital stock of $700,000 by H. J. Vane, J. A. Howlton and R. F. Carley, of La Salle. The company proposes to operate gas and electric plants.

WINSTON-SALEM, N. C.—The North Carolina Ser. Co. has been incorporated with a capital stock of $50,000 to construct and operate an electric-light plant.

LA MOURE, N. D.—The La Moure Lt. & Pwr. Co. has been incorporated with a capital stock of $24,000 by M. A. Erickson, T. A. Curtiss and others.

HARRISBURG, PA.—Seventeen charters were granted recently by the State Department, ten of which will operate in Schuylkill and adjoining counties. Each company is capitalized at $5,000 and the names are as follows: West Mahanoy, Schuylkill, East Mahanoy, Conyngham, Shenandoah, Mahanoy City, Frackville, Centralia, Ashland and Gilberton El. Co. Charters were taken out by Alfred Marshall, S. Fuhrman Marshall and Alfred M. Wildman, of Langhorne, for the Bristol, Hulmeville, Langhorne Manor, Middletown, Bensalem and South Langhorn Electric Cos. [illegible] capitalized at $ [illegible]. A charter was also granted to the Bradford El. Lt. & Pwr. Co., of Bradford, with a capital stock of $150,000.

HARRISBURG, PA.—Charters for 14 electric companies to operate in eastern Pennsylvania counties have been granted by the State Department. Seven of the companies are to operate in Bucks County, with an office in Allentown, and seven in Susquehanna County, with offices in Scranton. Charters for Bucks County were taken out by H. R. Fehr, A. S. Cantlin and Charles N. Wagner, of Allentown, and are as follows: Springfield Township, Richland Township, Hilltown, East Rock Hill Township, Doylestown, Hatfield and New Britain El. Lt. & Pwr. Cos. H. S. Kirk, W. J. Lewis and W. J. Arnold, of Scranton, were granted charters for the companies in Susquehanna County as follows: Lanesboro, Oakland Township, Great Bend, Great Bend Township, Bridgewater Township, New Milford and Susquehanna County Lt. & Pwr. Cos. The latter is to operate in Oakland Borough. Each company is capitalized at $5,000.

CHINCOTEAGUE, VA.—The Delmarva Lt., Ht. & Refrig. Corpn., has been incorporated with a capital stock of $50,000. The company recently purchased an ice and light plant and will develop from 180 hp to 250 hp. The officers are: Henry Conant, of Chincoteague, president; Joseph T. Rowley, treasurer, and Charles F. Wa[illegible], manager.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED DEC. 16, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

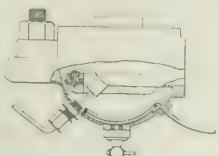
1,081,292. LOCOMOTIVE TRUCK; A. F. Batchelder, Schenectady, N. Y. App. filed Jan. 3, 1913. The parts of the electric locomotive on which the platform is supported on the truck frame are spring-supported and pivoted on an axis disposed longitudinally of the truck.

1,081,300. METHOD OF TESTING ELECTRICAL CONDUCTORS; H. M. Friendly, Portland, Ore. App. filed May 31, 1911. For measuring resistance, insulation and locating faults.

1,081,308. VAPOR ELECTRIC APPARATUS; A. McL. Jackson, Schenectady, N. Y. App. filed Jan. 9, 1904. Mercury-vapor rectifier for alternating current.

1,081,309. VAPOR ELECTRIC APPARATUS; A. M. Jackson, Schenectady, N. Y. App. filed Oct. 31, 1904. Thin-metal seal for the tube and a conductor provided with a conductive disk held in contact with the cap.

1,081,342. ELECTRIC TRACTION SYSTEM; L. B. Stillwell, Lockwood, N. J., and F. N. Waterman, Summit, N. J. App. filed Jan. 11, 1905. Source of polyphase current from which the motors take energy when driving load and to which the motors return energy when driven by the load and a rheostat automatically cut in to absorb returned energy in excess of that required.



1,081,729.—Heating Coil for Carburetors

1,081,365. THERMOPILE; W. W. Coblentz, Washington, D. C. App. filed Oct. 28, 1913 (dedicated to the public). Receivers attached to certain of the junctures of the thermal elements with some of the receivers overlapping.

1,081,368. SELECTOR MECHANISM; E. B. Craft and A. F. Dixon, New York, N. Y. App. filed Jan. 11, 1908. For use in automatic and semi-automatic telephone exchange systems.

1,081,413. ELECTRICAL SYSTEM; R. Varley, Englewood, N. J. App. filed June 16, 1913. Ignition system embodying two coils in inductive relation with means for short-circuiting one coil.

1,081,414. ELECTRIC HEATING ELEMENT; A. A. Warner, New Britain, Conn. App. filed May 6, 1913. Resistance wire formed into a coil and the coiled wire wound about a mandrel.

1,081,433. AUTOMOBILE SIGNALING APPARATUS; J. L. Cayer, Chicago, Ill. App. filed Oct. 16, 1912. A front signaling device operates a rear signaling device.

1,081,463. APPARATUS FOR GENERATING STEAM; J. B. Pentz, New York, N. Y. App. filed March 15, 1913. Water is supplied, drop by drop, to a vaporizing chamber, whence vapor flows to a superheating chamber.

1,081,490. DEVICE FOR MUFFLING SOUNDS; A. Dare, Philadelphia, Pa. App. filed March 15, 1912. For rendering it impossible for a second person to hear message spoken into telephone.

1,081,493. ANTISEPTIC CONTAINER; E. M. Docringer and A. C. St. Marie, San Francisco, Cal. App. filed Nov. 23, 1912. Hollow conoidal antiseptic containing body having lugs engaging in the perforated partition of a telephone mouthpiece.

1,081,498. ELECTRIC LIGHT FIXTURE; L. Gudeman, New York, N. Y. App. filed Jan. 27, 1913. Portable lamp stand in which the strain of clamping the parts together is taken up by a central pipe.

1,081,531. METHOD OF MAKING STORAGE-BATTERY ELECTRODES; H. C. Hubbell, Newark, N. J. App. filed April 11, 1910. Forms thread-like material from powdered metallic nickel or cobalt, mixes with hydroxide of same, dries and then deposits metallic nickel or cobalt on exposed surfaces.

1,081,550. ELECTROPNEUMATIC BRAKING SYSTEM; W. C. Myers, Oakland, Cal. App. filed May 22, 1913. Combination of pneumatic and dynamic braking.

1,081,572. ELECTRICAL SIGNALING SYSTEM; H. Bewlay, Newark, N. J. App. filed July 2, 1912. Alternating current is superimposed upon direct current for the operation of selective signaling apparatus.

1,081,581. RECEPTACLE FOR INCANDESCENT ELECTRIC LAMPS; J. S. Crossley, Solvay, N. Y. App. filed Dec. 31, 1910. Waterproof socket provided with a plurality of integral ribs in the interior of the porcelain body.

1,081,635. ELECTRICAL MEANS FOR PRODUCING SOUND; O. Siritter, Berlin, Germany. App. filed Nov. 9, 1911. Electric horn in which the tone is regulated by an adjustable spring.

1,081,641. ALTERNATING-CURRENT RECTIFIER; E. J. Wiggins, Chicago, Ill. App. filed May 12, 1913. Rotary type; has means for accelerating the movable member to a given speed.

1,081,656. ATTACHMENT PLUG; A. M. Bradley, Napoleon, Ohio. App. filed March 13, 1913. Plug is attached by simply pushing it into a socket, it having yielding threaded parts which spring into engagement with socket.

1,081,671. HIGH-TENSION DISCONNECTING SWITCH; A. S. Kalenborn and A. J. Pahl, San Francisco, Cal. App. filed Dec. 30, 1911. The contact members rotate toward and away from each other on the axis of the wire.

1,081,681. ALTERNATING-CURRENT-MOTOR CONTROL; D. Larson, Yonkers, N. Y. App. filed Aug. 31, 1910. For elevators; includes inductive apparatus for automatically regulating current to the motor and means for retarding action of said apparatus.

1,081,696. MAGNETO-ELECTRIC GENERATOR; E. P. and F. I. Remy, Anderson, Ind. App. filed Feb. 17, 1910. Armature mounted in non-revolvable position relative to the rotary inductors.

1,081,712. KEY CONSTRUCTION AND RELEASE FOR TELEPHONIC APPARATUS; W. P. Andrick, E. Lowe and H. W. Haff, Jamaica, N. Y. App. filed Sept. 2, 1911. Keys complete circuits; automatically stay as long as communication is desired and automatically return when communication is terminated.

1,081,729. HEATING COIL FOR CARBURETORS; W. A. Erkenbrack, Webster, S. D. App. filed July 11, 1913. Heating coil disposed in bottom of float chamber beneath the float.

1,081,749. ELECTRIC DISTRIBUTION SYSTEM; L. B. Jones, Kansas City, Mo. App. filed March 15, 1913. Whenever demand for current is created the prime mover for the generator is brought into motion and continues to run so long as the demand for current exists.

1,081,760. IGNITION DYNAMO; C. T. Mason, Sumter, S. C. App. filed April 23, 1912. Stationary magnet and a rotor so positioned that the magnetic flux is established through winding, the rotor at all times maintaining the same polarity.

1,081,789. ELECTRIC SWITCH; G. B. Thomas, Bridgeport, Conn. App. filed Aug. 11, 1911. Pull switch in which movement is obtained by spirally slotted sleeve.

1,081,827. STARTING DEVICE FOR ELECTRIC MOTORS OR THE LIKE; W. Griebe, Brooklyn, N. Y. App. filed Feb. 12, 1913. Embodies blocks or slides carrying different resistances which may be interchangeably inserted in the starting box.

1,081,843. INDICATOR; L. S. Larson, Toledo, Ohio. App. filed March 11, 1913. Device which automatically indicates to the engineer the amount of water in the ballast tanks.

1,081,884. BURGLAR ALARM; E. C. and F. W. Bertagnolli, Central City, Col. App. filed Aug. 22, 1912. Includes flexible circuit wires stretched across the window or other opening.

1,081,912. SMELTING FURNACE; K. O. E. Olausson, Trollhattan, Sweden. App. filed Sept. 6, 1911. Electric furnace in which a condensing chamber is arranged outside the furnace chamber, wherein the condensible gases are separated from the non-condensible gases.

1,081,925. RAILWAY SIGNALING SYSTEM; A. V. T. Day, New York, N. Y. App. filed July 24, 1906. For controlling traffic on the electric-traction systems.

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